



Research article

Determinants of enterprise's financial security

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Supplementary

Appendix A

Table A.1. A model for assessing the enterprise's financial security statuses based on discriminant statistical models of bankruptcy.

Model	Scale of probability of bankruptcy	Status of financial security
5-factor Altman's model (for companies whose shares are not traded on the stock market) $Z=0.717 \times x_1 + 0.847 \times x_2 + 3.107 \times x_3 + 0.42 \times x_4 + 0.998 \times x_5$ x_1 – working capital to total assets ratio x_2 – retained earnings to total assets ratio x_3 – EBIT to total assets ratio x_4 – market value of equity to debt ratio x_5 – sales to total assets ratio	$Z_A > 2.9$ – low $2.5 < Z_A \leq 2.89$ – possible $1.23 < Z_A \leq 2.5$ – high $Z_A \leq 1.23$ – critically high	High financial security Sufficient financial security Satisfactory financial security Low financial security
Springate's model $Z=1.03 \times x_1 + 3.07 \times x_2 + 0.66 \times x_3 + 0.5 \times x_4$ x_1 – working capital to total assets ratio x_2 – EBIT to total assets ratio x_3 – income before taxes to current debt ratio x_4 – sales to total assets ratio	$Z_S > 2.451$ – low $0.862 \leq Z_S \leq 2.451$ – possible $Z_S < 0.862$ – critically high	High financial security Sufficient financial security Low financial security
Taffler's and Tisshaw's model $Z=0.53 \times x_1 + 0.13 \times x_2 + 0.18 \times x_3 + 0.16 \times x_4$ k_1 – profit from sale to current liabilities ratio k_2 – current assets to liabilities ratio k_3 – current liabilities to total assets ratio k_4 – sales to total assets ratio	$Z_{TT} > 0.3$ – low $0.2 \leq Z_{TT} \leq 0.3$ – high $Z_{TT} < 0.2$ – critically high	High financial security Satisfactory financial security Low financial security
Lis's model $Z=0.063 \times x_1 + 0.092 \times x_2 + 0.057 \times x_3 + 0.001 \times x_4$ k_1 – current assets to total assets ratio k_2 – profit from sale to total assets ratio k_3 – retained earnings to total assets ratio k_4 – market value of equity to debt ratio	$Z_L > 0.037$ – low $Z_L \leq 0.037$ – critically high	High financial security Low financial security

Source: compiled by the authors on the basis of Altman et al., 1983; Lis 1972; Springate and Gordon, 1978; Taffler and Tisshaw, 1977.

Appendix B

Table B.1. Financial stability degree of the Ukrainian enterprises by the type of economic activity.

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	FA _R	0.5	0.4	0.4	0.2	0.5	0.5	0.5	0.5	0.6
	FS _R	0.6	0.6	0.5	0.3	0.5	0.6	0.6	0.6	0.7
	CM _R	0.5	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.5
Industry	FA _R	0.4	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2
	FS _R	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
	CM _R	0.1	-0.03	-0.2	-0.4	-0.4	-0.4	-0.3	-0.3	-0.1
Construction	FA _R	0.1	0.01	-0.1	-0.04	-0.1	-0.02	0.02	0.03	0.05
	FS _R	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2
	CM _R	0.4	1.4	0.6	0.9	1.6	4.4	-3.8	-3.8	-1.7
Wholesale and retail trade	FA _R	0.1	-0.02	-0.05	-0.02	0.01	0.04	0.1	0.1	0.1
	FS _R	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
	CM _R	0.5	1.1	0.4	-0.1	1.7	0.5	0.4	0.5	0.5
Transportation and storage	FA _R	0.5	0.4	0.7	0.6	0.6	0.5	0.5	0.5	0.5
	FS _R	0.7	0.6	0.8	0.8	0.8	0.7	0.6	0.7	0.6
	CM _R	-0.003	-0.1	-0.03	-0.01	-0.05	-0.1	-0.2	-0.1	-0.1
Accommodation and food service activities	FA _R	0.4	0.1	-0.1	-0.2	-0.1	0.1	0.1	0.1	0.2
	FS _R	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	CM _R	-0.1	-1.5	2.4	1.2	3.5	-3.3	-1.6	-2.4	-1.5
Information and communication	FA _R	0.3	0.04	0.4	0.1	0.2	0.2	0.3	0.3	0.3
	FS _R	0.6	0.4	0.6	0.4	0.5	0.5	0.5	0.5	0.6
	CM _R	0.0	-3.9	-0.2	-1.0	-0.3	-0.4	-0.6	-0.1	0.1
Financial and insurance activities	FA _R	0.6	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4
	FS _R	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
	CM _R	0.9	0.8	0.8	0.8	0.8	0.6	0.6	0.6	0.6
Real estate activities	FA _R	0.3	0.1	0.0	-0.1	0.0	0.0	0.1	0.1	0.2
	FS _R	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	CM _R	-0.1	-1.2	6.1	2.8	5.4	-39.7	-1.4	-2.1	-1.0
Professional, scientific and technical activities	FA _R	0.3	0.4	0.6	0.6	0.5	0.6	0.5	0.5	0.5
	FS _R	0.5	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6
	CM _R	0.2	0.2	-0.01	-0.03	-0.04	0.1	0.2	0.1	0.1
Administrative and support service activities	FA _R	0.8	0.7	0.7	0.7	0.6	0.6	0.4	0.4	0.4
	FS _R	0.8	0.8	0.7	0.7	0.7	0.7	0.5	0.5	0.5

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Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Education	CM _R	0.01	0.01	-0.05	-0.1	-0.1	-0.2	-0.5	-0.5	-0.4
	FA _R	0.7	0.7	0.6	0.6	0.6	0.4	0.3	0.5	0.2
	FS _R	0.8	0.8	0.7	0.7	0.7	0.6	0.5	0.6	0.3
Human health and social work activities	CM _R	0.1	0.1	-0.01	0.02	0.02	-0.2	-0.4	-0.3	-0.6
	FA _R	0.5	0.3	0.3	0.3	0.3	0.5	0.7	0.7	0.6
Arts, entertainment and recreation	FS _R	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8
	CM _R	-0.2	-0.4	-0.3	-0.2	-0.4	-0.04	0.04	0.1	0.1
	FA _R	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.4
Other service activities	FS _R	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
	CM _R	-0.4	-0.4	-0.5	-0.8	-0.7	-0.4	-0.8	-0.5	-0.6
	FA _R	0.3	0.3	0.3	0.4	0.3	0.5	0.4	0.4	0.4
	FS _R	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.4
	CM _R	-0.9	-0.7	-0.4	-0.2	-0.5	-0.3	-0.3	-0.3	-0.4

Source: calculated by the authors on the basis of State Statistics Service of Ukraine

Table B.2. Liquidity degree of the Ukrainian enterprises by the type of economic activity.

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	CU _R	1.7	1.6	1.5	1.2	1.5	1.6	1.5	1.6	1.9
	QR	1.1	1.1	1.2	1.0	1.0	1.0	0.9	1.0	1.1
	CA _R	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Industry	CU _R	1.07	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	QR	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	CA _R	0.1	0.1	0.1	0.1	0.05	0.05	0.1	0.1	0.1
Construction	CU _R	1.07	1.03	1.0	0.9	0.9	0.9	0.9	0.9	0.9
	QR	0.8	0.8	0.7	0.7	0.6	0.7	0.6	0.6	0.6
	CA _R	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Wholesale and retail trade	CU _R	1.05	1.0	1.0	1.00	1.03	1.03	1.04	1.05	1.07
	QR	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8
	CA _R	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Transportation and storage	CU _R	1.0	0.9	0.9	1.0	0.9	0.9	0.8	0.8	0.9
	QR	0.8	0.7	0.8	0.8	0.7	0.7	0.6	0.7	0.7
	CA _R	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1
Accommodation and food service activities	CU _R	0.9	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	QR	0.7	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5
	CA _R	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Information and communication	CU _R	1.0	0.7	0.8	0.9	0.9	0.8	0.7	0.9	1.1
	QR	0.9	0.7	0.8	0.8	0.8	0.8	0.6	0.9	1.0

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Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Financial and insurance activities	CA _R	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.4	0.4
	CU _R	2.7	1.7	1.7	1.8	1.7	1.6	1.4	1.5	1.5
	QR	2.0	1.7	1.7	1.8	1.7	1.5	1.4	1.5	1.5
Real estate activities	CA _R	0.9	0.7	0.6	0.7	0.5	0.4	0.3	0.3	0.3
	CU _R	0.9	0.8	0.7	0.7	0.6	0.7	0.7	0.7	0.7
	QR	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
Professional, scientific and technical activities	CA _R	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	CU _R	1.2	1.2	1.0	0.9	1.0	1.1	1.4	1.2	1.1
	QR	0.9	1.0	0.7	0.7	0.7	0.8	1.0	0.9	1.0
Administrative and support service activities	CA _R	0.2	0.3	0.2	0.2	0.1	0.2	0.4	0.3	0.2
	CU _R	1.0	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.7
	QR	1.0	1.0	0.8	0.8	0.7	0.6	0.6	0.6	0.6
Education	CA _R	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	CU _R	1.2	1.2	1.0	1.0	1.0	0.8	0.8	0.7	0.8
	QR	1.1	1.1	0.9	0.9	1.0	0.8	0.7	0.6	0.7
Human health and social work activities	CA _R	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
	CU _R	0.8	0.7	0.7	0.8	0.7	0.9	1.1	1.4	1.2
	QR	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.9	0.7
Arts, entertainment and recreation	CA _R	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.6	0.5
	CU _R	0.6	0.6	0.6	0.7	0.6	0.7	0.4	0.5	0.5
	QR	0.6	0.5	0.6	0.6	0.6	0.6	0.4	0.5	0.5
Other service activities	CA _R	0.2	0.1	0.2	0.2	0.1	0.1	0.05	0.1	0.1
	CU _R	0.5	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7
	QR	0.4	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.5
	CA _R	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1

Source: calculated by the authors on the basis of State Statistics Service of Ukraine

Table B.3. Return on capital degree of the Ukrainian enterprises by the type of economic activity.

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	ROA	4.84	5.55	15.04	5.93	7.61	7.27	9.13	7.28	17.84
	ROE	9.56	13.10	37.36	24.53	15.78	14.70	17.84	13.33	29.98
Industry	ROA	0.73	-8.28	-7.70	-0.27	2.78	4.49	4.58	-0.56	9.62
	ROE	-0.58	-30.86	-39.30	-4.69	10.22	16.94	14.68	-5.61	31.13
Construction	ROA	-1.75	-10.12	-8.04	-2.92	-0.95	1.39	2.95	-0.34	1.21
	ROE	-18.31	-888.74	161.25*	73.55*	24.94*	-62.35	109.1	-25.04	18.25
Wholesale and retail trade	ROA	-0.53	-10.94	-5.76	0.41	1.97	3.73	5.17	1.69	4.96
	ROE	-13.58	554.95*	130.95*	17.82*	98.64	67.52	57.55	11.04	37.79
Transportation and storage	ROA	0.22	-5.33	-1.30	1.03	-1.65	-2.20	1.55	1.42	2.80

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Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Accommodation and food service activities	ROE	-0.79	-14.93	-2.46	0.94	-2.74	-4.34	1.82	1.46	4.07
	ROA	-3.43	-24.05	-23.90	-5.69	5.02	6.26	9.55	-8.09	9.86
Information and communication	ROE	-10.28	-199.22	220.54*	31.96*	-65.39	83.58	68.82	-81.72	49.73
	ROA	7.56	-16.28	-5.44	2.87	10.15	10.58	12.97	7.76	14.53
Financial and insurance activities	ROE	16.58	-439.76	-16.29	13.55	42.17	37.78	40.99	26.26	33.64
	ROA	1.66	-1.44	-2.62	0.14	5.17	5.95	3.68	5.14	6.02
Real estate activities	ROE	2.52	-4.32	-8.43	-0.63	13.52	15.44	8.97	12.67	14.13
	ROA	-2,13	-23.32	-12.42	-7.64	-2.59	0.00	6.30	-4.41	2.08
Professional, scientific and technical activities	ROE	-7.21	-259.48	473.55*	107.71*	72.41*	-46.23	47.12	-47.18	10.59
	ROA	-1.47	-16.08	-5.44	2.33	4.68	3.00	9.27	-1.12	4.91
Administrative and support service activities	ROE	-5.25	-37.29	-9.14	4.45	6.62	4.22	14.62	-3.11	8.21
	ROA	-0.49	-4.42	-3.63	-1.41	-0.82	0.13	3.22	0.23	2.62
Education	ROE	-0.80	-6.58	-5,82	-2.55	-1.64	-0.23	7.52	-0.08	5.92
	ROA	5.95	3.58	3.93	3.51	3.78	4.11	6.29	1.48	1.48
Human health and social work activities	ROE	7.14	3.73	4.95	4.33	4.65	7.75	20.59	1.78	3.74
	ROA	-0.25	-11.55	-8.22	2.41	2.02	4.64	2.99	13.79	5.08
Arts, entertainment and recreation	ROE	-2.63	-41.47	-30.19	4.16	3.11	7.69	3.60	20.30	7.33
	ROA	-3.89	-9.18	-10.05	-4,51	-5.88	-1.22	0.28	-3.59	-5.06
Other service activities	ROE	-13.36	-29.85	-36.48	-25.59	-24.58	-4.17	-0.02	-8.53	-13.52
	ROA	-0.43	-0.31	4.36	3.15	0.11	1.40	4.23	1.11	3,44
	ROE	-2.52	-3.46	10.95	6.31	-0.90	2.32	7.91	1.55	6.70

Source: calculated by the authors on the basis of State Statistics Service of Ukraine

Notice: *high positive (incorrect) values because net profit and equity have a negative value

Table B.4. Key indicators of the Ukraine's credit market.

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Average credit rate, %	28.0	16.8	21.0	18.5	16.4	19.0	18.6	14.1	13.0
Average deposit rate, %	19.0	8.0	12.0	11.4	9.1	8.0	10.0	5.4	4.0

Source: compiled by the author on the basis of National Bank of Ukraine

Table B.5. Risk indicators (probability of bankruptcy) of the Ukrainian enterprises by the type of economic activity.

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	Z _A	1.49	3.11	3.15	1.88	3.01	3.16	3.20	3.21	3.71
	Z _{TT}	0.37	0.38	0.37	0.33	0.36	0.37	0.36	0.37	0.42
	Z _S	1.09	1.19	1.65	1.23	1.27	1.24	1.29	1.22	1.84
	Z _L	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.07
Industry	Z _A	2.97	3.51	3.66	3.82	4.15	4.36	4.19	4.01	4.79
	Z _{TT}	0.34	0.34	0.35	0.36	0.38	0.38	0.37	0.37	0.40
	Z _S	0.81	0.43	0.52	0.88	1.06	1.14	1.09	0.89	1.41
	Z _L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Construction	Z _A	1.45	2.68	2.29	2.64	1.28	3.22	3.41	1.34	3.48
	Z _{TT}	0.32	0.33	0.33	0.35	0.37	0.38	0.40	0.41	0.42
	Z _S	0.78	0.47	0.58	0.79	0.92	1.06	1.16	1.02	1.14
	Z _L	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Wholesale and retail trade	Z _A	4.97	6.83	7.38	7.05	7.72	7.94	7.77	7.40	8.46
	Z _{TT}	0.52	0.52	0.52	0.52	0.54	0.55	0.53	0.53	0.58
	Z _S	1.43	1.04	1.27	1.49	1.64	1.75	1.78	1.63	1.90
	Z _L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
Transportation and storage	Z _A	2.23	2.80	2.13	2.12	2.60	2.67	3.06	2.38	2.82
	Z _{TT}	0.29	0.29	0.20	0.22	0.24	0.25	0.27	0.24	0.27
	Z _S	0.60	0.37	0.21	0.42	0.32	0.36	0.62	0.54	0.69
	Z _L	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Accommodation and food service activities	Z _A	1.89	2.51	2.92	3.32	3.91	4.16	4.63	3.12	4.92
	Z _{TT}	0.31	0.30	0.34	0.36	0.39	0.41	0.44	0.38	0.51
	Z _S	0.48	-0.44	-0.28	0.57	1.09	1.19	1.43	0.52	1.58
	Z _L	0.01	-0.01	-0.02	-0.02	-0.01	0.00	0.01	0.00	0.01
Information and communication	Z _A	3.22	4.07	2.88	4.10	4.80	5.08	5.45	5.40	6.47
	Z _{TT}	0.37	0.39	0.29	0.41	0.44	0.46	0.47	0.50	0.57
	Z _S	1.21	0.27	0.34	1.12	1.48	1.54	1.64	1.52	2.03
	Z _L	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Financial and insurance activities	Z _A	2.47	1.89	2.11	1.98	1.39	1.98	1.98	1.97	1.94
	Z _{TT}	0.49	0.40	0.41	0.41	0.39	0.38	0.37	0.38	0.37
	Z _S	1.10	0.90	0.88	0.96	1.18	1.19	1.12	1.20	1.21
	Z _L	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05
Real estate activities	Z _A	0.67	0.61	0.81	0.86	0.95	1.03	1.19	0.98	1.17
	Z _{TT}	0.20	0.21	0.22	0.23	0.23	0.24	0.24	0.23	0.24
	Z _S	0.29	-0.62	-0.03	0.21	0.39	0.54	0.81	0.35	0.61
	Z _L	0.01	0.00	-0.00	-0.00	-0.00	0.01	0.01	0.01	0.01
Professional, scientific and technical activities	Z _A	1.14	1.50	1.66	1.93	1.97	2.43	2.44	2.06	2.45
	Z _{TT}	0.29	0.27	0.21	0.23	0.25	0.28	0.31	0.28	0.29
	Z _S	0.64	-0.20	0.07	0.56	0.76	0.73	1.13	0.56	0.85

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Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Administrative and support service activities	Z _L	0.04	0.02	0.01	0.02	0.02	0.02	0.03	0.03	0.03
	Z _A	1.88	1.92	1.74	1.69	1.60	1.72	1.76	1.60	1.97
	Z _{TT}	0.19	0.21	0.20	0.20	0.19	0.20	0.23	0.23	0.25
	Z _S	0.21	0.03	0.11	0.25	0.29	0.36	0.60	0.49	0.64
Education	Z _L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Z _A	3.06	4.51	4.37	4.68	5.21	4.85	4.72	3.58	4.69
	Z _{TT}	0.36	0.36	0.37	0.41	0.45	0.44	0.46	0.35	0.53
	Z _S	1.06	0.90	0.98	1.05	1.17	1.19	1.34	0.83	1.36
Human health and social work activities	Z _L	0.03	0.03	0.03	0.03	0.04	0.03	0.01	0.02	0.03
	Z _A	2.65	3.65	4.32	5.10	5.24	5.17	4.67	4.83	5.32
	Z _{TT}	0.30	0.31	0.34	0.39	0.39	0.37	0.33	0.37	0.39
	Z _S	0.58	0.11	0.32	0.97	0.97	1.02	0.78	1.52	1.06
Arts, entertainment and recreation	Z _L	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.03	0.03
	Z _A	1.47	2.31	0.86	0.91	1.04	1.22	1.35	1.14	1.37
	Z _{TT}	0.22	0.23	0.18	0.20	0.20	0.21	0.20	0.20	0.22
	Z _S	0.23	-0.02	-0.15	0.19	0.12	0.36	0.35	0.19	0.20
Other service activities	Z _L	-0.00	-0.00	-0.00	-0.01	-0.01	-0.00	-0.00	-0.00	0.00
	Z _A	3.15	3.70	3.95	4.10	4.47	4.35	4.74	4.56	7.12
	Z _{TT}	0.52	0.47	0.47	0.48	0.55	0.52	0.57	0.59	0.89
	Z _S	1.16	1.12	1.34	1.27	1.33	1.25	1.52	1.44	2.29
	Z _L	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03

Source: calculated by the authors on the basis of State Statistics Service of Ukraine



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