

Non-performing Loans and Housing Prices in Taiwan

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Abstract

We set out in this study to empirically examine the relationship between house prices and bank stability based upon an exploration of quarterly data obtained from Taiwanese banks covering the years 2006 to 2015. There are various divergent views on the ways in which persistent rises in house prices can influence ‘non-performing loans’ (NPLs); one view is that when house prices rise, this may raise collateral value, and as a result, NPLs will be reduced, whilst an alternative view is that increasing house prices may give rise to issues of moral hazard and adverse selection, thereby leading to an overall increase in NPLs and greater accumulation of risky assets within the banks. The results of the dynamic panel data analysis carried out in this study reveal the existence of a long-run, negative relationship between NPL ratios and the housing price index; however, no such negative relationship is discernible in the short run. Our findings offer policy implications for the emerging markets in the aftermath of the sub-prime mortgage crisis; according to our research results, policies aimed at reducing the duration of any housing market recession may improve bank stability.

JEL classification numbers: C23, G21

Keywords: Non-performing loans; Bank-specific determinants; Housing market

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1. Introduction

The primary aim of this study is to identify the determinants of ‘non-performing loans’ (NPLs) in the aftermath of the 2008 sub-prime mortgage crisis. Virtually all countries around the world experienced sluggish economic growth and higher unemployment rates as a result of the financial crisis; however, some of these countries have also been confronted with deterioration in their credit risk, an additional setback which other countries have apparently managed to avoid.

According to a World Bank report, there has been a significant rise in the global average percentage of NPLs to total gross loans, from 2.99 per cent in 2008, to 4.3 per cent in 2015; and indeed, most of the countries in the regions of Europe and Central Asia continue to experience increases in their NPL ratios¹. Although some of these countries reported extremely high NPL ratios in 2015, as high as 18 per cent in Italy, 34.7 per cent in Greece and 45.6 per cent in Cyprus, over the same period, the NPL ratios in the East Asia and Pacific regions have been in decline, from 2.28 per cent in 2008, to 1.59 per cent in 2015.

Several prior related studies argue that the determinants of NPLs are mainly associated with either macroeconomic variables (such as economic growth, national debt, the unemployment rate and the inflation rate) or with bank-specific characteristics (such as asset management quality or financial supervision). However, in addition to the traditional perspectives, recent studies have also begun to explore the role potentially played by house prices, although the impacts on credit risk arising from property prices are still unclear.

During the recent economic recession period, some countries experienced significant declines in house prices, whilst others have continued to experience housing price ‘bubbles’. For example, between 2009 and 2015, according to BIS data, residential property prices fell by around 16 per cent in Italy, 26 per cent in Cyprus, and 39 per cent in Greece². In contrast, however, house prices in East Asia have steadily risen; over the same period, residential property prices have increased by about 5 per cent in Japan, 19 per cent in Korea and 35 per cent in Taiwan.

Although the housing price index in Taiwan increased steadily between 2009 and 2015, the economic growth rate has remained sluggish, with the average GDP growth rate languishing at around 3 per cent throughout this period; indeed, from a negative GDP growth rate of -1.57 per cent in 2009, it had risen to only 0.65 per cent in 2015. Nevertheless, whilst the overall economy was clearly in recession as a result of the sub-prime mortgage crisis, the NPL ratios had improved significantly, from about 1 per cent in 2009, to just 0.3 per cent in 2015.

¹ Full details are available from the World Bank Database at: <http://data.worldbank.org/indicator/FB.AST.NPER.ZS?contextual=aggregate&end=2015&start=2007&view=chart>.

² These figures are obtained from the BIS Residential Property Price Statistics at: http://www.bis.org/statistics/pp_detailed.htm?m=6%7C288%7C593

Exactly what has caused such low NPL ratios remains unclear, thus, our primary aim in this study is to investigate the determinants of non-performing loans in Taiwan over the years 2006 to 2015. This issue is regarded as being extremely important, essentially because bank insolvency has become a critical problem for those countries experiencing deteriorations in their bank assets in the aftermath of the sub-prime mortgage crisis. The ways in which the global housing markets can jeopardize both the short- and long-term soundness of a country's financial sector remain ambiguous; thus, an examination of empirical data on Taiwan may offer some policy implications for bank stability.

2. Literature Review

Bank stability is invariably associated with NPL ratios, and indeed, according to numerous empirical studies examining this issue, the determinants of NPLs are primarily associated with macroeconomic and bank-specific variables, including GDP growth rate, interest rates, unemployment rates, returns on assets, returns on equity, loans to savings ratios, national debt and CPI inflation. The extant literature contains a wealth of empirical investigations on the determinants of NPLs,³ with most of these studies providing evidence in support of the view that macroeconomic determinants have clear associations with NPL ratios.

From a recent examination of seven Central and Eastern European countries, Škarica (2014) reported that the NPL ratios in these countries exhibited growth throughout the four-year (2007-2011) crisis period, with the respective NPL ratios in 2011 in Bulgaria, Romania, Latvia and Croatia being as high as 16.87 per cent, 14.3 per cent, 17.23 per cent and 12.27 per cent; Škarica concluded that the high NPL ratios of these countries were mainly due to the economic slowdown attributable to the sub-prime mortgage crisis.

In addition to the macroeconomic determinants of non-performing loans, some studies have tested the determinants of bank characteristics; for example, Dimitrios et al. (2016) noted that returns on assets and returns on equity had negative correlations with the NPL levels found in Euro-area countries, whilst other recent studies have also begun to explore the potential effects of asset prices on bank stability (Koeeter and Poghosyan, 2010; Pan and Wang, 2013).

Various studies have shown that a typical boom and bust in the housing market can give rise to severe financial instability, which will ultimately have direct impacts on a country's economic growth prospects, since real estate is frequently used as collateral for loans (Goodhart and Hofmann, 2007) and housing asset characteristics are associated with the quality of bank loans.⁴

³ Examples include Keaton and Morris (1987), Gambera (2000), Nkusu (2011), Louzis, Vouldis and Metaxas (2012); Kauko (2012), Škarica (2014) and Dimitrios, Louri and Tsionas (2016).

⁴ See, for example, Evans, Leone, Gill and Hilbers (2000), Reinhart and Rogoff (2008), Davis and Zhu (2011) and Moscone, Tosetti and Canepa (2014).

From an examination of 1999-2012 sample data on US banks, Tajik, Aliakbari, Ghalia and Kaffash, (2015) found that house price fluctuations significantly affected the evolution of NPLs, with the impact of house prices being found to vary across different loan categories and types of banks. They also noted that NPLs were more sensitive to house price fluctuations during a period of economic downturn.

The interactions between house prices and NPLs have been empirically tested in various studies, resulting in these relationships being interpreted from different perspectives; and indeed, there are two contrasting views on the ways in which housing prices can affect bank loans. One view posits that rising house prices can increase collateral value, thereby improving the ability of borrowers to engage in mortgage refinancing whilst simultaneously reducing the risk of default (Kiyotaki and Moore, 1997; Wan 2018). According to this view, higher real estate prices will enhance bank stability, which implies a negative relationship between house prices and NPL ratios.⁵

The alternative viewpoint argues that rising house prices may induce perverse incentives or moral hazard leading to excessive lending from the banks and more betting by speculators on the related assets (Evans et al., 2000; Dell’Ariccia and Marquez, 2006). According to this view, higher house prices may create greater information asymmetry, which could result in banks holding greater levels of risky assets, with such higher real estate prices ultimately leading to an increase in the level of instability in the banks. This perspective therefore clearly implies a positive relationship between house prices and NPL ratios.

From their examination of the relationship between house prices and loan quality in the US, Tajik et al. (2015) indicated that fluctuations in house prices at state level were negatively related to changes in NPL ratios, whilst other studies emphasize the impacts of house price deviations from their fundamental value; that is, the creation of a ‘housing bubble’.

According to Koetter and Poghosya (2010), any increase in deviations from the fundamental value of properties will give rise to problems of moral hazard and adverse selection, which can clearly increase the probability of loan default, and indeed, their study identified an obvious positive relationship between deviations in house prices and NPL ratios. Pan and Wang (2013) carried out a similar empirical study on US Metropolitan Statistical Areas, based upon a threshold model, and found that house price deviations were likely to reduce (increase) NPL ratios in areas with higher (lower) income growth.

Significant evidence has been provided to show that instability in the housing market can lead to instability in the banking sector, with several related studies providing international comparisons clearly showing initial sharp surges in house prices during periods of banking crises, followed by steady declines.⁶ The

⁵ Examples include Daghli (2009), Niimimaki (2009) and Moscone et al. (2014).

⁶ See, for example, Lindgren, Garcia and Saal (1996), Enoch and Green (1997), Kaminsky and Reinhart (1999) and Evans et al. (2000).

theoretical models used in these studies suggest that when a housing bubble bursts, house owners or speculative investors may find it difficult to roll over their loans and may be unwilling, or unable, to repay their mortgages; consequently, the collapse of a housing bubble may lead to an increase in NPL ratios, ultimately leading to greater bank instability.

In an attempt to explore this issue in the present study, we collected 2006-2015 macroeconomic variables and data from 29 Taiwanese banks, in conjunction with quarterly data from the housing price index covering the periods Q2 2006 to Q4 2015.⁷ Panel data analysis was subsequently undertaken to verify the relationships that may exist between bank-level data on NPL ratios, the macroeconomic variables and the housing price index. Our study adopts ‘mean-group’ (MG) and ‘pooled mean group’ (PMG) approaches to estimate the relationships in the dynamic panels essentially because housing price data during boom or bust periods is usually found to be non-stationary.

The investigation of the determinants of non-performing loans in Taiwan over our ten-year sample period should provide a valuable contribution to the extant literature on bank stability. The main findings of our study are that in the long-run, a negative relationship is found to exist between NPL ratios and the housing price index, whilst in the short-run, the relationship is found to be positive; however, all of the estimated coefficients were found to be insignificant.

3. Models and Econometric Estimation

In the pooled estimators, such as the fixed and random effects, the slope coefficients and error variances are assumed to be identical or homogeneous. The MG method estimates separate regressions and then calculates the coefficient means, where the slope coefficients can be heterogeneous. The PMG method involves an intermediate procedure within which constraints are placed on the long-run coefficients, thereby ensuring that they are identical, whilst also allowing the short-run coefficients and error variances to differ across groups, thereby imposing a homogeneity restriction on the long-run relationship coefficients.

As noted in Pesaran, Shin and Smith (1999), as a result of various factors, there are often good reasons to expect to find similarities across different groups in the long-run equilibrium relationships between the variables, such as budgetary or solvency constraints, arbitrage conditions or common technologies that influence all groups in a similar way. Such long-run slope homogeneity between the coefficients can be evaluated using Hausman test statistics.

A dynamic heterogeneous panel estimator can be constructed based upon an ‘autoregressive distributed lag’ (ARDL) model. For simplicity, the ARDL (1,1...1) model can be expressed as:

⁷ Full details are available at: <http://pip.moi.gov.tw/V2/E/SCRE0201.aspx>.

$$y_{it} = \lambda_i y_{i,t-1} + \sum_{j=0}^1 \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (1)$$

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta'_i X_{it} + \delta'_{it} \Delta X_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where $\Delta y_{it} = y_{it} - y_{i,t-1}$, $\Delta X_{it} = X_{it} - X_{i,t-1}$, $\phi_i = -(1 - \lambda_i)$, $\beta_i = \sum_{j=0}^1 \delta_{ij}$.

We assume that the disturbances, ε_{it} , are independently distributed across i and t , with zero means, positive variances and finite fourth-order moments; the ε_{it} are also distributed independently of the regressors, X_{it} . We further assume that the long-run equation is stable, and that $\phi_i < 0$, such that a long-run relationship is assumed to exist between y_{it} and X_{it} . The long-run coefficients on X_{it} , which are defined in this study as $\theta_i = -\beta'_i / \phi_i$, are the same across the groups, with both the long-run coefficients, θ_i , and group-specific error-correction coefficients, ϕ_i , being computed using maximum likelihood (ML) estimations.

In order to explore the relationships between the NPL ratios and house prices, the autoregressive distributed lags, ARDL(1,1), the dynamic panel representation of the long-run equation, are expressed as:

$$NPL_{it} = \lambda_i NPL_{i,t-1} + \delta_{10i} HP_{it} + \delta_{11i} HP_{it-1} + \mu_i + \varepsilon_{it}, \quad (3)$$

and the error-correction representation is:

$$\Delta NPL_{it} = \phi_i (NPL_{i,t-1} - \mu_i - \theta_{1i} HP_{it-1}) + \delta_{10} \Delta HP_{it} + \varepsilon_{it}, \quad (4)$$

where NPL are the quarterly NPL ratios, which include all categories of bank loans between Q2 2006 and Q4 2015; and HP denotes the housing price index in logarithmic form. The bank-level data includes 29 local Taiwanese banks, with the panel analysis being carried out using MG, PMG and fixed effect methods to identify the relationships between the NPL ratios and housing price deviations.

4. Results

The estimation results of the panel data analysis of the NPL ratios and house prices, as described in Equations (3) and (4), are presented in Table 1, where we report three specifications, based upon a sample of 1,131 observations covering the years 2006 to 2015. All of the error correction coefficients in the three specifications are found to have negative signs, with significance at the 1 per cent level.

Table 1: Panel data analysis results on NPLs and house prices^a

Variables	PMG Estimators ^{b,d}	MG Estimators ^{b,d}	Hausman Test ^{c,d} p-value	Fixed Effect ^{b,d}
Intercept	1.1572***	2.7890***		2.7269***
	(0.2114)	(0.6582)		(0.4910)
Error Correction Coefficients				
ϕ	-0.1281***	-0.1693***	0.0010***	-0.1610***
	(0.0226)	(0.0264)		(0.0174)
Long-Run Coefficients				
HP	-1.7883***	-4.3918***		-4.3838***
θ	(0.1969)	(0.7986)		(.5047)
Short-Run Coefficients (Changes in HP)				
δ	0.5175	0.5030		0.5404
	(0.4047)	(0.3625)		(0.3913)
No. of Banks	29	29		29
No. of Obs.	1,102	1,102		1,102

Notes:

^a The dependent variable is “non-performing loans (NPLs).”^b PMG and MG respectively refer to “pooled mean group” and “mean group” estimations.^c The null hypothesis in the Hausman Test is that difference between the coefficients is not systematic and that the Hausman test statistic has a probability greater than the χ^2 value.^d *** indicates significance at the 1 per cent level; and figures in parenthesis are standard errors.

In all three specifications, the long-run effects of house prices on the NPL ratios are found to have negative signs, with significance at the 1 per cent level, whilst the short-run effects of house prices on the NPL ratios are found to have positive signs, albeit with no significance. The intercepts in all three models are found to have positive signs, with significance at the 1 per cent level.

The null hypothesis of long-run slope homogeneity in the coefficients is rejected by the Hausman test statistic, which implies that the MG estimators are preferable to the PMG method. The empirical results confirm that long-run equilibria are more likely in the housing market (Herring and Wachter, 1999), with the results being consistent with the view that house prices may increase both collateral value and bank stability; however, the impacts of house prices on the NPL ratios are found to exist only in the long run, not in the short run.

According to various studies within the extant literature, rising house prices can potentially have either positive or negative impacts on non-performing loan ratios. In the present study, we empirically examine quarterly data on 29 Taiwanese

banks covering the years 2006 to 2015, with our dynamic panel data analysis revealing the existence of a negative long-run relationship between the housing price index and NPL ratios. In contrast, the short-run relationship appears to be positive, although the estimated coefficients are found to be insignificant.

5. Conclusions

Ambiguous relationships have been reported within the extant literature between residential property prices and the quality of bank loan performance. Any increase in house prices can, on the one hand, lead to an increase in the collateral value on the property, which would clearly help to enhance the quality of bank loans; on the other hand, however, any increase in house prices may also tend to induce excessive lending and attract greater attention by speculative investors, thereby leading to overall deterioration in the quality of bank loan performance.

Furthermore, to the best of our knowledge, within the majority of the prior related studies, there appears to have been very little discussion on the ways in which variations in the duration of a housing boom or bust can affect bank stability. In the present study, we carry out empirical examinations of these relationships, based upon selected data, and attempt to distinguish between the short-run and long-run impacts of residential property prices on NPL ratios through the application of ‘mean-group’ (MG) and ‘pooled mean group’ PMG analyses. Our empirical results provide evidence in support of the hypothesis that residential property prices can have direct influences on the quality of bank loan performance, since they go some way towards explaining the reasons behind the low levels of NPLs in Taiwan under the economic recession attributable to the sub-prime mortgage crisis.

The empirical evidence presented in this study suggests that the persistent increases in house prices following the sub-prime mortgage crisis can help to explain the phenomenon of low NPL ratios in Taiwan, with our findings potentially offering implications for overall financial stability and for policy makers in the emerging markets. We find that the housing market may have a very important role to play in ensuring financial stability, since NPL ratios can be reduced if any decline in house prices is made to spread over longer periods of time. This further implies that policies aimed at shortening any housing market recession can help to improve bank stability. Our empirical results support the view that higher real estate prices tend to enhance bank stability, which also implies a negative relationship between house prices and non-performing loan ratios.

References

- [1] Bertus, M. and B. Stanhouse, "Rational Speculative Bubbles in the Gold Futures Market: An Application of Dynamic Factor Analysis", *Journal of Futures Markets*, 2001, vol. 21, pp. 79-108.
- [2] Case, K.E and R.J Shiller, "Is There a Bubble in the Housing Market? Comments and Discussion", *Brookings Papers on Economic Activity*, 2003, vol. 2, pp. 299-362.
- [3] Daghish, T., "What Motivates a Subprime Borrower to Default?", *Journal of Banking and Finance*, 2009, vol. 33, no. 4, pp. 681-93.
- [4] Davis, E.P. and H. Zhu, "Bank Lending and Commercial Property Cycles: Some Cross-country Evidence", *Journal of International Money and Finance*, 2011, vol. 30, no.1, pp. 1-21.
- [5] Dell'ariccia, G. and Marquez, R., "Lending Booms and Lending Standards", *The Journal of Finance*, 2006, vol.61, pp. 2511–2546.
- [6] Dimitrios, A., H. Louri and M. Tsionas, "Determinants of Non-performing Loans: Evidence from Euro-area Countries", *Finance Research Letters*, 2016, vol. 18, pp. 116-19.
- [7] Enoch, Charles and J. H. Green, *Banking Soundness and Monetary Policy*, IMF, 1997.
- [8] Evans, O., A.M., Leone, M.S. Gill and P.L.C. Hilbers, "Macroprudential Indicators of Financial System Soundness, IMF Occasional Papers No.192, International Monetary Fund, 2000.
- [9] Gambera, M., "Simple Forecasts of Bank Loan Quality in the Business Cycle", *Emerging Issues*, 2000, Federal Bank of Chicago.
- [10] Goodhart, C. and B. Hofmann, *House Prices and the Macroeconomy: Implications for Banking and Price Stability*, 2007, Oxford, UK: Oxford University Press.
- [11] Hansen L.P. and T.J. Sargent, "Formulating and Estimating Dynamic Linear Rational Expectations Models", *Journal of Economic Dynamics and Control*, 1980, vol.2, pp. 7-46.
- [12] Herring, R. and Susan Wachter, "Real Estate Booms and Banking Busts: An International Perspective", *Center for Financial Institutions Working Papers*, 1999, pp. 99-27, Wharton School Center for Financial Institutions, University of Pennsylvania.
- [13] Kaminsky, Graciela L. and Carmen M. Reinhart, "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", *American Economic Review*, 1999, vol. 89, no. 3, pp. 473-500.
- [14] Kauko, K., "External Deficits and Non-performing Loans in the Recent Financial Crisis", *Economics Letters*, 2012, vol. 115, no. 2, pp. 196-99.
- [15] Keeton, W. and C. Morris, "Why Do Banks' Loan Losses Differ?", *Economic Review*, May, 1987, pp. 3-21.
- [16] Kiyotaki, N. and J. Moore, "Credit Cycles", *Journal of Political Economy*, 1997, vol 105, pp. 211-48.

- [17] Koetter, M. and T. Poghosyan , “Real Estate Prices and Bank Stability”, *Journal of Banking and Finance*, 2010, vol. 34, no. 6, pp. 1129-1138.
- [18] Lau, E.E.L., G.K.R. Tan and S. Rahman, “Assessing Pre-crisis Fundamentals in Selected Asian Stock Markets”, *Singapore Economic Review*, 2005, vol. 50, pp. 175-196.
- [19] Lindgren, C., Garcia, G. G. and Matthew I. Saal, *Bank Soundness and Macroeconomic Policy*, 1996, IMF.
- [20] Louzis, D.P., A.T. Vouldis and V.L. Metaxas, “Macroeconomic and Bank-specific Determinants of Non-performing Loans in Greece: A Comparative Study of Mortgage, Business and Consumer Loan Portfolios”, *Journal of Banking and Finance*, 2012, vol.36, no. 4, pp.1012-1127.
- [21] Moscone, F., E. Tosetti and A. Canepa, “Real Estate Market and Financial Stability in US Metropolitan Areas: A Dynamic Model with Spatial Effects”, *Regional Science and Urban Economics*, 2014, vol.49, pp. 129-146.
- [22] Niinimäki, J.P., “Does Collateral Fuel Moral Hazard in Banking?”, *Journal of Banking and Finance*, 2009, vol. 33, no. 3, pp. 514-521.
- [23] Nkusu, M., “Non-performing Loans and Macro-financial Vulnerabilities in Advanced Economies”, IMF Working Paper No. WP/11/161, 2011 International Monetary Fund.
- [24] Pan, H. and C. Wang, “House Prices, Bank Instability and Economic Growth: Evidence from the Threshold Model”, *Journal of Banking and Finance*, 2013, vol.37, no.5, pp. 1720-1732.
- [25] Pesaran, S., Y. Shin and R. Smith, “Pooled Mean Group Estimation of Dynamic Heterogeneous Panels”, *Journal of the American Statistical Association*, 1999, vol. 68, pp. 621-634.
- [26] Piergiorgio A., “Bubbles and Fads in the Stock Market: Another Look at the Experience of the US”, *International Journal of Finance and Economics*, 2005, vol. 11, pp. 195-203.
- [27] Poterba J.M. and L.H. Summers, “The Persistence of Volatility and Stock Market Fluctuations”, *American Economic Review*, 1986, vol. 76, pp. 1142-1151.
- [28] Škarica, B., “Determinants of Non-performing Loans in Central and Eastern European countries”, *Financial Theory and Practice*, 2014, vol. 38, no. 1, pp. 37-59.
- [29] Tajik, M., S. Aliakbari, T. Ghalia and S. Kaffash, “House Prices and Credit Risk: Evidence from the United States”, *Economic Modelling*, 2015, vol. 51, pp. 123-135.
- [30] Junmin Wan, “Non-performing loans and housing prices in China”, *International Review of Economics & Finance*, 2018, vol. 57, pp. 26-42.
- [31] Xiao, Q. and G.K.R. Tan, “Signal Extraction with Kalman Filter: A Study of the Hong Kong Property Price Bubbles”, *Urban Studies*, 2007, vol. 44, pp. 865-888.