# Competition-Stability Relationship in the Banking Sector

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## ABSTRACT

The goal of the current research is to study the competition-stability relationship in the Latvian banking sector.

Research period covers seven years – from 2007 till 2013. The sample consists of 16 Latvian commercial banks. Financial data is extracted from BankScope database.

The main method applied to achieve the established goal is a multiple regression analysis. Bank stability is used as a dependent variable and proxied by risk index. To measure the level of competition Lerner index and Boone indicator are calculated.

Besides, the consistency between concentration and competition measures is tested applying a correlation analysis. Concentration in the banking sector is measured using Herfindahl-Hirschman Index (HHI) and concentration ratio CR5. Calculations are performed in SPSS environment.

The research revealed no statistically significant relationship between the values of Lerner index and Boone indicator estimated for Latvian sample. The hypothesis about the consistency between different competition measures is rejected. In turn, the hypothesis about positive effect of competition on bank soundness is rejected only in the case when competition is proxied by Lerner index. Using Boone indicator as a competition measure, the results are doubtful.

**Keywords**: Bank stability, competition, Latvian banks.

## 1. INTRODUCTION

Competition in the banking sector can bring significant benefits to the market players, national economy and society, but also can be a source of a potential instability due to the fact that competition forces banks to take more risk.

Recent studies support the positive relationship between the level of competition and overall stability in the banking sector [1][2][3][4]. The World Bank's view is that "competition in the banking system is desirable for efficiency and maximization of social welfare". [5]

In turn, OECD experts in the report "Bank competition and stability" examine the interrelationship between banking competition and financial stability, considering the experience from the recent global crisis. They conclude that "that competition can be both good and bad for stability." [6]

Considering that banks are the major players in the financial system of the Baltic States, in particular in Latvia, the studying of competition-stability relationship in the Latvian banking market can provide vitally important information to policy makers.

The goal of the paper is to investigate the relationship between bank stability and competition in the banking market. The present study continues the research described in the previous paper that was aimed to investigate the relationship between concentration, competition and efficiency in the Baltic banking market. [7] However, the sample is limited with only Latvian banks, because the range of applied ratios is extended. Besides, the relationship between different indices used to measure competition is tested. The following hypotheses are tested in the current study:

*H1: There is a statistically significant relationship between different competition measures.*

*H2: Competition in the Latvian banking sector has a positive impact on bank stability.*

To test the first hypothesis the authors perform a correlation analysis to identify the statistical link between competition and concentration ratios. Concentration in the Latvian banking sector is measured with Herfindahl-Hirschman Index (HHI) and concentration ratio (CR5). To measure competition Lerner index and Boone indicator are used.

To test the second hypothesis the authors run a multiple regression analysis. Bank stability proxied by Risk index is used as a dependent variable. Explanatory variables include proxy for competition level in the banking sector, bank size, profitability, productivity and liquidity.

Sample data are extracted from BankScope data basis covering the period of 2007-2013. The financials of 16 Latvian commercial banks are analyzed.

The present research contributes to literature on investigation of bank performance in the Baltic States and Latvia, in particular. Considering the limited number of papers on related issues published by the local authors, it is important to continue studying in order to have the latest empirical data about Baltic banking sector.

## 2. COMPETITIONS, CONCENTRATION AND STABILITY IN BANKING

Competition in the banking sector is frequently measured by concentration ratios, such as market share of the largest banks (CR3, CR5, CR10) or Herfindahl-Hirschman Index (HHI). However, many researchers insist on distinguishing between concentration and competition. In 2010, the OECD Competition Committee organized a roundtable discussion on competition, concentration and stability in the banking sector. One of the conclusions made through discussion was that "concentration, among other structural indicators, is not a good proxy for competition." A set of other factors should be taken in consideration – for instance, market contestability, switching costs, size of competitors, customers, and etc. [8]

The relationship between concentration and competition in the banking market has been investigated in the wide range of studies. [8][9][10][11][12] There is empirical evidence of the existence [12][13][14] and non-existence [10][15] of the relationship between bank competition and concentration.

The comprehensive overview of different ratios employed in measuring bank competition is provided by Bikker and Haaf [13], as well as by Leon [16].

Measuring of competition level is based on the structural and non-structural approaches. In structural models concentration ratios (CR5 and HHI) are used to describe the relationship between competitive performance and market structure. [11] Non-structural measures of competition are estimated, applying Iwata model [17], Bresnahan model [18] and Panzar and Rosse (PR) model [19]. Besides, the researchers use such competition measures, as Lerner index [20] and Boone indicator [21].

The results of studies can be largely influenced by the kind of measures used by the researchers. Carbo et al. [22] compared five indicators of banking market competition in their cross-country study over 1995-2001, based on data about 14 European countries. They concluded that "existing indicators of competition are found to give conflicting predictions of competitive behavior across countries, within countries, and over time."

Table 1 summarizes the information about the competition measures used in recent studies.

Table 1.
**Measures of competition used in recent studies**

| Source | Measures of competition |
| --- | --- |
| Casu, Girardone 2006 [10] | PR H-statistics |
| Schaek et al. 2006 [1] | Lerner index, Boone indicator |
| Abbasoğlu et al. 2007 [15] | H-statistics |
| Maudos, Guevara 2007 [23] | Lerner index |
| Liu et al. 2010 [24] | Lerner index, PR H-statistics |
| Andries, Capraru 2012 [25] | Lerner index, PR H-statistics |
| Pawlowska 2012 [11] | Lerner index, PR H-statistics |
| Repkova 2012 [26] | Lerner index |
| Castellanos, Garza-García 2013 [27] | Boone indicator |
| Park 2013 [12] | PR H-statistics, Boone indicator |
| Amidu, Wolfe 2013 [3] | Lerner index |

Competition in the banking marker has been studied by many researchers not only as an individual issue, but also in the context of competition-stability relationship. The results confirm both negative [28] and positive [1][3][4][24] trade-off between competition and bank soundness.

The evidence on positive link between competition and efficiency frequently is based on investigation of competition-efficiency relationship. Competition "helps make the financial sector more efficient". [6] In turn, "more efficient banks have better screening and monitoring procedures in place, and are consequently less likely to suffer from non-performing loans". [1] Akins et al. [4] found that "banks facing greater competition earn lower interest margins and make investments with lower risks". Amidu and Wolfe [3] supported positive effect of competition on bank soundness, because "diversification across and within both interest and non-interest income generating activities of banks increases".

In turn, Beck et al. [28] empirically confirmed competition-fragility hypothesis, analyzing data of 17055 banks in 79 countries. They state that competition "erodes banks' pricing power, increases banks' risk taking behavior and is hence detrimental for financial stability."

OECD experts point to the controversy in results while studying competition-stability relationship in banking. In OECD report "Bank Competition and Financial Stability" it was stated that "structural and non-structural measures of competition are found to be both positively and negatively associated with financial stability, depending on the country analyzed and the measure of financial stability used." [6]

The investigation of competition-stability link is frequently performed applying the regression analysis. Bank stability is associated with the level of bank risk that, in turn, is proxied by risk index (Z-score). [28][29] Z-score usually has been regressed against Lerner index or Boone indicator [1][3][30]

Liu et al. [24] in their comprehensive study of 11 European banking markets over 1997-2008 found that banking sector risk measures (including Z-score) are "unrelated to the various competition measures." The researchers concluded that "this raises doubts about the generality of the findings of previous

empirical studies that investigate competition-stability and competition-fragility issues."

Considering the lack of the topic-related papers published by the local researchers, the authors of the present paper make an attempt to fill the gap in the literature on competition-stability issues in the Baltic banking sector. The current research contributes to the data set on competition in banking.

## 3. RESEARCH METHODOLOGY

The present research is based on processing of bank financial data extracted from BankScope database and statistics on structural indicators from the European Central Bank data warehouse. Research sample involves 16 Latvian banks operating in the market. Period of seven years – from 2007 till 2013 – is analyzed. The number of the analyzed banks is limited with the information available in BankScope.

To test the first hypothesis about the relationship between concentration level and competition and, consequently, to check the consistency between concentration and competition measures, the authors perform a simple correlation analysis in SPSS environment.

Concentration is measured with Herfindahl-Hirschman Index (HHI) and the concentration ratio CR5. The HHI is calculated by summing up the squared market shares of all companies competing in the market. CR5 is the market share of five largest banks in the market in terms of assets.

To measure competition in the banking sector, the authors used two indices: Lerner index and Boone indicator.

Lerner index is estimated using the formula (1):

$$L_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \qquad (1)$$

where   $P_{it}$ is the price of banking outputs for the i-th bank at time t,
   $MC_{it}$ is the marginal costs for the i-th bank at time t.

Lerner index estimated for each individual bank denotes its pricing power. Based on the theory, Lerner can range between 0 and 1. However, in the real market situation its value can exceed 1 (in case of positive marginal costs) or it can be negative. [31]

The alternative measure of competition proposed by Boone (2000) is based on the idea that „in a more competitive industry firms are punished more harshly in terms of profits for cost inefficiency". [32] Profit-elasticity index that is usually referred to as Boone indicator is estimated from the formula (2):

$$\ln \pi_{it} = \alpha + \beta \ln MC_{it} \qquad (2)$$

where   $\pi_i$ is the profit of the i-th bank at time t,
   MC it is the marginal costs for the i-th bank at time t.

According to Griffith et al. [32] „more efficient firms (those with lower marginal costs) have lower prices, higher market shares, higher price-cost margins and higher profits."

Using this measure for analyzing competition in a banking sector, some researchers transform the formula of Boone indicator and replace the value of bank profit with a bank market share [1][33](formula (3)).

$$\ln MS_{it} = \alpha + \beta \ln MC_{it} \qquad (3)$$

where   $MS_{it}$ is the market share of the i-th bank at time t.

However, the original formula is also applied in calculations. [16][34][35][36] In the Global Financial Development report [5] the World Bank's experts offer to calculate Boone indicator by regressing „the log of a measure of profits (such as return on assets)" against a log measure of marginal costs.

According to the European Central Bank's report [37] "banks with lower marginal costs expected to have larger market power, expressed in their market shares". Thus, β is expected to be negative. The stronger competition is, the stronger this effect will be, and the larger, in absolute terms, this (negative) value of β.

Both indices – Lerner index and Boone indicator – require in their calculation an estimation of marginal costs. Marginal costs ($MC_{it}$) are calculated from translog cost function (formula (4)). [26][31]

$$\ln TC = a_0 + a_1 \ln Y + 0.5a_2 (\ln Y)^2 + \sum_{j=1}^{3} \beta_j \ln w_j$$

$$+ \sum_{j=1}^{3} \sum_{k=1}^{3} \beta_{jk} \ln w_j \ln w_k + \sum_{j=1}^{3} \gamma_j \ln Y \ln w_j + \varepsilon \qquad (4)$$

where   TC – total costs,
   Y (output) – total assets,
   $w_1$ (input 1) – labour price,
   $w_2$ (input 2) – price of borrowed funds,
   $w_3$ (input 3) – capital price;
   k>j.

The coefficients estimated from the cost function (formula (4)) are used to calculate marginal costs (MC) applying the formula (5).

$$MC = \frac{TC}{Y} (\alpha_1 + \alpha_2 \ln Y + \sum_{j=1}^{3} \gamma_j \ln w_j) \qquad (5)$$

Following the experience of other researchers [26][23][33], the measures needed for the calculation purposes are estimated with the formulas from the Table 2.

Table 2.
**Calculation of Lerner index and Boone indicator: procedure**

| Measure | Calculation |
|---|---|
| $P_{it}$ | Total revenues (TR) / Total assets |
| TR | Interest revenues + non-interest revenues |
| TC | Interest expenses + Non-interest expenses |
| $w_1$ | Personnel expenses / Total assets |
| $w_2$ | Interest expenses / Deposits and short-term funding |
| $w_3$ | Other operating expenses / Fixed assets |
| $MS_{it}$ | Loans of the i-th bank / Volume of loans in a banking sector |

All the financials summarized in the Table 2 can be directly extracted from BankScope data base.

For the research purposes the authors estimate Boone indicator, using both formulas: formula (2) and formula (3). However, the application of the formula (2) in its original form is impossible due to the negative net income generated by Latvian banks in 2008-2010. The value of operating profit in many cases also was negative. To overcome this problem the value of bank profit is replaced by the volume of "Gross interest income". Applying the formula (3) for calculations bank market share is expressed in terms of total issued loans to public. Boone indicator is estimated both for individual banks and for the banking sector as a whole. Sector-level estimation is performed using the data on all banks' financial results in a particular year.

Lerner index is also estimated using the aggregated data about the Latvian banking sector.

To have the basis for comparison, the authors analyzed the information from recent papers on competition in Europe. The latest available data on competition in Latvia is for 2010. Values of Lerner index and Boone indicator estimated by other researchers are summarized in the Table 3.

Table 3.
**Competition in Latvia: comparative findings**

| Source | Lerner | Boone |
|---|---|---|
| Federal Reserve Bank of St. Louis [38][39] | 2010: 0.219 2009: 0.273 2008: 0.261 | 2010: 0.221 2009: 0.137 2008: 0.095 |
| Andries, Capraru 2012 [25] | Mean 2001-2009: 0.699 | |
| Weill 2011[40] | Mean 2002-2008: 0.167 | |
| Ahi 2013[41] | | Mean 2003-2010: -4.18 |
| Clerides *et al.* 2013 [36] | Mean 1997-2010: 0.286 | |

To test the second hypothesis and to determine the relationship between competition in the market and bank stability in the Latvian banking sector, the authors run a multiple regression analysis. The analyzed functional relationship takes the following form:

$$Z_i = f(Comp, Size_i, Profit_i, Productivity_i, Liquidity_i) \qquad (6)$$

where  $Z_i$ is a soundness measure calculated for an individual bank;
$Comp$ is a measure of competition level in the banking market;
$Size_i$ is a bank size expressed by the volume of loans;
$Profit_i$ is a profitability of an individual bank;
$Productivity_i$ is a productivity of an individual bank;
$Liquidity_i$ is a liquidity measure of an individual bank.

In measuring bank soundness the authors follow the experience of other researchers and use Z-score or Risk index as a stability indicator. [30][28][3][1] Risk index measuring the probability of insolvency is based on the likelihood of return to assets being negative and larger than the capital-asset ratio. [42] It incorporates data on the bank's expected profits, the likelihood that these profits will be realized, and a bank's capital base. [43] Z-score is calculated from the formula (7):

$$Z_{it} = \frac{E(ROA_{it}) + CAP}{StDev(ROA)} \qquad (7)$$

where  $Z_i$ is a probability of insolvency of the i-th bank at time t;
$E(ROA)$ is the expected value of return on assets (can be equated to the most recent value of ROA);
$CAP$ is a capital-to-asset ratio (equity ratio);
StDev(ROA) is a standard deviation of ROA ($\sigma$).

The explanatory variables are expressed by the ratios summarized in the Table 4.

Table 4.
**Proxies for explanatory variables**

| Variable | Measure |
|---|---|
| *Comp* | Lerner index Boone indicator (formula 3) |
| *Size_i* | Natural logarithm of the volume of total bank assets (lnA) |
| *Profit_i* | Net interest margin (NIM) |
| *Productivity_i* | Cost-to-income ratio (C/I) |
| *Liquidity_i* | Loans-to-deposits ratio (L/D) |

The regression analysis is performed, using data directly extracted from BankScope or calculated for the year 2013. Thus, the database consists of seven indices: dependent variable is bank soundness proxied by Risk index (Z-score) and six independent variables (two proxies for competition in the sector and four bank-specific measures). Two regression models will be constructed: one containing Lerner index and another – with Boone indicator.

Testing of the first hypothesis (H1) about the consistency between different competition measures is based on an evaluation of correlation significance. Five measures are analyzed: B1 – Boone indicator from the formula (3), B2 – Boone indicator from the formula (2), L – Lerner index, CR5 – concentration ratio, HHI – Herfindahl-Hirschman Index. The most attention is paid to the link between Lerner index and Boone indicator, because the inconsistency between Lerner index and HHI was confirmed in the previous research. [7]

Testing of the second hypothesis (H2) is based on the assessment of regression coefficients. Statistically significant positive or negative coefficients will point to the positive or negative effect of competition on bank soundness.

**4. RESULTS**

The values of Lerner index and Boone indicator for the period of 2007-2013 estimated for Latvian banking sector are presented in Fig. 1.

The values of Lerner index reported in the present paper differ from the results received in the previous research. [7] The reason is in the calculation procedure. Before, the authors calculated Lerner index for a banking sector as an average of values estimated for individual banks. However, the authors concluded that the approach based on usage of aggregated data is more suitable, because it allows making cross-country studies. In the current paper the sample involves only 16 Latvian banks. Actually, BankScope provides the information

about 22 banks. The authors intentionally excluded the number of financial institutions from the list. For instance, *Reverta* was excluded, because this is a loan restructuring institution that does not provide the whole range of bank's services. However, making cross-country studies the researchers usually do not have a free approach to the internal information. Thus, it is better to use the aggregated data from BankScope to get more accurate and comparable results.
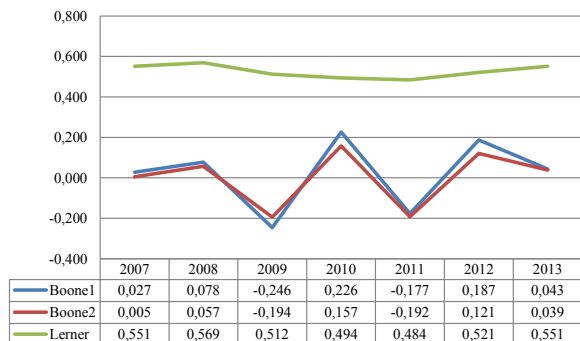


**Figure 1**. Competition in the Latvian banking sector

It is difficult to make any unambiguous conclusion about the consistency between the received results and findings of other researchers (see Table 3). The latest available data on competition in Latvia is for 2010. In turn, mean values are estimated for much longer periods. Lerner index estimated for Baltic countries by local researchers [44] is much lower that the values of the present study.

The values of Boone indicator in most cases, excluded 2009 and 2011, are positive. This is, in turn, does not fit to the theory. However, positive values of Boone indicator are also possible, as described in other studies [1][37]. According to Tabak *et al.* [33], there can be two explanations: "(i) the market has an extreme level of collusion or (ii) the banks are competing on quality."

The results of the correlation analysis that is aimed to test the first hypothesis are presented in the Table 5. Structural competition indices – CR5 and HHI – are extracted from the European Central Bank's data warehouse for the period of 2007-2013. [45]

Table 5.
**Results of the correlation analysis**

|     |      | B1    | B2    | L     | CR5    | HHI    |
|-----|------|-------|-------|-------|--------|--------|
| B1  | ρ    | 1     | **0.990** | 0.237 | -0.205 | -0.135 |
|     | Sig. |       | 0.000 | 0.609 | 0.660  | 0.773  |
| B2  | ρ    | **0.990** | 1 | 0.328 | -0.100 | -0.032 |
|     | Sig. | 0.000 |       | 0.473 | 0.831  | 0.946  |
| L   | ρ    | 0.237 | 0.328 | 1     | 0.726  | 0.694  |
|     | Sig. | 0.609 | 0.473 |       | 0.065  | 0.084  |
| CR5 | ρ    | -0.205 | -0.100 | 0.726 | 1     | **0.972** |
|     | Sig. | 0.660 | 0.831 | 0.065 |        | 0.000  |
| HHI | ρ    | -0.135 | -0.032 | 0.694 | **0.972** | 1 |
|     | Sig. | 0.773 | 0.946 | 0.084 | .000   |        |

The bolded values of the correlation coefficient point to the significant correlation with p-value ≤ 0.01.
Two pairs of indices are highly correlated ones: (1) B1 and B2; (2) CR5 and HHI. Thus, there is no relationship between concentration and competition ratios estimated for the Latvian

banking sector. Besides, measuring competition level with two different indices (Lerner index and Boone indicator) it is difficult to find common interpretation of the received results.

The closer Lerner index is to 1, the closer is the market to a monopoly. Analyzing the values of Lerner index, it can be concluded that competition in the Latvian banking sector is at "average level". Low level of negative Boone indicator (in absolute terms) in 2009 and 2011 indicates the "low level" of competition. However, positive values in other years point to the necessity of in-deep performance investigation at the bank-level. It is worth analyzing the contribution of individual banks to get an insight into the studied issue.

At the current stage of the research the stated hypothesis about the consistency of different competition measures is rejected. In this regard, the unambiguous conclusion can be made about the invidiousness of measuring competition with concentration ratios.

To test the second hypothesis about the impact of competition on bank soundness, riskiness of Latvian banks was evaluated (Table 6).

Table 6.
**Riskiness of Latvian banks in 2013**

| Bank Name | CAP | ROA | σ | Z |
|-----------|-----|-----|---|---|
| Swedbank | 0.202 | 0.023 | 3.059 | 0.073 |
| SEB banka | 0.102 | 0.006 | 2.193 | 0.049 |
| ABLV Bank | 0.057 | 0.016 | 1.656 | 0.044 |
| Rietumu Bank | 0.097 | 0.024 | 0.961 | 0.125 |
| Citadele Banka | 0.056 | 0.006 | 2.287 | 0.027 |
| DNB Banka | 0.097 | 0.005 | 2.323 | 0.044 |
| PrivatBank | 0.057 | 0.004 | 3.533 | 0.017 |
| Norvik Banka | 0.049 | -0.025 | 3.142 | 0.008 |
| Baltikums Bank | 0.113 | 0.025 | 0.957 | 0.144 |
| Regional Investment Bank | 0.084 | 0.002 | 0.880 | 0.097 |
| Trust Commercial Bank | 0.134 | 0.004 | 2.735 | 0.050 |
| Baltic International Bank | 0.098 | -0.001 | 2.735 | 0.036 |
| Meridian Trade Bank | 0.061 | 0.006 | 0.282 | 0.236 |
| UniCredit Finance | 0.352 | -0.022 | 1.820 | 0.181 |
| Latvijas Pasta banka | 0.116 | 0.020 | 1.927 | 0.071 |

Without deep analyzing of the results, a positive moment can be mentioned: there are no negative values of risk index in 2013.

Performing the regression analysis with Z as a dependent variable, two regression models were created (Table 7).

Table 7.
**The results of the regression analysis: model summary**

| Competition measure | $R^2$ | Adj. $R^2$ | Sig. | DW |
|---------------------|-------|------------|------|-----|
| Boone indicator | 0.618 | 0.591 | 0.000 | 1.620 |
| Lerner index | 0.618 | 0.591 | 0.000 | 1.620 |

R-squared in both cases is equal to 0.618, indicating that 62 per cent of the variation in the bank soundness is explained by these models. The models are statistically significant (Sig. = 0.000 ≤ 0.01).

Both models involve only one explanatory variable – competition proxy. All bank-specific factors were excluded due to the low statistical significance (the results are identical in both cases):

Size:             Sig. = 0.209 > 0.01
Profit:           Sig. = 0.912 > 0.01
Productivity:     Sig. = 0.743 > 0.01
Liquidity:        Sig. = 0.615 > 0.01

In turn, for competition variable the regression coefficients are statistically significant and positive in both models (for Lerner: B = 0.146 (Sig. = 0.000), for Boone: B = 1.782 (Sig. = 0.000)).

Critical values for Durbin-Watson statistics are determined for p = 1 (number of regressors) and the appropriate number of observations (n = 15 banks for 2013). Durbin-Watson statistics indicates no autocorrelation in residuals (DW is greater than its upper critical value: DW = 1.620 > $D_U$ = 1.070).

Despite the statistical significance of the models, the authors refrain from final comments on testing the stated hypothesis. Based on the model with Lerner index, the hypothesis is rejected (lower competition determines bank soundness). As for the model with Boone indicator, the question is about its value in each particular year – positive or negative.

The most valuable contribution of the present paper is an updating of the data set on structural indices of the Latvian banking sector. The revealed problems could be a motive for other researchers to pay attention to the analyzed issues.

## 5. CONCLUSIONS

The present paper continues the series of studies performed with the sample data of the Latvian banking sector. The overall goal of these studies is to fill the information gap in the literature, considering the small number of papers on bank performance, efficiency and banking market structure, published by the local researchers.

Two research hypotheses are tested and the results are, as follows:

*H1: There is a statistically significant relationship between different competition measures.* – REJECTED

*H2: Competition in the Latvian banking sector has a positive impact on bank stability.* – REJECTED (preliminary conclusion)

The relationship between competition level and stability in the banking sector should be a topic for further studies. The unambiguous conclusion should be made, based on the research results: it is not correct to use concentration ratios as proxies for competition. Concentration and competition should be analyzed as closely related, but nevertheless different concepts.

## 6. ACKNOWLEDGEMENTS

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