3 Assessing Macrofinancial Implications and Resolution Policies of Nonperforming Loans

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3.1 Introduction

Nonperforming loans (NPLs), however hard banks and their supervisors try, are an unavoidable by-product of the banking business. They burden the banks, strain their liquidity, increase their funding costs, reduce their capacity to extend new loans, and deplete their earnings. This is why resolving NPLs is regarded as essential to banking.

Empirical analysis of the determinants of NPLs examines the role of macroeconomic variables and of bank-specific factors in driving their movements. Evidence of the macroeconomic factors influencing credit risk points to the countercyclical behavior of NPLs (Klein 2013). An expansion in real gross domestic product (GDP) leads to an improvement in borrower repayment capacity, a reduction of default risk, and a decline in NPLs; economic contraction works in the opposite direction. More generally, better macroeconomic conditions—a decline in unemployment, inflation, currency depreciation, and global financial volatility, among other factors—constrain NPL ratios (Roy 2014; Ha, Trien, and Diep 2014; Lee and Rosenkranz 2019). In their examination of the bank-specific factors associated with higher NPLs in Asia, Lee and Rosenkranz (2019) point to decreased capitalization, lowered profitability, increased risk appetite, past loan growth, and fall in credit supply.

NPLs not only directly damage banks, but also eventually burden the entire economy by keeping banks from adequately performing the role of financial intermediation, slowing down overall economic activity. Empirical studies

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also confirm the negative macrofinancial feedback effects of NPLs. Espinoza and Prasad (2010), Nkusu (2011), De Bock and Demyanets (2012), Klein (2013), and Lee and Rosenkranz (2019) find that an increase in the NPL ratio generates a strong, albeit short-lived, negative response in economic activities such as output growth, employment, and credit growth, although the magnitude differs depending on the sample group of countries and the sample period.

Besides, a large and sustained buildup of NPLs could raise the possibility of a banking crisis, which usually develops into a nationwide financial crisis, levying a heavy toll on the entire economy. Previous financial crises have demonstrated the long-lasting negative impacts NPLs can have on financial stability and economic performance, as their effects persist beyond crisis periods. Ari et al. (2019), investigating NPL ratios in 88 banking crises since 1990, find that pre-crisis NPL problems and the severity of post-crisis recessions are closely related and argue that reducing pre-crisis vulnerabilities and quickly addressing NPL problems during a crisis are vital for post-crisis output recovery.

Consequently, the identification of policy options to effectively manage and respond to a buildup in NPLs has gained attention in recent years. Policy makers have diverse tools for tackling a large and sustained buildup of NPLs and to resolve them, including establishing public asset management companies (AMCs), asset protection schemes, and debt write-offs, together with injections of public funds to recapitalize banks. Although each of these measures can resolve NPLs from banks' loan portfolios and lower the overall NPL ratio, substantial costs are involved. These costs should be weighed against the benefit of reducing NPLs for macrofinancial issues, including economic growth, unemployment, exchange rates, and the supply of credit.

This study evaluates the effectiveness of NPL resolution policies by assessing the macrofinancial implications of NPLs. It uses a new NPL dataset constructed from bank-level NPL data provided by Standard & Poor's (S&P) Global Market Intelligence.

To do so, the chapter adopts a two-step strategy. First, the analysis investigates whether NPL resolution policy measures bring about a sharp drop in the overall NPL ratio of an economy. We focus on these sharp drops because NPL reduction tends to start with just such a precipitous decline in the overall NPL ratio. In particular, Balgova, Plekhanov, and Skrzypińska (2017) observe that among 178 episodes of NPL reduction,

143 (about 80%) began as such. Focusing on the sharp drops thus allows us to investigate policy effectiveness and the associated macrofinancial effects. Observation of NPL ratio behavior indeed reveals that, from time to time, ratios move sharply up and down. While it is possible that the factors that have proved significant in explaining the overall movements of NPL ratios also explain the sharp movements, it is also possible that not all the factors are useful in doing so. Indeed, other factors may be responsible for the sharp movements. For example, besides improved macroeconomic conditions, NPL resolution measures such as the establishment of public AMCs and injection of public funds may account for the sharp reductions.

Second, the analysis evaluates the effect of a sharp drop in an NPL ratio on the performance of macrofinancial variables by estimating the average treatment effect on the treated. NPL reductions starting with a sharp drop in the ratio are regarded as the treatment group, and the episodes of high and persistent NPL ratio as the control group. Balgova, Plekhanov, and Skrzypińska (2017) made the first attempt to measure the effects of NPL reduction measures on macroeconomic performance by estimating the average treatment effect on the treated.

In the chapter, the next section introduces the literature that empirically investigates the determinants of NPLs and that measures the macroeconomic feedback effects of NPL reduction. Section 3.3 describes the NPL ratio data. Section 3.4 estimates dynamic panel models for NPL ratios and discusses the results. In addition, panel probit models for sharp rises and sharp drops in NPL ratios are estimated. Section 3.5 measures the macrofinancial effects of an NPL reduction by estimating the treatment effect on the treated. Section 3.6 concludes.

3.2 Literature Review

Much of the existing literature on NPLs investigates macroeconomic factors and bank-specific factors rather than the adoption of NPL resolution policies. Bank-specific factors focus on the variables that may signal or influence the risk-taking practices of banks. On the other hand, macroeconomic factors focus on the variables expected to affect borrowers' debt servicing abilities. These studies find that deteriorating macroeconomic conditions—such as lower economic growth, higher unemployment or inflation rates, greater currency depreciation, sudden reversals of portfolio flows, and higher global financial volatility—tend to raise NPL ratios.

For example, Nkusu (2011), investigating the determinants of NPLs across 26 developed countries, finds that deteriorating macroeconomic conditions such as lower economic growth and higher unemployment lead to higher NPL ratios. De Bock and Demyanets (2012) use panel data consisting of 25 emerging market economies to find that lower economic growth, currency depreciation, weaker terms of trade, and lower debt-creating capital inflows deteriorate loan quality and decrease credit growth. In particular, their analysis reveals that sudden reversals of portfolio inflows are likely to be followed by a sharp deterioration in loan quality. Klein (2013), using bank-level data from 16 countries in Central, Eastern, and Southeastern Europe, demonstrates that NPL ratios are significantly affected by the unemployment, GDP growth, and inflation rates.

Lee and Rosenkranz (2019), using panel data of 165 commercial banks from 17 emerging economies in Asia, find that both macroeconomic and bank-level variables are key to explaining the evolution of banks' NPL ratios in Asia, which themselves have strong negative feedback effects on the economy (Box 3.1). In particular, higher NPL ratios are associated with higher unemployment and inflation rates, greater currency depreciation, and lower economic growth. They also find that NPL ratios tend to rise when global financial volatility is higher. Likewise, Espinoza and Prasad (2010), investigating a sample of 80 banks in the Gulf Cooperation Council region, find that NPL ratios are positively correlated with greater global financial volatility. In addition to macroeconomic factors, meanwhile, Ozili (2019) investigates the influence of financial development on NPLs. Using a global sample of country-level panel data, Ozili finds that two financial sector development proxies—foreign bank presence and financial intermediation (as measured by private credit by banks to GDP)—are positively associated with NPL ratios.

Box 3.1: Assessing the Determinants of Nonperforming Loans in Asia

To evaluate the determinants of nonperforming loans (NPLs) in Asia, a dynamic panel data model is estimated examining macroeconomic and bank-level variables. The analysis employs panel data of individual banks' balance sheets from BankScope and macroeconomic indicators from CEIC. The sample covers annual data for 1995–2014. Bank-level data consists of 165 commercial banks in 17 emerging economies in Asia, and the dataset covers more than 60%

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Box 3.1 (continued)

of the banking sector's assets in most of the sample countries. The data on NPLs consists of 2,271 observations. Across all specifications and estimation methods, the results suggest that banks' NPL ratios exhibit strong serial correlation, with an estimated coefficient of the lagged dependent variable ranging between 0.6 and 0.9.

The results of the dynamic panel data model across all specifications underline that both macroeconomic indicators and bank-level variables play an important role in explaining the evolution of banks' NPL ratios. The real GDP growth rate, change in unemployment rate, and inflation rate have a considerable effect on NPLs. An economic slowdown raises unemployment and hampers debt servicing capacity, prompting a rise in NPLs. Higher inflation can similarly hurt debt servicing capacity as it weakens real income when wages are sticky. The VIX, exchange rate, and the Asian financial crisis dummy also have an important impact on the evolution of NPLs across banks in emerging Asia as greater global risk aversion and tighter financing conditions exacerbate a surge in distressed assets. Bank-specific factors have a statistically significant, though relatively small, effect on the buildup of credit risk. In particular, a lower equity-to-asset ratio, signifying lower capital, is associated with higher NPLs. The loans-to-deposit ratio—a measure of bank liquidity—and past excessive lending, as captured by lagged loans growth, are similarly associated with an increase in credit risk. On the other hand, increasing return on equity, signifying higher bank profitability, reduces NPLs (table).

Estimation Results Dynamic Panel Regression

VARIABLES	
Nonperforming loans (lagged)	0.697***
Macroeconomic variables	
Unemployment rate	0.129***
Inflation rate (lagged)	0.010**
Exchange rate (lagged)	0.000
Real GDP growth rate (lagged)	−0.017***
Volatility index	0.006***
Asian financial crisis (dummy)	0.383***

Bank-level variables	
Equity-to-assets ratio (lagged)	−0.005
Return on equity (lagged)	−0.002*
Loans-to-deposits ratio (lagged)	0.001***
Loans growth rate (twice lagged)	0.0004***

GDP = gross domestic product.
Note: Results reflect fixed effects estimation. The dependent variable is the logit transformation of the NPL ratio. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.
Source: Lee, J., and P. Rosenkranz. 2019, Nonperforming Loans in Asia: Determinants and Macrofinancial Linkages, ADB Economics Working Paper Series No. 574.

Unlike these studies, Balgova, Plekhanov, and Skrzypińska (2017) evaluate the effectiveness of NPL policy measures by focusing on episodes of sharp reductions in NPL ratios. Estimating a two-part model, they investigate if policy measures such as establishing public AMCs, injecting public funds, adopting macroprudential regulations, and loosening criteria for NPL recognition reduce overall NPL ratios. They find that the introduction of AMCs is more effective than bank recapitalization in reducing NPL ratios, but that AMCs are more effective in reducing NPL ratios when used alongside bank recapitalization.

Balgova, Plekhanov, and Skrzypińska (2017) also measure the macrofinancial effects of NPL reduction policies by estimating the average treatment effect on the treated. They use the episodes of sharp drops in NPL ratios as the treatment group and the episodes of persistently high NPLs as the control group. Using propensity score matching analysis, they find that sharp reductions in NPL ratios lead to extra growth (in per capita GDP) in excess of 1.5 percentage points a year over several years.

By contrast, other empirical studies measuring the macrofinancial effects of NPLs investigate impulse response functions estimated from panel vector autoregressive (VAR) models. Panel VAR models are used to avoid the simultaneity problem arising from NPLs and macrofinancial variables affecting each other. These studies try to estimate the macrofinancial effects of NPLs in different groups of countries: Espinoza and Prasad (2010) in the Gulf Cooperation Council countries; Nkusu (2011) in advanced economies; De Bock and Demyanets (2012) in emerging economies; Klein (2013) in the Central, Eastern, and Southeastern European countries; and Lee and Rosenkranz (2019) in the emerging economies in Asia. These studies find that the rise in NPL ratios has strong, albeit short, negative effects on macrofinancial variables such as growth, unemployment, and credit expansion.

3.3 Nonperforming Loan Data and Reduction Episodes

3.3.1 The New Nonperforming Loan Dataset

We construct a country-level panel dataset of NPL ratios using bank-level data from S&P Global Market Intelligence, which is the new name of SNL Financials after its merger with S&P Capital IQ. S&P provides access to about 200 items from the financial statements of banks. It is regarded as an alternative to BankScope, which is now called Orbis Bank Focus.

The continuity of the BankScope data was not ensured when BankScope was rebranded. The new NPL dataset constructed may be regarded as an alternative to the NPL ratio available from the International Monetary Fund (IMF) Financial Soundness Indicators.

Since the S&P database provides information on NPLs at the bank-level only, the analysis computes the NPL ratio of a country by aggregating the NPLs of all the banks belonging to the country. One of the problems with constructing country-level data from bank-level data is that not all banks belonging to a country are covered by the data source. Although the S&P data covers banks across 192 countries, its coverage of individual banks differs significantly across countries and sometimes across years. As a result, only the countries where the S&P database covers at least 25% of the total assets of the entire banking sector of the country are selected. The data for the total amount of assets of the banking sector are collected from the IMF International Financial Statistics. This selection criterion leaves us with 76 countries.

3.3.2 Episodes of Nonperforming Loan Reduction

We focus on two types of episodes—NPL reductions and rises. Adapting the operational definition of an NPL reduction episode used by Balgova, Plekhanov, and Skrzypińska (2017), this analysis defines it as a period of consecutive drops in the NPL ratio, with the cumulative reduction exceeding 6 percentage points.[2] Sometimes, such a period is interrupted by a short and small rise in the NPL ratio and, thus, such a rise is not regarded as an interruption in the episode so long as it is limited to a single year and involves a relatively small rise—that is, less than a 1.6-percentage-point increase in the NPL ratio. Likewise, an NPL rise episode is defined as a period of consecutive rises in the NPL ratio with the cumulative rise exceeding 6 percentage points. These operational definitions allow us to identify 41 episodes of NPL reduction and 47 of rise from the newly constructed dataset of NPL ratios.

Among the 41 episodes of NPL reduction, 24 start with a more than 4-percentage-point drop in the NPL ratio in a single year, which this analysis calls a sharp drop in the NPL ratio.[3] Among the 47 NPL rise episodes,

[2] Balgova, Plekhanov, and Skrzypińska (2017) use the criterion of a cumulative reduction of the NPL ratio exceeding 7 percentage points. Use of this criterion does not affect the results of this chapter significantly.

[3] Balgova, Plekhanov, and Skrzypińska (2017) use the criterion of a more than 5-percentage-point drop. In order to increase the number of episodes of sharp drops, we adopt the criterion of a more than 4-percentage-point drop.

22 start with a sharp rise in the NPL ratio. Therefore, more than half of the episodes of NPL reduction and NPL rise start with a year of sharp movement in the NPL ratio, although more so for an episode of NPL reduction. This motivates us to focus on episodes of sharp drops in the NPL ratio to explore the determinants of the NPL ratio and to evaluate the effectiveness of NPL resolution policy measures. Figure 3.1 shows the movement of the NPL ratio for the 24 episodes of NPL reduction starting with a sharp drop in the NPL ratio.

3.4 Determinants of Sharp Movements in Nonperforming Loan Ratios

Before proceeding to analyze the determinants of sharp movements in the NPL ratio, the analysis starts by estimating a linear panel regression model:

$$\Delta NPL_{c,t} = \alpha + \beta \Delta NPL_{c,t-1} + \mu \boldsymbol{X}_{c,t} + \theta \boldsymbol{Frame}_{c,t} + v_{c,t} \qquad (3.1)$$

In this equation, $\Delta NPL_{c,t}$ denotes the change in the NPL ratio of country c in year t. $\boldsymbol{X}$ is a vector of control variables which consists of country-specific macroeconomic variables and global macroeconomic variables. Country-specific macroeconomic variables include real GDP growth rate, inflation rate, rate of change in exchange rate, and rate of change in real estate prices. Global macroeconomic variables include the volatility index (VIX), rate of change in global commodity prices, and a global financial crisis (GFC) dummy.

Since the debt servicing capability of borrowers is positively affected by higher economic growth and lower inflation, the growth and inflation rates are expected to have a negative coefficient and a positive coefficient, respectively. The change in real estate prices may have opposite effects on NPLs. On one hand, property market booms are expected to enhance the debt servicing ability of borrowers. On the other, they may deteriorate the quality of loans as loan screening criteria become looser during property booms. A sharp currency depreciation is expected to increase the amount of NPLs in countries that rely heavily on external debt, as currency depreciation increases the debt service burden of foreign currency-denominated loans. Since exchange rates are expressed in units of local currency per US dollar, a positive value for the rate of change in the exchange rate implies a currency depreciation. Thus, the coefficient of this variable is expected to be positive.

Figure 3.1: Episodes of NPL Reduction Starting with a Sharp Drop in the NPL Ratio

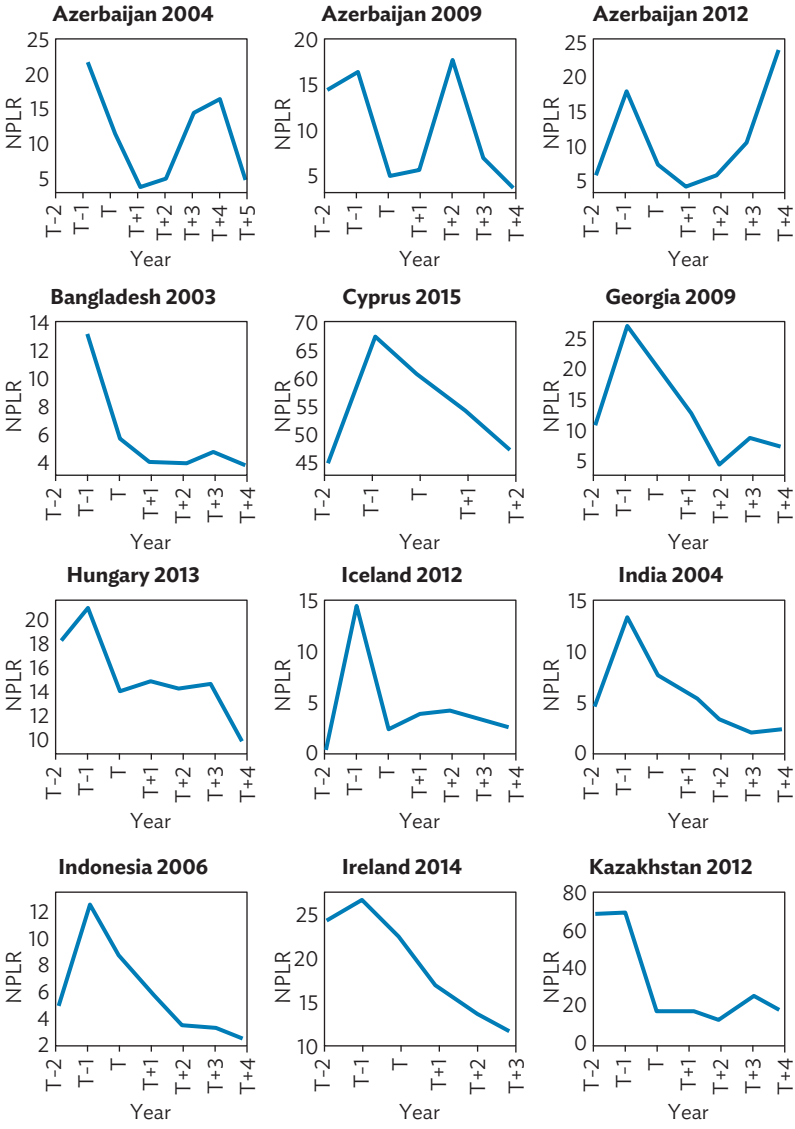

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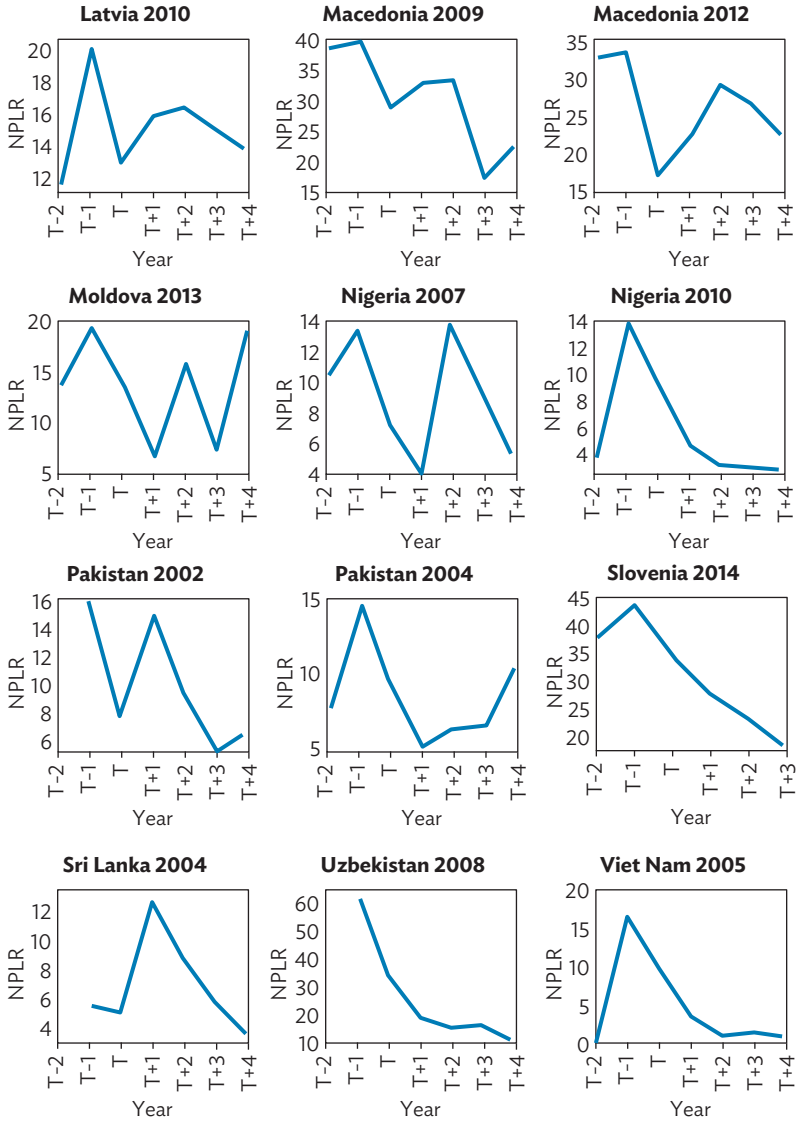
Figure 3.1 (continued)



NPL = nonperforming loan, NPLR = nonperforming loan ratio.
Source: Authors' calculations using data from Standard & Poor's Global Market Intelligence (accessed August 2018).

The VIX represents market volatility and risk attitude in global financial markets. Higher financial market volatility makes it harder for borrowers with high risk profiles to have their loans rolled over. As a result, the coefficient of the VIX is expected to be positive. The GFC dummy takes a value of 1 for 2008 and 2009, and 0 otherwise, and is expected to have a positive sign. Changes in commodity prices are expected to have different effects on the loan quality of countries depending on whether these are commodity exporters or importers. Lower commodity prices will negatively affect commodity exporting countries, raising their NPL ratios.

Frame is a vector of policy dummy variables which takes a value of 1 if the corresponding NPL resolution framework was in operation during the year. We consider the existence of public AMCs, injection of public bailout funds, and strengthening of macroprudential regulations as NPL resolution policy measures. Data on public AMCs is available from the Building Better Bad Banks project by Hallerberg and Gandrud (2015). The database contains information on 139 cases of AMCs across 62 countries during 1996–2016. The data on financial sector bailouts is taken from Bova et al. (2016). The database includes 95 cases of financial sector bailouts across 66 countries. The macroprudential policy dummy takes a value of 1 if the macroprudential policy on banks is strengthened. The data is available from Cerutti, Claessens, and Laeven (2015).

Table 3.1 presents the description and data source for the variables included in equation (3.1). Table 3.2 presents the descriptive statistics for these variables. The NPL ratio data themselves are an unbalanced panel. The explanatory variables are collected from different data sources and their sample coverage differs with data availability. Table 3.3 displays the results of panel unit root tests. Both tests strongly reject the existence of a unit root for all the variables tested.

Table 3.1: Variables and Data Source

Variable	Description	Frequency	Source
Change in NPL ratio	Change in ratio of NPLs over total loans	Yearly	Standard & Poor's Global Market Intelligence
Growth rate	Real GDP annual growth rate	Yearly	World Bank World Development Indicators
Inflation rate	Commodity price index annual growth rate	Yearly	World Bank World Development Indicators
Rate of change in exchange rate	Rate of change of local currency/US dollar	Yearly	CEIC
Rate of change in real estate prices	Rate of change of housing price index	Yearly	CEIC
Volatility Index (VIX)	Chicago Board Options Exchange Volatility Index	Yearly	Bloomberg
Rate of change in global commodity price	Primary commodity prices	Yearly	International Monetary Fund
Existence of public AMCs	= 1 if a public AMC is in operation either at t, t-1, or t-2	Yearly	Assigned
Injection of public bailout funds	= 1 if a bailout exists either at t, t-1, or t-2	Yearly	Assigned
Macroprudential policy	= 1 if a positive change in macroprudential policy index occurs at t, t-1, or t-2	Yearly	Assigned

AMC = asset management company, GDP = gross domestic product, NPL = nonperforming loan.
Source: Authors' compilation.

Table 3.2: Descriptive Statistics

Statistic	Mean	S.D.	Min	Max	Observations
NPL ratio (%)	6.072	0.966	0.002	94.480	1,104
ΔNPL ratio (%)	0.273	4.579	-52.252	72.431	1,104
Growth rate (%)	3.534	3.893	-14.814	34.500	1,104
Inflation rate (%)	4.677	5.472	-4.470	59.220	1,090
Exchange rate (%)	2.967	15.713	-28.751	232.166	1,104
Property price (%)	4.362	7.453	-29.302	43.345	500
Commodity price (%)	5.129	18.418	-31.886	26.328	1,104
VIX	19.382	6.460	11.090	32.693	1,104
AMC dummy	0.568	0.496	0	1	621
Bailout dummy	0.145	0.352	0	1	801

AMC = asset management company, NPL = nonperforming loan, S.D. = standard deviation, VIX = volatility index.
Sources: Authors' calculations using data from Bloomberg; Bova et al. (2016); CEIC database; Hallerberg and Gandrud (2015); International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

Table 3.3: Panel Unit Root Tests
(Fisher-type unit root test)

Variable	Fisher-ADF	Fisher-PP
NPL ratio	399.99***	336.04***
Change in NPL ratio	502.24***	1149.10***
Real GDP growth	472.18***	520.76***
Inflation	400.37***	591.15***
Change in exchange rate	438.56***	788.94***
Loan growth rate	314.26***	528.34***
Change in house prices	142.98***	211.05***
VIX	233.55***	138.97***
Change in price index	268.71***	597.53***

ADF = Augmented Dickey Fuller, GDP = gross domestic product, NPL = nonperforming loan, PP = Phillips-Perron, VIX = volatility index.
Notes: *** = significant at 0.1%. Empirical results have been derived using Stata 15 software. Reported unit root tests were conducted with one lag.
Sources: Authors' calculations using data from Bloomberg; CEIC database; International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

Since the lagged dependent variable is included as one of the explanatory variables in equation (3.1), the model to be estimated is a dynamic panel model. To get a consistent estimate for this dynamical panel model, this analysis uses the generalized method of moments (GMM) estimator suggested by Arellano and Bond (1991). Table 3.4 shows the estimation results for various model specifications. The results for model 1 show that only the growth rate and VIX are significant in explaining the change in the NPL ratio. In addition, the sign of the coefficient estimates is consistent with the theoretical prediction: higher growth rate helps lower NPL ratios, while higher volatility in international financial markets tends to raise NPL ratios. Other variables, such as the inflation rate, the rate of currency depreciation, and the rate of change in commodity prices that usually display significance in explaining the level of NPL ratios in previous empirical literature, fail to demonstrate significance in explaining the change in NPL ratios. Meanwhile, the coefficient of the lagged dependent variable is negative, implying that a year of a large rise (drop) in the NPL ratio is likely to be followed by a year of drop (rise) in the NPL ratio.

Table 3.4: Dynamic Panel Regression Models

Variable	(1)	(2)	(3)	(4)
ΔNPL(t-1)	-0.0724** (-2.07)	-0.0152 (-0.31)	-0.0716** (2.04)	-0.0051 (-0.10)
Growth	-0.1124** (-2.40)	-0.0927** (-2.39)	-0.1178** (-2.48)	-0.2958** (-3.78)
Inflation	0.0436 (0.98)	0.2599** (4.69)	0.0373 (0.83)	-0.0360 (-0.58)
Exchange rate change	0.0017 (0.16)	0.0001 (0.01)	0.0019 (0.19)	-0.0087 (-0.65)
Property		-0.0221 (-1.37)		
Commodity	-0.0083 (-0.99)	-0.0017 (-1.27)	-0.0063 (-0.72)	0.0057 (0.49)
VIX	0.1029** (4.04)	0.0677** (3.95)	0.0696* (1.78)	0.1256** (3.62)
Global financial crisis			0.7271 (0.96)	
AMC				-1.8328** (-2.40)
Sample	902	418	902	521

AMC = asset management company, NPL = nonperforming loan, VIX = volatility index.
Note: ** = significant at 1%, * = significant at 5%.
Sources: Authors' calculations using data from Bloomberg; CEIC database; Hallerberg and Gandrud (2015); International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

In their analysis of determinants of NPLs in Asia, Lee and Rosenkranz (2019) find that both macroeconomic and bank-specific variables play an important role in explaining the evolution of banks' NPL ratios in Asia, which tend to be persistent in their levels (Box 3.1). Lower output growth, higher unemployment, and increased inflation are found to be associated with an elevation in NPLs. Greater global risk aversion, tighter financing conditions, and financial crises also contribute to a buildup in distressed assets. In addition, bank-specific factors are found to have a statistically significant, albeit relatively small effect in increasing credit risk. Lower bank profitability, reduced capital, and past excessive lending are associated with elevated credit risk. The present analysis reinforces the findings of Lee and Rosenkranz (2019) on the effect of output growth, inflation, and global risk aversion to credit risk.

Model 2 adds the change in property prices as an explanatory variable. The result is similar to that of model 1, except that the coefficient of inflation rate is significantly positive. Meanwhile, property prices do not affect NPL ratios significantly. As can be seen from the sample size, adding the variable of

the rate of change in property prices not only changes the set of explanatory variables, but also changes the sample group. This is because the data for property prices is available only for about half of the entire sample. In model 3, the GFC dummy is added as an explanatory variable, but the result is similar to that of model 1. The GFC dummy is not significant either. It seems that the global financial crisis is taken care of by the VIX variable, as this increased sharply during that crisis.

Finally, model 4 includes the AMC dummy as an explanatory variable. A significantly negative coefficient for the AMC variable would imply the effectiveness of public AMCs in preventing the acceleration of NPL accumulation or in reducing NPLs. The estimated coefficient is significantly negative, implying that public AMCs are effective in keeping NPL ratios from rising. We also included dummy variables for public bailout funds and strengthening macroprudential regulation, but none of these variables are significant. The results of models 3 and 4 also demonstrate that currency depreciation does not have a significant effect on the NPL ratio, which is also the case in models 1 and 2.

3.4.1 Episodes of a Sharp Rise in the Nonperforming Loan Ratio

Next, the chapter looks into the determinants of a sharp rise in the NPL ratio. Investigating the factors responsible for sharp rises in the NPL ratio is of interest because economic crises, including financial and currency crises, are usually associated with a sharp rise in the NPL ratio. For this reason, this analysis looks at whether focusing on sharp movements in NPL ratio makes any difference in identifying the source of change in the NPL ratio. To focus on the determinants of a sharp rise in the NPL ratio, the following panel probit model is estimated:

$$P(SRL_{c,t}=1)= \Phi(\alpha + \beta \Delta NPL_{c,t-1} + \mu \boldsymbol{X}_{c,t} + \gamma \boldsymbol{Frame}_{c,t}) \qquad (3.2)$$

In equation (3.2), $SRL_{c,t}$ is a dummy variable that takes the value of 1 if a sharp rise in the NPL ratio occurs during year t in country c, and 0 otherwise. A sharp rise in the NPL ratio is defined as a more than 4-percentage-point rise in the NPL ratio in a given year. Other variables included in equation (3.2) are the same as those included in equation (3.1). The probit model is estimated with random effects and Table 3.5 presents results.

In Table 3.5, models 1 and 2 are estimated without the AMC dummy and models 3 and 4 with the AMC dummy. Models 1 and 3 are estimated with the lagged dependent variable as an explanatory variable, which is replaced by the lagged value of the NPL ratio in models 2 and 4. A major difference between the results of the dynamic panel model and those of the panel probit model is the significance of the effect of currency depreciation on the change in the NPL ratio. The estimates in Table 3.5 consistently demonstrate that a larger currency depreciation increases the possibility of a sharp rise in the NPL ratio. The results also support the general view that stronger growth lowers the possibility of a sharp rise in the NPL ratio. As for the global variables, VIX has a significant positive effect on NPL ratios, implying that larger volatility and lower risk appetite in global financial markets raise the possibility of a sharp rise in the NPL ratio. Changes in commodity prices, however, do not have a significant effect on this possibility. In conclusion, it is found that there is a difference between the determinants of a sharp rise in the NPL ratio and the determinants of changes in the NPL ratio. In particular, currency depreciation and global financial market volatility turn out to be key macroeconomic variables that explain sharp rises in the NPL ratio.

Table 3.5: Determinants of Sharp Rises in the NPL Ratio

Variable	(1)	(2)	(3)	(4)
ΔNPL(t-1)	0.1490 (1.04)		0.0150 (1.04)	
NPL(t-1)		0.0215** (2.37)		0.0169 (0.92)
Growth	-0.0248 (-1.45)	-0.0129 (-0.84)	-0.0246* (-1.79)	-0.0503* (-1.63)
Inflation	0.0229* (1.85)	0.2169** (2.19)	0.0235* (1.89)	0.0074 (0.38)
Exchange rate	0.0078** (2.17)	0.0068** (2.14)	0.0076** (2.16)	0.0081** (2.01)
Commodity	-0.0021 (-0.54)	0.0009 (0.24)	-0.0021 (-0.51)	0.0013 (0.27)
VIX	0.0242** (2.00)	0.0284** (2,71)	0.0243** (2.00)	0.0360** (2.44)
AMC			0.0652 (0.29)	0.0024 (0.01)
Constant	-2.5474** (-8.03)	-2.5432** (-9.89)	-2.5751 (-7.73)	-2.5441** (-6.40)
Sample	983	1,064	983	1,064

AMC = asset management company, NPL = nonperforming loan, VIX = volatility index.
Note: ** = significant at 1%, * = significant at 5%.
Sources: Authors' calculations using data from Bloomberg; Hallerberg and Gandrud (2015); International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

As for NPL resolution policies, the coefficient of the AMC dummy is not significantly different from 0, meaning that public AMCs are not effective in preventing a sharp rise in the NPL ratio. We also estimated a model with the AMC dummy replaced by the public bailout dummy and the macroprudential regulation dummy, neither of which was significant.

3.4.2 Sharp Drops in the Nonperforming Loan Ratio

While it is possible that the factors that proved significant in explaining movements of the NPL ratio can explain these sharp movements as well, it is also possible that not all these factors explain sharp movements in NPL ratios. Other factors may even be responsible for these sharp movements. As a matter of fact, estimation of the probit model for sharp rises in the NPL ratio demonstrates that the macroeconomic variables that have significant effects on sharp rises in the NPL ratio are somewhat different from those that are significant in explaining general movements in NPL ratios. To see if this is also the case with sharp drops in the NPL ratio, the probit model for sharp drops in the NPL ratio is estimated and the results are presented in Tables 3.6 and 3.7.

Table 3.6: Determinants of Sharp Drops in the NPL Ratio: Models 1–4

Variable	(1)	(2)	(3)	(4)
ΔNPL(t-1)	0.0452**	0.0256	0.0406**	0.0446**
	(3.07)	(1.13)	(2.30)	(3.05)
Growth	0.0505**	0.0371**	0.0488**	0.0507**
	(2.36)	(2.25)	(2.02)	(2.35)
Inflation	-0.0395	0.0290	-0.0622*	-0.0305
	(-1.56)	(1.32)	(-1.75)	(-1.27)
Exchange rate	0.0048	-0.0017		
	(0.93)	(-0.18)		
Commodity	0.0057			
	(1.19)			
VIX	-0.0432**	-0.0638**	-0.0580**	-0.0403**
	(-2.56)	(-2.43)	(-2.47)	(-2.42)
AMC		0.9037**		
		(2.54)		
Bailout			0.1572	
			(0.44)	
MPP				-0.1226
				(-0.66)
Constant	-1.4411**	-2.1508**	-1.1151**	-1.4076**
	(-4.06)	(-3.56)	(-2.41)	(-3.84)
Sample	983	560	737	957

AMC = asset management company, MPP = macroprudential policy, NPL = nonperforming loan, VIX = volatility index.
Note: ** = significant at 1%, * = significant at 5%.
Sources: Authors' calculations using data from Bloomberg; Bova et al. (2016); CEIC database; Cerutti, Claessens, and Laeven (2015); Hallerberg and Gandrud (2015); International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

Table 3.7: Determinants of Sharp Drops in the NPL Ratio: Models 5–7

Variable	(5)	(6)	(7)
ΔNPL(t-1)	0.0235 (0.91)	0.0238 (0.95)	0.02558 (1.11)
Growth	0.0710 (1.60)	0.0518 (1.24)	0.0802** (2.16)
Inflation	0.0273 (1.13)	0.0272 (1.15)	0.0338 (1.42)
VIX	-0.0661* (-1.84)	-0.0782** (-2.20)	-0.0689** (-2.50)
AMC	0.9112** (2.05)	0.7377* (1.66)	0.8648** (2.08)
Bailout	-0.4747 (-0.80)	-0.6124 (-0.99)	
MPP	0.1242 (0.37)		-0.4582 (-0.79)
AMC*Bailout		0.5578 (1.29)	
AMC*MPP			0.2740 (0.41)
Constant	-2.2274** (-2.71)	-1.8240** (-2.50)	-1.9252** (-3.08)
Sample	494	516	538

AMC = asset management company, MPP = macroprudential policy, NPL = nonperforming loan, VIX = volatility index.
Note: ** = significant at 1%, * = significant at 5%.
Sources: Authors' calculations using data from Bloomberg; Bova et al. (2016); Cerutti, Claessens, and Laeven (2015); Hallerberg and Gandrud (2015); Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

$$P(SDL_{c,t}=1)=\Phi(\alpha+\beta\Delta NPL_{c,t-1}+\mu \boldsymbol{X}_{c,t}+\gamma \boldsymbol{Frame}_{c,t}) \qquad (3.3)$$

$SDL_{c,t}$ is a dummy variable that takes 1 if a sharp drop in the NPL ratio occurs during year t in country c and 0 otherwise. A sharp drop in the NPL ratio is defined as a more than 4-percentage-point drop in a given a year.

Model 1 is estimated with only macroeconomic variables as explanatory variables. The results show that higher growth raises the possibility of a sharp drop in the NPL ratio. Unlike the results for the panel regression model and the probit model for sharp rises in the NPL ratio, however, the rate of currency depreciation does not have any significant effects on the possibility of a sharp drop in the NPL ratio. The coefficient of VIX, however, is significantly negative, implying that stability in global financial markets is a key factor in sharp drops in the NPL ratios.

Models 2, 3, and 4 add each of the three NPL policy dummy variables: namely the public AMC dummy, the public bailout dummy, and the macroprudential regulation dummy, to the set of explanatory variables to examine the effectiveness of NPL resolution policies. The coefficient of the AMC dummy in model 2 is significantly positive, implying that public AMCs are helpful in achieving a sharp drop in the NPL ratio. Neither of the other policies, injection of public bailout funds and strengthening macroprudential regulations, however, significantly affects the possibility of achieving a sharp drop in the NPL ratio. Model 5 includes all three policy dummies as explanatory variables. It turns out that only the coefficient of the public AMC dummy is significantly positive.

Model 6 adds the interaction term between the AMC dummy and the public bailout dummy as an explanatory variable. A significantly positive value for this interaction term would imply that it is more likely for policy makers to reduce NPL ratios by implementing both policy measures together rather than adopting each of the policy measures separately. Balgova, Plekhanov, and Skrzypińska (2017) find that public AMCs are more effective in reducing NPL ratios when they are used with public bailout funds. It turns out that although the coefficient of the interaction term is positive, it is not significantly different from 0. Model 7 adds the interaction term between the AMC dummy and the macroprudential policy dummy, but the coefficient is not significantly different from 0 either.

The empirical finding that the public AMC dummy is the only NPL policy variable that consistently demonstrates significance in all of the model specifications should be interpreted with care. As a matter of fact, the result that establishing a public AMC significantly raises the possibility is not surprising. It is because it is the function of public AMCs to acquire NPLs from banks and thereby remove NPLs from banks' balance sheets. The empirical results in Tables 3.6 and 3.7 confirm the belief in this study that public AMCs have been utilized by countries to resolve a large amount of NPLs from banks' balance sheets and they were able to achieve this goal to a certain degree.

A more important question is whether lowering the NPL ratio by removing NPLs from bank balance sheets is effective in significantly improving macrofinancial performance. This will be examined in the next section.

3.5 Evaluating the Macrofinancial Effects of Nonperforming Loan Reduction

Estimation of the probit models for sharp drops in the NPL ratio demonstrates that public AMCs can be effective in sharply lowering NPL ratios in countries suffering from severe and consistent NPL problems. Given the finding that NPL resolution policies are capable of achieving a sharp drop in the NPL ratio of the banking sector of an economy, it is asked whether an NPL reduction can improve the macrofinancial performance of an economy. Following Balgova, Plekhanov, and Skrzypińska (2017), the analysis looks for the answer by estimating the average treatment effect on the treated (ATET). As equation (3.4) shows, the ATET is defined as the expected difference between the observed outcomes in the treatment group (Y_{1i}) and the counterfactual economic outcomes that would have occurred in the treatment group in the absence of treatment (Y_{0i}).

$$\text{ATET} = E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 1] \qquad (3.4)$$

The first term in equation (3.4) is the average change in the NPL ratio in the treatment group, which is an observable quantity from the sample. Since the second term is not observable, the analysis selects episodes from the control group that closely match an episode in the treatment group. In this study, episodes of NPL reduction starting with a sharp drop in the NPL ratio, are regarded as the treatment group, and episodes with persistently high NPL ratios as the control group. We define a sharp drop in the NPL ratio as a more than 4-percentage-point drop in the NPL ratio in a single year, and a persistently high NPL ratio as one higher than 6 percentage points persisting for at least 3 consecutive years. Note that this study uses achievement of a sharp drop in the NPL ratio rather than adoption of a certain policy measure as the criterion for the treatment group. Thus, the analysis implicitly assumes that the episodes of NPL reduction starting with a sharp drop in the NPL ratio are achieved by implementation of NPL resolution measures, including introduction of public AMCs.

The selection of matching episodes from the control group is based on the estimated propensity of an episode in the control group to belong to the treatment group conditional on a set of economic characteristics. We consider different sets of economic characteristics, including GDP growth rate and inflation rate during the year of the sharp drop. In various other specifications, the analysis also matches per capita GDP at purchasing power parity, GDP growth rate during the year preceding the sharp drop, public debt-to-GDP ratio, investment-to-GDP ratio, and unemployment rate. This study focuses on two macroeconomic outcomes (GDP growth

rate and unemployment rate) and two financial outcomes (rate of currency depreciation and credit creation effect measured by change in money supply [M2] as a fraction of GDP).

Table 3.8 presents the estimates of the average treatment effect on the treated for 4 years after a sharp drop in the NPL ratio. Thus, year 0 is the year in which a sharp drop in the NPL ratio occurs. As the table shows, estimates for the average treatment effect display improved macroeconomic performance in higher GDP growth and lower unemployment rates during the 4 years after the treatment, although significant improvement in the growth rate is only visible during the first 2 years. The estimates for the average treatment effect also demonstrate that sharp drops in NPL ratio through NPL resolution policies have positive feedback effects on financial variables. In particular, sharp currency appreciation (a sharp drop in the exchange rate) and larger increase in the M2/GDP ratio are achieved. A higher value for M2/GDP may imply more active credit creation by banks. These positive feedback effects, however, do not last long.

Table 3.8: Average Treatment Effect on the Treated

Variable/Effect	Year 1	Year 2	Year 3	Year 4
GDP growth rate	2.4564**	2.3006*	1.4371	-0.1777
	(0.9517)	(1.2664)	(1.3342)	(1.0323)
Unemployment rate	-1.1434*	-1.3694*	-2.1099*	-0.9036
	(0.6940)	(0.7613)	(1.1936)	(1.3655)
Exchange rate change	-13.2709*	-4.8804*	0.8324	11.5421*
	(6.8998)	(2.8478)	(3.5748)	(6.5404)
Change of M2/GDP	1.1449	1.5218**	0.0499	0.5988
	(2.2919)	(0.7437)	(1.5199)	(1.0895)
Control	40	40	37	34
Treated	37	37	35	31

GDP = gross domestic product, M2 = money supply.
Note: ** = significant at 1%, * = significant at 5%.
Sources: Authors' calculations using data from CEIC database; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

3.6 Macrofinancial Effects of Nonperforming Loans in Asia

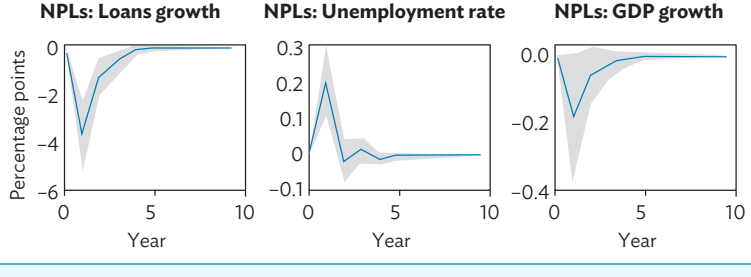
Lee and Rosenkranz (2019) find evidence supporting the existence of macrofinancial feedback effects of NPLs in Asia. In particular, they find that a buildup in NPLs prompts a contraction in loans growth, increase in unemployment, and reduction in output. The other direction of causality also holds as deteriorating macroeconomic conditions contribute to a buildup in distressed assets. Box 3.2 provides more detail.

Box 3.2: Assessing the Macrofinancial Feedback Effects of Nonperforming Loans in Asia

To investigate the macrofinancial feedback effects of nonperforming loans (NPLs) in Asia, Lee and Rosenkranz (2019) employ a panel vector autoregression (PVAR) model. The analysis uses panel data of economy-level macroeconomic indicators covering annual data for 1994–2014 for 32 countries, mostly in emerging Asia. The baseline model includes (i) change in the NPL ratio, (ii) year-on-year growth rate of loans, (iii) change in the unemployment rate, and (iv) change in the monetary policy rate. In an additional specification, the unemployment rate is replaced with GDP growth.

The results of the PVAR analysis illustrate how a buildup of NPLs can affect the real sector of the economy and spill over through macrofinancial feedback effects. In particular, an increase in NPLs leads to a reduction in credit supply, a rise in unemployment, and a slowdown in overall economic activity (figure). A one-standard-deviation shock in the NPL ratio would trigger a 0.18-percentage-point contraction in the GDP growth rate, about a 3.61-percentage-point decline in the loan growth rate, and a 0.21-percentage-point increase in unemployment after a year. The corresponding figures over 3 years are 0.1, 1.5, and 0.1 percentage points. In their analysis, they also find the results are, moreover, bidirectional as macroeconomic factors can simultaneously prompt changes in the NPL ratio. Greater GDP growth and credit supply decrease the NPL ratio, while tighter monetary policy and rising unemployment increase the NPL ratio.

Estimated Impulse Response Functions to a Shock in the NPL Ratio



GDP = gross domestic product, NPL = nonperforming loan.
Notes: The figures correspond to impulse responses to a one-standard-deviation shock in the NPL ratio. A one-standard-deviation shock to the NPL ratio is equal to 3.5 percentage points in the baseline model, and 3.1 percentage points in specification 2. 95% confidence intervals are generated by 5,000 Monte Carlo draws.

Source: Lee, J. and P. Rosenkranz. 2019. Nonperforming Loans in Asia: Determinants and Macrofinancial Linkages. *ADB Economics Working Paper Series.* No. 574. Manila.

We also assess the macrofinancial implications of NPLs and the effectiveness of NPL resolution policies focusing on Asian countries. The Asian panel constructed from the S&P data contains 18 countries: Armenia, Azerbaijan, Bangladesh, the People's Republic of China, Georgia, India, Indonesia, Japan, Kazakhstan, the Republic of Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Uzbekistan, and Viet Nam. There are 23 cases of sharp drops in NPLs, and 12 out of these 23 cases are episodes of NPL reduction as defined in section 3.3.

We assess the determinants of sharp drops in NPLs by estimating a panel probit model and the results are presented in Table 3.9. Model 1 includes only macrofinancial variables as explanatory variables. The results are similar to those from the global panel. A sharp drop in the NPL ratio is more likely when the hike in the NPL ratio during the previous year is larger or when the global financial market is less volatile. The growth rate, however, is not significant, implying that higher growth does not increase the possibility of achieving a sharp drop in the NPL ratio.

Table 3.9: Determinants of Sharp Drops in the NPL Ratio: Asian Countries

Variable	(1)	(2)	(3)	(4)
ΔNPL(t-1)	0.0824 (2.96)	0.0616 (1.46)	0.0808** (2.37)	0.7223** (2.91)
Growth	0.0380 (0.96)	-0.0122 (-0.10)	0.0585 (1.26)	0.0350 (0.86)
Inflation	0.0408 (0.87)	0.2145** (2.79)	-0.0009 (-0.01)	0.0318 (0.66)
Exchange rate	-0.0144 (-0.69)	0.0107 (0.53)	-0.0109 (-0.51)	-0.0180 (-0.74)
Commodity	-0.0016 (-0.14)	-0.0074 (-0.34)	-0.0029 (-0.21)	-0.0001 (-0.01)
VIX	-0.0547* (-1.91)	-0.2047** (-2.51)	-0.0904* (-1.92)	-0.0530* (-1.79)
AMC		0.7013 (1.16)		
Bailout			-0.1893 (-0.23)	
MPP				-0.1812 (-0.52)
Constant	-1.1649** (-2.05)	-0.1903 (-0.16)	-0.5721 (-0.66)	-1.1313* (-1.81)
Sample	227	139	158	957

AMC = asset management company, MPP = macroprudential policy, NPL = nonperforming loan, VIX = volatility index.
Note: ** = significant at 5%, * = significant at 10%.
Sources: Authors' calculations using data from Bloomberg; Bova et al. (2016); CEIC database; Cerutti, Claessens, and Laeven (2015); Hallerberg and Gandrud (2015); International Monetary Fund; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

Models 2, 3, and 4 examine the effectiveness of three policy measures—public AMCs, injection of public bailout funds, and strengthening macroprudential regulations—by adding policy dummies one by one. It turns out that none of these NPL policy measures were significant in achieving a sharp drop in the NPL ratio. While such a result may be interpreted to mean that these policy measures were not effective in reducing NPLs in Asia, it is also noted that these policy measures have not been actively adopted by Asian countries experiencing NPL problems. For example, public AMCs existed in only 5 of 23 cases of sharp drops in NPL ratios. Only one case was accompanied by injection of public bailout funds and seven cases were accompanied by strengthening of macroprudential regulations.

To see if a sharp reduction in the NPL ratio has been effective in improving the macrofinancial performance of Asian economies, Table 3.10 shows the average treatment effect on the treated estimated using the Asian panel. As can be seen from the table, the average treatment effect displays improved macrofinancial performance in the event of a higher growth rate, currency appreciation, and stronger credit creation, which is also the case with the global panel. Unlike the result from the global panel, however, the effect on unemployment rate is not significant. Although unemployment rate goes down during the 4 years after a sharp drop in the NPL ratio, it is not statistically significant. Although it cannot be identified what kinds of policy measures effectively reduced NPLs in Asian countries, it can be concluded that once a significant reduction in NPLs is achieved, this can improve the macrofinancial performance of the country.

Table 3.10: Average Treatment Effect on the Treated: Asian Countries

Variable/Effect	Year 1	Year 2	Year 3	Year 4
GDP growth rate	2.8392**	6.8319**	4.9166**	1.3269
	(1.3929)	(1.9194)	(2.3852)	(2.1913)
Unemployment rate	-0.7870	-0.1985	-0.7378	-0.9141
	(1.8653)	(1.5209)	(1.4824)	(1.8224)
Exchange rate change	-40.0811*	-7.9623**	-4.0174	11.5109
	(24.0658)	(2.4244)	(7.8140)	(10.3290)
Change of M2/GDP	1.1895	3.5332	3.1583*	2.8240**
	(1.3247)	(3.3450)	(1.8115)	(1.2230)
Control	11	11	11	10
Treated	14	14	13	13

GDP = gross domestic product, M2 = money supply.
Note: ** = significant at 5%, * = significant at 10%.
Sources: Authors' calculations using data from CEIC database; Standard & Poor's Global Market Intelligence; and World Bank World Development Indicators (accessed August 2018).

3.7 Conclusion

Previous empirical analyses point to the important role of both macroeconomic and bank-specific variables in driving NPLs. A deterioration in macroeconomic conditions—for example, indicated by a reduction in output growth, rise in unemployment, increase in inflation, and rise in global risk aversion—is associated with elevated credit risk. Factors influencing the risk-taking behavior of banks also play a role in a rise in distressed assets. Lower bank profitability, excessive past lending, and increased liquidity are associated with a higher NPL ratio.

Empirical evidence points to the effect of financial distress on the real economy, underlining the harmful macrofinancial feedback effects of NPLs. Analysis of the effectiveness of NPL resolution measures are therefore critical to ensuring financial stability and sustained economic growth.

This study therefore empirically evaluates the effectiveness of NPL resolution policy measures using a new NPL dataset constructed from bank-level data from S&P Global. The study focuses on episodes of sharp movements in NPL ratios because a large portion of NPL reduction episodes start with a year in which the NPL ratio drops sharply. Estimation of panel probit models reveals that while slower growth, sharper currency depreciation, and higher global financial market volatility are associated with sharp rises in NPL ratios, sharp drops in NPL ratios can be explained by faster growth and lower global financial market volatility. In particular, the empirical analysis consistently demonstrates that public AMCs can be an effective tool in achieving a sharp drop in NPL ratios and thus play a critical role in NPL resolution. Public AMCs, however, are not effective in preventing a sharp rise in NPL ratios, which implies that public AMCs are useful mostly as a crisis resolution measure.

The estimated average treatment effects on the treated underpin that a sharp drop in NPLs is associated with favorable macrofinancial effects, in line with Lee and Rosenkranz (2019), who examine Asian economies in particular. NPLs yield harmful macrofinancial feedback effects and a reduction in the NPL ratio leads to an amelioration of deteriorating macroeconomic conditions. We also undertake an empirical exercise focusing on Asian economies only. While the results are slightly less significant, they underpin the negative macrofinancial feedback effects associated with NPLs.

The significant effect of a buildup in credit risk on the real economy underlining the macrofinancial feedback effects of distressed assets calls for the swift and rapid adoption of NPL resolution measures. While this analysis suggests an effective role for public AMCs in reducing the size of NPLs, it remains important to strengthen national legal, regulatory, and supervisory frameworks and institutional capacities, as well as to build and develop a market for effectively addressing NPLs.

While the analysis abstracted from cross-border spillover effects, increasingly interlinked financial markets highlight possible spillovers and contagion from cross-border bank lending and rapid deterioration of bank asset qualities. This highlights the important role of regional cooperation to help identify and mitigate possible spillovers and cross-border contagion. Growing cross-border banking activities in Asia and the emergence of possibly systemically important regional banks further underpin the need for regional regulatory dialogue and cooperation, including cross-border resolution mechanisms.

References

Arellano, M. and S. Bond. 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*. 58 (2). pp. 277–297.

Ari, A., S. Chen, and L. Ratnovski. 2019. The Dynamics of Non-Performing Loans During Banking Crises: A New Database. *IMF Working Paper*. WP/19/272. Washington, DC: IMF.

Asian Development Bank (ADB). 2017. The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience? *Asian Economic Integration Report 2017.* Manila. pp. 96–136.

_____ 2018. Toward Optimal Provision of Regional Public Goods in Asia and the Pacific. *Asian Economic Integration Report 2018.* Manila. pp. 121–177.

Balgova, M., A. Plekhanov, and M. Skrzypińska. 2017. Reducing Non-Performing Loans: Stylized Facts and Economic Impact. Working Paper.

Bova, E., M. Ruiz-Arranz, F. Toscani, and H. Ture. 2016. The Fiscal Costs of Contingent Liabilities: A New Dataset. *IMF Working Paper*. Washington, DC: IMF.

Capiro, G. and D. Klingebiel. 1996. Bank Insolvencies: Cross-Country Experience. *World Bank Policy Research Working Paper*. No. 1620. Washington, DC: World Bank.

Cerutti, E., S. Claessens, and L. Laeven. 2015. The Use and Effectiveness of Macroprudential Policies: New Evidence. *IMF Working Paper*. WP/15/61. Washington, DC: IMF.

De Bock, R., and A. Demyanets. 2012. Bank Asset Quality in Emerging Markets: Determinants and Spillovers. *IMF Working Paper.* WP/12/71. Washington, DC: IMF.

Deloitte LLP. 2018. *Deloitte Deleveraging Asia 2018*.

Espinoza, R. and A. Prasad. 2010. Nonperforming Loans in the GCC Banking System and Their Macroeconomic Effects. *IMF Working Paper.* WP/10/224. Washington, DC: IMF.

French, K. and J. Poterba. 1991. Investor Diversification and International Equity Markets, *American Economic Review*. 81 (2). pp. 222–26.

Ha, V., L. Trien, and H. Diep. 2014. Macro Determinants of Non-Performing Loans and Stress Testing of Vietnamese Commercial Banks' Credit Risk. *VNU Journal of Science: Economics and Business*. 30 (5E). pp. 1–16.

Hallerberg, M., and C. Gandrud. 2015. *Building better bad banks: The Political Economy of Public Asset Management Companies for Resolving Financial Crises*. http://fgch.github.io/amc-site/.

Jassaud, N. and K. Kang. 2015. A Strategy for Developing a Market for Nonperforming Loans in Italy. *IMF Working Paper*. WP/15/24. Washington, DC: IMF.

Klein, N. 2013. Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. *IMF Working Paper*. WP/13/72. Washington, DC: IMF.

Lee, J. 2017. Regional Experience in Dealing with Distressed Assets in Asia. Mimeograph. Asian Development Bank.

Lee, J. andP. Rosenkranz. 2018. Case Studies on NPL Reduction Measures in the ASEAN+3 Region. Unpublished.

Lee, J. and P. Rosenkranz. 2019. Nonperforming Loans in Asia: Determinants and Macrofinancial Linkages. *ADB Economics Working Paper Series*. No. 574. Manila: ADB.

Martin, R. 2019. NPL Market Development – Challenges, Opportunities and Lessons from Europe. Presentation material.

Nkusu, M. 2011. Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies. *IMF Working Paper*. WP/11/161. Washington, DC: IMF.

Ozili, P. K. 2019. Non-Performing Loans and Financial Development: New Evidence. *Munich Personal RePEc Archive Paper*. No. 92338.

Park, C.Y. and K. Shin. 2017. A Contagion through Exposure to Foreign Banks during the Global Financial Crisis. *ADB Economics Working Paper*. No. 516. Manila: ADB.

Roy, S. 2014. Determinants of Nonperforming Assets in India-Panel Regression. *Eurasian Journal of Economics and Finance*. 2 (3). pp. 69–78.