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In search of a benchmark for the quick ratio: The Polish-German setting

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ABSTRACT

Objective: The objective of the article is to empirically assess the benchmarks for the quick ratio (QR) commonly provided in the Polish literature. The article challenges the suggestion of a single benchmark despite a country's and industry's uniqueness. It concentrates on the Polish-German setting because of the intensive cooperation between the two countries.

Research Design & Methods: Apart from reviewing and critiquing the existing literature, the article presents the results of empirical analysis. The research sample comprised 998 710 Polish firm-years and 1 579 619 German ones. Data was retrieved from the Orbis Database for going concern, non-financial firms from 2013 to 2022. Research methods comprised analyses of distributions, including descriptive statistics and histograms, parametric and nonparametric ANOVA, and trend analysis.

Findings: The analysis shows that the benchmark for the quick ratio depends on the country, industry, period, and firm size. Standards should be drawn from quartiles instead of the arithmetic mean because of the high variability of QR. The range for QR is respectively wide. For Poland, it ranges from 0.6 (the first quartile) to 2.7 (the third quartile), with a median of 1.2 for the total sample. For Germany, it ranges from 0.7 (the first quartile) to 3.9 (the third quartile), with a median of 1.6. Benchmarks vary annually in Poland and Germany. Medians and third quartiles increase over time. They grow faster in Germany. There are substantial between-industry differences in both countries. The pattern of these differences is unique to a country. The size of the firm negatively influences the desired liquidity level in both countries.

Implications & Recommendations: Because of substantive between-country, industry, period, and firm size differences in benchmarks, analysts and investors must be sensitive to the standards they use in assessing investment opportunities. A shock in the economy increases risk and, hence, benchmarks.

Contribution & Value Added: The article's main contribution is the empirical verification of benchmarks for the quick ratio provided in the Polish literature. Analysts should not trust theoretical concepts when looking for benchmarks. They must compare the firm's financial standing with that of other firms from the same country, industry, period, and of a similar size.

Article type: research article

Keywords: liquidity ratios; quick ratio; financial analysis; Poland; Germany

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INTRODUCTION

Perhaps the easiest way to assess the financial health of a business is to compare it with its counterparts in the same country, region, or industry. This simple idea requires a high-quality benchmark that stems from sound theory and is verified by empirical analysis.

The article aims to empirically assess the quick ratio (QR) benchmarks commonly provided in the Polish literature. It also analyses the suggestion of a single benchmark despite a country's, period's,

industry's, and firm size uniqueness. I concentrate on the Polish-German setting because of the intensive cooperation between these two countries.

The quick ratio measures a company's short-term liquidity and describes its ability to pay short-term obligations using the most liquid assets. Despite some differences between accounting systems worldwide, liquid assets are current assets that can be easily converted into cash with a minimal price decrease. Current liabilities are company debts due to be paid within one year. Wójtowicz (2022) extensively analyses benchmarks for the current ratio. In this article, I concentrate exclusively on the benchmarks for the quick ratio.

A theoretical approach suggests that 1 is the *standard* of a QR. This means a business is equipped with enough liquid assets to pay off its current liabilities instantly. A well-known accounting-rooted relationship suggests that a quick ratio of less than 1 may signal problems with the ability to pay off current liabilities in the short run. A value above 1 suggests that a business is furnished with enough current assets to pay its creditors. A ratio that aligns with the industry average or is higher is acceptable. On the other hand, a current ratio lower than the industry average may signal an increased risk of bankruptcy.

The aforementioned point of view stems from understanding the meaning and nature of accounting concepts. Unfortunately, these general rules and conclusions are not necessarily valid in practice, and I am going to challenge them empirically. The average of the distribution is exposed to outliers; hence, the benchmark may be biased towards the right tail of the distribution. The differences between industries' ratios are supposed to be significant. In some industries, high current asset turnovers result in a low balance sheet value. At the same time, extended maturity of liabilities increases their amount.

I suspect between-country differences in the average level of liquidity powered by country-related factors. Unusual circumstances, such as the COVID-19 pandemic, increase business risk and the expected liquidity level. In the next section, these issues are formulated as hypotheses.

The novelty of my article is the empirical verification of the benchmark for the QR provided in the literature. I empirically test benchmarks and identify patterns they follow for Polish and German firms. My empirical approach permits the verification of premises stemming from the theoretical first step. Furthermore, a between-country comparison of the two European economies sheds light on the size of a firm as an anticipated factor influencing liquidity levels.

The remainder of the article is organised as follows. The next section contains a literature review and develops the hypotheses. Next, I will include the sample selection process and the description of the data, followed by results and discussion. The last section will conclude the study and explain the limitations and avenues for further research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Liquidity ratios describe a firm's ability to pay off current debts without raising extra capital. Failure in that respect may quickly result in the company's bankruptcy. Liquidity ratios include the current ratio, quick ratio (QR), and cash ratio. Although these ratios are commonly known, QR is defined in the next section for clarity. The QR builds on accrual items; hence, it may be impacted by accrual and real earnings management. Comporek (2023) shows that the scope of the former practices for listed companies is the largest in industrial companies in the growth and maturity phase. Such firms constitute a small fraction of my sample.

Surprisingly, international accounting and finance literature concerning benchmarks for liquidity ratios is very scant, although it dates back to the 1960s (Lev, 1969). Building on the existing literature, one may conclude that universal, internationally recognised benchmarks do not exist or are useless in practice. Furthermore, benchmarks and, broadly speaking, liquidity-related relationships are industry-specific. Tóth *et al.* (2013) find that in the Slovak Republic, the liquidity level in agriculture is much lower than in other industries. Similarly, Lesiak and Sajnóg (2018) report a significant positive relationship between net working capital and liquidity ratios. There exists a considerable and industry-specific correlation between liquidity ratios and the Return on Assets (ROA) both in family farms (Bereżnicka, 2014) and in meat processing (Szymańska & Lukoszová, 2021). Hence, authors try to assess the financial situation of firms searching for industry-related benchmarks (Maślach *et al.*, 2019), (Lisek *et al.*, 2019).

Several Poland-related articles and monographs suggest theoretical benchmarks for the quick ratio. Generally, the recommended benchmark is about 1 (Sierpińska & Jachna, 2006). Other authors, *e.g.* Michalski (2005), propose a benchmark of above 1. Finally, some authors suggest a benchmark in the specific range, *e.g.* 0.7-1.5 (Kreczmańska-Gigol, 2020). Unfortunately, cited authors do not reference the literature or research behind their proposed standards. Furthermore, they often quote one another, so the reader does not know if the benchmarks are based on empirical analysis or whether they represent the authors' beliefs. Niemiec (2014) provides a comprehensive review of the proposed benchmarks for liquidity ratios.

I am aware of only one research article empirically analysing benchmarks for the liquidity ratio in the Polish context. Niemiec (2014) provides a framework based on extensive trend analysis. His suggested benchmarks are asymptotes of the arctangent function. Specifically, he claims QR above 0.7, preferably from 0.7 (first quartile) to 2.6 (third quartile), with a median of 1.3. The above conclusion is drawn from the entire sample provided by the Financial Analysis Committee of the Scientific Council of the Accountants Association in Poland (Komisja ds. Analizy Finansowej Rady Naukowej Stowarzyszenia Księgowych w Polsce) for the period 2002-2012. The Financial Analysis Committee has analysed distributions of yearly values of financial ratios by industry in Poland since 2002. All companies included are obliged to (Dudycz & Skoczylas, 2023):

- prepare financial statements in line with the Polish Accounting Act,
- provide financial statements for two consecutive years for comparison,
- have a fiscal year equal to 12 months,
- have a nonnegative value of the owner's equity.

Due to the sample selection process, the overall sample comprises a considerable number of companies, and the number of firms is increasing over time. They range from small sole proprietorships to blue chips listed on the Warsaw Stock Exchange (Dudycz & Skoczylas, 2023).

A detailed analysis of the Financial Analysis Committee's data shows that the ratios' average and median values vary considerably. Means are much higher than medians; hence, the distributions are asymmetric, with substantial outliers. The analysis shows significant differences between industry ratios. Sestanj-Peric *et al.* (2019) point out that even after removing outliers, arithmetic means' informativeness remains weak. They suggest using medians and interquartile ranges instead.

Analysts may regard the diversity of the sample as an opportunity but also as a threat. The size of the business entails different institutional conditions, so it may encapsulate the outcome of various risks influencing the liquidity level. On the other hand, the breakdown by industry follows the Classification of Business Activities in Poland (Polska Klasyfikacja Działalności – PKD); hence, an international comparison of these ratios is impossible. Only intra-industry trend analysis and a between-industry comparison is feasible. The economic behaviour of a firm is influenced by many formal and informal institutions, which may establish different economic conditions and risk factors.

Furthermore, the impact of culture is conditional on the level of regulation and monitoring in a country (Kanagaretnam *et al.*, 2011). In such circumstances, benchmarks established for one country are not helpful for another. Between-countries differences may also stem from the accounting profession (de)regulation (Hońko *et al.*, 2023).

I decided to compare Poland and Germany for several reasons. Firstly, both countries are members of the European Union, and firms follow the same European legal regulations. Secondly, Germany is the biggest EU economy measured by total GDP, while Poland is the sixth. In other words, differences in liquidity levels resulting from macroeconomic conditions may exist. Thirdly, both countries are neighbours involved in intensive mutual international trade; hence, such a comparison may be meaningful to managers and analysts from both countries. In 2021, Germany exported USD 84.2 billion to Poland. Germany's exports to Poland have increased at an annualised rate of 9.2%, from USD 8.55 billion in 1995 to USD 84.2 billion in 2021 (OEC, 2023). In 2022, Poland exported USD 95.22 billion and remains the fifth trade partner of Germany (Trading Economics, 2023).

I conjecture that the QR benchmarks may differ from those suggested in the literature quoted above. Furthermore, benchmarks may vary over time between industries and countries and may

depend on the firm size. Finally, the average industry and yearly quick ratio values differ from medians.

The hypotheses address these issues as follows:

- H1: Mean values of QR differ from medians;
- H2: Mean values of QR differ from the benchmarks most commonly provided in the literature;
- H3: Medians of QR differ from the benchmarks most widely offered in the literature;
- H4: Mean values and medians of QR differ between Poland and Germany;
- H5: Mean values and medians of QR vary over time in Poland and Germany;
- H6: Mean values and medians of QR differ between industries in Poland and Germany;
- H7: Benchmarks for the liquidity ratio depend on the size of the firm.

RESEARCH METHODOLOGY

The size of the business and its legal form entail different institutional conditions. Wanting to present a broad picture and capture factors influencing the quick ratio, I included all firms meeting some of the general criteria described below. I concentrated on the period 2013-2022. I started with 2013 because the earlier the period, the lower the data availability in the database. Data availability for the last period, 2022, is also limited. Nonetheless, I aimed to capture the impact of the COVID-19 pandemic.

I retrieved data from the Orbis Database. The sample consisted of Polish and German going concern firms. I excluded firms with incomplete data on quick ratios and firms with negative owner's equity.

The definition of the quick ratio (QR), *i.e.* the LIQR field in the Orbis Database, is the following:

$$QR = \frac{TCA - TI}{TCL} \tag{1}$$

in wchich:

TCA - Total Current Assets (field 13061);
TI - Total Net Inventories (field 20010);
TCL - Total Current Liabilities (field 14011).

The reason for retrieving ready-made QR, *i.e.* the LIQR field, is twofold. Firstly, the database is incomplete regarding current assets, total inventories, and current liabilities. However, it contains calculated QR even if it lacks the mentioned elements; hence, I can significantly increase the sample. Secondly, building on ratios provided by the professional service, I can be certain of its high quality and limited or non-existent inconsistencies in my between-country analysis.

My preliminary selection process stems from the NACE Rev. 2 classification and legal form of the business.

Firstly, I used the NACE Rev. 2 classification, a statistical classification of economic activities in the European Community, to break down firms between industries (Eurostat, 2023). I concentrated on the broad structure of NACE Rev. 2, which breaks industry classification into sections marked with capital letters of the Latin alphabet. I included firms assigned to sections from A to J and M in my database. I excluded: financial and insurance activities (K); real estate activities (L); administrative and support service activities (N); public administration and defence (O); education (P); human health and social work activities (Q); arts, entertainment, and recreation (R); other service activities (S); activities of households as employers (T); and activities of extraterritorial organisations and bodies (U). Some firms assigned to these sections face unique regulations and are monitored by specialised national supervisory authorities. For some firms, the measurement of liquidity with QR may be meaningless.

Secondly, the Orbis Database classifies business units according to categories of standard legal forms. I excluded firms classified as branches (of foreign companies), companies with unknown legal forms, foreign companies, non-profit organisations, other legal forms, and public authorities. I included sole proprietorships, partnerships, private limited companies, and public limited companies.

For Poland, the initial sample consisted of 998 717 observations, *i.e.* going concern firms-years meeting the first and second general criteria. I excluded seven firms with negative total assets, so the final sample consisted of 998 710 firm-years. For Germany, the sample consisted of 1 579 619 observations. Tables 1 and 2 show the distribution according to NACE Rev. 2 section and year.

Table 1. Number of observations per year and the NACE Rev. 2 section, Poland

Year / Section	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
A	2219	2356	2506	2325	3367	3099	3171	3258	3193	2141	27 635
B	321	362	386	401	620	598	599	611	601	415	4914
C	13 666	14 524	15 685	16 141	22 342	22 694	23 824	24 561	24 670	16 661	194 768
D	886	982	1059	1076	1903	1930	2082	2234	2339	1699	16 190
E	1323	1405	1461	1515	2144	2140	2181	2238	2265	1788	18 460
F	6531	7218	8242	8835	16 120	16 923	18 803	20 259	21 398	13 984	138 313
G	19 450	21 003	22 801	23 361	34 636	34 401	35 747	36 892	37 150	24 721	290 162
H	2644	2960	3396	4166	6851	7219	7879	8468	8746	5764	58 093
I	1675	1922	2117	2163	4575	4696	5058	5280	5197	3040	35 723
J	3840	4310	4650	4874	10 027	9611	10 216	10 910	11 122	7251	76 811
M	6453	7033	7854	8313	18 626	17 837	18 868	19 765	19 955	12 937	137 641
Total	59 008	64 075	70 157	73 170	121 211	121 148	128 428	134 476	136 636	90 401	998 710

Description of sections: A: agriculture, forestry, and fishing; B: mining and quarrying; C: manufacturing; D: electricity, gas, steam, and air conditioning supply; E: water supply; sewerage, waste management, and remediation activities; F: construction; G: wholesale and retail trade; repair of motor vehicles and motorcycles; H: transportation and storage; I: accommodation and food service activities; J: information and communication; M: professional, scientific, and technical activities.
Source: own study in Stata.

Table 2. Number of observations per year and the NACE Rev. 2 section, Germany

Year/ Section	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
A	1390	1838	2252	2595	2743	3025	3523	3909	3849	1187	26 311
B	240	317	465	543	509	681	792	864	847	73	5 331
C	14 925	18 639	28 437	33 219	32 500	42 241	49 144	52 787	53 412	6 868	332 172
D	2798	3728	4819	5524	5531	6670	8 008	8314	7780	1100	54 272
E	893	1132	1566	1830	1793	2346	2790	3055	3079	339	18 823
F	8 236	11 161	20 431	24 562	23 646	32 892	39 466	45 094	46 045	4580	256 113
G	16 658	21 682	34 298	40 544	40 330	52 257	61 469	66 985	67 693	8621	410 537
H	3508	4614	7048	8374	8423	11 431	13 541	14 668	14 791	616	88 014
I	2052	2826	4349	5382	5579	7480	8997	9440	8963	597	55 665
J	4366	5697	8052	9470	9897	12 526	14 854	16 231	16 585	2411	100 089
M	8747	12 397	18 813	23 159	22 735	30 143	35 937	37 928	37 488	4945	232 292
Total	63 813	84 031	130 530	155 202	153 686	201 692	238 521	259 275	260 532	32 337	1 579 619

Source: own study in Stata.

My research methods comprised analysis of distributions, including descriptive statistics and histograms, parametric and nonparametric ANOVA, and trend analysis.

RESULTS AND DISCUSSION

Figures 1 and 2 show the histograms for QR for the sample in both countries. Both Figures show histograms truncated at QR equal to 8.0 because each distribution has a long right tail.

Bar width equals 0.2. For Poland and Germany, the percentage of observations presented in Figures 1 and 2 is calculated for QRs truncated at 8.0. For Poland, five bars from 0.2 to 1.2 include a similar percentage of observations. Taken together, they equal about 45%. However rough this assessment is, it estimates a benchmark range for QR for the total sample. This range differs substantially from the ranges provided in the literature. For Germany, only three bars, from 0.2 to 0.8, include a similar percentage of observations. These bars contain about 25% of the truncated sample. This provisional verification supports hypotheses H3-H6.

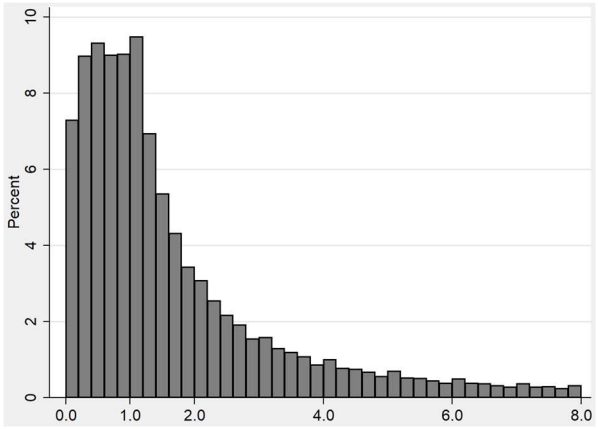

Figure 1. Histogram for the quick ratio, Poland
Source: own elaboration based on QR calculation.

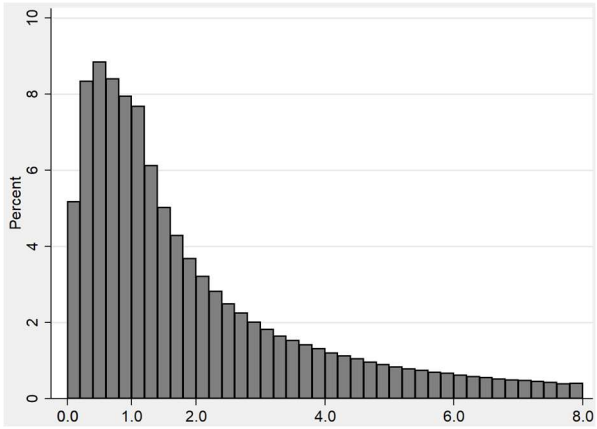

Figure 2. Histogram for the quick ratio, Germany
Source: own elaboration based on QR calculation.

Table 3. Descriptive statistics of the quick ratio (QR) per year in Poland

Year / Parameter	No. of Obs.	Mean	Std. Dev.	25%	Median	75%	Skewness	Kurtosis
2013	59 008	2.9	7.1	0.6	1.1	2.3	7.1	67.1
2014	64 075	2.9	6.9	0.6	1.1	2.3	7.0	65.8
2015	70 157	3.0	7.2	0.6	1.2	2.4	7.0	64.6
2016	73 170	2.9	7.0	0.6	1.2	2.3	7.3	70.4
2017	121 211	3.3	7.8	0.6	1.2	2.5	6.4	55.4
2018	121 148	3.3	7.8	0.6	1.2	2.6	6.4	55.3
2019	128 428	3.5	8.3	0.6	1.3	2.8	6.1	49.7
2020	134 476	3.7	8.6	0.7	1.4	3.0	5.9	45.9
2021	136 636	3.8	8.7	0.7	1.3	3.0	5.8	44.8
2022	90 401	4.1	9.1	0.7	1.4	3.3	5.5	40.5
Total	998 710	3.4	8.0	0.6	1.2	2.7	6.3	52.1

Source: own study in Stata.

Tables 3 and 4 show descriptive statistics of the QR per year for the total sample in both countries. Distributions of QR are highly asymmetric, with skewness equalling, respectively, 6.3 and 5.2 in the sample. I do not include the Min and Max of the distributions in the Tables, but in every country and year, Min equals zero, and Max equals 100. Hence, both distributions are heavily skewed to the right. Kurtosis is a measure of the heaviness of the tails of a distribution. In the Poland (Germany) sample, kurtosis of 52.1 (36.5) signals extremely tailed distribution.

Table 4. Descriptive statistics of the quick ratio (QR) per year in Germany

Year / Parameter	No. of Obs.	Mean	Std. Dev.	25%	Median	75%	Skewness	Kurtosis
2013	63 813	3.8	9.0	0.6	1.2	2.9	5.7	42.8
2014	84 031	4.9	11.7	0.6	1.3	3.5	4.8	29.0
2015	130 530	4.5	10.0	0.7	1.5	3.7	5.2	36.0
2016	155 202	4.4	9.6	0.7	1.5	3.7	5.4	38.2
2017	153 686	4.6	10.1	0.7	1.5	3.8	5.2	34.9
2018	201 692	4.5	9.8	0.7	1.5	3.8	5.2	36.2
2019	238 521	4.5	9.6	0.7	1.6	3.9	5.3	37.6
2020	259 275	4.8	9.7	0.9	1.8	4.4	5.1	35.0
2021	260 532	4.5	9.2	0.8	1.7	4.2	5.4	39.6
2022	32 337	5.0	9.9	0.9	1.9	4.7	5.0	33.6
Total	1 579 619	4.5	9.8	0.7	1.6	3.9	5.2	36.5

Source: own study in Stata.

For Poland (Germany), an arithmetic mean equals 3.8 (4.5) and differs from the median equal 1.2 (1.6). The observed differences between the arithmetic mean and medians stem from the asymmetry of the distributions. For analysts, this means that they should use the median as a benchmark; the mean seems useless because of the high asymmetry and variability of distributions. The Polish sample and yearly medians are close to the benchmarks suggested in the abovementioned literature. For Germany, the yearly and sample medians are higher.

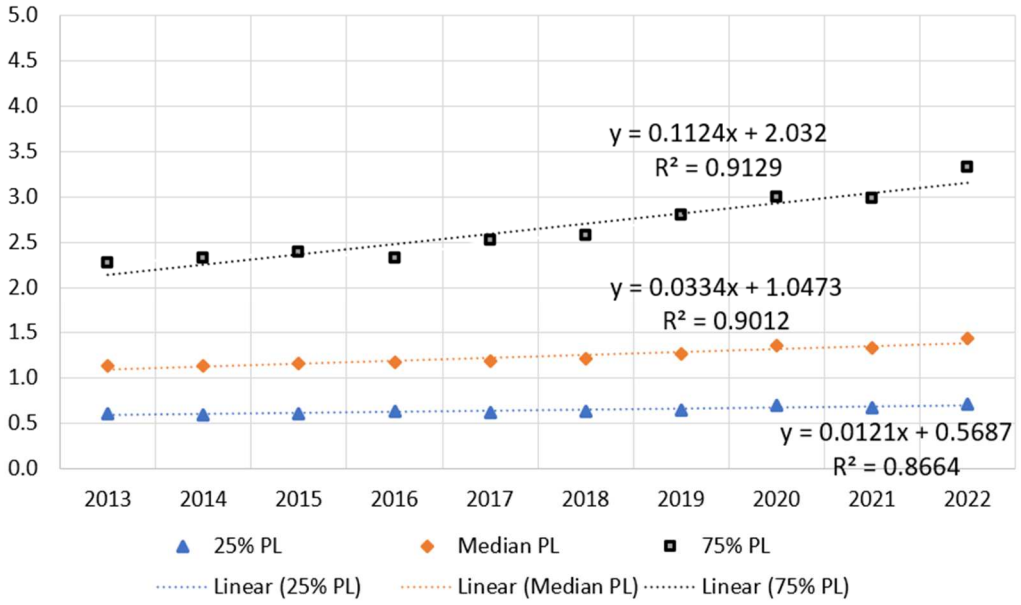

Figure 3. Median, first (25%), and third (75%) quartile of QR per year, Poland
Source: own elaboration based on a quick ratio calculation.

Interpreting the interquartile ranges (Tables 3 and 4) for total samples is inspiring. The range for Poland says that 50% of firm-years have a value of QR from 0.6 to 2.7, with a median of 1.2. Firms included in the sample are going concern units; hence, I interpret this range as empirical verification of the benchmarks suggested in the literature. The first (25%) and the third (75%) quartile are far removed from the theoretical standards. Moreover, the first quartile is respectively stable over time, but the third quartile increases in 2013-2022, especially in 2020-2022. Therefore, I fit linear trend lines to quartiles to verify my temporary conclusions. Figure 3 shows the yearly quartiles of QR and regression results.

The intercept for the first quartile linear model (Figure 3) says that its estimated value in 2012 was 0.57 and is increasing yearly by 0.0121 on average; hence, it is very stable. The intercept for the third quartile linear model says its estimated value in 2012 was 2.03 and is increasing annually at a fast pace, by

0.1124 on average. In other words, the quartile range is, on average, becoming increasingly wider year by year because of the increase in the third quartile. The first quartile (close to 0.6) is reasonably stable over time. It may be interpreted as an empirically verified minimum of the benchmark for the QR. I conjecture that the increase in QR is due to the increased risk of business activity, especially during the COVID-19 pandemic season and the war in Ukraine. The median also grows over time at a rate of 0.0334 per year, from 1.05 in 2012. All R^2 coefficients are high, so linear models fit the data in the research period.

Table 4 and Figure 4 tell a corresponding story for Germany. The main similarity between the Polish and German settings is in the general pattern, *i.e.* an increase in quartiles over time. However, there are also substantial differences. The third quartile and median in 2012 were higher in Germany than in Poland, *i.e.* 3.01 and 1.21, respectively. They grow yearly at an average rate of 0.1519 and 0.0627. Hence, median QR grows almost two times faster in Germany than in Poland. The total interquartile range says that 50% of firm-years have a value of QR from 0.7 to 3.9, with a median of 1.6.

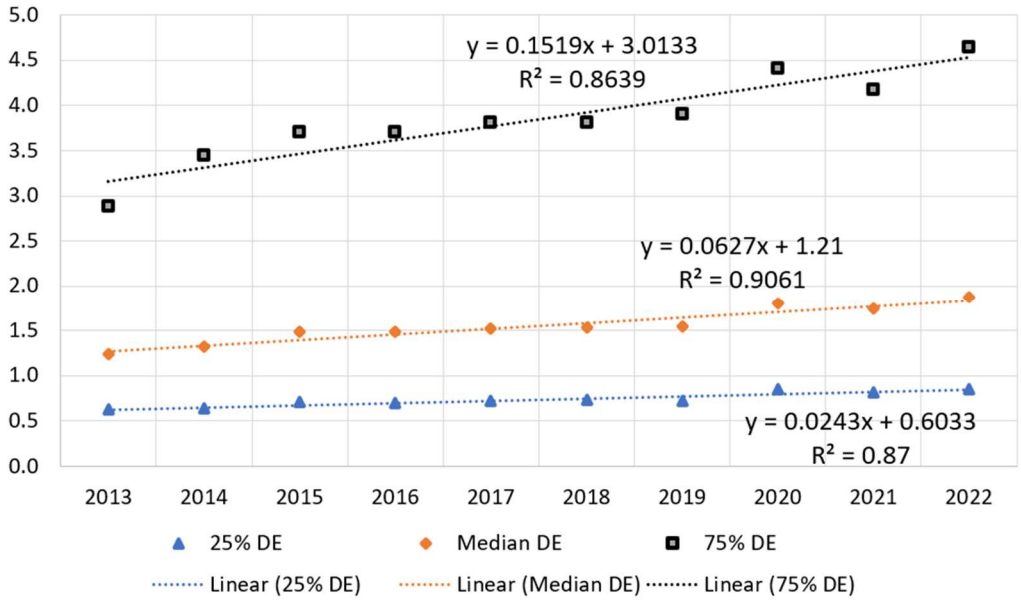

Figure 4. Median, first (25%), and third (75%) quartile of QR per year, Germany
Source: own elaboration based on a quick ratio calculation.

I ran a Student's two-group mean-comparison t-test to verify whether there are any statistically significant differences between the means of the QR for Poland and Germany. The hypotheses for the test are H_0: population means are equal; H_1: Germany's population mean is greater than Poland's population mean. The p-value <0.0001; hence, the null hypothesis should be rejected. Unfortunately, QR is not normally distributed, and the p-value<0.0001 in Bartlett's test for equal variances. In other words, the underlying assumptions for the Student's t-test are broken. To verify these results, I ran the nonparametric equality-of-medians test. The hypotheses for the test are: H_0: population medians are equal; H_1: population medians are not equal. The p-value<0.0001. Statistic tests show that QR country medians differ, so hypothesis H4 should not be rejected. In other words, there are significant between-country differences in QR. For analysts, it is a premise for using country-related benchmarks. In my opinion, there is a substantive difference between medians for Poland and Germany: 1.2 vs 1.6. Furthermore, the direction of the difference suggests that German managers run their businesses with greater caution than their Polish counterparts.

The differences between quartiles and means presented in Tables 3 and 4 provisionally support hypothesis H5. Wanting to strengthen my tests, I run ANOVA for Polish and German firms to verify whether there are statistically significant differences between the yearly means and medians of the QR. The p-value<0.0001, so the null hypothesis (means are equal) should be rejected in both countries. As mentioned above, QR is not normally distributed, and the p-value in Bartlett's test for equal vari-

ances is p<0.0001, so the ANOVA assumptions are again broken. To verify my results, I ran the nonparametric Kruskal-Wallis ANOVA. Similarly, the p-value<0.001 for both countries. Statistic tests showed that QR medians vary yearly, so hypothesis H5 should not be rejected.

The above analysis and discussion verify some of my research hypotheses. Hypothesis H1 is supported, *i.e.* arithmetic means differ significantly from medians. Hypothesis H2 is supported, *i.e.* the mean values of the distributions are far from the literature benchmarks. The conclusion about H3 is unclear. From one point of view, H3 should be rejected because the literature benchmarks implicitly refer to medians. From another point of view, the authors do not consider changes over time. Hence, building on medians, one may conclude that the benchmark is about 1.2 and, on average, is growing year by year. Hypothesis H4 is supported, so analysts must be cautious in the case of the Poland-Germany analysis and perhaps in every international setting. In the same vein, means and medians vary over time in both countries. Furthermore, they grow yearly at country-specific rates. Hypothesis H5 is supported.

The following analysis stage goes deeper into assessing QR benchmarks for industries and the firm size.

Table 5. Descriptive statistics of the quick ratio (QR) per NACE Rev. 2 section in Poland

Section / Parameter	No. of Obs.	Mean	Std. Dev.	25%	Median	75%	Skewness	Kurtosis
A	27 635	5.4	11.5	0.6	1.4	4.3	4.3	25.0
B	4914	3.5	7.9	0.6	1.3	3.0	6.2	53.5
C	194 768	2.7	6.4	0.6	1.1	2.3	7.6	78.5
D	16 190	4.0	10.6	0.4	1.0	2.4	5.1	32.6
E	18 460	2.5	6.0	0.5	1.2	2.4	8.5	97.3
F	138 313	3.8	8.8	0.7	1.4	2.9	5.8	45.0
G	290 162	2.6	6.9	0.5	1.0	1.9	7.4	72.8
H	58 093	2.9	6.4	0.9	1.3	2.4	7.6	77.1
I	35 723	3.2	7.9	0.4	1.1	2.5	6.5	55.8
J	76 811	4.5	9.1	0.9	1.8	4.0	5.4	39.9
M	137 641	5.1	10.1	1.0	2.0	4.6	4.8	31.8
Total	998 710	3.4	8.0	0.6	1.2	2.7	6.3	52.1

Source: own study in Stata.

Table 6. Descriptive statistics of the quick ratio (QR) per NACE Rev. 2 section in Germany

Section / Parameter	No. of Obs.	Mean	Std. Dev.	25%	Median	75%	Skewness	Kurtosis
A	26 311	5.7	12.4	0.7	1.7	4.5	4.3	23.8
B	5331	4.8	9.4	0.7	1.6	4.6	4.5	29.5
C	332 172	4.2	8.4	0.7	1.6	4.0	5.5	42.7
D	54 272	4.8	11.7	0.6	1.3	2.9	4.6	27.2
E	18 823	4.4	9.2	0.9	1.7	3.9	5.5	40.6
F	256 113	3.3	7.0	0.6	1.4	3.2	7.0	67.6
G	410 537	3.8	8.8	0.6	1.3	3.1	5.8	45.2
H	88 014	3.8	8.4	0.9	1.6	3.2	70.1	50.5
I	55 665	4.4	9.6	0.8	1.6	3.8	5.3	37.5
J	100 089	6.1	11.0	1.2	2.5	5.9	4.4	26.8
M	232 292	7.2	13.7	1.1	2.4	6.4	3.8	19.0
Total	1 579 619	4.5	9.8	0.7	1.6	3.9	5.2	36.5

Source: own study in Stata.

Tables 5 and 6 show descriptive statistics of QR per NACE Rev. 2 section in Poland and Germany, respectively. The results show that distributions differ between industries proxied by NACE sections. For Poland, the lowest median of 1.0 is for sections D and G. The highest median of 2.0 is for section M. Arithmetic means and standard deviations also differ. Although parametric ANOVA assumptions are broken, I ran parametric and nonparametric analyses for Poland and Germany. Not surprisingly, in all tests, p-value<0.0001. For analysts, benchmarks vary between industries in both countries. Moreover, differences in benchmarks proxied by medians are substantial. The above results support

hypothesis H6. Their practical consequences are hard to overestimate. One may ask a question about the *proper* value of the QR; however, the answer is not simple. It depends on the business's country of origin, period, and industry.

Tables 5 and 6 also show that the pattern of the between-industry differences is unique to a country. For instance, the highest median in Poland is for section M (2.0). In Germany, the highest median is for J (2.5), and the median for M (2.4) is second in this ranking.

The last hypothesis – H7 – addresses the impact of the firm size on the liquidity level. I proxy the size of the firm following general EU regulations. Small and medium-sized enterprises (SMEs) represent 99% of all businesses in the EU. The main factors determining whether an enterprise is a Micro/Small/Medium/Big unit are staff headcount and either turnover or balance sheet total assets (European Commission, 2023). SMEs are essential European creators of jobs and development (Pichler, 2018).

Due to the scant availability of data on turnover and total assets, especially for Germany, I concentrate on headcount only. Following the EU regulations, I classify a business as *micro* if the staff headcount<10; *small* if headcount>=10 and headcount<50; *medium* if headcount>=50 and headcount<250; and *big* otherwise.

Table 7 shows descriptive statistics per company size category for Poland and Germany. The total number of observations differs from the totals presented in Tables 3 and 4 because of the missing data in the Orbis database. I use 47.7% of the data set for Poland and 73.1% for Germany.

Table 7. Descriptive statistics of the quick ratio (QR) per company size in Poland and Germany

Size / Parameter	No. of Obs.	Mean	Std. Dev.	25%	Median	75%
Poland						
Micro	227 487	3.79	8.44	0.70	1.36	3.14
Small	160 591	2.31	4.31	0.68	1.24	2.35
Medium	69 101	1.61	2.49	0.55	1.02	1.81
Big	18 995	1.34	1.70	0.58	0.97	1.53
Total	**476 174**	**2.88**	**6.49**	**0.65**	**1.23**	**2.50**
Germany						
Micro	344 358	5.73	11.63	0.79	1.77	5.04
Small	556 405	3.86	7.71	0.75	1.60	3.78
Medium	199 341	2.97	6.10	0.73	1.38	2.97
Big	53 840	2.48	4.78	0.80	1.36	2.48
Total	**1 153 944**	**4.20**	**8.81**	**0.76**	**1.57**	**3.80**

Source: own study in Stata.

I ran parametric and nonparametric ANOVA for Poland and Germany for the last time. Again, in all tests, p-value<0.0001. Table 7 and ANOVA results generate several important conclusions. Firstly, the size of the business matters. I find the negative impact of the size on the average liquidity level proxied by various measures. Secondly, there is a negative relationship between the size of the business and the variability of QR proxied by the standard deviation of the distribution. For analysts, it is a signal that benchmarking for small firms is more complex than for big ones. These relationships apply to Poland and Germany. Thirdly, the observed excess of the median liquidity for German firms over their Polish counterparts remains relatively stable and, in each group, equals about 0.4. Fourthly, the total descriptive statistics reported in Table 7 are close to those reported in Tables 3 and 4. In my opinion, the existing differences have no substantial significance for analysts. In other words, I performed a robustness test of the results using the subsample. Hence, hypothesis H7 is supported.

CONCLUSIONS

The article aimed to empirically verify the benchmarks for the quick ratio – QR – commonly provided in the Polish literature. It also challenged the suggestion of a single benchmark despite a country's,

period's, industry's, and firm size uniqueness. The article concentrated on the Polish-German setting because of the intensive cooperation between the two countries.

The analysis shows that the benchmark depends on the country, industry, period, and firm size. Benchmarks must be drawn from quartiles instead of the arithmetic mean. The high variability of QR renders the mean useless for analysts. The commonly proposed theoretical benchmark for QR of about 1 may be used only as a rough suggestion. The findings show that the range for QR is much broader. For Poland, it ranges from 0.6 (the first quartile) to 2.7 (the third quartile), with a median of 1.2 for the total sample. It is close to the range empirically established by Niemiec (2014). For Germany, it ranges from 0.7 (the first quartile) to 3.9 (the third quartile), with a median of 1.6.

Tests indicate that benchmarks vary annually in Poland and Germany. Trend analysis permits the identification of the pattern and magnitude of the change in the benchmark. Medians and third quartiles increase over time and grow faster in Germany.

There are substantial between-industry differences in both countries. Furthermore, the pattern of these differences is unique to a country.

Finally, the size of the firm negatively influences the desired liquidity level. In both countries, the same relationship holds. The bigger the firm, the lower the liquidity level.

My research, as any other, has its limitations, but it provides an opportunity for future inquiry. Firstly, further research may extend to between-country settings. Secondly, the benchmarks for the cash ratio may be analysed. Thirdly, the question of techniques useful in benchmark identification remains open.

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