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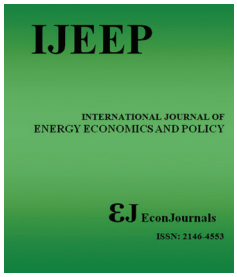

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A Pooled Mean Group Approach to the Joint Effects of Oil Price Changes and Environmental Risks on Non-Performing Loans: Evidence from Organisation of the Petroleum Exporting the Countries

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ABSTRACT

This paper revisits the work of Idris and Nayan (2016a) on the joint effects of oil price volatility and environmental risks on non-performing loans (NPLs). Therefore, the current paper uses evidence from 13 Organisation of the petroleum exporting countries spanning 1996-2015. The present situation of worldwide NPLs is persistent and on the rise which indicates a global deterioration of loans qualities. The NPLs is more pronounced amongst the OPEC countries whose average ratio of NPLs is on the verge of the banking crisis. This directly affects further loan creation, banks' liquidity, investment and productivity. Notwithstanding, the different measures put in place by regulatory authorities in OPEC countries to tackle the situation, the problem persists. The motivation of this paper is to examine the impact of systematic risks factors of oil price changes and environmental risks on NPLs by employing Pooled Mean Group methods. The results reveal that oil price changes significantly but inversely affect NPLs while environmental risks factor is found to be significantly and positively affecting NPLs. The policy implications of the findings are that for the OPEC countries to achieve financial stability they should reduce the impact of systematic risks on their financial systems. Therefore, for a continuous minimization of bad loans, the OPEC economies should efficiently increase their earnings from the oil exportation or alternatively through increased diversification of the OPEC economies from the monoculture economic activity of oil exportation. Furthermore, environmental risks should be mitigated through strong legislation for all businesses and economic units in the countries to be covered by adequate insurance covers against these calamities. Finally, OPEC governments should ensure that their prudential guidelines cover lending to business activities that are prone to such systematic risks.

Keywords: Non-performing Loans, Oil Price, Environmental Risks, OPEC Countries, Pooled Mean Group Methods
JEL Classifications: G32, Q43, Q54

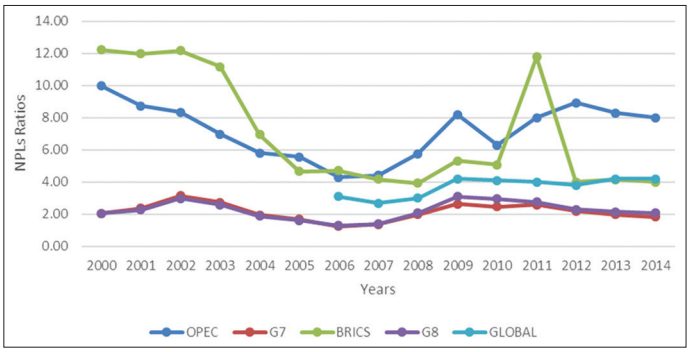
1. INTRODUCTION

The current situation of deteriorated world non-performing loans (NPLs) as exhibited in Figure 1 is an indication of financial fragility and a threat to global financial stability that require urgent resolution (Idris and Nayan, 2016b). Although, the problem is much more pronounced among the GIPSI[1] countries as observed by Castro (2013) the intensity of NPLs amongst the OPEC countries is also a source of concern giving their position in terms of possession of over 80% of world proven oil reserve which represents over 35% source of world energy (Idris and Nayan, 2016a; OPEC, 2016).

This is a revisit to an earlier paper of Idris and Nayan (2016a) that investigated the relationship between oil price changes, environmental risks and NPLs amongst the OPEC countries which employed the static panel methods. This current paper provides new and additional evidence of the relationship by employing a dynamic panel method of Pooled Mean Group (PMG) to estimate the dataset of 13 OPEC member states spanning 1996-2015. There are many factors that have been found to be causing NPLs which

1 These are the countries of Greece, Ireland, Portugal, Spain and Italy.

Figure 1: Average non-performing loans ratios of the global, organisation of the petroleum exporting countries, G7, G8 and Brazil, Russia, India, China and South Africa (BRICS) Countries



are systematic and unsystematic in nature, that is, macroeconomic, industry-specific and bank-specific determinants. However, real gross domestic products (RGDP) and unemployment rate determinants have been fascinating due to their influence on economic units' cash-flows generating abilities upon which banks lend.

The growth in economic activities which in this study is denoted by real GDP can impact positively on NPLs through increased and steady cash-flow of the borrowers thereby improving their abilities to pay back loans and/or interests as at when due while a fall in the real GDP can propel NPLs because it will curtail their repayment abilities. Similarly, an increase in the unemployment rate can be transmitted to NPLs theoretically because of more persons that will be out of job and fall of demand for goods and services. Thus, affecting the general cash-flows of the economic agents hence the rise of credit default and successive NPLs.

Furthermore, the channels through which oil price changes and occurrence of disasters can affect NPLs depends on their directions. For example, an upward oil price change can increase the cash-flows of the economic units and improve their loan repayment abilities while a downward change in oil price can negatively impact on their repayment abilities thereby deteriorating the NPLs positions. Likewise, the occurrence of a major disaster can cause fatalities, injuries, displacements of economic agents and/or affect critical infrastructure thereby interrupt the general business activities of an economy. These disruptions can affect cash generating abilities of not only the borrowing customers and their loans repayment abilities but also general demand for goods and services thereby creating defaults which can lead to NPLs.

This paper relies on the systemic risks theory and credit-credit theory in explaining the effect of oil price changes and environmental risks on NPLs. Love and Turk Ariss (2014), Collier and Skees (2013), Collier et al. (2011), Haldane and May (2011), Sy (2007). The remaining sections of this paper are in the following sequence: Section 2 discusses relevant literatures on GDP, unemployment rate, systemic risks factors of oil price changes and environmental risk and NPLs. Further, Section 3 highlights the data and empirical method of the study. The fourth section discusses the empirical findings. Lastly, Section 5 concludes the paper and offers policy implications of the findings.

2. REVIEW OF RELATED LITERATURE

There is no dispute amongst researchers on what constitutes NPLs which is generally perceived to mean a loan whose principal and/or interest that has not been paid for over 90 days. For example, Beck et al. (2015), Akinlo and Emmanuel (2014), Klein (2013) and Minton et al. (2009) consider NPLs as loans on which principal repayment and/or interest have not been made for a period of over 90 days. Nevertheless, this excludes restructured loans and repayments that have been received through recovery actions (Idris and Nayan, 2016a).

Despite the importance of bank assets quality to economic growth and development, the NPLs data from World Development Indicators (WDI) and Bank scope spanning 2000-2014 in Figure 1 reveal a global persistent and rising level of NPLs as well as a large proportion of NPLs amongst OPEC member states compared to those of the major economic groupings of G7, G8 and BRICS. Therefore, this magnitude of NPLs poses a serious challenge to financial stability not only to the OPEC countries but also to the world at large hence the need for policymakers and researchers to investigate the problem bad loans in OPEC countries.

Although, there are several researches that have been conducted around the world on the determinants of NPLs but much of them revolve around bank-specific, industry-specific variables and macroeconomic variables of GDP, interest rate, inflation rate, exchange rate and unemployment (Beck et al., 2015; Ghosh, 2015; Makri et al., 2014; Castro, 2013; Louzis et al., 2012; Mileris, 2012; Pesola, 2011; Vogiazas and Nikolaidou, 2011). Nonetheless, there are few studies that attempted to investigate the influence of oil price changes and environmental risks, such as the studies of Al-Khazali and Mirzaei (2017), Idris and Nayan (2016a), Miyajima (2016), Klomp (2014) and Collier et al. (2011).

The OPEC countries are highly confronted by the challenges of frequent oil price changes and prevalence of natural and technological disasters as detailed in statistics provided by OPEC (2016) and EM-DAT[2] (2016) respectively. Consequently, investigating the effects of these variables on NPLs amongst the OPEC member states will avail us with insights on the policy responses that will minimise the problem of NPLs and ensure sustainable financial stability.

The variables of GDP and unemployment rate have been studied intensively as determinants of NPLs but the findings are far from being conclusive. A country's GDP is an important macroeconomic determinant of NPLs and has been included by numerous researchers in their models and has been found to have a significant relationship with NPLs. For example, Ghosh (2015) finds a significant inverse relationship between GDP and NPLs. Similarly, the study of Makri et al. (2014) reveals that an annual percentage growth rate of GDP denoted a significant negative relationship to NPLs. Further, the Castro (2013) discovers a significant and an

2 Guha-Sapir and Below, Hoyois-EM-DAT: The CRED/OFDA International Disaster Database-www.emdat.be-Université Catholique de Louvain-Brussels-Belgium.

inverse relationship between a growth in GDP and NPLs. Also, Louzis et al. (2012) discover a negative association between GDP and NPLs. Therefore, this paper expects RGDP to have a significant but inverse effect on NPLs.

Correspondingly, the rate of unemployment is widely used by numerous researchers due to its association with economic activities of economies which impact on households' income and demand for goods and services hence its effect on general cash-flows of economic agents. Quagliariello (2007) opines that unemployment rate effects on business activities of economies do influence economic units' ability to repay their debts. The finding of the relationship between unemployment and NPLs is inconclusive. For example, the studies of Anastasiou et al. (2016a), Konstantakis et al. (2016a), Ghosh (2015), Castro (2013) and Louzis et al. (2012) documented a statistically significant and positive effect of the unemployment rate on NPLs. Nevertheless, Akinlo and Emmanuel (2014) reveal a positive but a non-significant relationship between unemployment rate and NPLs. Hence, this paper anticipates a positive influence of unemployment rate on NPLs. As stated earlier apart from RGDP and unemployment rate, the factors of oil price changes and environmental risks can also influence the level of countries NPLs.

Despite the significance of oil price and environmental risks to global economy very limited attention has been given to their impact on financial stability hence there are scarce studies on the relationship between the variables and NPLs. The vast majority of these limited studies are restricted to their effects on economic growth and financial activities, such as the studies of Breunig and Chia (2015), Mcdermott et al. (2014), Shabnam (2014), Sotoudeh and Worthington (2014) and Cavallo et al. (2013). Other related studies are those of Collier and Skees (2013), Berg and Schrader (2012), Aguiar-Conraria and Soares (2011), Farzanegan and Markwardt (2009), Poghosyan and Hesse (2009), and Aintablian et al. (2007). However, in the recent time there emerge evidence on the relationships between oil price changes, environmental risks and NPLs in studies such as; Al-Khazali and Mirzaei (2017), Idris and Nayan (2016a), Miyajima (2016), Klomp (2014) and Collier et al. (2011).

Consequently, this paper is motivated the global and OPEC's levels of financial fragility being typified by the large magnitude and persistent ratios of NPLs and the deteriorating global oil price and an increasing intensity and vulnerability to both national and international disasters. Furthermore, we are also encouraged by the inconsistency of the findings of the previous studies on the relationship between GDP, unemployment rate and NPLs which were basically conducted outside the peculiarities of OPEC countries. Thus, investigating the links between these systemic risk variables of oil price changes, environmental risks and NPLs can contribute in minimising the NPLs amongst the OPEC member states as well as improving their general bank assets qualities.

3. DATA AND EMPIRICAL METHOD

This section stipulates the variables that were included in modelling the relationship between the systemic risks of oil price, environmental risks factors and NPLs to find out if they provide additional explanatory power when added to the baseline model of the macroeconomic determinant of NPLs amongst the OPEC member countries.

Thus, this paper took evidence from the dynamic panel data of 13 OPEC member states and employed the PMG methods to examine whether the decline in oil price and high frequency of natural and technological disasters can provide an explanation to their deteriorated bank loan qualities.

3.1. Data Descriptions

The paper uses annual aggregated data spanning 1996-2015 obtained from Bank scope datastream in the case of NPLs. Further, the data on oil price changes, environmental risks, RGDP and unemployment variables were obtained from OPEC databanks, EM-DAT database and World Bank's WDI respectively. The details are provided in Table 1.

3.2. Econometric Techniques

This paper with some modifications follows the work of Anastasiou et al. (2016a) in developing equation 1 as the model specified for this study. The model has NPLs as the dependent variable while the variables of interest which are the oil price changes and environmental risks. The control variables are the RGDP and unemployment rate.

$$NPLR_{it} = \beta_0+\beta_1 OP_{it}+\beta_2 ERS_{it}+\beta_3 RGDP_{it}+\beta_8 UNEMP_{it}+\varepsilon_{it} \quad (1)$$

Where,

NPLR represents the ratio of NPL to total loan. OP and ERS mean oil price changes and environmental risk respectively. RGDP refers to real GDP. UNEMP is the unemployment rate and Ɛ means error term, whereas it represents every country overtime.

The paper investigates the long run relationship between NPLs and the variables of interest of the study using PMG. Following Pesaran

Table 1: Summary of the definition of variables

Variables	Measurement	Sources	Expenditure outcome
NPLR	NPL/total loans	Bank scope date base	n.a
RGDP	Real GDP (constant 2005 US$)	WDI-World Bank database	(-)
UNEMP	Unemployment rate (%)	WDI-World Bank database	(+)
OP	OPEC basket price	OPEC database	(-)
ERS	Environmental risks	EM-DAT	(+)

NPLR: Non-performing loans ratio, RGDP: Real gross domestic product, UNEMP: Unemployment rate, OP: Oil price changes, ERS: Environmental risks

et al. (1999) the advantages of PMG over other heterogeneous cointegration techniques are that PMG constrains the long run estimates to be similar across entities. Furthermore, the model is appropriate for this study due to the common product of OPEC member states which is expected to influence the long run coefficient in a similar way.

Moreover, the PMG method of estimation intermediate between the mean group (MG) and dynamic fixed effect (DFE) which allows both slope and intercepts to vary among groups and fixed effect modelling where only slopes are fixed, the intercept is allowed to differ among groups. The unrestricted ARDL model specification is depicted in equation 2.

$$y_{it} = \sum_{j=1}^{p} \beta_{ij} y_{i,t-j} + \sum_{j=1}^{q} \alpha'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where, y_{it} is the dependent variable, $x_{i,t-j}$ is the vector of explanatory variables for country i. The subscript, t = 1, 2, 3,…. T for time t and i = 1, 2, 3 … N, for countries in the sample. The symbol μ_i denotes fixed effect parametisation. Similarly, equation 2 can be rewritten as VECM Model as shown in equation 3.

$$\Delta y_{it} = \lambda_i (y_{it} = y_{i,t-1} - \beta'_i x_{i,t-1} + \mu_i + {}_{it} + \sum_{j=1}^{p-1} \beta_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \alpha'_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

Where l_i is the error correction term coefficient and β_i represents long run parameters which are assumed to be common across entities. Empirically, the model for this paper is presented in equation 4.

$$NPLR_{it} = \beta_{0t} + \beta_{1t} OP_{it} + \beta_{2t} ERS_{it} + \beta_{3t} RGDP_{it} + \beta_{4t} UNEMP_{it} + \mu_i + \mathcal{E}_{it} \quad (4)$$

Where $NPLRs_{it}$ is the non-performing loans; OP_{it} represents oil price changes; ERS_{it} is the environmental risks; $RGDP_{it}$ is the real gross domestic products and $UNEMP_{it}$ is the unemployment rate. i = 1, 2, 3 … 13 for the number of countries in the sample and t = 1, 2, 3… 20 for the number of periods/years. The dynamic panel ARDL (1, 1, 1, 1, 1) specification of Equation 4 is presented in Equation 5.

$$NPLR_{it} = \beta_{1i} + \beta_{2i} OP_{it-1} + \beta_{3i} ERs_{it-1} + \beta_{4i} RGDP_{it-1} + \beta_{5i} UNEMP_{it-1} + \lambda i NPLs_{i,t-1} \mu_i + \mathcal{E}_{it} \quad (5)$$

Furthermore, owing to its advantages over other dynamic panels estimators as highlighted above and elsewhere in the thesis the PMG is being used, researchers. The PMG estimators have been used in researches by authors such as Bangake and Eggoh (2012), Iwata et al. (2011), Ndambendia and Njoupouognigni (2010) and Tan (2009). Moreover, some of the earlier researchers that used the PMG estimators are those of Goswami and Junayed (2006), Martínez-Zarzoso and Bengochea-Morancho (2004), Bassanini and Scarpetta (2002) and Pesaran et al. (1999).

4. EMPIRICAL FINDINGS

The correlation analysis is conducted to determine the direction and strength of association between explained and explanatory variables. The analysis further indicates the possibility of the existence of high-order linear correlation (multicollinearity) amongst the explanatory series. The strength of correlation coefficient among the explanatory variables shows the possibility of having multicollinearity in a model. From Table 2, the probability values indicate that the null hypothesis of no correlation among pairs of variables is mostly rejected in all variables. Although there exists a significant correlation among the explanatory variables, the correlation coefficients are found reasonably below the threshold value of multicollinearity. This is emphasised to be 80 percent level of association (Kennedy, 1993) in Sufian & Habibullah, 2010), anything below 90 percent (Saif-Alyousfi, Saha, & Md-Rus, 2017a) and (Saif-Alyousfi, Saha, & Md-Rus, 2017b) and even 90 percent (Tabachnick & Fidell, 2013).

The results further indicate that when homogeneity assumption is imposed on the long run coefficients, it tends to increase the standard errors and alter the coefficient under the null hypothesis of no significant difference between MG and PMG and that PMG is more efficient. This is clear from the non-significance of the Hausman test of χ^2 value, 0.000 with a probability of 1.000. If homogeneity of all variables is imposed on all the long run coefficient, then the maximum log likelihood falls from the MG value of 251.080 to that of PMG value 212.983.

The advantage of the PMG model over the usual DFE is that it allows the dynamic specification to differ among countries in the short run. It is equally important to stress that the estimates of ARDL (1,1,1,1,1,1,1) are robust to misspecification bias. This is because, in addition to the lag length selection, the time length is found larger than the entities. Finally, the results in Table 3 indicate that the estimates of the PMG seem quite robust to misspecification bias, outliers and lag order selection. Hence, the most appropriate model based on Hausman test presented beneath Table 3.

The parameter estimates of the PMG model reveal that one US dollar increase in the price of oil will lead to an average decrease in the ratio of NPL by 0.02%. The coefficient is statistically significant at one percent level. The finding implies that an increase in the oil price for oil exporting economies like those of OPEC member states will improve the cash flow position of borrowing customers. This will enhance their ability to pay back loans as at when due, thereby reducing the ratio of the banks' NPLs. Although there is no much empirical evidence on the relationship between oil price and NPLs, however, the result of this study aligns with the interesting study of Al-Khazali and Mirzaei (2017), Idris and Nayan (2016a) and Miyajima (2016) which found a negative relationship between oil price and NPLs.

Furthermore, the coefficient of environmental risks is found positively related to NPLs. The coefficient implies that an index increase in the level of environmental risks will lead to on average, about 0.17% increase in the ratio of NPL in the OPEC member states. The statistic is significant at 99% confidence interval. The

Table 2: Correlation and multicollinearity analysis

Series	NPL	OP	UNEMP	RGDP	ERS
NPL	1.000000				
OP	−0.355476 (0.0029)	1.000000			
UNEMP	−0.092514 (0.4530)	−0.038742 (0.7538)	1.000000		
RGDP	−0.495449 (0.0000)	0.452180 (0.0001)	−0.252268 (0.0380)	1.000000	
ERS	0.121646 (0.3231)	−0.224009 (0.0663)	−0.033281 (0.7876)	−0.290119 (0.0164)	1.000000

NPL, OP, UNEMP, RGDP and ERS represent non-performing loans, oil price changes, unemployment, real gross domestic products and environmental risks respectively. The values in parenthesis are the probability value of the correlation coefficients. Source: Researcher's computation

Table 3: Pooled estimate of ARDL (1,1,1,1,1): Dependent variable: NPLS for OPEC countries

Variables	Mean group (MG)	PMG	DFE
OP	1.350 (1.387)	−0.020*** (0.006)	0.117 (0.228)
ERS	−0.587 (1.079)	0.174*** (0.061)	0.743 (1.277)
RGDP	−4.582*** (0.582)	−4.090*** (0.973)	40.020 (28.379)
UNEMP	25.997 (24.765)	0.249*** (0.086)	−0.322 (1.809)
Speed of adjustment	−0.652** (0.295)	−0.468** (0.181)	−0.201*** (0.052)
MLL	251.080	212.983	144.310
Number of countries	13	13	13
Hausman test		0.000 (1.000)	

The values in parentheses are asymptotic standard errors. The asterisks, *** and ** denote significance level at 1% and 5% respectively. The figures in parenthesis against Hausman represent the probability value of the test, PMG: Pooled mean group, DFE: Dynamic fixed effect, MLL: Maximum log likelihood. Source: Author's computation

probable explanation of this scenario is that on the outbreak of a major natural and/or technological disaster, the loan repayment process can be put to a halt because the affected economic units will lose their source of revenues, employees will lose their sources of earnings as well as demand for goods and services will decrease due to the sustained losses. The findings of this study is related to the findings of Collier et al. (2011) which reveal a positive relationship between the disaster of El Nino and restructured loans as well as the findings of Berg and Schrader (2012) which reveal a relationship between environmental risks and, loan demand and access to credit. However, the finding of this study is similar to the study of Idris and Nayan (2016a) which finds a statistically significant and positive relationship between environmental risks and NPLs amongst the OPEC countries.

The study controlled for RGDP and unemployment in the estimation process. This is because the RGDP and unemployment rate are in most cases consistently providing negative and positive relationship respectively. This study is not an exception, the coefficient of RGDP is negative and statistically significant at one percent level. It suggests that a billion US dollars' increase in RGDP will lead to a reduction in the ratio of NPLs on average by 4.09%. This is in line with other series of studies in both developed countries of Europe, US, Australia, and other developing countries such as Nigeria and Tunisia (Abid et al., 2014; Akinlo and Emmanuel, 2014; Makri et al., 2014; Zaib et al., 2014; Castro, 2013; Louzis et al., 2012).

On the contrary, the coefficient of unemployment is positively and statistically significant. This shows that OPEC like other countries in the World, one percent increase in the level of unemployment will cause an average increase in the ratio of NPLs by 0.25%. Meaning that increase in the number of unemployed in an economy usually goes a long way with increased loans quality deterioration. This finding is in consonance with the results of studies such as Anastasiou et al. (2016a) and Anastasiou et al. (2016b), Konstantakis et al. (2016b) Castro (2013) and Messai and Jouini (2013) who equally found a positive relationship between unemployment rate and NPLs.

The Table 3 also displays the coefficient of the error correction term. This measures the speed or degree of adjustment. It is the reasonable length of time taken for deviation to adjust back to equilibrium in the long run. It is often that deviations usually occur in the short run, however, it is expected to adjust and revert back to equilibrium in the long run. The speed of adjustment in this study indicates that about 47% of deviations that occur among the group of countries in the short run will adjust back to equilibrium within the subsequent year. This is considered reasonable enough especially for OPEC member states which are bedevilled with the uncertainty of oil price which is their major source of dependence.

5. CONCLUDING REMARKS

The paper focuses on the effects of systemic risks on the ratio of NPL of 13 OPEC member states. It examines the objectives by employing PMG method and using annual panel data set for 20 years, spanning 1996-2015. The result shows the estimated coefficient of oil price changes is found negative and significantly related to NPL in OPEC countries. This evidently indicates that positive changes in the oil prices lead to a decrease in the ratio of NPLs as found in the studies of Al-Khazali and Mirzaei (2017), Idris and Nayan (2016a) and Miyajima (2016) Also, the estimated results from Table 3 indicate that the environmental risks positively affect the NPL of the OPEC countries as documented by the studies of Idris and Nayan (2016a), Klomp (2014) and Collier et al. (2011).

The policy implication of this finding is that for the OPEC member countries to achieve financial stability they need a continuous minimization of bad loans. Therefore, the OPEC economies should efficiently increase their earnings from the oil exportation. Although these disasters are mostly natural in nature with fewer governments control over their occurrence, yet, the governments

of OPEC member states can mitigate their effects on NPL within their limits by ensuring strong legislation for all businesses and economic units in the countries to take adequate insurance cover against these calamities.

Therefore, this article recommends that future researches should be conducted considering other countries of the world that export petroleum products even if they are not OPEC members. Additionally, we recommend that future studies should look at the comparative analysis between NPL in the conventional and non-performing financing in Islamic banking platforms.

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