Evaluating the Interaction of Bank Characteristics and Unexpected Crises on Nonperforming Loans in Malaysia

Normah Erra Zulkifli, Zuriyati Ahmad

In-Text Citation: (Zulkifli & Ahmad, 2023)
To Cite this Article: Zulkifli, N. E., & Ahmad, Z. (2023). Evaluating the Interaction of Bank Characteristics and Unexpected Crises on Nonperforming Loans in Malaysia. *International Journal of Academic Research in Accounting Finance and Management Sciences*, *13*(2), 141–151.

Full Terms & Conditions of access and use can be found at
http://hrmars.com/index.php/pages/detail/publication-ethics

Evaluating the Interaction of Bank Characteristics and Unexpected Crises on Nonperforming Loans in Malaysia

Normah Erra Zulkifli[1], Zuriyati Ahmad[2]

[1]Faculty of Business Management, Universiti Teknologi MARA, Shah Alam, Malaysia, [2]Faculty of Business Management, Universiti Teknologi MARA, Cawangan Terengganu, Malaysia
Email: normaherrazulkifli@gmail.com
Corresponding Author's Email: zuriy271@tganu.uitm.edu.my

Abstract
Over the last few decades, Malaysia has experienced a large number of nonperforming loans, which is accompanied by a significant deterioration in the banking system. The problem also arises when Malaysia's economy has been attacked by the sudden crises, which literally distracts the banking characteristics. Therefore, this study is conducted to investigate the impact of bank characteristics and unexpected crises on nonperforming loans in Malaysia's commercial banks. Data from sixteen (16) commercial banks spanning from 2007 to 2020 are used. Panel data analysis is utilized to examine the impact of the interaction between bank characteristics and unexpected crises on the bank's nonperforming loans. The finding reveals that unexpected crises influence nonperforming loans through the interaction of bank characteristics. It discloses the existence of unexpected crises alongside deterioration in bank characteristics may lead to the problem of nonperforming loans arising in the banking system. The severity of the crises erodes the banking confidence in publicly serving the loans as before and leaves the banks facing a significant burden in the higher accumulation of loans unperformed. Further, this result suggests that a strict and in-depth lending policy based on the current economic environment and conditions must be provided to ensure uniformity in the credit facilities.
Keywords: Financial Crisis, Bank Characteristics, Pandemic, Banking System, Default Loan.

Introduction / Background

The issue of nonperforming loans has received considerable critical attention when the number of nonperforming loans in Malaysian banks shows an increasing trend recently. The rate has been up to 1.8% in 2020 (which is from 1.5% in 2018) and is expected to rise again for several years due to the effect of the pandemic crisis taking a long time to cure (Deloitte, 2020; Goh & Lee, 2020). Even though Malaysia's economy has regained the recovery momentum after several years but the problem of nonperforming loans is still found as a tail risk for banks (Yang, 2022). New Straits Times (2022) also highlights the issue of credit cost in

the banks staying higher than the pre-pandemic level due to the high estimation of nonperforming loans ratio against the actual ratio under loan moratorium.

Although the banks have undergone remarkable changes over this period, the existence of the problem of nonperforming loans continues to harm the performance of the banks (Yamunah et al., 2019). It is stated that 70 percent of credit risk had been incurred in banking operations while the remaining 30 percent is contributed by market and operational risk (Ameni et al., 2017). Failure of banks in monitoring the loans properly and efficiently may lead to the loan quality deteriorating and escalate the problem of nonperforming loans (Mazreku et al., 2018). The pressure however becomes deeper when the economy has been attacked by the sudden attack of crises (Anil et al., 2020). The existence of a crisis before witnessing the sudden crashes and shocks incurred in the economy tends to change the way and action banks in making decisions (Carlos et al., 2020). The crises led to a fluctuation in the nonperforming loans due to the fact of many individuals and businesses had to deal with the issue of default as their capacity to pay back loans has been distracted (Olusegun, 2019). Past crises have witnessed the case of bank insolvency as related to tight liquidity problems and deterioration in asset quality as a result of repeatedly suffering from the severe problem of nonperforming loans (Zaini et al., 2010; Basit & Sulaiman, 2017).

Unexpected crises are referring to situations or events that are unpredictable and can cause a sudden halt in the economy and also the banking system (Arjen, 2009; Justin & Volker, 2012). Previous crises found an increasing rate of household debt from 24.5% in 2003 to 48.9% in 2007. It continuously becomes a burden to the banks and is expected to be more persistent when the economy recently facing the outbreak of the pandemic Covid-19. The outbreak of this crisis due to the infectious disease (Covid19) that spreading over the region and country distracts the way of bank operates their businesses as loan growth, earnings, provision, and liquidity are affected (Deloitte, 2020). The presence of crises affects the borrower's ability to repay the debt and raises the number of outstanding loans that continue to increase as well as increasing banking liquidity (Zulkifli & Ahmad, 2022). The pressure banks face through the trap of loan default triggers the performance of banks in Malaysia (Tan, 2020) and dragged down 10% of the credit losses in the banking impairment (The Edge Market, 2020). Against this background, aims to investigate the impact of bank characteristics and unexpected crises on Malaysia's commercial banks.

The remainder of the paper proceeds as follows, Section 2 highlights an overview of the relevant literature and develops our hypothesis. Section 3 continues with a discussion of the methodology under consideration. The empirical results will be described in Section 4, and Section 5 concludes.

Literature Review

Unexpected crises are one of the crucial indicators that influence nonperforming loans in the banking system. Malaysia has been experiencing several impactful events when the economy has been attacked by a series of unexpected crises (Johnsten, 2004) such as economic crisis, financial crisis and pandemic crisis. The financial crisis and pandemic crisis are known as part of unexpected crises which could disrupt the performance of an entire system in the economy. The existence of these crises is found uncertain and very hard to predict. It also causes all the countries to always take precautionary action to avoiding these events hit the global economy again. Once the event of crisis starts to bursts, it could lead to more problems involving all sectors and affect the circulation of money in the economy. Claessens and Kose (2013) defined a financial crisis as substantial volatility of asset price, credit volume, external

financing, large-scale balance sheet problems, the need for scale government support, and the disruption in financial intermediation. Alp, Elekdag and Lall (2012) justified the financial crisis as severe international financial pressure and a sharp contraction in the global economy. Meanwhile, a pandemic crisis refers to a situation where the outbreak of disease dispersed around the world and the contagion of the pandemic crisis cause a re-emergence of the nonperforming loans problem. Both of these events reveal the weaknesses in the financial sector and hence ended with significant changes for many years.

Malaysia experienced several economic events since independence which include the two oil crises of 1973-1974 and 1979-1981, the second commodity crisis in 1985-1986, the financial and currency crisis in 1997-1998, the global financial crisis in 2008-2009 and the pandemic crisis as the recent in 2020. All these events are found as impactful events that can cause chaos in the economy and disrupt the development of the country (Richard, 2012; Basit & Sulaiman, 2017; Junkyu & Peter, 2019). The issue has received considerable critical attention for the last few decades. During that time, it becomes an increasing interest for all institutions since it causes a lot of problems to happen especially in financial institutions and intermediation. Over the past century, the banks faced a dramatic increase in the number of nonperforming loans since the debts keep increasing during the economic downturn (Ozili, 2017; Ozili, 2019; Olusegun, 2019). Although this crisis existed because of the unproductive debts at the first, the onslaught of the crisis on the other hand also caused the debt to continue to rise day by day and led to the increased risk of loan problems in the financial institution and economy.

The global connection of banks across the world makes the contagion of crises become worse as it is easily transferred from one country to other countries (Sundarajan et al., 2002; Giovanni, 2011). Rajha (2016) found that banks face a dilemma when repossessed houses and land during the crisis hit are worthless on the market than the bank had loaned out originally. Peter and Junkyu (2019) studied 17 emerging Asia countries and showed a strong relationship between pre-crisis (1995-2007) and post-crisis (2008-2014) with nonperforming loans. In the case of the recent crisis, Olurogun et al (2020) also reveal that the return on equity that is highly affected by this uncertainty specifically during this Covid19 causes a rising case of default risk in the Turkish economy. By using the interaction method, Kryzanowski, Liu and Zhang (2022) clarify the pandemic appears as a problem that could affect nonperforming loans significantly. This study also uses the interaction between Covid-19 and bank capital (COVID*Capital) and Covid-19 and dummy variables for foreign banks, state-owned banks and Big Five banks (COVID*Dummy) on the nonperforming loans.

Methodology

In evaluating the level of Malaysia's nonperforming loans, the study will apply the panel static analysis that includes 16 commercial banks spanning from 2007 to 2020. Adaption of the model equation includes attributes of bank characteristics and unexpected crises inspired by previous studies such as Ozili (2017); Kryzanowski et al (2022) that used the interaction method between bank characteristics specific and crises on the nonperforming loans. To develop the estimation model, the Theory of Overindebtness introduced by Braucher (2006) is chosen in this case. This theory explains that the pressure bank faced with a high number of nonperforming loans derived from growth in the bank loan. It thus follows by return on asset, loan to asset and non-interest income. The inclusion of GDP and interest rate as controlling

variables was also found to be related to the nonperforming loans. Therefore, the equation modeled is as follows;

$$NPL_{it} = \alpha + \beta_1 LG_{it} + \beta_2 ROA_{it} + \beta_3 LTA_{it} + \beta_4 NII_{it} + \beta_5 GDP_{it} + \beta_6 IR_{it} + \beta_7 LG*CRi_{it} + \beta_8 ROA*CRi_{it} + \beta_9 LTA*CRi_{it} + \beta_{10} NII*CRi_{it} + \varepsilon$$

Where
NPL	= Nonperforming loans
α	= Constant term
β	= Coefficient
LG	= Loan growth
ROA	= Return on asset
LTA	= Loan to asset
NII	= Non-interest income
GDP	= Gross Domestic Product
IR	= Interest Rate
LG*CRi	= Loan growth *Unexpected crises
ROA*CRi	= Return on asset *Unexpected crises
LTA*CRi	= Loan to asset *Unexpected crises
NII*CRi	= Non-interest income *Unexpected crises
i	= Number of banks
t	= Number of years
ε	= Normal error term

A panel of static data is conducted to run the tests of the model. It is performed by three analysis which includes Pooled Ordinary Least Square (POLS), Random Effect Model (REM) and Fixed Effect Model (FEM) to gain the robustness of the parameter coefficient of the relationship between bank characteristics, unexpected crises and nonperforming loans. Out of 27 commercial banks in Malaysia, this study only focuses on 16 commercial banks for the uniformity of the data. With the utilization of 224 observations, the sampling period of this study spanned from 2007 to 2020, which covers a total of 14 years. The data is obtained from Worldbank Database and Datastream Eikon Thompson.

Table 1

Variables Description

Variables	Definition	Source
Nonperforming Loan	Interest and principal payments which past due over 90 days and the measurement used is in Malaysia Ringgit (MYR)	Datastream
Loan growth	An average of the increases in the bank's total loans where it is measured the percentage change in total outstanding loans in the banks	Datastream
Return on Asset	A ratio of banks generate their profits from its total assets.	Datastream
Loan to Asset	Leverage as it indicates that the percentage of assets that are being financed with debt.	Datastream
Non-Interest Income	Any income that generated by banks from sources unrelated to the collection of interest payments	Datastream
Unexpected Crises	Unexpected and unpredictable situation or circumstances that causes the sudden halt of the economy.	Dummy
Gross Domestic Product	Primary indicator that used in measuring the health of a country's economy	Worldbank Database
Interest Rate	Rate of interest as a reward that has been paid by the borrower to the lender for the use of money for a period.	Worldbank Database

Result / Discussion

After following all the testing procedures, the random effect model is chosen and the result is demonstrated in Table 5.

Table 5

Summary of regression analysis

NPL	Coefficient	t	P > I t I
cons	3.6300	2.49	0.013
LG	-0.0036	-4.31	**0.000***
ROA	-1.9800	6.78	**0.004**
LTA	994363.7	0.57	0.566
NII	0.1620	6.96	**0.000***
GDP	-2.700	-2.88	**0.004**
IR	-1.1000	-1.30	0.195
LG*CRi	-0.0070	-7.42	**0.000***
ROA*CRi	-1.1700	-1.68	**0.093**
LTA*CRi	1834010	1.47	0.142

NII*CRi	0.2304	8.90	**0.000***
R-squared	0.7228	**Probability > (F-statistic)**	0.0000
Adjusted R-squared	0.6425		
Notes : ***significant at 1% level, **significant at 5% level, *significant at 10% level.			

The result from the random effect model indicates the value of R^2 equal to 0.7228, which implies that 72.28% of total variation nonperforming can be explained by LG, ROA, LTA, NII, the interaction of CRi, GDP and IR, whereas the remaining value of 27.72% cannot be explained by the independent variables due to the variables that are not included in the model. Loan growth shows a positive with significance related to nonperforming loans at a 0.01 significance level. A high significance indicates that banks will face a higher accumulation in nonperforming loans when the number of loans increases. It is consistent with a study by (Aylin, 2017). A lower bank's performance in evaluating their customer's quality and lending activities might turn this loan into a loan unperformed. Granting more loans without proper evaluation and monitoring can cause the banks to fall into a high risk of nonperforming loans and harm the quality of the loans

ROA is found to be statistically significant with a negative effect as expected. This result depicts that banks that have a 1% return on their asset may have a possibility to have a lower number of nonperforming loans for about 1.98%. Profitable banks are more efficient in dealing with their lending activities since they have the capability to hire more skillful and professional officers to handle the bank's outlook and performance. This finding is in line with (Rathria et al., 2018; Laxmi et al., 2018). While in the case of LTA variable, the result found nonperforming loans did not affect by the bank's loan to the asset.

The coefficient of NII reveals a positive and highly significant which is incompatible with the expectation of the study. This result clarifies a high income of RM1 million in the bank non-interest will definitely contribute to the RM0.162 million higher in the number of nonperforming loans. The outcome highlights the fact of the banks will create more loans when they have excess capital or alternative income, which encourages significantly higher default loans incurred.

GDP and interest rate were found to have a negative relationship as expected but with different levels of significance. The coefficient of GDP estimates that a 1% increase will decrease 2.7% of nonperforming loans. It indicates that GDP will influence the nonperforming loans with a 5% level of significance (p value=0.004). While for interest rate, it is found that interest rate did not give any significant impact on the nonperforming loans (p value=0.195).

As the major highlight is unexpected crises (CRi), this study interacts with the unexpected crises through bank characteristics and found all the result shows a highly significant influence on the nonperforming loans except only for loan to asset. For the interaction of unexpected crises through loan growth (LG*CRi), there is a negative magnitude with a high significance at level 1%. This indicates a higher crisis will interact with growth in bank loans and minimized the problem of nonperforming loans. The finding is consistent with the expectation even the

magnitude has an inverse direction as a higher crisis will distract the growth in the loans and causes a significant rise in the number of loans unperformed (Greenwald et al., 2021; Beck & Keil, 2022). Interaction of unexpected crises through return on asset (ROA*CRi) also shows a negative and statistically significant at the 5% significance level convincing the nonperforming loans can be reduced when there is an interaction between unexpected crises and return on asset. Well-capitalized banks with stable and high profitability are more sheltered against global shock. In fact, the more stable sources of funding or income that banks have, the high possibility of banks will reduce their credit supply. The further also reveals that changes in the nonperforming loans arise as there is an interaction happens between unexpected crises and non-interest income. The significance level is at a level of 1% which clarified that the influencer of the interaction of unexpected crises through non-interest income could lead to significant changes in the nonperforming loans. The high significance shown by this study discovers that the existence of crises unexpectedly will influence the changes in nonperforming loans through the bank characteristics. It also implies nonperforming loans in Malaysia's commercial banks are not only affected by unexpected crises directly but also react through the interaction of bank characteristics.

Conclusion

This study tries to investigate the impact of bank characteristics and unexpected crises on Malaysia's nonperforming loans. Panel data analysis was used to examine the combined interaction between bank characteristics and unexpected crises on non-performing loans. The finding revealed that nonperforming loans are not only affected by unexpected crises directly but also react through the interaction of bank characteristics. All the bank characteristics except loan to asset show a highly significant influence on the nonperforming. Therefore, the disclosure of interaction used by this study functionally exposes the action taken by the banks when dealing with profitability, liquidity and even asset quality during the crises that might spark the problem of nonperforming loans. From the policy perspective, the findings imply that policymakers should implement countercyclical policy measures to reduce a significant rise of nonperforming loans during periods of economic downturn. Hence, having a strict lending policy with a thorough evaluation and monitoring by responsible regulators or officers is needed.

References

Alias, M. N., & Nor, A. H. (2015). Impaired Financing Determinants of Islamic Banks in Malaysia. Information Management and Business Review, 7(3), 17-25.

Ameni, G., Hasna, C., & Ali, M. O. (2017). The effects of liquidity risk and credit risk on bank stability: Evidence from the MENA region. Borsa Istanbul Review, 17(4), 238-248. https://doi.org/10.1016/j.bir.2017.05.002

Anil, A., Sophia, C., & Lev, R. (2020). COVID-19 and non-performing loans: Lessons from past crises. Research Bulletin No.71, European Central Bank, 71, 1-7. https://doi.org/10.2139/ssrn.3632272

Arjen, B. (2009). The New World of crises and crisis management: Implications for Policymaking and research. Review of Policy Research, 26(4), 367-377. https://doi.org/10.1111/j.1541-1338.2009.00389.x

Aylin, E. (2017). Assessing the Impact of Non-Performing Loans on Economic Growth in Turkey. American Research Journal of Business Management, 2016, 1-8. doi:10.21694/2379-1047.16007

Bank Negara Malaysia. (2022). Financial Stability Review First Half 2022. https://www.bnm.gov.my/documents/20124/8440087/fsr22h1_en_book.pdf

Basit, A., & Sulaiman, S. S. (2017). The Impact of Global Financial Crisis 2008 on Banking Sector in Malaysia. International Journal of Accounting and Business Management, 5(2), 149-169.

Beck, T., & Keil, J. (2022). Have banks caught corona? Effects of COVID on lending in the U.S. Journal of Corporate Finance, 72, 1-4 https://doi.org/10.1016/j.jcorpfin.2022.102160

Braucher, J. (2006). Theories of Overindebtedness: Interaction of Structure and Culture. Theoretical Inquiries in Law, 7(2), 324-346.

Carlos, C., Stijn, C., & Leonardo, G. (2020). How do bank-specific characteristics affect lending? New evidence based on credit registry data from Latin America. Journal of Banking & Finance, 3(4), 1-15.https://doi.org/10.1016/j.jbankfin.2020.105818

Deloitte. (2020). COVID-19 potential implications for the banking and capital markets sector. Deloitte China. https://www2.deloitte.com/cn/en/pages/financial-services/articles/banking-and-capital-markets-impact-covid-19.html

Gabeshi, K. (2016). The Impact of Macroeconomic and Bank Specific Factors on Albanian Non-Performing Loans. European Journal of Sustainable Development Researh, 2(1), 95-102.

Giovanni, C. (2011). Crisis and Recovery in Malaysia :An Assessment of Financial and Real Sector Development from 1990 to 2009. A Doctoral Thesis, University of London, United Kingdom. 1-295.

Goh, J., & Lee, E. (2020). Malaysia's banking system can handle COVID-19 challenges, says BNM deputy governor. The Edge Markets. https://www.theedgemarkets.com/article/malaysias-banking-system-can-handle-covid19-challenges-says-bnm-deputy-governor

Greenwald, D. L., Krainer, J., & Paul, P. (2021). The Credit Line Channel. Federal Reserve Bank Of San Francisco Working Paper Series, 1-93. https://www.frbsf.org/economic-research/wp-content/uploads/sites/4/wp2020-26.pdf

Justin, Y. L., & Volker, T. (2012). The crisis in the euro zone: Did the euro contribute to the evolution of the crisis?. Policy Research Working Papers. https://doi.org/10.1596/1813-9450-6127

Kryzanowski, L., Liu, J., & Zhang, J. (2022). Effect of COVID-19 on non-performing loans in China. Finance Research Letter. https://doi.org/10.1016/j.frl.2022.103372

Laxmi, K., Ram, K., & Shouyang, W. (2018). Macroeconomic and bank-specific determinants of non-performing loans: Evidence from Nepalese banking system. Journal of Central Banking Theory and Practice, 7(3), 111-138. https://doi.org/10.2478/jcbtp-2018-0026

Mazreku, I., Morina, F., Misiri, V., Jonathan, & Grima, S. (2018). Determinants of the level of non-performing loans in commercial banks of transition countries. European Research Studies Journal, 21(3), 3-13. https://doi.org/10.35808/ersj/1040

Muhammad, K. A., Asima, A., & Zahid, S. (2020). Determinants of non-performing loans in the banking sector in developing state. Asian Journal of Accounting Research, 5(1), 135-145.https://doi.org/10.1108/ajar-10-2019-0080

New Straits Times. (2022, July 20). Malaysian banks' bad debts to rise this year, says S&P. New Straits Times Business. https://www.nst.com.my/business/2022/07/815363/malaysian-banks-bad-debts-rise-year-says-sp

Noraini, I., Nur, A., Maizaitulaidawati, H., Izzaamirah, I., & Sahaida, H. (2017). Bank Efficiencies and Non-Performing Loan of Commercial Banks in Malaysia. Journal of Humanities, Language, Culture and Business (HLCB), 1(5), 34-40.

Olurogun, L. A., Torun, M., Bas, T., & Bekun, F. V. (2020). Spillover effects of COVID-19 uncertainty on non-performing loans of the Turkish agricultural sector on bank performance. J. for Global Business Advancement, 13(4), 514. https://doi.org/10.1504/jgba.2020.10034585

Olusegun, O. O. (2019). Determinants of Non-performing Loans of Deposit Money Banks in Sub Saharan Africa. A Doctoral Thesis, Kwara State University Malete, Kwara State, Nigeria, 1-198.

Ozili, P. K. (2017). Non-Performing Loans and Financial Development: New Evidence. University of Essex Working Paper, 1-26.

Ozili, P. K. (2019). Non-performing loans and financial development: New evidence. The Journal of Risk Finance, 20(1), 59-81.https://doi.org/10.1108/jrf-07-2017-0112

Peter, R., & Junkyu, L. (2019). Nonperforming loans in Asia: Determinants and Macrofinancial linkages. ADB Economics Working Paper Series No 574. https://doi.org/10.2139/ssrn.3357289

Radivojevic, N., & Jovovic, J. (2017). Examining of Determinants of Non-Performing Loans. Prague Economic Papers, 26(3), 300-316. DOI:10.18267/j.pep.615

Rajha, K. S. (2016). Determinants of Non-Performing Loans: Evidence from the Jordanian Banking Sector. Journal of Finance and Bank Management, 4(1), 125-136.

Rathria, R. A., Kadarusman, Y. B., Anggriono, K., & Setiadi, R. (2018). Bank-specific factors affecting non-performing loans in developing countries: Case study of Indonesia. The Journal of Asian Finance, Economics and Business, 5(2), 35-42. https://doi.org/10.13106/jafeb.2018.vol5.no2.35

Sundararajan, V., Enoch, C., Jose, A. S., Hilbers, P., Krueger, R., Moretti, M., & Slack, G. (2002). Financial Soundness Indicators: Analytical Aspects and Country Practices. Occasional Paper International Monetary Fund Washington Dc 2002.

Tan, Y. (2020). Banks' asset quality in focus. The Star. https://www.thestar.com.my/business/business-news/2020/06/01/banks-asset-quality-in-focus

The Edge Market. (2020). S&P global revises outlook on five Malaysian banks to negative. The Edge Markets.https://www.theedgemarkets.com/article/sp-global-revises-outlook-five-malaysian-banks-negative

Vijaya, K., & Pallavi, K. (2019). Macroeconomic and Bank Specific Determinants of NonPerforming Loans in UAE Conventional Bank. Journal of Banking and Finance Management, 2(1), 1-12.

Yamunah, V., Sanil, S. H., & Tang, S. P. (2019). The study on factors that influencing banks' non-performing loans in Malaysia. International Journal of Engineering and Advanced Technology, 8(5), 1289-1297. https://doi.org/10.35940/ijeat.e1183.0585c19

Yang, C. (2022). Can Malaysian banks absorb the possible increase in bad loans? AMRO ASIA. https://www.amro-asia.org/can-malaysian-banks-absorb-the-possible-increase-in-bad-loans/

Zaini, M. K., Chan, S. G., & Sallahuddin, H. (2010). Bank efficiency and non-performing loans: Evidence from Malaysia and Singapore. Prague Economic Papers, 19(2), 118-132. https://doi.org/10.18267/j.pep.367

Zulkifli, N. E., & Ahmad, Z. (2022). Nonperforming loans in Malaysia's commercial banks: Analysis of trend and issues. International Journal of Academic Research in Accounting, Finance and Management Sciences, 12(2). https://doi.org/10.6007/ijarafms/v12-i2/12930