“Bank provisioning, business cycles and bank regulations: a comprehensive analysis using panel data”

AUTHORS	Chung-Hua Shen Meng-Fen Hsieh Chien-Chiang Lee

ARTICLE INFO	Chung-Hua Shen, Meng-Fen Hsieh and Chien-Chiang Lee (2008). Bank provisioning, business cycles and bank regulations: a comprehensive analysis using panel data. *Banks and Bank Systems*, *3*(4)
RELEASED ON	Friday, 06 February 2009
JOURNAL	"Banks and Bank Systems"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES **0**

NUMBER OF FIGURES **0**

NUMBER OF TABLES **0**

Meng-Fen Hsieh (Taiwan), Chung-Hua Shen (Taiwan), Chien-Chiang Lee (Taiwan)

Bank provisioning, business cycles and bank regulations: a comprehensive analysis using panel data

Abstract

The empirical analysis is performed through the system of Generalized Method of Moments (GMM) dynamic panel data estimations on a panel of 49 countries observed in the period of 1991-2002. The evidence shows that with steady growth in both the economy and bank earnings, bank management will tend to increase loan loss provisions (LLP), whereas with a buoyant economy but negative growth in bank earnings, management will exhibit an inclination to reduce LLP. Regarding the influence of bank regulation on provisions, the evidence shows that under certain circumstances banks make more provision based on regulatory considerations. This explains why bank regulations regarding LLP across countries do have an effect on the banks' provisioning behavior.

Keywords: loan loss provisions, pro-cyclicality, income-smoothing, dynamic panel data.
JEL Classification: G21, E58.

Introduction

The relationship between bank loan loss provisions (LLP) and business cycles has been focus of a great deal of empirical study of late, in large part because of the promulgation of the Basel II Accord at the end of the year 2006. Under Basel II, banks are required to provide sufficient capital or reserve in accordance with their clients' probability of default. The default risk of an enterprise increases when the external economy experiences a decline; this is marked by an upsurge in banks' LLP. Against this, a sudden leap in the external economy decreases the probability of defaults, which then induces banks to decrease their LLP. The general expectation, therefore, is that bank loan loss provisioning becomes pro-cyclical.

The concept of pro-cyclicality[1], when applied to the new capital requirements, is that in a downturn, for instance, when risks are more likely to materialize, capital requirements might increase. Thus, capital requirements and output growth will move in opposite directions (Ayuso et al., 2004). The implication here is that when an economy faces a downturn, banks are apt to increase their loan loss reserves, meaning that they probably do not provide sufficient LLP in good years to save for bad years. In fact, numerous researchers provide evidence that many banks intend to increase their loan loss provisioning when the economy is in a downward trend. Among these are Ayuso et al. (2004) with a Spanish data who find the negative relationship between capital buffers and business cycle. Other country studies are, among others, Estrella (2004), Lindquist (2004), and Rime (2001) who analyze the capital pro-cyclicality in a European context, respectively. And Laeven and Majnoni (2003) with a 45-country sample[2], on the weight of this evidence find that the negative relationship between LLP and economic growth seems to be confirmed.

Business cycles aside, bank earnings positively affect LLP. The consensus is that there is a positive relationship between LLP and earnings, so called *income-smoothing effect*. Greenwalt and Sinkey (1988) investigate whether large bank-holding companies employed their loan-loss provision to smooth accounting earnings. The discretionary nature of the estimation process and its use over successive periods provide managers with the opportunity to smooth income. Such behavior might be exhibited by charging additional amounts to loan-loss expenses in years of peak earnings while decreasing the loan-loss provision or delaying recognition of write-offs when earnings are down[3]. This has been substantiated more by Collins et al. (1995) and Kanagaretnam et al. (2004), among others, who find evidence in suppert of the income-smoothing effect. By contrast, Moyer (1990), Wetmore and Brick (1994), Beatty et al. (1995) and Ahmed et al. (1999) do not support the income-smoothing effect. They examine LLP as a mean to manipulate a bank's capital adequacy. A manager can increase the primary capital adequacy by increasing the LLP[4]. More

[1] To avoid confusion, in what follows the movement in a financial indicator is said to be "pro-cyclical" if it tends to amplify business cycle fluctuations. According to this definition, for instance, provisions behave pro-cyclically if they fall in economic upswings and rise in downswings (Borio et al., 2001).

[2] In addition to the research studies mentioned here that have empirically verified the pro-cyclicality of banks' provisioning behavior, Borio et al. (2001) use a simulation approach to investigate the important links between financial development and business cycles; loan loss provisioning is another one of the factors. Lowe (2003) also investigates the issue during periods when the economy is in good shape, especially under circumstances marked by a dramatic growth in loans and a rapid increase in the credit risk of bank loans.

[3] See page 304 for more details.

[4] The other reason is based on the credibility of a bank/company, as suggested by Greenawalt and Sinky (1988), Fudenberg and Tirole (1995) and Defond and Park (1997), among others. Furthermore, rather than just serving as window dressing for a financial report, Kim and Santomero (1993) argued that a positive correlation between earnings and provisions may well be the result of optimal statistical forecasting

specifically, managers will increase LLP when pre-managed earnings (EBTP) are high, and decrease LLP when pre-managed earnings (EBTP) are low (Ahmed et al., 1999; Kim and Kross, 1998; Kanagaretman et al., 2004)[1]. Furthermore, by separating earnings on the basis of whether they are positive or negative, Laeven and Majnoni (2003) also find that positive earnings have a positive influence on LLP, whereas negative earnings have a negative effect. However, the interaction relationship between earnings and business cycles on provisioning has not been documented.

The objective of this article is twofold. The first purpose is to explore the relationships among business cycles, earnings and bank LLP. In order to identify and test for different geographical regions and different regulations on provisioning, we use recent two-step system Generalized Method of Moments (GMM) dynamic panel data techniques proposed by Arellano and Bover (1995) and Blundell and Bond (1998), which can deal with the possible simultaneity among LLP, economic growth and bank earnings, so as to concentrate on the causal effect of the exogenous component of economic growth and bank earnings on loan loss provisioning. Using panel data also allows us to control for country-specific effects and to incorporate information from individual countries over time.

This study departs from previous studies in the literature in that we assume that business cycles and earnings have an interactive effect on banks' loan loss provisioning behavior. We attribute this to a negative relationship between LLP and business cycles and a positive relationship between LLP and bank earnings. Thus, there are four possible scenarios.

In the first scenario, when both the economy and bank earnings are in good shape, in consideration of the *income-smoothing effect*, we expect banks to increase their LLP by virtue of the good economy and banks' confidence in the future. In sharp contrast, in consideration of the *pro-cyclicality effect*, we do not expect banks to increase their LLP. Thus, these two different effects offset each other, leaving us uncertain about the sign of the coefficient. In the second scenario, when the external economy is in bad shape but bank earnings are in good shape, both forces are expected to lead to a positive coefficient. Thus, we expect the *income-smoothing intense effect*. Third, when the economy is in good shape but bank earnings are in negative, we expect that these conditions likely give banks the incentive to reduce their provisions. Hence, the *reverse income-smoothing intense effect* should be at work. Finally, in the fourth scenario, when the economy and bank earnings are both in bad shape, it is difficult to predict the coefficient.

We also contend that provisioning must be influenced not only by business cycles and bank earnings, but also by the regulatory system. Cavallo and Majnoni (2002) indicate that in countries with less governance, or with common law origin, or with relatively more external investor rights, banks tend to decrease provisions. Nevertheless, empirical research on this issue has been scarce. Is the behavior of bank provisioning in a particular country affected by that country's banking regulations on provisions? To explain the current trends vis-à-vis provisioning, the existing literature most commonly classifies countries on the basis of either their membership in international organizations, such as the G10, OECD and the EU, or their geographic location, like Europe, Latin America and Asia. But, by any measure, even when countries are in the same international organization or located in roughly the same geographical region, the regulations on provisioning in each country are simply not the same.

The second purpose of this article, therefore, is to explore whether bank regulations in different countries have an influence on bank LLP. Generally speaking, LLP can be divided into two categories: specific provisions and general provisions. A specific provision is a reserve that covers a specific loan loss and is fully or partially tax deductible, while a general provision covers a potentially uncertain loan loss, based on economic and earnings forecasts. It is worth noting that banks can take a deduction for general provisions up to a predefined percentage of eligible loans, for instance 0.3% in Japan and 2% in Taiwan. The tax deductibility of loan losses is undeniably a compelling force for banks to set aside adequate LLP. Thus, for individual countries, we explore three specific issues which may impact the *income-smoothing effect*.

First, can general provisions be included in Tier II capital? Despite differences in the tax deductibility of loan losses, a specific provision cannot usually be included in Tier II capital. In the case of general provisions, however, there are different treatments in different countries. For instance, in France, Germany, the UK, the U.S.A. and many non-G-10

with respect to loan losses and hence is not necessarily due to misleading provisioning behavior as supposed in income-smoothing theory. Defond and Park (1997) used discretionary accruals as the basis to predict next period earnings. Evidence suggests that in considering job security when current earnings are 'poor' and expected future earnings are 'good', managers 'borrow' 'future earnings' for use in the current period. Conversely, when current earnings are 'good' and expected future earnings are 'poor', managers 'save' current earnings for possible use in the future.

[1] Kanagaretman et al. (2004) employ book-to-price ratio as an alternative under/over valuation measure.

countries[1], including Taiwan, general provisions can be included in Tier II capital. By contrast, in Brazil, the Netherlands and Spain, general provisions cannot be counted as part of Tier II capital. We expect that if countries allow general provisions to be included in Tier II capital and bank earnings are rising, then banks probably intend to set aside greater provisions. On these grounds, the *intense income-smoothing effect* should be in force.

Secondly, do countries set minimum or benchmark provisioning requirements for standard loans? France, Germany, the UK, the USA, Singapore, Brazil and Chile, for instance, do not have minimum requirements. On the other hand, in several countries, general provisions are set at compulsory levels; in Italy, Argentina and China, to name a few, banks are required to provision 1 percent of their loans outstanding. In Taiwan, loans are classified into 5 categories based on the quality of loan, and banks are required to provision at least 2%, 10% and 50% for category 3, 4 and 5 type of loan, respectively[2]. We expect that if countries set minimum or benchmark provisioning requirements for standard loans and if bank earnings are rising, then banks likely provision more. Thus, the *intense income-smoothing effect* should be in force.

Thirdly, we investigate whether any legal penalties have been imposed on banks for inaccurately classifying a loan or underestimating provisions in at least the past five years. Even the most sophisticated legislative code must be tracked back to evaluate how well it is enforced. World Bank (2002) and Laeven and Majnoni (2003) also focus on the enforcement of regulations in their cross-country research. Corporate law gives directors and auditors certain rights and obligations to ensure that financial statements provide a fair and accurate statement of a bank's financial position and that banks comply with adequate provisioning practices. Banking and financial legislation often provides specific penalties for violations of prudential regulations, in general, and for contraventions of the banking and financial services act, in particular. For instance, in Hong Kong, as in most other jurisdictions, the penalty for violating any provision of the Banking Ordinance could be a fine, imprisonment, or both. In France, underestimating provisions constitutes an offense to the extent that it affects the fairness and accuracy of the information that is provided to the public, as defined in the 1966 Commercial Company Law. Similar interpretations of commercial and banking laws are used in Mexico, Russia, Saudi Arabia, Spain and the West African Monetary Union (WAMU). In some countries, penalties are applicable to bank directors and managers, and these include fines, temporary disqualification, demotion, dismissal and even imprisonment. Not only that, when a violation affects the preparation of a final financial statement, it infringes on the auditor's obligations (as in Germany)[3]. Thus, we expect that if any legal penalties have been imposed on banks because of an inaccurate classification of loans or an underestimation of provisions in at least the past five years and bank earnings are rising, then the banks implicated intend to provision more. This would mean that the *intense income-smoothing effect* is at play.

The remainder of this paper is organized as follows. Section 1 describes the econometric model we employ. Section 2 provides the data and the descriptive statistics. Section 3 discusses the empirical results, and the last section reviews the conclusions we draw and presents some important policy implications.

1. Econometric framework

1.1. Basic model. In regard to the development of our econometric model, Degeorge et al. (1999) provided a two-period model in which managers manage reported earnings to maximize their own compensation. In their model, the firm's latent earnings may reflect one of three situations: (1) The firm may be so far below the threshold that trying to reach it via managing earnings would be too costly. In this case, the firm seeks to report earnings that are less than its latent earnings, an approach referred to as "saving for a better tomorrow". (2) If the firm is below its target earnings but reaching the target is not too costly, the managers may use their influence to boost reported earnings and achieve the target, a process described as "borrowing for a better today." (3) Firms that exceed the target may reduce their current reported earnings to be able to report higher earnings in the next period, a process referred to as "reining in". The authors noted that the three thresholds may be relevant to reported earnings: zero earnings, the prior year's earnings per share, and stock analysts' earnings expectations.

[1] Countries allowing general provisions to be counted as part of Tier II capital include some G-10 countries – France, Germany, Italy, Japan, the UK and the USA – and some non-G-10 countries, such as Argentina, Australia, Chile, China, the Czech Republic, Hong Kong, India, Mexico, Saudi Arabia, Singapore, South Africa, South Korea, the Russian Federation and Taiwan.

[2] In Taiwan, according to Article 5 of the "Regulations Governing the Procedures for Banking Institutions to Evaluate Assets and Deal with Non-performing/Non-accrual Loans", amended on Jan. 6, 2004, the minimum standard for loan loss provision shall be the sum of 2% of the balance of Category Two credit assets, 10% of the balance of Category Three credit assets, 50% of the balance of Category Four credit assets and the full balance of Category Five credit assets.

[3] See World Bank (2002), pp. 30-31 for details. In the case of Taiwan, the relevant regulations stipulate the terms of punishment in the event that banks or managers violate applicable laws, regulations, or bank rules. However, no records of actual punishment are made available.

In order to carry this two-period model out, this study extends the model proposed by Laeven and Majnoni (2003) by using loan loss provisions divided by total assets as the dependent variable (LLPTA) and explore the influence of business cycles and bank earnings on bank provisioning[1]. In a departure from the Laeven and Majnoni (2003) model, we classify business cycles into growth and decline. We also distinguish between positive and negative earnings that may influence banks' provisioning behavior. Regarding the estimation methodology, we follow the dynamic panel data approach suggested by Arellano and Bover (1995) and Blundell and Bond (1998), and we use recently developed two-step dynamic panel system generalized GMM techniques to address potential endogeneity in the data. This method is also helpful to amend the bias induced by omitted variables in cross-sectional estimates, and the inconsistency caused by endogeneity both in cross-sectional and traditional static panel regressions. Our dynamic panel models are written as

$$\begin{aligned} LLPTA_{ijt} &= \alpha_0 + \alpha_1 EBPT^{+}_{ijt} + \alpha_2 EBPT^{-}_{ijt} + \\ &+ \alpha_3 \Delta LOAN_{ijt} + \alpha_4 Z_{ijt} + \alpha_5 T_t + v_i + \varepsilon_{ijt} \end{aligned}, \quad (1)$$

$$\begin{aligned} \alpha_1 &= \theta_{11} GDP^{+}_{it} + \theta_{12} GDP^{-}_{it} \\ \alpha_2 &= \theta_{21} GDP^{+}_{it} + \theta_{22} GDP^{-}_{it} \end{aligned}, \quad (2)$$

$$\begin{aligned} EBPT^{+} &= \max(EBPT, 0) \\ EBPT^{-} &= \min(EBPT, 0) \end{aligned}. \quad (3)$$

Here, $i = 1,\ldots,N$; $t = 1,\ldots, T$; i is the i-th country; j stands for the j-th bank in country i; $N = 49$; and t ranges from year 1991 to year 2002. v_i , T_t and ε_{ijt} are, respectively, the unobservable country- and time-specific effects, and the error term. *EBPT* (Earnings before Provision and Tax) represents net earnings and is measured by each bank's total assets. $EBPT^{+}$ denotes that *EBPT* is positive in a specific year, but $EBPT^{-}$ denotes that it is negative. Since the business cycle variable appears in the provisioning literature as a proxy for credit risk, a major explanatory variable of loan loss provisioning. Thus, real GDP growth referring to as business cycle factor is included in the model. GDP^{+} indicates that the economy is in good shape (i.e., the GDP real growth rate is higher than the 1991-2002 average value), while GDP^{-} shows it is in a state of decline (i.e., the GDP real growth rate is less than the average value for that period). When equations (2) and (3) are inserted into (1), then $GDP^{+}EBPT^{+}$ denotes conditions in which both the economy and bank earnings are in good shape; $GDP^{+}EBPT^{-}$ denotes conditions in which the economy is in good shape but bank earnings are falling.

The dependent variables include *Loan growth*. *Z* is the set of other control variables, such as Equity, NPL growth, Net Charge-Off etc., and T_t is the year dummy. We estimate the system by dynamic GMM with moment conditions $E[\Delta LLPTA_{ijt-s}(v_i + \varepsilon_{ijt})] = 0$ and $E[\Delta Z_{ijt-s}(v_i + \varepsilon_{ijt})] = 0$ for s = 1 on the predetermined variables Z. The instruments for the regression are levels of the right-hand side variables and the country-specific effect in equation (1); there is no correlation between the differences of these variables and the country-specific effect. We can validate the estimated model through a Sargan test of over-identifying restrictions.

1.2. Sensitivity tests. Besides considering interactions between business cycles and bank earnings in bank provisioning, this study also includes legal regulations pertaining to provisioning. For countries that allow banks to include general provisions in Tier II capital, the dummy variable D_{tier2} is set as one. And for those that set minimum or benchmark provisioning requirements for standard loans, the dummy variable $D_{minires}$ is set as one. If countries have legal penalties that have been imposed on banks for the inaccurate classification of loans or the underestimation of provisions in at least the past five years, the dummy variable $D_{penalty}$ is set as one. Accordingly, the above model can not reflect the regulatory practices. Thus, our modified equation is:

$$\begin{aligned} LLPTA_{ijt} &= [\beta_0 + \beta_1 EBPT^{+}_{ijt} + \beta_2 EBPT^{-}_{ijt} + \beta_3 \Delta LOAN_{ijt} + \beta_4 Z_{ijt} + \beta_5 T_t] \times D_{regulation} \\ &+ [\gamma_0 + \gamma_1 EBPT^{+}_{ijt} + \gamma_2 EBPT^{-}_{ijt} + \gamma_3 \Delta LOAN_{ijt} + \gamma_4 Z_{ijt} + \gamma_5 T_t] \times (1 - D_{regulation}), \\ &+ v_i + \varepsilon_{ijt} \end{aligned} \quad (4)$$

$$D_{regulation} = (D_{tier2}, D_{Minires}, D_{penalty}). \quad (5)$$

[1] Further research may take the loan loss provisions ratio in terms of total loans, that would avoid ponderous explanations. However, Cavallo and Majnoni (2002), Laeven and Majnoni (2003) use total assets as the denominator of the dependent variable.

The impact of three regulations on income-smoothing effect can be analyzed as follows. First, when a country allows its banks' general provisions to be included in Tier II capital, its banks have one more motivation to provision when earnings increase. Thus, permitting general provision to be included in Tier II strengthens the income-smoothing effect, suggesting coefficient of $\beta_1 D_{tier2} > \gamma_1(1 - D_{tier2}) > 0$. Next, when a country requires minimum provision, banks are prone to provision more in order to fulfill this requirement. Thus, permitting the minimum requirement also uphold the income-smoothing effect, suggesting that $\beta_1 D_{\min ires} > \gamma_1(1 - D_{\min ires}) > 0$. Last, banks are more prudent with LLP if they are operating in a jurisdiction that imposes penalties on not provisions. Thus, once they have earnings, they tend to provision more, enhancing the *income-smoothing effect.* $\beta_1 D_{penalty} > \gamma_1(1 - D_{penalty}) > 0$ and $\beta_2 D_{penalty} < \gamma_2(1 - D_{penalty}) < 0$.

2. Data and descriptive statistics

This study analyzes the commercial banks of 49 countries, and to do so, it takes banks' financial statements from *BankScope* database. The empirical analysis covers the 1991-2002 sample period. Since most studies on cyclicality have been longer than 10 years and each version of *BankScope* only provides 8-year data, we combine 1999 and 2002 data (data can be traced back to 1991, the earliest data set provided by *BankScope*). As the number of banks in each edition is not constant, we compile bank names one by one from two different editions and delete the repeated years. The definitions of the variables and sources of the data are given in Table 1.

In this study, there are two possible treatments for the data. In one treatment, we use the equity ratio as the benchmark since, from a comparative standpoint, it is the most complete variable. If a bank lacks 5 years or more of data, then that bank is deleted from the sample. We use the other treatment to deal with overlapping data if a bank provides consolidated and unconsolidated financial reports at the same time; normally the latter is more complete, and thus, it is kept. Table 2 presents the compilation of our data for the number of banks and the descriptive statistics of the main economic variables for each country.

As shown in the first column of Table 2, of the total number of banks (4,024) in the sample countries, the USA (446), Germany (372) and France (356) have the largest number. The second column shows banks' total assets (TA) by country, and the top three countries are Sweden (49,468 million USD), Japan (49,258) and the Netherlands (30,370), values far higher than the whole sample average (9,540 million USD). The third column shows the loan ratio, which is total loan divided by total assets (Loan/TA), where the full sample average is 53.89%. The fourth column is the loan loss provision ratio, which is loan loss provision divided by total assets (Loan loss provision/TA), with the average value of 1.09% for all countries. It should be pointed out that the loan ratio for New Zealand is the highest three, thus, in theory, it might be expected that New Zealand's loan loss provision ratio should be relatively high. But it is the lowest, revealing that it violates the Matching Principle between loan (revenue) and provision (expense).

Particularly interesting too is the case of Taiwan. Its loan ratio is 68.07%, which is significantly higher than the 53.89% average, but its loan loss provision ratio is only 0.72%, which is significantly lower than the average 1.09%. As shown in column 5, the loan loss reserve ratio for Taiwan is only 0.87%, ever so much lower than the full sample average of 2.90%; in no way, therefore, is provisioning in the Taiwan banking industry sufficient. Turning to the GDP growth rate in column 6 of Table 2, the average value is 3.16%.

Table 3 provides the statistical information for other economic variables. The first column is Equity/TA, where the sample average is 9.80%, the highest value is in Brazil (17.19%), and the lowest in Ecuador (-0.17%). The second column is EBPT/TA, where the average value is 1.06%; the highest value is in Turkey (3.37%), while the lowest is in Uruguay (-4.87%). Column 3 lists the data for NCO/TA, and the average is only 0.87%; Argentina has the highest (6.14%), and the Netherlands has the lowest (0.01%). The fourth column lists the data for NPL/TA; the highest ratios are in Thailand (22.98%), Indonesia (16.97%) and Kenya (12.90%), all well above the average (4.59%). The lowest is in the USA (0.47%).

Table 4 reports the mean results for the independent and dependent variables. On the basis of GDP and earnings, when the economy and banks' earnings are both in a good shape, the LLP/TA ratio is 0.72% which is the lowest level. When the economy remains good, but earnings become negative, the LLP/TA ratio is higher (1.85%). The third scenario is where the ratio is 0.95%. However, when both the economy and banks' earnings exhibit a downward trend, the LLP/TA ratio reaches the highest level (3.63%) and has the highest standard error (13.49%), indicating that banks on average provision more and are much more volatile.

Loan growth exhibits only one positive figure when the economy and earnings are both good, i.e., 0.23%, showing that a good external and internal environment will induce banks to lend more. However, when the economy and earnings are in a bad state, the banks' loan growth will have the highest negative growth (-3.52%), meaning that banks will take more precautions in their lending.

It is interesting to find that when banks' earnings are positive, regardless of whether the economy is good or bad, the equity ratios are ranked as the lowest two ones, indicating that positive earnings make banks feel safe by keeping their equity structure at a lower level. As regards the Non-Performing Loan growth and Net Charge-Off ratios, these two ratios reach their lowest level (and highest volatility also) when the economy and earnings are in good condition, but they also reach their highest level when the economy, both externally and internally, is facing a downward trend, meaning that banks are not forward looking.

If variables are classified based on geographical location, it is found that banks located in Latin America set aside the highest provision (1.98%) and that highest equity ratio (0.02%) that are accompanied by the highest NPL growth and Net Charge-Off of 0.98% and 2.55%, respectively. It is learnt from this case that these variables cannot be overlooked. Besides Latin America, banks in Asia have the second high loan loss provisions (1.59%), and the rest are ordered as follows: Japan (0.66%), the USA (0.60%) and Europe (0.59%). It is particularly worth mentioning that the equity ratio in Japan has a small value (0.00003%) compared with the others, and this may not only reflect the fact that Japanese banks are extremely large in size, but that Japan has a fragile financial system.

Table 4 also presents data pertaining to relevant regulations on provisioning. First, as concerns countries that allow general provisions to be counted as part of Tier II capital, all five variables are smaller than those of other countries, thus contravening our intuition. Secondly, with respect to countries that set minimum or benchmark provisioning requirements for standard loans, banks on average set more provisions than the other countries (0.94% vs. 0.74%), which coincides with our expectations. The same pattern occurs with countries that have imposed legal penalties on banks for having inaccurately classified loans or for having underestimated provisions in at least the past five years. This shows that legal enforcements will push banks to provision more (0.78% vs. 0.61%).

Table 5 presents the correlation coefficients between the independent and dependent variables. It is clear that the *pro-cyclical effect* holds. For instance, the correlation between GDP growth rate and Loan loss provision is negative, which means that when the economy is growing, banks tend to decrease their provisions.

3. Empirical results

3.1. Basic model. Columns A and B in Table 6 show the dynamic interaction effect of GDP growth, Earnings and Loan growth. We find that the coefficient of GDP growth is positive, whereas that of Earnings is positive, and the latter is consistent with Laeven and Majnoni (2003). And, important to note, only the *income-smoothing effects* is supported. A clear trend is noted in these results: with a higher growth rate for Non-performing loans or Net charge-offs, or a higher equity ratio, banks increase their provisions.

Columns C and D in Table 6 report our modified dynamic model which considers whether business cycles and earnings have an interactive effect on provisioning. First, in column C, the coefficient of $GDP^{+}EBPT^{+}$ is 0.023, which shows that banks provision more when earnings are positive without being affected by the good economic condition into account. The coefficient of $GDP^{+}EBPT^{-}$ is -0.143 and significant, suggesting that good economy upholds the negative-earnings income-smoothing effect. That is, banks provision less when earnings are negative and this effect is enhanced by the good economy. In the third scenario, i.e., when the economy is in a downward trend but banks enjoy positive earnings, the coefficient of $GDP^{-}EBPT^{+}$ turns out to be a desirable positive (0.021), thus bust of the economy strengthens the positive-earnings income-smoothing effect. Finally, the coefficient of $GDP^{-}EBPT^{-}$ is -0.046 and significant, indicating that when the economy is in a downturn and bank earnings are not satisfactory, banks tend to decrease their provisions.

In column D, the control variable is added. All the coefficients of the variables remain the same except for $GDP^{-}EBPT^{-}$ as the coefficient changes from negative to desirable positive, and this, in a significant manner. This shows that bust of the economy also strengthens the negative-earnings income-smoothing effect and this irrefutably confirms that policy in the financial system vis-à-vis provisioning is not forward looking[1]. Since the regressions in Table 6 pass the Sargan tests, this two-step system GMM estimator seems to offer a particularly useful assessment of GDP growth, Earnings and Loan growth.

[1] See Borio et al. (2001) and Beattie et al. (1995) for more details.

3.2. Impact of geographical location on provisioning. Table 7 groups countries by location: Europe, the USA, Japan, Latin America and Asia. Except for Asia, all the coefficients of $GDP^{+} \times EBPT^{+}$ are significantly positive, implying that when both the economy and earnings are growing, banks raise their provisions. This shows that the *income-smoothing effect* is stand and less influenced by business cycle. By contrast, the coefficient for Asia is significantly negative; this attests to the dominance of the *pro-cyclical effect* in Asia. The $GDP^{+} \times EBPT^{-}$ coefficients are all negative. This implies that when the economy is on an upward trend but earnings are poor, banks tend to decrease their provisions. Again, the *income-smoothing effect* is stand and less influenced by business cycle. The $GDP^{-} \times EBPT^{+}$ coefficients are not consistent across all five zones. Significantly negative as they are in Europe, the USA and Latin America, they uphold neither the *pro-cyclical effect* nor the *income-smoothing effect*. In Japan and Asia, the coefficients are desirable positive ones, meaning both the *pro-cyclical effect* and the *income-smoothing effect* hold.

Finally, the coefficients for $GDP^{-} \times EBPT^{-}$ also differ by geographical location. In Europe and Latin America, they are positive and significant for the latter. This signals that when the economy is on a downturn trend of the business cycle and earnings are not good, banks tend to raise their provisions, showing that the *income-smoothing effect* is not stand and much influenced by business cycle. In the USA, Japan and Asia, on the other hand, the coefficients are negative showing the *income-smoothing effect* is dominant. The major difference between Asia and the other four zones is that banks do not provide sufficient (higher) provisions during periods when economic growth and earnings are on the increase. Implicit here is that prior to the 1997 Asian crisis, banks had evidently not provisioned enough to be able to confront the serious loan losses that were about to occur. Instead, banks provisioned more during the very period in which the economy was suffering when bank earnings were good. It is suggested that this is an important lesson that should have been learned from the crisis.

Table 8 has the same geographical classifications as Table 7, but the control variables are added and led to a significant drop of observations. Thus, there are some exceptions compared with Table 7. As for the control variables, the results do not change much and are basically consistent with those in Table 6. There are exceptions in Europe, Japan and Asia. The coefficient for the equity ratio shifts from significantly positive to significantly negative. In Japan, the absolute value increases, which shows that Japanese banks with a higher ratio of equity capital tend to decrease provisions proportionately.

3.3. Impact of regulatory systems on provisioning. Table 9 reports on the impact of regulatory systems pertaining to provisioning. That is, can general provisions be included in Tier II capital? Is there any minimum provision required? Have any legal penalties been imposed on banks in at least the past five years? First of all, compared with benchmark model (Column C of Table 6) countries with penalties records on provisioning, the $GDP^{+} \times EBPT^{+}$ coefficients intend to be greater than the bench model ones (0.0754 versus 0.023). This result is consistent with our hypothesis, which is the *intense income-smoothing effect* is at play under taking regulations into consideration.

Secondly, the coefficients of $GDP^{+} \times EBPT^{-}$ found that countries do not allow general provisions as part of Tier II and countries without any minimum requirements, their banks intend to provision less than benchmark model. Thirdly, the coefficient of $GDP^{-} \times EBPT^{-}$ for countries which have no minimum requirements is significantly negative. This illustrates that when regulatory systems are taken into account, the *income-smoothing effect* is still existed and less impacted by business cycles.

Table 10 follows Table 9, and the control variables are included. Sample size also drops significantly, though, there are still some findings. First, for countries which allow general provisions to be considered as Tier II capital, the coefficient of $GDP^{+} \times EBPT^{-}$ is significantly negative and smaller than the benchmark model matching our expectation (-0.463 versus -0.095). Second, the situation with $GDP^{-} \times EBPT^{+}$ is also different; in countries which have penalty records available on provisioning, the coefficient becomes significantly negative and smaller than that shown for the basic model (-0.717 versus 0.015). This means the *income-smoothing intense effect* is upheld. It is important to note, therefore, that the enforcement of bank regulations on loan loss provisioning does indeed have an impact on banks' provisioning behavior.

Conclusions

The first objective of this article is to explore the relationships among business cycles, earnings and bank loan loss provisions by employing recent two-step system GMM techniques developed for dynamic panels on a panel of 49 countries observed in the period of 1991-2002. This study differs from previous studies in the literature because we assume

that business cycles and earnings have an interactive impact on the behavior of bank loan loss provisioning. We attribute this to a negative relationship between business cycles and LLP and a positive relationship between bank earnings and LLP. Next, unlike pervious studying, the GMM panel estimator exploits the time-series variation in the data, accounts for unobserved country-specific effects, allows for the inclusion of lagged dependent variables as regressors, and controls for endogeneity of all the explanatory variables.

The evidence shows that with steady growth in both the economy and bank earnings, bank management tends to increase LLP, whereas with a buoyant economy but negative growth in bank earnings, management shows a tendency to reduce LLP. In these scenarios, the *income-smoothing effect* appears to be held and less affected by business cycles. By contrast, when the economy is in a downward trend and banks suffer losses, management evidently increases LLP. In this case, the reversed *income-smoothing effect* is stand and strongly influenced by business cycles. When geographical location is taken into account, the *income smoothing effect* has a dominant power and less affected by business cycles.

The implication that emerges from this part of the empirical results is that prior to the 1997 Asian crisis, banks had obviously not been provisioning enough to be able to meet the challenge they faced when the severe loan losses later occurred. Instead, banks provisioned more during the very period in which the economy was suffering but bank earnings were good. It is suggested that the relevant authority and banks take serious note of this given that they had been provisioning more, the severity of the crisis may have been mitigated.

As to whether country-wide bank regulations influence bank loan loss provisioning, it is found that when the economy and bank earnings are both showing steady or negative growth, the *intense income-smoothing effect* is at work. In other scenarios, neither *income-smoothing* nor *pro-cyclicality* holds. This accounts for the fact that bank regulations on loan loss provisioning across 49 countries do have an impact on banks' provisioning behavior.

The implication here is that even when countries are in the same international organization or are located in roughly the same geographical region, the regulations with respect to provisioning in each country are just not the same. Policymakers and researchers need to pay considerably more attention to the enactment and enforcement of relevant regulations on provisioning.

References

1. Ahmed, A.S., Takeda, C., Thomas, S. (1999). Bank loan loss provisions: a re-examination of capital management, earnings management and signaling effects. Journal of Accounting and Economics 28, 1-25.
2. Arellano, M., Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68, 29-51.
3. Ayuso, J., Perez, D., Saurina J. (2004). Are capital buffers pro-cyclical? Evidence from Spanish panel data. Journal of Financial Intermediation 13 (2), 249-264.
4. Beattie, V.A., Casson, P.D., Dale, R.S., McKenzie, G.W., Sutcliffe, C.M.S., Turner, M.J. (1995). Banks and Bad Debts: Accounting for loan losses in international banking. New York USA, John Wiley and Sons.
5. Beatty, A., Chamberlain, S.L., Magliolo, J. (1995). Managing financial reports of commercial banks: The influence of taxes, regulatory capital, and earnings. Journal of Accounting Research 33, 231-261.
6. Blundell, R., Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87, 115-143.
7. Borio, C., Furfine, C., Lowe, P. (2001). Procyclicality of the financial system and financial stability: Issues and policy options. BIS Paper No. 1, 1-57.
8. Cavallo, M., Majnoni, G. (2002). Do banks provision for bad loans in good times? Empirical evidence and policy implications. In: Levich, R., Majnoni, G., Reinhart C. (Eds), Ratings, Rating Agencies and the Global Financial System, 319-342. Boston, Kluwer Academic Publishers, Dordrecht and London.
9. Collins, J.H., Shackelford, D.A., Wahlen, J.M. (1995). Bank differences in the coordination of regulatory capital, earnings, and taxes. Journal of Accounting Research 33, 263-291.
10. Defond, M.L., Park, C.W. (1997). Smoothing income in anticipation of future earnings. Journal of Accounting and Economics 23, 115-139.
11. Degeorge, F., Patel, J., Zeckhauser, R. (1999). Earnings management to exceed thresholds. Journal of Business 72, 1-33.
12. Estrella, A. (2004). The cyclical behavior of optimal bank capital. Journal of Banking and Finance 28, 1469-1498.
13. Fudenberg, D., Tirole, J. (1995). A theory of income and dividend smoothing based on incumbency rents. Journal of Political Economy 103, 75-93.
14. Greenawalt, M.B., Sinky, J.F. (1988). Bank loan-loss provisions and the income smoothing hypothesis: An empirical analysis, 1976-1984. Journal of Financial Services Research 1, 301-318.

15. Kanagaretnam, K., Lobo, G.J., Yang, D.H. (2004). Joint tests of signalling and income smoothing through bank loan loss provisions. Contemporary Accounting Research 21, 843-884.
16. Kim, D., Santomero, A.M. (1993). Forecasting required loan loss reserves. Journal of Economics and Business 45, 315-329.
17. Kim, M.S., Kross, W. (1998). The impact of the 1989 change in bank capital standards on loan loss provisions and loan write-offs. Journal of Accounting and Economics 25, 69-99.
18. Laeven, L., Majnoni, G. (2003). Loan loss provisioning and economic slowdowns: Too much, too late? Journal of Financial Intermediation 12, 178-197.
19. Lindquist, K.G. (2004). Banks' buffer capital: How important is risk? Journal of International Money and Finance 23, 493-513.
20. Lowe, P. (2003). Credit Risk Measurement and Pro-cyclicality. Monetary and Economic Department, Bank for International Settlements, Banking supervision at the crossroads, 136-163.
21. Moyer, S.E. (1990). Capital adequacy ratio regulations and accounting choices in commercial banks. Journal of Accounting and Economics 13, 123-154.
22. Rime, B. (2001). Capital requirements and bank behaviour: Empirical evidence for Switzerland. Journal of Banking and Finance 25, 789-805.
23. Wetmore, J.L., Brick, J.R. (1994). Loan loss provisions of commercial banks and adequate disclosure: A note. Journal of Economics and Business 46, 299-305.
24. World Bank (2002). Bank Loan Classification and Provisioning Practices in Selected Developed and Emerging Countries. Washington D.C., Finance Forum.

Appendix

Table 1. Definitions and sources of the variables

Micro	from *BankScope* -- Bureau van Dijk
LLP/TA	Loan loss provision / Total assets
LLR/TA	Loan loss reserve / Total assets
$EBPT$	Earnings before provision and tax / Total assets
$EBPT^+$	*EBPT* is positive in the specific year, and it is a true value rather than a dummy variable. $EBPT^+ = \max(EBPT, 0)$
$EBPT^-$	*EBPT* is negative in the specific year, and it is a true value rather than a dummy variable. $EBPT^- = \min(EBPT, 0)$
Loan ratio	Total Loan / Total Assets
Loan growth	$(LOAN/TA)_t - (LOAN/TA)_{t-1}$
Equity	(Equity / Total Assets)
NPL growth	$(NPL/TA)_t - (NPL/TA)_{t-1}$
Net charge-off	Net charge-off / Total Assets
Macro	from *World Bank Development Indicator*
GDP	GDP growth is real growth in GDP per capita (annual %).
GDP^+	GDP real growth rate is greater than the 1991-2002 average value.
GDP^-	The GDP real growth rate is less than the 1991-2002 average value.
GDP per capita	GDP per capita (constant 1995 U.S.$)
Bank regulation	From Laeven and Majnoni (2003), for the case of Taiwan is collected by the authors.
D_{tier2}	In countries which allow banks to include their general provisions in Tier II capital, the dummy variable is set as 1; otherwise as 0.
$D_{Minires}$	In countries which set minimum or benchmark provisioning requirements for standard loans, the dummy variable is set as 1; otherwise as 0.
$D_{penalty}$	In countries which have imposed legal penalties on banks for the inaccurate classification of loans or the underestimation of provisions in at least the past five years, then the dummy variable is set as 1; otherwise as 0.

Table 2. Number of banks and the descriptive statistics of the main economic variables

No.	Country	Number of banks	Total assets Million USD	Loan / TA (%)	Loan loss provision /TA (%)	Loan loss reserve/TA (%)	GDP growth rate (%)
1	Argentina	64	1,582	48.21	2.51	5.65	2.63
2	Australia	27	15,318	73.35	0.65	1.30	3.52
3	Austria	31	4,828	44.98	0.49	1.07	2.15
4	Belgium	36	16,833	34.94	0.31	0.18	1.93
5	Brazil	90	4,859	33.84	2.09	2.82	2.5
6	Canada	35	23,764	65.77	0.80	1.41	2.78
7	Chile	15	2,837	62.66	0.57	1.48	5.88
8	Colombia	21	935	60.32	1.79	2.23	2.37
9	Denmark	55	4,661	55.80	1.06	3.13	2.24
10	Ecuador	22	242	48.52	4.82	12.24	2.25
11	Egypt	27	2,450	45.83	1.17	6.44	4.18
12	Finland	5	17,427	49.35	0.51	1.06	1.95
13	France	206	10,776	48.64	0.80	4.14	1.84
14	Germany	162	7,922	47.56	0.52	2.01	1.67
15	Greece	19	7,216	41.74	0.52	1.44	2.62
16	Hong Kong	34	11,211	48.86	0.47	1.36	4.05
17	India	56	3,742	43.12	0.67	0.94	5.4
18	Indonesia	42	1,727	57.84	4.57	8.85	4.28
19	Ireland	12	14,404	57.20	0.23	1.01	7.09
20	Israel	15	8,700	63.83	0.64	2.71	4.41
21	Italy	54	18,821	48.09	0.50	2.02	1.52
22	Japan	140	49,258	70.25	0.66	1.46	1.27
23	Jordan	10	4,068	43.36	0.60	5.20	5.1
24	Kenya	17	248	52.10	1.40	5.80	1.6
25	Malaysia	23	5,165	57.66	0.90	2.96	6.37
26	Mexico	25	7,427	53.96	1.19	2.81	2.98
27	Netherlands	29	30,370	46.73	0.26	0.92	2.56
28	New Zealand	6	7,910	75.58	0.12	0.69	3.04
29	Nigeria	14	794	27.74	1.22	5.32	2.59
30	Norway	9	9,552	79.85	0.68	2.41	3.35
31	Pakistan	19	1,375	43.01	0.62	3.11	3.75
32	Peru	14	1,094	56.01	1.94	4.12	3.79
33	Philippines	13	928	54.23	0.61	2.52	3.18
34	Portugal	27	7,980	42.16	0.42	1.48	2.53
35	Singapore	10	14,550	64.32	0.74	4.53	6.47
36	South Africa	13	7,057	74.76	1.18	2.68	1.99
37	South Korea	16	20,924	57.29	1.09	1.60	6.03
38	Spain	84	8,719	44.15	0.37	1.53	2.62
39	Sri Lanka	6	811	56.76	0.53	2.59	4.55
40	Sweden	5	49,468	51.19	0.91	3.68	1.91
41	Switzerland	143	1,453	53.68	0.36	2.29	0.81
42	Taiwan	35	12,198	68.07	0.72	0.87	5.47
43	Thailand	13	10,207	74.70	1.49	5.51	4.49
44	Turkey	26	3,248	35.23	1.18	1.43	3.12
45	U.K.	93	19,830	37.87	0.66	2.15	2.27
46	United States	324	10,217	60.19	0.60	1.17	2.92
47	Uruguay	5	627	77.43	4.83	1.42	1.37
48	Venezuela	10	1,292	43.54	1.29	2.86	1.25
49	Zimbabwe	6	433	58.31	0.98	5.62	0.28
Average		44	9,540	53.89	1.09	2.90	3.16
Total	2,163		467,460				

Note: Values reported in this table are the average values after those banks which lack at least 5 years of data have been deleted. The rest of this study adopts this sample.

Table 3. Descriptive statistics of the micro and macro economic variables

No.	Country	Equity/TA (%)	EBPT/TA (%)	NCO/TA (%)	NPL/TA (%)
1	Argentina	18.15	-0.91	6.14	7.89
2	Australia	7.37	0.46	0.62	1.41
3	Austria	8.81	0.79	Na	Na
4	Belgium	9.30	0.95	Na	0.52
5	Brazil	17.19	2.57	2.27	2.86
6	Canada	8.39	0.93	0.57	2.54
7	Chile	12.31	0.97	0.51	0.64
8	Colombia	16.26	1.43	0.89	4.04
9	Denmark	10.68	1.20	Na	1.12
10	Ecuador	-0.17	-1.60	3.93	3.35
11	Egypt	9.00	1.21	0.20	Na
12	Finland	5.45	0.47	0.18	1.29
13	France	9.96	0.85	0.76	6.06
14	Germany	9.32	0.79	Na	Na
15	Greece	7.89	1.09	0.39	2.68
16	Hong Kong	14.26	1.78	0.42	2.71
17	India	4.95	0.60	0.58	3.10
18	Indonesia	6.81	-1.76	2.55	16.97
19	Ireland	8.16	0.97	0.24	0.61
20	Israel	9.03	0.53	0.22	5.45
21	Italy	8.29	0.84	1.02	3.78
22	Japan	3.99	-0.04	0.31	3.46
23	Jordan	7.45	1.02	0.20	8.21
24	Kenya	12.22	3.12	1.17	12.90
25	Malaysia	9.80	1.53	Na	0.90
26	Mexico	16.16	1.07	0.87	3.20
27	Netherlands	9.15	1.01	0.01	0.77
28	New Zealand	4.95	1.31	0.11	0.55
29	Nigeria	9.49	3.31	0.28	5.71
30	Norway	6.13	0.71	0.28	3.22
31	Pakistan	6.92	1.25	0.10	6.17
32	Peru	10.59	1.34	0.96	6.12
33	Philippines	16.46	1.34	0.30	7.64
34	Portugal	7.26	0.82	0.33	2.36
35	Singapore	14.10	1.59	0.61	8.09
36	South Africa	14.44	1.29	0.87	3.35
37	South Korea	5.76	-0.18	1.40	4.41
38	Spain	17.80	1.56	0.40	Na
39	Sri Lanka	8.00	1.78	0.03	8.76
40	Sweden	6.81	0.49	Na	7.28
41	Switzerland	16.93	2.04	Na	1.44
42	Taiwan	13.59	0.87	2.05	1.28
43	Thailand	6.07	-0.91	0.80	22.98
44	Turkey	10.06	3.37	0.03	2.63
45	U.K.	12.56	1.74	0.58	2.21
46	United States	9.86	2.28	0.55	0.47
47	Uruguay	2.07	-4.87	1.39	7.16
48	Venezuela	12.87	4.71	0.79	2.66
49	Zimbabwe	7.34	4.34	0.51	5.52
	Average	9.80	1.06	0.87	4.59

Table 4. Means of variables (%)

	LLP/TA	*Loan growth*	*Equity*	*NPL growth*	*Net charge-off*
Based on GDP and earnings					
$GDP^{+} \times EBPT^{+}$	0.7231 (2.389)	0.2253 (8.146)	0.0065 (0.040)	0.0745 (3.024)	0.5381 (2.999)
$GDP^{+} \times EBPT^{-}$	1.851 (5.956)	-0.4781 (13.957)	0.0154 (0.348)	1.701 (9.353)	1.663 (3.738)
$GDP^{-} \times EBPT^{+}$	0.9527 (3.806)	-0.2615 (7.987)	0.0063 (0.045)	0.1441 (4.534)	0.7392 (2.839)
$GDP^{-} \times EBPT^{-}$	3.629 (13.487)	-3.520 (14.578)	0.0476 (0.311)	2.643 (20.315)	5.896 (16.608)
Based on geographical location					
Europe	0.5893 (1.231)	0.0999 (8.354)	0.0145 (0.110)	-0.1341 (4.426)	0.4190 (1.395)
USA	0.5977 (3.198)	-0.0027 (8.137)	0.0046 (0.042)	0.0124 (0.419)	0.5504 (3.232)
Japan	0.6628 (1.389)	-0.0760 (2.561)	0.00003 (0.00007)	0.5501 (2.493)	0.3162 (0.669)
Latin America	1.9839 (5.218)	-0.5682 (12.718)	0.0204 (0.086)	0.9765 (4.438)	2.545 (6.996)
Asia	1.5922 (7.739)	-0.3707 (8.590)	0.0043 (0.056)	0.3259 (12.369)	1.4785 (7.902)
Based on regulation					
Can general provisions be included in Tier II capital?					
Yes	0.7721 (2.731)	-0.1461 (8.469)	0.0070 (0.056)	0.1411 (3.025)	0.6168 (3.049)
No	1.0387 (3.288)	0.0250 (10.872)	0.0371 (0.217)	0.4789 (2.679)	1.5699 (5.722)
Is there any minimum provision required?					
Yes	0.9421 (3.049)	-0.2827 (8.224)	0.0067 (0.052)	0.3728 (3.255)	0.7066 (3.007)
No	0.7406 (2.688)	-0.0387 (9.140)	0.0134 (0.113)	0.0093 (2.835)	7.2923 (3.684)
Have any legal penalties been imposed in at least the past five years?					
Yes	0. 7836 (2.819)	0.0133 (9.983)	0.0138 (0.113)	0.0379 (2.871)	0.7778 (3.909)
No	0.6100 (2.127)	-0.1518 (6.804)	0.0062 (0.060)	0.3007 (3.073)	0.4004 (1.649)

Note: Values in parentheses are standard errors.

Table 5. Correlation coefficients of the microeconomic and economic development variables

	LLP/TA	LLR/TA	Equity/TA	NCO/TA	Loan/TA	NPL/TA	EBPT/TA	GDP growth rate
LLP/TA	1	0.49	-0.24	0.40	0.03	0.38	-0.40	-0.18
LLR/TA		1	-0.40	0.39	-0.03	0.81	-0.26	-0.08
Equity/TA			1	0.16	-0.19	-0.10	0.33	0.01
NCO/TA				1	-0.04	0.09	-0.01	-0.08
Loan/TA					1	0.05	-0.05	0.05
NPL/TA						1	-0.19	-0.20
EBPT/TA							1	0.11
GDP growth rate								1

Table 6. Test results of the effects of pro-cyclicality and income-smoothing

	(A)	(B)		(C)	(D)
GDP growth	0.001** (2.354)	-0.001 (-1.041)	$GDP^{+} \times EBPT^{+}$	0.023 (1.115)	0.075** (4.098)
			$GDP^{+} \times EBPT^{-}$	-0.143** (-2.603)	-0.095** (-3.401)
			$GDP^{-} \times EBPT^{+}$	0.021 (1.247)	0.028** (3.092)
EBPT	0.104** (2.978)	0.036* (1.674)			
			$GDP^{-} \times EBPT^{-}$	-0.046** (-2.464)	0.015** (2.882)
Loan growth	-0.020** (-3.646)	-0.008* (-1.778)	*Loan growth*	-0.019** (-3.840)	-0.010** (-2.056)
Equity		32.818** (2.513)	*Equity*		24.622* (1.856)
NPL growth		0.281** (11.125)	*NPL growth*		0.263** (11.280)
Net charge-off		0.678** (14.352)	*Net Charge-off*		0.689** (15.918)
Sargan test (p-value)	0.086	0.179	Sargan test (p-value)	0.115	0.181
No. of observations	14,046	3,855	No. of bank-years	14,046	3,643
No. of banks	2,163	2,163	No. of banks	2,163	2,163

Notes: 1. The dynamic panel model is adopted. Due to space constraints, the constant term is not reported. The independent variable is the ratio of loan loss provision divided by total assets (*LLPTA*). *GDP growth* is real growth in per capita GDP in annual percent. *EBPT* equals earnings before provision and tax divided by total assets. *Loan growth* is equal to the loan growth rate. *Equity* is the ratio of equity capital divided by total assets. *NPL growth* is the non-performing loan growth rate. *Net charge-off* is the ratio of net charge-off against total assets. 2. GDP^{+} (GDP^{-}) means that the GDP real growth rate is greater (less) than the 1991-2002 average value. $EBPT^{+}$ ($EBPT^{-}$) denotes that *EBPT* is positive (negative) in the specific year, and it is a true value rather than a dummy variable. $GDP^{+} \times EBPT^{+}$ shows that both the economy and bank earnings are in good shape. 3. Values in parentheses are t-values; ***, ** and * indicate the 1%, 5% and 10% level of significance, respectively. 4. Sargan test: the null hypothesis is that the instruments used are not correlated with the residuals. All equations include time dummies as regressors and instruments. ** and * indicate the significance at the 5% and 10% levels, respectively. Instruments: lagged levels for differences, lagged differences for levels. Two-step estimates.

Table 7. Test results of the effects of pro-cyclicality and income-smoothing — geographical location added

	Europe	USA	Japan	Latin America	Asia
$GDP^{+} \times EBPT^{+}$	0.007** (4.216)	0.142** (25.628)	0.352** (7.104)	0.045** (8.548)	-0.499** (-7.483)
$GDP^{+} \times EBPT^{-}$	-0.033 (-1.337)	-0.031 (-0.631)	-0.380** (-2.434)	-0.209** (-5.954)	-0.119 (-0.400)
$GDP^{-} \times EBPT^{+}$	-0.032** (-3.053)	-0.033** (-4.223)	0.090** (2.900)	-0.019** (-3.524)	0.063** (10.852)
$GDP^{-} \times EBPT^{-}$	0.048 (0.042)	-0.550** (-21.486)	-0.183** (-3.456)	0.104** (9.229)	-0.081** (-3.656)
Loan growth	0.001 (0.376)	-0.022** (-5.612)	0.028** (3.178)	-0.013** (-2.218)	-0.082** (-3.054)
Sargan test (*p*-value)	0.185	0.574	0.165	0.388	0.280
No. of observations	4,612	2,391	992	1,930	1,099
No. of banks	938	324	140	244	217

Notes: 1. The same as Table 6. 2. "Europe" includes Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Sweden, Spain, Switzerland and the United Kingdom. "Latin America" includes Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela. "Asia" includes India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, Taiwan and Thailand. "USA" indicates the United States of America.

Table 8. Test results of the effects of pro-cyclicality and income-smoothing – geographical location and control variables added

	Europe	USA	Japan	Latin America	Asia
$GDP^{+} \times EBPT^{+}$	0.006** (3.303)	0.038** (16.023)	0.058* (1.867)	0.023** (1.964)	-0.014 (-0.489)
$GDP^{+} \times EBPT^{-}$	-1.096** (-1175.294)	0.015 (0.338)	-0.109** (-2.117)	0.042 (0.133)	-0.471** (-2.781)
$GDP^{-} \times EBPT^{+}$	-0.081** (-3.151)	0.008 (1.380)	0.202** (13.524)	-0.019** (-2.357)	0.044** (13.181)
$GDP^{-} \times EBPT^{-}$	-1.025 (-0.568)	-0.755** (-12.043)	0.064 (1.076)	0.012** (4.642)	0.042** (4.976)
Loan growth	-0.009** (-28.147)	0.005** (3.094)	-0.023** (-5.555)	-0.005 (-0.781)	-0.029** (-2.703)
Equity	-20.766** (-3.891)	13.794** (4.962)	-19039.54** (-21.061)	41.484** (3.750)	-40.604 (-1.053)
NPL growth	0.243** (126.341)	0.150** (6.623)	0.093** (16.608)	0.205** (10.023)	0.309** (24.533)
Net charge-off	0.784** (120.977)	0.869** (89.308)	0.186** (7.258)	0.288** (5.046)	0.450** (16.245)
Sargan test (p-value)	0.699	0.687	0.160	0.991	0.922
No. of observations	149	1,899	819	126	219
No. of banks	939	324	140	244	217

Note: The same as Table 6 and Table 7.

Table 9. Test results of the impact of regulations on provisioning

	Can general provisions be included in Tier II capital?		Is there any minimum provision required?		Have any legal penalties been imposed in at least the past five years?	
	Yes	No	Yes	No	Yes	No
$GDP^{+} \times EBPT^{+}$	0.069** (9.312)	0.091** (14.958)	0.015** (2.900)	0.071** (9.530)	0.0754** (11.257)	0.005** (8.417)
$GDP^{+} \times EBPT^{-}$	-0.117** (-2.586)	-0.770** (-13.496)	-0.095* (-1.758)	-0.489** (-7.133)	-0.140** (-2.574)	-0.163** (-6.244)
$GDP^{-} \times EBPT^{+}$	-0.026** (-4.823)	-0.035** (-4.736)	-0.021** (-6.336)	-0.033** (-5.053)	-0.017** (-2.698)	-0.019** (-3.915)
$GDP^{-} \times EBPT^{-}$	0.074** (5.609)	0.068** (2.498)	0.069** (8.846)	-0.357** (-5.374)	-0.0171 (-0.597)	0.0.96 (0.860)
Loan growth	-0.009** (-2.837)	-0.004 (-1.342)	-0.008** (-2.497)	-0.010** (-3.113)	-0.013** (-4.362)	-0.001 (-0.258)
Sargan test (p-value)	0.083	0.094	0.411	0.091	0.144	0.094
No. of observations	1,435	8,598	4,165	5,868	5,051	3,899
No. of banks	1,274	1,274	548	929	699	607

Notes: 1. The same as Table 6. 2. Countries that allow general provisions to be counted as part of Tier II capital include some G-10 countries, such as France, Germany, Italy, Japan, the UK and the USA, and some non-G-10 countries, such as Argentina, Australia, Chile, China, the Czech Republic, Hong Kong, India, Mexico, Saudi Arabia, Singapore, South Africa, South Korea, the Russian Federation and Taiwan. 3. Countries which set minimum or benchmark provisioning requirements for standard loans include some G-10 countries, such as Italy and Japan, and some non-G-10 countries, such as Argentina, Australia, China, Hong Kong, India, South Korea, Mexico, South Africa, Spain, the Russian Federation and Taiwan. 4. Countries which have penalty records on provisioning available include some G-10 countries, such as France, Italy and the USA, and some non-G-10 countries, such as Brazil, China, the Czech Republic, Hong Kong, Mexico, Saudi Arabia, Singapore and the Russian Federation.

Table 10. Test results of the impact of regulations on provisioning – control variables added

	Can general provisions be included in Tier II capital?		Is there any minimum provision required?		Have any legal penalties been imposed in at least the past five years?	
	Yes	No	Yes	No	Yes	No
$GDP^{+} \times EBPT^{+}$	0.070** (11.767)	0.029** (2.379)	0.005 (1.138)	0.049** (12.812)	0.047** (18.322)	0.004 (0.811)
$GDP^{+} \times EBPT^{-}$	-0.463** (-16.392)	-0.023 (-0.118)	0.086 (0.861)	-0.522** (-23.486)	-0.056 (-1.279)	-0.953** (-8.472)
$GDP^{-} \times EBPT^{+}$	-0.020** (-4.617)	-0.082** (-4.635)	-0.008 (-1.469)	0.014* (1.756)	0.007 (0.833)	-0.011* (-1.804)
$GDP^{-} \times EBPT^{-}$	0.022** (4.431)	2.361 (0.383)	0.018** (6.861)	-0.859** (-11.723)	-0.717** (-0.855)	0.080** (3.763)
Loan growth	-0.003 (-1.020)	-0.004 (-0.601)	-0.021** (-6.400)	0.006** (3.514)	0.004** (2.402)	0.002 (0.732)
Equity	7.989** (2.478)	48.260** (4.797)	48.729** (2.975)	18.911** (4.947)	15.103** (3.634)	-173.312** (-8.366)
NPL growth	0.092** (5.752)	0.127** (3.469)	0.166** (9.095)	-0.005 (-0.891)	0.188** (9.053)	0.071** (17.788)
Net charge-off	0.791** (38.307)	0.076 (1.450)	0.467** (14.804)	0.827** (70.484)	0.845** (75.609)	0.478** (14.669)
Sargan test (p-value)	0.841	0.647	0.817	0.577	0.872	0.792
No. of observations	3,133	96	1,127	2,102	1,991	1,160
No. of banks	1,274	203	548	929	699	607

Note: The same as Table 6 and Table 9.