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# Assessing the Effectiveness of Banking Sector Nonperforming Loan Resolution Policies and Measures

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# Outline

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1. Introduction
2. Related Literature
3. Data
4. Empirical Models and Estimation Results
5. Conclusions and Policy Recommendations

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# Introduction

# Motivation

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- Previous financial crises have demonstrated long-lasting negative impacts NPLs can have on financial stability and economic performance, as the effects of elevated NPL levels persist beyond crisis periods.
- Consequently, identification of policy options to effectively manage and respond to a buildup in NPLs has gained attention in recent years.
- Episodes of NPL reduction tend to start with a sharp drop in overall NPL ratio.
  - Balgova et al. (2017) observes that among 178 episodes of NPL reduction 143 cases (about 80%) began with a sharp drop in NPL ratio.
  - Such an observation allows us to focus on episodes of a sharp drop in NPL ratio to investigate the effectiveness of policy options and their macro-financial effects.

# Major Findings

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- This paper intends to identify the driving forces of episodes of sharp drops in the NPL ratio.
  - Employing a data set comprising macroeconomic and financial variables of 76 economies from 1996-2016, we assess the effectiveness of NPL resolution measures.
  - We thereby also aim to identify what policy measures of NPL resolution were effective in facilitating sharp drops in NPLs.
  - We find that not only favorable macroeconomic conditions, but also public Asset Management Companies significantly increase the probability of achieving a sharp drop in the NPL ratio.
  - Estimation of the dynamic panel model demonstrates that public AMCs are also effective in mitigating NPL accumulation.
  
- Estimation of the Average Treatment Effect of the Treated reveals that sharp drops in NPL ratio followed by NPL reduction episodes enhance real macroeconomic performance and favorably affect financial variables.

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# Related Literature

# Literature: Determinants and Effects of NPLs

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- Empirical studies on the determinants of NPLs and their economic effects
  - Espinosa and Prasad (2010): 80 banks in the GCC region
  - Nkusu (2011): 26 advanced economies for 1998-2009
  - De Bock and Demyanets (2012): 25 emerging economies
  - Klein (2013): 16 Central and Eastern and South-Eastern Europe
  - Lee and Rosenkranz (2018): 40 Asian economies
  
- Findings
  - Both macroeconomic and bank-level variables play a key role in explaining the evolution of banks' NPL ratios in Asia, which themselves have strong negative feedback effects on the economy.
  - Deteriorating macroeconomic conditions such as lower economic growth, higher unemployment rate, higher inflation rate, higher degree of currency depreciation, sudden reversals of portfolio flows, and higher global financial volatility tend to raise NPL ratios.

# Literature: Effectiveness of NPL Resolution Policies

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## ➤ **Balgova et al. (2017)**

- Using a comprehensive NPL database covering 190 countries over 27 years, explore the determinants of change in NPL ratio focusing on the events of sharp drop in NPLs,
- Explore the effectiveness several NPL resolution measures,
- Find that introduction of public AMCs is effective in reducing NPLs but that AMCs are more effective in reducing NPL ratios when they are used together with bank recapitalization, and
- Find that sharp reductions in NPL ratios are associated with extra growth in excess of 1.5 percentage points per year over several years.

## ➤ **Ari et al. (2019)**

- Using a new dataset of NPLs during 88 banking crises since 1990, find that pre-crisis NPL problems and the severity of post-crisis recessions are closely related and thus call for reducing pre-crisis vulnerabilities and quickly addressing NPL problems during a crisis are vital for post-crisis output recovery.

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# Data

## ➤ NPL ratios

- Bank-level NPL data collected from S&P was aggregated to construct the country-level NPL ratios
- Countries are included if the banks in the S&P database cover at least 25% of the total assets of the entire banking sector
- Out of 192 countries, only 76 countries meet this criterion. Of the 76 countries, 20 countries are located in Asia and the Pacific\*

## ➤ AMC dummy variable

- = 1 if a public AMC is in operation either at  $t$ ,  $t-1$ , or  $t-2$
- 6 countries in Asia-Pacific have public AMCs
- from Building Better Bad Banks project by Hallerberg and Gandrud (2015) which documents 139 cases of AMCs across 62 countries during the period 1996-2017

# Episodes of NPL Reduction and Rise

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## ➤ Episodes of NPL reduction

- The period of consecutive drops in NPL ratio with the cumulative reduction in NPL ratio exceeding 6 percentage points
- A rise in NPL ratio is not regarded to interrupt an episode as long as it is limited to a single year and involves a relatively small rise in NPL ratio, that is a less than 1.6 percentage point increase in NPL ratio
- Sharp drop in NPL ratio: a more than 4 percentage point drop in NPL ratio in a single year
- Among the 41 episodes of NPL reduction, 24 episodes start with a sharp drop in NPL ratio

## ➤ Episodes of NPL rise and Sharp rises in NPL ratio

- Cumulative rise in NPL ratio exceeding 6% points and a more than 4 percentage point rise in NPL ratio in a single year
- Among the 47 episodes of NPL rise, 22 episodes start with a sharp rise in NPL ratio

# NPL Resolution Measures and Data

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- The following NPL resolution measures were investigated as the measures to deal with significant system-wide NPL problems.
  - Introducing public AMCs: Building Better Bad Banks project by Hallerberg and Gandrud (2015)
  - Injecting public bailout funds: data from Bova et al (2016)
  - Adopting and strengthening macro-prudential regulations on banks: Cerutti, Claessens and Laeven (2015)
  
- The following measures can also be used to deal with system-wide NPL problems but were not investigated due to data problem.
  - Enhancing the efficiency of the legal and judicial system for debt enforcement: Doing Business Database by World Bank
  - Changing the regulatory and supervisory criteria for NPL recognition
  - Building up corporate restructuring mechanisms

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# Empirical Models and Estimation Results

# 1. Panel Regression Model

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## ➤ Panel Regression Model

$$\Delta NPL_{c,t} = \alpha + \beta \Delta NPL_{c,t-1} + \mu X_{c,t} + \theta Frame_{c,t} + v_{c,t}$$

- X: macroeconomic variables
  - growth rate
  - inflation rate
  - rate of currency depreciation
  - rate of change in real estate price
  - global financial market volatility (VIX)
  - rate of change in global commodity price.
- Frame: policy dummy variables
  - existence of public AMCs
  - injection of public bailout funds
  - strengthening macro-prudential regulations

# Overview of Variables (1996-2016)

Variable	Description	Frequency	Source
Change in NPL ratio	Change in ratio of NPLs over total loans	Yearly	S&P Global Market Intelligence (S&P)
Growth rate	Real GDP annual growth rate	Yearly	World Bank's WDI
Inflation rate	CPI annual growth rate	Yearly	WB's WDI
Rate of change in exchange rate	Rate of change of local currency/USD	Yearly	CEIC
Rate of change in real estate price	Rate of change of Housing Price Index	Yearly	CEIC
Unemployment rate	Annual growth rate of unemployment	Yearly	WB's WDI
VIX	Chicago Board Options Exchange (CBOE)'s Volatility Index	Yearly	Bloomberg
Rate of change in global commodity price	Primary commodity prices*	Yearly	IMF
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 MP index occurs at t, t-1, or t-2	Yearly	Assigned

# Descriptive Statistics

	<b>Mean</b>	<b>S.D.</b>	<b>Min</b>	<b>Max</b>	<b>Observations</b>
NPL ratio (%)	6.072	0.966	0.002	94.480	1,104
$\Delta$ NPL 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
MPP dummy	0.390	0.481	0	1	1,052

# Panel Unit Root Test

	Fisher-ADF	Fisher-PP
NPL ratio	399.99***	336.04***
Change in NPL ratio	502.24***	1149.10***
Real GDP growth rate	472.18***	520.76***
Inflation rate	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 commodity price	268.71***	597.53***

# Dynamic Panel Regression: Arellano-Bond GMM

	(1)	(2)	(3)	(4)
$\Delta$ NPL(t-1)	-0.0152 (-0.31)	-0.0724** (-2.07)	-0.0716** (2.04)	-0.0051 (-0.10)
Growth	-0.0927** (-2.39)	-0.1124** (-2.40)	-0.1178** (-2.48)	-0.2958** (-3.78)
Inflation	0.2588** (4.69)	0.0436 (0.98)	0.0373 (0.83)	-0.0360 (-0.58)
Exchange Rate (depreciation rate)	0.0001 (0.01)	0.0017 (0.16)	0.0019 (0.19)	-0.0087 (-0.65)
Property	-0.0221 (-1.37)			
Commodity	-0.0017 (-1.27)	-0.0083 (-0.99)	-0.0063 (-0.72)	0.0057 (0.49)
VIX	0.0677** (3.95)	0.1029** (4.04)	0.0696* (1.78)	0.1256** (3.62)
GFC			0.7271 (0.96)	
AMC				-1.8328** (-2.40)
Sample	418	902	902	521

# 1. Dynamic Panel Regression: Result

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- Estimation of the dynamic panel model through the Arellano-Bond GMM estimation reveals that favorable macroeconomic and global financial conditions tend to reduce increase in NPL ratio.
  - Higher growth rate, lower inflation, and reduced volatility in international financial markets
  - Property price, global commodity price, exchange rate do not affect change in NPL ratio significantly.
  - Existence of AMCs significantly reduce increase in NPL ratio.
  - However, other policy measure such as injection of bailout funds and strengthening macro-prudential policies do not affect change in NPL ratio.

## 2. Panel Probit Models

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### ➤ Panel Probit Model

$$P(SRL_{c,t} = 1) = \Phi(\alpha + \beta\Delta NPL_{c,t-1} + \mu X_{c,t} + \theta Frame_{c,t} + u_{c,t})$$

$$P(SDL_{c,t} = 1) = \Phi(\alpha + \beta\Delta NPL_{c,t-1} + \mu X_{c,t} + \theta Frame_{c,t} + u_{c,t})$$

- SRL: a dummy variable that takes one if a sharp rise in NPL ratio happens
- SDL: a dummy variable that takes one if a sharp drop in NPL ratio happens
- Other variables included in the model are the same as those included in the dynamic panel regression model
- The Probit models are estimated with **random effects**

# Episodes of Sharp Rise: Panel Probit

	(1)	(2)	(3)	(4)
$\Delta$ NPL(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	1064	983	1064

# Episodes of Sharp Drop: Panel Probit

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

# Episodes of Sharp Drop: Panel Probit

	(5)	(6)	(7)
$\Delta$ NPL(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*Bail		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

### 3. Macro-financial Effects of NPL Reduction

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- Measure the macro-financial effects of NPL reduction by estimating the average treatment effect of the treated
  - Treatment group: episodes of a sharp drop in NPL ratio (episodes in which a more than 4 percentage point drop in NPL ratio in a single year followed by an episode of NPL reduction)
  - Control group: episodes of high and persistent NPL ratio (episodes in which NPL ratio higher than 6% persisted for at least three consecutive years)
  - The propensity score matching method is used to match each episode from the treatment group with episodes in the control group.
  - The variables used for the propensity score matching are growth rate, inflation rate, per capita GDP at PPP, public debt to GDP ratio, and unemployment rate in year 0.

## Results: Average Treatment Effects

Variable/Effect	Year 1	Year 2	Year 3	Year 4
GDP Growth Rate	2.4564** (0.9517)	2.3006* (1.2664)	1.4371 (1.3342)	0.3189 (1.2003)
Unemployment Rate	-1.1434* (0.6940)	-1.3694* (0.7613)	-2.1099* (1.1936)	-0.9036 (1.3655)
Exchange Rate Change	-13.2709* (6.8998)	-4.8804* (2.8478)	0.8324 (3.5748)	11.5421* (6.5404)
Change of M2/GDP	1.1449 (2.2919)	1.5218** (0.7437)	0.0499 (1.5199)	0.5988 (1.0895)
Control	40	40	37	34
Treated	37	37	35	31

### 3. Macro-financial Effects of NPL Reduction: Results

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- Sharp drops followed by NPL reduction episode enhances real macroeconomic performance
  - Higher output growth
  - Lower unemployment rate
  
- Sharp drops in NPL ratio also affects financial variables
  - Sharp short-term currency appreciation
  - Higher M2/GDP ratio

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# Conclusions and Policy Recommendations

# Conclusion and Policy Recommendations

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- Generally, a drop in GDP growth, higher inflation, and higher global financial market volatility are associated with sharp rises in NPL ratios.
- Public AMCs can be an effective tool in achieving a sharp drop in NPLs and thus play a critical role in NPL resolution.
- Public AMCs are also effective in reducing the size of NPL rise, which implies that public AMCs are useful not only as a crisis resolution measure but as a financial market stabilizer.
- The estimated average treatment effects underpin that a sharp drop in NPLs is associated with favorable macro-financial effects, calling for swift and rapid adoption NPL resolution measure.
- As next step, we will consider more policy variables, such as stringency of loan classification and provisioning, and assess their effectiveness of NPL resolution.

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**Thank you.**