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# Bank Liquity Risk and Bank Credit Risk: Implication on Bank Stability in Ghana

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***Abstract***— Bank sector crisis across the globe is largely blamed on the joint effort of bank liquidity and bank credit risks. And so, the twin concepts of liquidity and credit risks have come under keen academic scrutiny, especially in investment finance. Contributing to extant literature on these developments, secondary data were obtained from the websites of nine banks in Ghana, spanning 2008 to 2018, to determine how liquidity and credit risks separately and interactively impact bank stability in Ghana. Analysis of data was done using a panel regression through the fixed effects model after running the Hausman Test. The study confirms an inverse liquidity risk-bank stability relationship, emphasising the need to channel idle funds into interest earning securities to consolidate bank profits. Although a further revelation suggests an insignificant negative relationship between credit risk and bank stability, it re-echoes the need to implement policy recommendations made by the Banks and Specialised Deposit-Taking Institutions' ACT 2016 (ACT 930), section 62 of Ghana, on the threshold to lend funds to clients. Bank-size-stability relationship was positive. Increasing bank size through establishing more branches nationwide is encouraged but to a precautionary level, since banks tend to suffer diseconomies of large scale operations due to unregulated expansion. There is the need to observe the Basel III provisions on maintenance of a 30-day optimum liquidity threshold of up to 100% and above. Besides, banks should tighten up their credit requirements and also ensure loan repayments history is monitored to benefit clients who are in good standing.
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***Keywords***—Liquidity Risk, Credit Risk, Bank Crisis, Bank Stability

## I. INTRODUCTION

Managing risk in every organisation, especially in the financial sector, is key to institutional stability. This is necessary due partly to the continual increase in credit delinquencies which undermines security in the financial sector and economic recovery. Documented evidence confirms that poorly managed financial intermediation contributed to the subprime mortgage crisis [1]. This notwithstanding, some researchers still debate the exact causes of bank sector instability [2]. Even investment analysts continue to hold the belief that the 2007/2008 crisis was one sparked by differences in yield spreads emanating from a mismatch between credit and liquidity maturities. For instance, Fisher [2] posits that the two main justifications for the differences in yield spreads are credit risk and liquidity risk. This, he explains, is brought about by the absence of legislations to regulate the optimum level of liquid assets to be maintained at a given period by bank management to enable them oblige to creditor maturing debts [3, 4]. Crowe [5] cited in Maaka [6] sees risk as an uncertain potential event that has control over the success of a financial institution. In fact, risk has the likelihood of manipulating the outcome of an economic activity that potential investors earmark to commit financial resources. Due to these unfolding events, stakeholders in the financial sector are awakened to the realities of bank instability linked mostly to market imperfections. In these ensuing circumstances, it is imperative that depositor funds are given a guaranteed level of protection against bank failures [3].

Efforts are made by regulators of the bank institution at identifying potential sources of bank fragilities [7]. In the case of Cecchetti and Schoenholtz [8], they identify two likely risk situations that the bank could face; one is the uncertainty from panic withdrawals of funds by depositors (liquidity risk), and two; the delay or a complete failure by customers to fulfill their loan contractual obligations (credit risk). By dint of this, a firm is said to be illiquid when it has not adequate funds to settle its financial obligations against creditors without unacceptably incurring losses. Liquidity risk therefore arises when management of the bank expresses fear of being able to settle maturing indebtedness to creditors. When it occurs this way, the legal implication is that, such a firm is in default [9].

Since liquidity risk is closely linked to funding liquidity, Nikolaou and Drehmann [9] "define funding liquidity as *the ability to settle obligations with immediacy"*. Following this definition, it is clear that funding liquidity

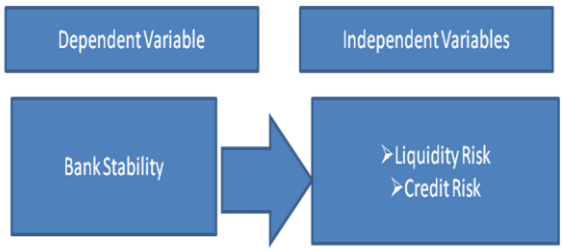
risk means a time frame within which a firm is unable to settle its indebtedness due to inaccessibility to funds. Banks' inability to raise funds due to a maturity mismatch between cash inflows and outflows constitute funding liquidity risk [10, 11]. This brings to bear the relevance of succinctly differentiating funding liquidity risk from liquidity risk; "*funding liquidity risk is binary in concept"*, thus, a bank is either able to raise funds to oblige to its debt or unable to do so. With liquidity risk, it is futuristic and over a time horizon [9]. Thus, whereas funding liquidity risk arises when banks are unable to source financial support to run their daily operations and to fulfill their financial commitments, liquidity risk is the uncertainty in the ability to meet creditor maturing debts. In this instance, the stability of banks is in disrepute.

Lending threshold by bank management is another concept that has suffered a checkered history. Due to high incidences of loan delinquencies, concerns are raised about the looming threats to financial stability. Cases of bank closures have an elaborate literature. Ghenimi, et al [12], have revealed that credit risk and liquidity risk are linearly related. As more loans are given out, the cash till of the bank is negatively affected. The implication here is that, increased credit risk induces a surge in liquidity risk. With reduced liquidity due to high appetite for granting loans, banks are more exposed to fragility. In considering all these imperfections in the bank environment, this study is a complementary attempt to approach bank stability issues empirically by assessing the effect of liquidity and credit risks on bank stability in Ghana.

The paper is structured into five sections; Section I comprises the introductory aspect of the study. The review of both theoretical and empirical literature is dealt with in section II, with methodology of the study occupying the centre spread of section III. Presentation of results and discussion in relation to empirical literature and practice come under section IV. In section V, conclusion is drawn from research findings. This is quickly followed by a paragraph where policy recommendations for implementation and adherence are made.

## II. RELATED WORK

The Modern Portfolio Theory (MPT) propounded by Markowitz [13] has been very useful to investment financiers and also to the risk-tolerant. And so MPT serves as a guide to investors in analysing portfolio risk. In an indirect fashion, bank management derives motivation from MPT when deciding on which securities to invest their idle funds and in what proportions, reminiscent of the liquidity implications. Management of banks are, by this theory, guided to decide on alternative investments or keeping optimum liquid assets to fulfill customer requests as they fall due. Corroborating this theory is the Flow of Funds Theory (FoFT), which facilitates the linkage between the financial system and the real economy through the lubricating role of money [14, 15]. This theory is also linked to the availability of cash and credit for smooth operations of the organisation. Since this is the basis of investment in an economy, it leads to capital accumulation at the macroeconomic level and indeed, a conduit for production of goods and services, which are a function of economic growth. This reiterates the fact that, at every given period within the space of operations of the organisation, there must necessarily be adequate cash to meet recurring expenses or readily available credit source to defuse funding challenges. This theory serves as a reminder to adopt prudent credit models, especially in the bank environment to forestall windfall crisis and to support bank stability.




Source: Researcher's Own Computation from Bank Financials (2008-2018)

Figure 1: Conceptual Framework

**Bank Stability**

One of the oversight responsibilities of the central bank is to study and identify early warning indicators of risk in the bank system [15]. This helps ensure optimal allocation of financial resources; only permissible under a sound and safe bank environment. Regulators must therefore endeavor to prevent expensive financial crisis that adversely affects the real economy [15]. There has however not been any generally accepted definition of bank stability, except to say it is a period within which claims from creditors are obliged to with immediacy and without unacceptable losses [9]. Other authorities in the bank sector have tried to link bank stability to the absence of bank crisis [16].

Due to the inability of regulators and scholars in the bank sector to agree on one definition of bank in/stability, it has compelled regulators of bank activities across the globe to independently and separately decide for themselves an acceptable definition in their peculiar situations. And as to whether to limit to only the bank institution or include the non-bank financial institution, is a matter of choice and dependent on conditions prevailing on each separate bank environment [17]. Nakamura and Steinsson [18] linked financial instability to a situation where the economic activities are negatively affected by fluctuations in price levels of financial assets. According to [17], what determines bank stability and how it affects financial system stability may take different forms across the globe. What influences bank stability in one economy may not necessarily be so in another economy and therefore needs a conceited approach. It is however well documented that,

after the global financial crunch in 2007, the focus of stakeholders in the industry was on insolvency risk analysis, due to the colossal loss suffered by most banks.

**Liquidity Risk and Bank Stability-Empirics**

Bank liquidity status is a measure of its ability to fulfil customer demands as they fall due. Since bank liquidity is a function of bank profitability, it is worthwhile to indicate that bank stability is dependent on bank performance in terms its profitability. As such, most studies on bank performance have, by protraction, linked their findings to bank stability in a latent fashion [18]. According to Iqbal [19], the direction of the bank is determined by how well it manages its liquidity issues. Liquidity risk has been categorised into two depending on institutional policies; market liquidity risk and funding liquidity risk [20, 21, 22]. Whereas the difficulty with which banks convert financial assets into cash refers to market liquidity risk, funding liquidity refers to the inability of banks to access cash and cash equivalents. These two are found to linearly correlate eachother [11].

Demirguc-Kunt and Huizinga [23] reported mixed results in their study on liquidity-risk performance relationship. Whilst positive relationship was established between liquidity risk and net profit margin, they confirmed an inverse relationship between liquidity risk and bank profitability, and in that sense bank stability. Liquidity risk was also linked negatively in the results of [24, 25, 26, 27]. While this negative liquidity risk-bank stability hypothesis appears to gain public acceptance, there is counter evidence that the holding cost of funds may more than compensate for the benefit of the high liquidity reserves [28]. In tandem with this, gauging bank stability by the average of liquid assets to customer and short-term funds [29] positively linked bank stability to bank profitability (ROA). Consolidating this position, Olagunju, David and Samuel [30] confirmed that liquidity risk-bank performance (stability) relationship is a positive one. In other evidenced instances, bank liquidity risk has also been linked positively to bank stability [31, 32].

**Credit Risk-Bank Stability Relationship**

Even though several works have been done on the joint influence of liquidity and credit risks on bank stability such as He and Xiong [33], this paper wades into the empirical discussion on how liquidity and credit risks interact and individually impact bank stability in Ghana. Acharya and Viswanathan [34], explain that risk-tolerant banks eventually reduce funds available to meet depositor demand, thereby exposing them to liquidity crisis. As mentioned earlier, credit risk involves fluctuations in debt instruments and derivative valuation which depends on the credit worthiness of borrowers [35, 36]. The level of bank stability improves with diminished non-performing loans. Jeon and Lim [37, 38], posit that banks with fewer loans are able to enhance their stability through coverage for clients' withdrawals. This means provision of fewer loans leaves enough liquid assets for creditor needs.

A body of literature has positively linked the interactive relationship between credit risks and bank stability. For instance, as cited in [36], Brewer [40] investigated the impact of credit risk on bank stability and found that bank loans are positively related with bank performance. However, a higher loan-to-assets ratio exposes the bank to more fragility [38]. Studies that reported contrary evidence were those of [44, 45, 46, 47, 48, 49].

A number of variables were adopted and controlled for credit risk and liquidity risk in the model. Empirically, Shapiro [50] cited in [31] identified that bank size has a statistically significant linear relationship with bank profitability. He explains that larger firms enjoy better negotiating powers which leads to lower financing cost of loans and transactions. Tumin [51] posits that larger banks enjoy economies of large scale operations which invariably influence bank profitability and ultimately supports bank stability. Garcia-Marco and Roles-Fernandez [52] and [53] advanced an argument in aid of larger sized bank preference. In Adusei' [55] research, although he studied rural and community banks, it revealed a significant positive relationship between funding risk and bank stability. The collapse of some indigenous Ghanaian banks was partly blamed on poor customer deposit mobilisation and misapplication of funds [55, 4]. Kohler [54] stress that economic use of large customer deposits could enhance bank stability whilst funds in the form of customer deposits channelled into unproductive ventures could worsen the already volatile situation. Adusei [18] again reveals that if more customer deposits are given out as loans the bank will much be exposed to insolvency risk. This development re-echoes the positive link between bank profitability (ROA) and bank stability (Return Adjusted Return on Equity to Assets) by [55] although an insignificant relationship.

## III. METHODOLOGY

Since available literature on risk exposure has not had any concrete establishment yet, this study incorporates four additional bank level regressors (BLR) that are relevant in determining the implications of bank liquidity risk and bank credit risk on bank stability in Ghana. The study first ran the fixed and random effect models to identify which was appropriate for usage. Ultimately, the fixed effect model was found to be appropriate for data analysis based on the Hausman Test results. Nine (9) banks were sampled from the current 23 operational banks in the Ghana bank industry based on the following criteria;

- banks that met the minimum capital requirement as at the time of data collection
- banks enlisted in the Ghana Stock Exchange
- banks that had published audited financials for the period of data collection (2008-2018)

**Dependent Variable**

Bank stability (STAB), as used by [18] is the dependent variable and calculated as below;

$$STAB_{i,t} = \left[ \frac{ROA_{i,t} + \frac{E_{i,t}}{A_{i,t}}}{\sigma ROA_{ip}} \right] \quad (1)$$

Where:

$STAB_{i,t}$ = Bank ***'i'*** Stability score at year ***'t'***

$ROA_{i,t}$ = Return on Assets Ratio of bank ***'i'*** at time ***'t'***

$\frac{E_{i,t}}{A_{i,t}}$ = Ratio of Bank ***'i'*** Equity at year ***'t'*** to bank ***'i'*** Assets at year ***'t'***

$\sigma ROA_{ip}$ = Standard Deviation of the Return on Assets of bank ***'i'*** across sample period ***'p'*** [19].

This is quite similar to that by [56] in his study of "*ownership structure and risk-taking behaviour in conventional and Islamic banks; evidence from MENA countries"*. This measure is regarded as a stability gauge since it is *the inverse of the probability of insolvency"* of the bank [57, 58].

**Independent and Control Variables**

A number of bank level characteristics deemed to influence bank stability were adopted as regressor variables. These included;

Bank liquidity risk (BLRISK) [measured as the ratio of total loans to total deposits of bank ***'i'*** at year ***'t'***];

$$\frac{TL_{i,t}}{TD_{i,t}} \quad (2)$$

Bank credit risk (BCRISK) [computed as the ratio of total loans to total assets of bank ***'i'*** at year ***'t'***].

$$\frac{TL_{i,t}}{TA_{i,t}} \quad (3)$$

These core explanatory variables were controlled for by the following variables;

Bank size (BSIZE) [Logarithm of total assets or Logarithm of Total Deposits];

$$Log([TA]/Log[TD]) \quad (4)$$

Bank capitalisation or adequacy ratio (BCAR) measures banks' ability to settle all indebtedness and to favourably deal with credit risk issues. According to the Bank for International Settlements (BIS), CAR is computed as follows;

$$\text{CAR} = \left[ \frac{TIER1 - CAP + TIER2 - CAP}{RISK - WEIGHTED - ASSETS} \right] \quad (5)$$

***Where;***

***Tier 1 Cap*** – Bank Capital that comprises Owner Equity plus Retained Earnings

***Tier 2 Cap*** = Encompasses bank supplementary capital which includes securities and reserves

***Risk-Weighted Assets*** = Depicts the combination of the probabilities of all classes of bank assets that face losses or gains (BIS)

Bank funding risk (BFUNDRISK) [taken as deposits to assets ratio plus equity to assets ratio divided by the standard deviation of deposits to assets ratio [18]. See formula below;

$$Z - score(FUNDRISK)_{i.t} = \left[ \frac{\frac{DEP}{TA_{i,t}} + \frac{E}{TA_{i.t}}}{\sigma\left(\frac{DEP}{TA_{ip}}\right)} \right] \quad (6)$$

**Model Specification**

$$Y_{it} = B_0 + B_1(BLRISK_{it}) + B_2(BCRISK_{it}) + B_3(BCAR_{it}) + B_4(FUNDRISK_{it}) + B_5(ROA_{it}) + \varepsilon_{it}$$

***Where;***

$Y_{it}$ = Bank ***'i'*** stability at year ***'t'***

$BLRISK_{it}$ = Bank ***'i'*** Liquidity Risk status at year ***'t'***

$BCRISK_{it}$ = Bank ***'i'*** Credit Risk status at year ***'t'***

$BCAR_{it}$ = Bank ***'i'*** Capital Adequacy Ratio at year ***'t'***

$FUNDRISK_{it}$ = Bank ***'i'*** Funding Risk status at year ***'t'***

$ROA_{it}$ = Bank ***'i'*** Profitability Performance (Measured by Return on Assets) at year ***'t'***

$\varepsilon_{it}$ = Error term of Bank ***'i'*** at year ***'t'***

$B_0$ = Constant term

$B_1$ *to* $B_5$ = Are parametres of regressor variables in the Model

## IV. RESULTS AND DISCUSSION

STAB is used in the sense of bank stability. The $R^2$ (Table 1) is about 21 percent; implying variance in the study variables explains 21 percent of bank stability. This further means a unit change in each explanatory variable will influence bank stability by 21 percent. The explanatory power of these variables in the model is quite weak, although Belete [59] thinks an $R^2$ greater than 20 percent is still large enough to reliably draw conclusions on model fitness. Given the *p* – value (0.0019) of the F – Statistic of 4.15, the information brought by the explanatory variables is statistically significant and better than what a basic mean would have brought. Besides, having run the Hausman Test (the *p* – value associated with the results is less than the alpha value of 0.05 (Prob> $chi^2$ = 0.0228[see Table 2]), by this, the null hypothesis which prefers the random effects model was rejected. Therefore, the fixed effects model was adopted for analysis of bank liquidity risk and bank credit risk and their relationship with bank stability [*Table* 2].

Table 1: Panel Regression Results

| | Fixed Effects | | | Random Effects | | |
|---|---|---|---|---|---|---|
| Var | Coeff | t-test | prob | Coeff | z-test | prob |
| CAP | 0.641 | 0.2 | 0.056 | -1.412 | -0.44 | 0.656 |
| SIZE | 3.223 | 3.52 | 0.001 | 2.498 | 2.71 | 0.007 |
| ROA | 0.199 | 1.51 | 0.003 | 0.009 | 0.09 | 0.925 |
| FRISK | 0.189 | 1.43 | 0.002 | 0.284 | 2.18 | 0.029 |
| CRISK | -3.342 | -1.14 | 0.260 | -3.615 | -3.00 | 0.003 |
| LRISK | -0.016 | -1.85 | 0.015 | 0.005 | 0.74 | 0.461 |
| CONST | 3.356 | 2.24 | 0.030 | 4.951 | 3.65 | 0.001 |
| | Overall | 0.214 | | Overall | =0.298 | |
| | | | | wald[ chi]^2 | | |
| | F(6,48) | 4.150 | | (6) | =23.74 | |
| | Prob>F | 0.002 | | | | |
| | | | | Pro>[ chi]^2 | =0.001 | |
| | N | =99 | | N | =99 | |
| | Durbin Watson Test | 1.9168 | | | | |

Table 2: Hausman Test Results

| | Coefficient | | | |
|---|---|---|---|---|
| | (b) | (B) | (b-B) | sqrt(diag(V_b-V_B)) |
| Var | Fixed | Random | Diff. | S.E |
| CAR | 0.641 | -1.412 | 2.053 | 0.471 |
| SIZE | 3.227 | 2.499 | 0.728 | - |
| ROA | 0.199 | 0.009 | 0.19 | 0.085 |
| FRISK | 0.189 | 0.284 | -0.095 | 0.025 |
| CRISK | -3.342 | -3.361 | 0.019 | - |
| LRISK | -0.016 | -0.005 | -0.011 | -0.021 |

b= consistent under H0 and Ha; obtained from xtreg
B=inconsistent under Ha; efficient under Ho; obtained from xtreg
Test: Ho difference in coefficients not systematic

$ch^2$ (6) =(b-B)'[V_b-V_B)^(-1)](b-B)
=14.69

Prob> $ch^2$ =0.0228

(V_b-V_B is not positive definite)

## V. DISCUSSION

Analysis of data per Table 1 shows a statistically negative relationship between bank liquidity risk and bank stability. This finding corroborates the results reported by [23]. The benefit with this inverse relationship lies in the bank's ability to attract higher returns on investment and interest income, as more of customer deposits are given out as loaned funds. This study agrees that maintaining high liquidity in the bank robs the bank of returns from investible assets, thereby worsening its profitability situation. In what seems to be in direct opposition, [31] established a positive relationship between bank liquidity risk and bank profitability and by protraction bank stability. He posits that maintaining high liquid assets adequately compensates the bank in terms of its credit worthiness. Besides, high liquidity gives the bank the opportunity to oblige with immediacy customer demands without incurring unnecessary losses [21].

Interestingly, result on Credit risk-Bank Stability relationship (*Table* 1) was inversely linked. Confirming this result, in their study of the impact of credit risk on bank performance, [46] find that credit risk has an inverse relationship with bank profitability which determines bank stability. What this means in investment sense under the negative relationship is that, as the default rate reduces, bank stability improves (decrease in vulnerability) and vice versa. In the case of [18] he found similar results and concluded that with deteriorating standards in lending funds to customers, banks are much exposed to instability consequences. When bank customers and counterparties fail to honour their loan repayment arrangements, the bank certainly encounters liquidity and insolvency challenges.

Similarly, [41] in Nigeria found a significant inverse relationship between credit risk and bank profitability. Since bank profitability is a function of bank stability, indirectly the finding was one of an inverse link with bank stability. This result points to a policy sense of needed control over funds given out to customers as loans. The study then concludes that a loose of control over loaned funds exposes banks to greater risk of illiquidity and distress. Other strands of studies that support this position are those of [48] and [49] who opine that bank performance decreases when credit risk surges.

Bank Size-Stability was linked positively in this paper, which agrees with the citation made of [50] by [31] that, large firms enjoy low cost of doing business due to their ability to negotiate favourably. By this, they concluded

that, larger firms have the urge to hedging and diversification of risk relative to smaller firms, thereby influencing long term survival. Larger firms therefore enjoy the advantage of economies of scale [51]. Another argument that supports larger bank size is by [52, 53]. Their argument is based on the hypothesised opinion that larger there is an improvement in the ability of bigger banks to relatively benefit from diversification of risk across product lines and that managers of these banking institutions are more skilful in managing organisational resources. This brings to bear the justification for larger firms to easily suppress volatility relative to smaller banks.

Funding-Bank Stability relationship was statistically positive in this study. *Table 1* finds FUNDRISK to have a statistically significant positive relationship with bank stability. These results imply that with an improvement in funding risk, the stability status of banks equally takes a positive trajectory, which is in sharp support with [18] study, who, although studied rural and community banks, revealed a significant positive relationship between funding risk and bank stability. This could mean that a positive change in the level of customer deposit mobilisation, bank stability can be guaranteed. The collapse of certain indigenous Ghanaian banks was partly premised on poor customer deposit mobilisation and misapplication of [4]. To confirm this, [54] and [23] stress that economic use of large customer deposits could enhance bank stability whilst funds in the form of customer deposits channelled into unproductive ventures could worsen the already volatile situation. Placing emphasise, [18] reveals that if more customer deposits are given out as loans (increasing loans to deposit ratio) the bank will much be exposed to stability crisis or insolvency risk.

The control variables in this study rather proved to impact bank stability positively. In the case of bank capital ratio (measured as equity capital to total assets), a statistically positive relationship was established with bank stability. This development re-echoes the positive link between bank profitability (ROA) and bank stability (Return Adjusted Return on Equity to Assets) by [18], although an insignificant relationship.

## VI. CONCLUSION AND FUTURE SCOPE

This study examined bank liquidity risk and bank credit risk and their implication on bank stability. Based on the findings, Liquidity risk had a statistically negative relationship with bank stability, emphasising the need to invest into interest earning securities to increase bank profitability and improve bank stability. Credit risk was found to insignificantly impact bank stability inversely. Notwithstanding this revelation, this study portends that it is worthwhile controlling volume of loanable funds to clients to reduce the exposure of banks to much fragility. Bank size and profitability play pivotal roles in bank stability and therefore decisions regarding bank size and profitability need be cautiously handled to avert any tendency of diseconomies of large scale operations.

Following the major findings, it is recommended that bank managers give credence to the liquidity cover ratio suggested by the Basel III Accord. Bank managers are advised not to keep excessive liquid assets, as this culture deprives banks of earning interest income which worsens profitability and by protraction bank stability**.** Single and counterparty obligor limits given banks on credit creation should be adhered to as a guide to limit much exposure to instability tendencies. Banks should keep a low loan-to-deposit ratio if they must escape extinction from the bank industry. Bank size could be cautiously increased since beyond certain level of asset growth could invite diseconomies of large scale operation.

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