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TINJAUAN PENGGUNAAN ANALISA REGRESI DALAM KAJIAN TENTANG KUALITAS AUDIT

A REVIEW ON THE USE OF REGRESSION ANALYSIS IN STUDIES OF AUDIT QUALITY

ABSTRACT/ABSTRAK

Kajian ini bertujuan untuk mereviu bagaimana analisa regresi digunakan dalam suatu fenomena abstrak seperti kualitas audit, suatu konsep yang penting dalam praktik audit (Schroeder et al., 1986) namun belum terdefinisi dengan jelas. Artikel yang direviu dalam kajian ini adalah artikel penelitian yang memasukkan kualitas audit sebagai variabel penelitian, baik sebagai variabel independen maupun dependen. Artikel-artikel tersebut dipilih dengan cara purposif sampling untuk mendapatkan keterwakilan yang seimbang antara artikel jurnal khusus audit dan akuntansi secara umum, serta mewakili jurnal *Anglo Saxon* dan *Anglo American*. Artikel yang direviu diterbitkan pada periode 1983-2011 oleh jurnal yang masuk dalam kategori A/A berdasarkan klasifikasi ERA pada tahun 2010. Kajian ini menemukan bahwa sebagian besar artikel-artikel tersebut menggunakan analisa regresi berganda dan menjadikan kualitas audit sebagai variabel dependen serta mengukurnya menggunakan proksi. Kajian ini juga menyoroti ukuran data sampel yang digunakan dan kurangnya pembahasan mengenai asumsi yang digunakan dalam analisa statistik. Kajian ini menyimpulkan bahwa efektivitas dan validitas penggunaan analisa regresi berganda dalam penelitian tidak hanya bergantung pada kemampuan peneliti untuk menggunakannya, namun juga pada kemampuan peneliti untuk mengkomunikasikan hasil penelitiannya kepada pembaca.

This study aimed to review how regression analysis has been used in studies of abstract phenomenon, such as audit quality, an importance concept in the auditing practice (Schroeder et al., 1986), yet is not well defined. The articles reviewed were the research articles that include audit quality as research variable, either as dependent or independent variables. The articles were purposefully selected to represent balance combination between audit specific and more general accounting journals and between Anglo Saxon and Anglo American journals. The articles were published between 1983-2011 and from the A/A class journal based on ERA 2010's classifications. The study found that most of the articles reviewed used multiple regression analysis and treated audit quality as dependent variable and measured it by using a proxy. This study also highlights the size of data sample used and the lack of discussions about the assumptions of the statistical analysis used in most of the articles reviewed. This study concluded that the effectiveness and validity of multiple regressions do not only depends on its application by the researchers but also on how the researchers communicate their findings to the audience.

INTRODUCTION

Statistical analysis based on linear regression[1] models, such as multiple regression, has become a major tool for the analysis of a wide range of empirical problems (Western, 1995). The popularity of this tool can be attributed to its easiness to use and understand and, under certain conditions, its ability to give '*best*'[2] estimates of population parameters '*efficiently*'[3] (Allison, 1999). Additionally, although regression analysis is originally developed for the analysis of measurable observations, it can be used to analyse abstract phenomena as well.

To study how regression analysis has been used in studying an abstract phenomenon, this study reviews research articles on audit quality. Audit quality is an important concept within the auditing practice because it is the key indicator of auditors' performance and, as such, has been one of the major research topics within the auditing discipline. Yet, despite its importance, no clear definition about audit quality has been developed, even in the auditing standards, and scholars still have different understanding of its meaning, not to mention how to measure audit quality [Schroeder et al., 1986]. The existing audit standards imply only that audit quality is achieved by the issuance of the "appropriate" audit report on the client's compliance with generally accepted accounting principles (Francis, 2011).

This study aimed to review the practices of multiple regression analysis used on the audit quality through research articles that using audit quality as a variable. This study will be beneficial for future researchers to be more effectively use multiple regression analysis on audit quality and then effectively communicating their research report.

METHODS

1. Theoretical Study.

Regression can simply be defined as statistical relations between variables (Kutner et al., 2004). The variables consist of a single dependent variable[4] and one or more independent variables[5]. If the model involves one independent variable only, the analysis is called simple regression[6]. When the model involves more than one independent variables, the analysis is called multiple regression. Regression can be used for three

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[1] The word '*regression*' is introduced by Sir Francis Galton (1822-1911), an English Scientist, in his study of the relationship between heights of fathers and sons (Upton and Cook, 2002)

[2] *Best* refers to the estimators with minimum sampling variation (Bohrnstedt and Carter, 1971).

[3] Efficient estimation produces standard errors that are as small as possible (Allison, 1999)

[4] Also known as the response variable or outcome variable (Upton and Cook, 2002)

[5] Also known as antecedent variables, background variables, predictor variables, explanatory variables, or controlled variables (Upton and Cook, 2002).

[6] If the model involve more than one dependent variables, the analysis is called multivariate analysis (Hair et al., 2006).

purposes: (1) description, (2) control, and (3) prediction[7] (Kutner et al., 2004).

Like any other statistical technique, regression analysis is developed with several assumptions. The assumptions define the boundaries within which regression analysis will work well. The main assumptions for the multiple regression analysis are (Berry, 1993, p. 12):

i. All independent variables (X_1, X_2, ..., X_k) are *quantitative* or *dichotomous*, and the dependent variable , Y, is *quantitative*, *continuous*, and *unbounded*. Moreover, all variables are measured without error

ii. All independent variables have *nonzero variance* (i.e., each independent variable has some variation in value)

iii. There is not *perfect multicollinearity* (i.e., there is no exact relationship between two or more of the independent variables)

iv. At each set values for the k independent variables, (X_{1j}, X_{2j}, ...,X_{kj}), $E(\varepsilon_j | X_{1j}, X_{2j},...,X_{kj}) = 0$ (i.e., the mean value of the error term is zero)

v. For each X_i, $COV(X_{ij}, \varepsilon_j) = 0$ (i.e., each independent variable is uncorrelated with the error term)

vi. At each set of values for the k independent variables, (X_{1j}, X_{2j}, ...,X_{kj}), $VAR(\varepsilon_j | X_{1j}, X_{2j},...,X_{kj}) = \sigma^2$, where σ^2 is a constant (i.e., the conditional variance of the error term is constant); this is known as the assumption of *homoscedasticity*.

vii. For any two observations, (X_{1j}, X_{2j}, ...,X_{kj}) and (X_{1h}, X_{2h},...,X_{kh}), $COV(\varepsilon_j, \varepsilon_h) = 0$ (i.e., error terms for different observations are uncorrelated); this assumptions is known as lack of *autocorrelation*.

viii. At each set of values for the k independent variables, ε_j is normally distributed.

As a set, point i to point vii assumptions are also known as *Gauss-Markov Theorem*.

In addition to the assumptions, Allison (1999) points out that the *robustness* of a regression model can be compromised if measurement errors and/or specification errors exist in the model. Specification errors occur when certain variables are mistakenly included or omitted in the model, or when the functional form to represent the variables is incorrect (Bohrnstedt and Carter, 1971). While measurement errors arise due to the assumption in the parametric statistic that the scale used to measure the variables is interval or ratio scale, which is not always the case in empirical problems being studied.

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[7] Allison (1999) describes that regression can be used in causal analysis, aiming to determine whether a particular independent variable really affects the dependent variable, and to estimate the magnitude of that effect. However, Kutner et al. (2004) argue that the existence of statistical relation between dependent and independent variable(s), no matter how strong it is, does not imply that dependent variable depends causally on independent variable(s). Keith (2006) takes a position that "…we can and do make causal inferences…under certain condi- in other cases, such inferences are invalid and misleading…(p.18)".

2. Sampling

Articles to be reviewed in this study are identified through searching in Business Source Premier database with the key word of audit quality and the publication date between 1983-2011. Only the research articles that include audit quality as research variable, either dependent or independent, are considered in this study. The articles then are purposefully selected to represent balance combination between audit-specific and more general accounting journals and between Anglo-Saxon and Anglo-American journals[8]. The journal where the articles published are A/A* class journals based on ERA 2010's classifications[9], with the consideration that research articles published in these journals represent benchmark or best practice in the conduct of research within the auditing discipline

3. Research Questions

The research articles has been analysed using these three major questions:

1) Does it mentions a definition of audit quality?
2) What is the measurement for the audit quality?
3) How the research data being analysed

RESULT AND DISCUSSION

Based on the sampling methods performed, there are 30 articles reviewed from three reputable journals, which are European Accounting Review, Auditing: A Journal of Practice & Theory, and The Accounting Review. The list of the articles and the result can be seen in Appendix 1. The discussion from the results are as follow:

1. Definition of Audit Quality

This study found out that from 30 research articles reviewed, there were 13 articles did not mention about audit quality definition. While the rest of 17 articles did mention about audit quality definition but with varied definition. These were some definition found in the majority of research articles:

1) An audit that improves the reliability of financial statement information
2) A probability of auditor would discover and report a breach in the client's accounting system
3) The magnitude of absolute discretionary accruals that influence audit opinion
4) Represents the present (acceptable quality) or absence (unacceptable quality) of audit repot and audit procedures required
5) The probability that auditors will report a known material error
6) The extent to which the audits result in reporting that is in compliance with GAAP

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[8] Anglo-Saxon and Anglo-American perspectives are generally considered as the major influencer of audit practices in the world
[9] http://www.arc.gov.au/era/

7) The joint probability that auditor will both discover a breach in the client's accounting system and disclose it.

Based from the observation on that research articles can be concluded that most scholars implied that audit quality can be achieved by a qualified audit report (reporting a breach on the accounting system or GAAP). This conslusion is in line with Francis's (2011) statement that the definition of audit quality in audit standards imply only that audit quality is achieved by the issuance of the "appropriate" audit report on the client's compliance with generally accepted accounting principles (Francis, 2011).

2. Measurement of Audit Quality

The approach used to investigate audit quality varies among journals. In general, multiple regression analysis is the most common method of analysis. Within this method, audit quality is mostly treated as dependent variable and is measured by using a proxy.

The use of a proxy to represent certain variable in the model is a common practice in the regression analysis. Upton and Cook (2002) define a proxy as a measurable variable that is used in place of a variable that cannot be measured. The alternative strategy of using a proxy is to delete the unmeasurable variable from the model (Trenkler and Stahlecker, 1996). In the studies of audit quality this approach is not common because the audit quality is the dependent variable in the model. Furthermore, studies show that, under the criterion of asymptotic bias, using a proxy, even the poor one, is better than dropping the

unmeasurable variable (McCallum (1972) and Wickens (1972)). Also, using the scalar valued mean square error (MSE) criterion, Aigner (1974) demonstrates that proxies are preferable in most, but not all, situations. Nonetheless, Maddala (1977) and Frost (1979) recommend the use of reliable proxy only.

In the reviewed research articles, several variables have been used as proxy of audit quality, such as discretionary accruals, auditor size or class, audit fees, and audit report with modified audit opinion, with discretionary accruals become the most commonly used proxy for audit quality. Use of difference proxies to replace the same concept might indicate lack of generally accepted or agreed audit quality measures. Even in the most commonly used proxy, i.e., discretionary accruals, there are still debates about the appropriateness of this variable as proxy of audit quality (Guay et al. 1996)

Berry (1993) warns that the use of proxy in regression analysis might result in measurement errors. When proxy is used, researcher can be lured into a false conclusion of valid measurement if there is little error in the measurement of the proxy itself. He further gives example about this issue:

> "…knowledge that per capita income is measured without any error would not be evidence of the absence of error in the measurement of the concept of level of development when income is used as proxy (p.58)".

Berry advises that researchers must be alert to two possible sources of measurement error when proxy variables are used as indicators:

(a) Random or non-random error in the measurement of the true score for the proxy

(b) Non-random error resulting from the inability of the true score on the proxy to reflect perfectly the concept being measured.

3. Data Analysis Technique

The observation on data analysis technique that should be taken as an interest is related to the sample size. Reviews on the studies in the articles found that even though the sample size varies among studies, in several studies the sample size can be as much as more than 10.000 observations/data. Normally, larger sample size is preferable in statistical analysis, however too large samples can also produce incorrect conclusions. Allison (1999) describes that too large sample is like a very sensitive measuring instrument. Because it is very sensitive, large sample will detect any artifactual relationships, such as the sample was not quite random or some bias in the data, along with the true relationships. As such, with very large samples, almost any variable in a regression model is likely to be statistically significant, even if it has no real effect. When a variable has a statistically significant coefficient, researchers tend to say that the coefficient is unlikely to be zero. This evidence can be seen in the studies being reviewed. When the sample is relatively large, some studies shows that the coefficient is statistically significant but the magnitude of this coefficient is relatively low (e.g., Krishnan (2003), Lawrence et al. (2011), Behn et al. (2008))

Another common observation is the lack of discussion about the assumptions of the statistical analysis used in the study. For multiple regression analysis, although studies have shown that violation to the assumptions does not impact severely the conclusion reached, providing information about assumptions will help readers understanding and interpreting the findings better. Furthermore, it is seldom for researchers to be able to do research without having to violate some assumptions. As such, by providing further analysis on the assumptions being violated and how this violation affect the interpretation of the findings, researchers have shown his/her mastery on the statistical analysis used.

Guidelines for Future Research

Reviews of research articles on audit quality indicates that the concept of audit quality is definitely still abstract, in terms of the definition and the measurement. The use of various proxies in the studies can be interpreted either positively or negatively. On the positive side, different proxies might indicate the richness of the concept being studied. Yet, on the other hand, too many proxies will prevent the accumulation of knowledge on audit quality, not to mention on the identification of the variables that may affect the audit quality and the relationships among these variables. Having limited proxies are better also as it will minimize the risks of measurement errors. As such, future studies on audit quality should focused more on identifying high quality variables that can be used as generally accepted proxies of audit quality and then focus the research on identifying variables that affect audit quality based on these proxies. Furthermore, using common proxy will facilitate comparisons and comprehensions between studies and accumulation of knowledge about the audit quality.

As observed by Berry, (1993), although most social scientists can recite the formal definitions of the various regression assumptions, many have little appreciation of the substantive meanings of the assumptions. Further, he argues that the use of regression analysis to generate substantive conclusions that are regularly worth believing requires that users consider (a) whether each of the assumptions of regression is likely met in each specific research project at hand and, when some are not met, (b) the implications of these violations. As such, the discussion about how the study has been conducted in the term of the assumptions of the analytical used should be present on any research report to facilitate better interpretation of research findings.

Also, because audit quality is not well defined at this stage, it would be interesting if the researchers in the area approach this topic using various statistical analytical tools. In the last 30 years, statisticians have introduced a number of sophisticated methods. These methods go by such names as logistic regression, Poison regression, structural equation modelling, and survival analysis (Allison, 1999). By using different statistical analysis tools, researcher can approach the subject from different point of view that is necessary to study such abstract concept as audit quality. Perhaps, they can consider using the other paradigm, i.e., interpretivist or critical study approach, in addition to positivist approach that seem to be the major paradigm in the journals being studied. Using different research paradigm will broaden and enrich the understanding about audit quality.

CONCLUSION

The effectiveness and validity of statistical analysis, such multiple regressions, do not depend on the way this tool is applied by researchers only, but also depend on how well researchers communicate their findings to the audience. The researcher might had done the research perfectly, but if they fail to communicate the findings effectively, the readers will not see the benefit and the quality of the research undertaken and, consequently, the research will be impactless.

Referring to communication theory, a communication is considered effective when the sender and the receiver having the same understanding about the message. Similarly, because research study reports/articles represent a communication media between researchers and the readers, the researchers should make sure that they provide as much information as feasible to facilitate readers understanding and interpretation on the research results.

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APPENDIXES

Tabel 1. Review Result of Research Articles fromThe Accounting Review Journal

Journal	The Accounting Review
Published by:	American Accounting Association
Periods	1980 -

No.	Article	Definition of Audit Quality	Measurement of Audit Quality	Data Analysis Technique		
				1. How frequently has the technique been used?	*2. How were the variables selected?*	*3. Were the assumptions of the technique tested?*
1.	*Can Big 4 versus Non-Big 4 Differences in Audit-Quality Proxies Be Attributed to Client Characteristics?* Alastair Lawrence, Miguel Minutti-Meza, Ping Zhang Vol. 86, No. 1, 2011 pp. 259-286	No information	discretionary accruals the *ex ante* cost-of-equity capital analyst forecast accuracy	Multiple regression analysis	Adopted from prior studies	No information
2.	*Litigation Risk,Audit Quality, andAudit Fees: Evidence from Initial Public Offerings* Ramgopal Venkataraman, Joseph P. Weber, Michael Willenborg Vol. 83, No. 5, 2008 pp. 1315–1345	No information	abnormal accruals	Multiple regression analysis	Adopted from prior studies	No information
3.	*Big 4 Office Size and Audit Quality* Jere R. Francis and Michael D. Yu Vol. 84, No. 5, 2009 pp. 1521–1552	No information	going-concern audit reports client earnings properties (abnormal accruals and earnings benchmark tests)	Multiple regression analysis	Adopted from prior studies	No information
4.	*Client Importance, Institutional Improvements, and Audit Quality in China: An Office and Individual Auditor Level Analysis* Shimin Chen, Sunny Y. J. Sun, Donghui Wu Vol. 85, No. 1, 2010 pp. 127–158	No information	auditor's propensity to issue a modified audit opinion (MAO)	Ordered logistic regression model	Adopted from prior studies	No information
5.	*Is Self-Regulated Peer Review Effective at Signaling Audit Quality?* Jeffrey R. Casterella, Kevan L. Jensen, W. Robert Knechel Vol. 84, No. 3, 2009 pp. 713–735	No information	the presence (absence) of an alleged audit failure as an indicator of lower (higher) audit quality	Multiple regression analysis	Adopted from prior studies	No information
6.	*Internal Audit Quality and Earnings Management* Douglas F. Prawitt, Jason L. Smith, David A. Wood Vol. 84, No. 4, 2009 pp. 1255–1280	No information	six individual characteristics specifically indicated by external auditing standards relating to the competence and objectivity of and the work performed by the internal auditors.	Multiple regression analysis	Adopted from prior studies	No information
7.	*Audit Partner Tenure and Audit Quality* Peter Carey and Roger Simnett Vol. 81, No. 3, 2006 pp. 653–676	No information	the auditor's propensity to issue a going-concern opinion for distressed companies, the amount of abnormal working capital accruals, the extent to which key earnings targets are just beaten (missed)	Multiple regression analysis	Adopted from prior studies	No information

Data Analysis Technique							Others
4. What data screening efforts were conducted?	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	No information	72,600 firm-year	Adjusted R^2	Model 1 = 0.11-0.14 Model 2 = 0.28-0.33	Yes	Sensitivity analysis Bootstrapping, Kernel Weighting, and Random Sub-samples	
No information	No information	454 firm-commitment	Adjusted R^2	9.3% - 13.1%	Yes	No information	
No information	Elimination	6,568 firm-year observations	Adjusted R^2	0.687 0.723	Yes	Sensitivity analyses	
No information	Elimination	8,917 firm-year observations	Pseudo R^2	24.13% - 24.32%	Yes	Sensitivity analyses	
No information	No information	158	Pseudo R^2 Log Likelihood	Pseudo R2 = 18.9% and 22.3% Log Likelihood = 78.69% and 75.45%	Yes	No information	
No information	No information	528 firm-year observations	Adjusted R^2	0.233	Yes	Sensitivity analysis.	
Filtering out irrelevant data	Elimination	1,021 companies	Pseudo R^2 Adj. R^2	Pseudo R^2 0.358 Adj. R^2 .012 and .040	Yes	Sensitivity analysis	

No.	Article	Definition of Audit Quality	Measurement of Audit Quality	Data Analysis Technique		
				1. How frequently has the technique been used?	*2. How were the variables selected?*	*3. Were the assumptions of the technique tested?*
8.	*Audit Quality and Properties of Analyst Earnings Forecasts* Bruce K. Behn, Jong-Hag Choi, Tony Rang Vol. 83. No. 2, 2008 pp. 327-349	an audit that improves the reliability of financial statement information and allows investors to make a more precise estimate of the firm's value	Auditor size, Big 5 versus non-Big 5; and the degree of an auditor's industry specialization	Multiple regression analysis	Adopted from prior studies	No information
9.	*Determinants of Audit Quality in the Public Sector* Donald R. Deis, Jr. and Gary A. Giroux Vol. 67. No. 3, 1992 pp. 462-479	the probability that the auditor will both discover and report a breach in the client's accounting system	Quality control review (QCR) findings	Multiple regression analysis	Adopted from prior studies	No information
10.	*Auditor Tenure and Perceptions of Audit Quality* Aloke Ghosh and Doocheol Moon Vol. 80, No. 2, 2005 pp. 585–612		Auditor tenure	Multiple regression analysis	Adopted from prior studies	No information

Data Analysis Technique							Others
4. What data screening efforts were conducted?	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	No information	9,261 firm-year observations	Adjusted R^2	15%	Yes	Sensitivity analysis	
No information	Elimination	232 QCRs over a five-year period (1984-1989)	F statistic R^2 Adjusted R^2	F-statistic : 7.116 (p = 0.0001); R2: 0.24, Adjusted R^2: 0.21	Yes	No information	
Imposing restrictions on the sample	No information	35,826 firm-years	Adjusted R^2	0.125-0.169	Yes	Sensitivity analysis	

Tabel 2. Review Result of Research Articles fromThe Auditing: A Journal of Practice & Theory Journal

Journal	Auditing: A Journal of Practice & Theory
Published by:	American Accounting Association
Periods	1980 -

No.	Article	Definition of Audit Quality	Measurement of Audit Quality	Data Analysis Technique	
				1. How frequently has the technique been used?	2. How were the variables selected?
1.	Audit Office Size, Audit Quality, and Audit Pricing Jong-Hag Choi, Chansog (Francis) Kim, Jeong-Bon Kim, and Yoonseok Zang Vol. 29, No. 1, May 2010 pp.73-97	The magnitude of abnormal accruals as a proxy for audit quality.	1. abnormal accruals obtained from the Ball and Shivakumar (2006) model which controls for the asymmetric timeliness of accruals in recognizing economic gain and loss, and 2. abnormal accruals adjusted for firm performance using Kothari et al.'s (2005) procedure.	Multiple regressions analysis	Adopted from prior studies
2.	Do Abnormally High Audit Fees Impair Audit Quality? Jong-Hag Choi, Jeong-Bon Kim, and Yoonseok Zang Vol. 29, No. 2, Nov 2010 pp. 115-140	the magnitude of absolute discretionary accruals	1.discretionary accruals using the model of Ball and Shivakumar (2006), which controls for the asymmetric timeliness of accruals in recognizing economic gain and loss, and 2. discretionary accruals obtained by applying the performance adjusted modified Jones model Kothari et al. (2005).	Multiple regressions analysis	Adopted from prior studies
3.	Firm versus Partner Measures of Auditor Industry Expertise and Effects on Auditor Quality Hsin-Yi Chi and Chen-Lung Chin Vol. 30, No. 2, May 2011 pp. 201-229	magnitude of discretionary accruals probability of issuing a modified audit opinion	estimate discretionary accruals using an approach proposed by Kothari et al. (2005) and focus on current accruals because prior research suggests that management has the most discretion over current accruals where MAO equals 1 if the company receives a modified audit opinion, and 0 otherwise	Multiple regressions analysis	Adopted from prior studies
4.	Education Requirements, Audit Fees, and Audit Quality Arthur Allen and Angela Woodland Vol. 29, No. 2, Nov 2010 pp. 1-25	measured using discretionary accruals	the unsigned residuals from the modified Jones (1991) model Dechow et al. (1995)	Multiple regressions analysis	Adopted from prior studies
5.	Audit Procurement: Managing Audit Quality and Audit Fees in Response to Agency Costs Kevan L. Jensen and Jeff L. Payne Vol. 24, No. 2, Nov 2005 pp. 27-48	auditor industry expertise as being a reasonable proxy for certain aspects of audit quality	the number of clients in the same industry (municipal audits) audited by a particular auditor in the same year	Multiple regressions analysis	Adopted from prior studies
6.	The Effect of Risk of Misstatement on the Propensity to Commit Reduced Audit Quality Acts under Time Budget Pressure Paul Coram, Juliana Ng, and David R. Woodliff Vol. 23, No. 2, Sep 2004 pp. 159-167	The dependent variable was the propensity of the auditor to commit RAQ measured on a l-to-7 scale.	Two commonly cited RAQ acts, namely, accepting doubtful audit evidence and truncating an audit sample	MANOVA	Adopted from prior studies

Data Analysis Technique								Oth-ers
3. Were the assumptions of the technique tested?	*4. What data screening efforts were conducted?*	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	Filtering out irrelevant data	No information	n H_1= 19499 firm-years n H_2= 16559 firm-years	R^2	R^2 model 1 = 0.2068; 0.2064; 0.1635; 0.1635 R^2 model 2= 0.7371; 0.7461; 0.7588	yes	Sensitivity analysis	
No information	Filtering out irrelevant data	No information	9,815 firm-years	R^2	81%	yes	Sensitivity analysis	
No information	Filtering out irrelevant data	No information	8,140 and 8,863 firm-year observations for accruals and audit opinion analyses, respectively	F value Log pseudo likelihood Pseudo R^2	F-value: 24.02 Adj. R^2: 0.165	yes	Sensitivity analysis	
Model assumptions such as normalcy of error terms were examined, and no significant problems were detected	Filtering out irrelevant data	No information	10,969 firm-years from 2,768 firms.	R^2	R^2= 0.816	yes	Sensitivity analysis	
No information	Filtering out irrelevant data	Elimination	228 municipal organizations	R^2	R^2 = 10 percent.	yes	Sensitivity analysis	
No information	nonresponse bias	No information	103 audit seniors	F value	F = 1.45, p = 0.116	yes	No information	

No.	Article	Definition of Audit Quality	Measurement of Audit Quality	Data Analysis Technique	
				1. How frequently has the technique been used?	2. How were the variables selected?
7.	*The Impact of Competition on the Quality of Governmental Audits* Paul A. Copley and Mary S. Doucet Vol. 12, No. 1, 1993 pp. 88-98	Audit quality represents the presence (acceptable quality) or absence (unacceptable quality) of those reports and audit procedures required under the provisions of federal assistance programs.	the degree of compliance with professional standards	Multiple regressions analysis	Adopted from prior studies
8.	*Factors that Audit Committee Members Use as Surrogates for Audit Quality* Michael C. Knapp Vol. 10, No. 1, Spring 1991 pp. 35-52	a quality audit is one in which an auditor reduces detection risk to a point where ultimate audit risk is at an "appropriately low level. the conditional probability that auditors will report a known material error.	the likelihood that the auditor would discover the material error (discover assessment) and the conditional probability that the auditor would require the client to correct the error or, if the client refused, would report the error in the audit opinion (disclosure assessment)	multivariate analysis of variance (MANOVA)	Adopted from prior studies
9.	*The Differentiation of Quality among Auditors: Evidence from the Not-for-Profit Sector* Jagan Krishnan and Paul C. Schauer Vol. 19, No. 2, Fall 2000 pp. 9-25	the extent to which the audits result in reporting that is in compliance with GAAP	The first approach is an indirect one, looks at correlates of audit quality, such as audit fees, auditor litigation, and user' perception of quality	Multiple regressions analysis	Adopted from prior studies
10.	*Audit Quality and the Pricing of Discretionary Accruals* Gopal V. Krishnan Vol. 22, No. 1, Mar 2003 pp. 109-126	The joint probability of detecting and reporting material financial statement errors	A significant difference in audit quality between Big 6 and non-Big 6 auditors and higher audit quality is associated with Big 6 auditors.	Multiple regressions analysis	Adopted from prior studies
11.	*Factors Associated with the Incidence of Reduced Audit Quality Behaviors* Charles F. Malone and Robin W. Roberts Vol. 15, No. 2, Fall 1996 pp. 49-64	RAQ behaviors are defined as actions taken by an auditor during an engagement which reduce evidence-gathering effectiveness inappropriately	RAQ behaviors were measured by asking subjects' six questions about their own RAQ acts	Multiple regressions analysis	Adopted from prior studies

Data Analysis Technique								Others
3. Were the assumptions of the technique tested?	*4. What data screening efforts were conducted?*	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	No information	No information	140 entities	Pseudo R^2	Pseudo R^2=0.114	Yes	No information	
No information	manipulation checks for each in dependent variable were included in the supplemental questions appended to the instrument.	Elimination	122	MANOVA	The results of the MANOVA test disclose that only the auditor size class (p < .05) and length of auditor tenure (p < .01) main effects were significant.	Yes	No information	
No information	No information	No information	164	Adjusted R^2	Adjusted R^2: 0.341 Adjusted R^2: 0.286	Yes	Sensitivity tests Alternative model (probit models)	
No information	Excluded data that are not relevant to the study	No information	18.658 firm-year observations	Adjusted R^2	Adjusted R^2: 0.054 Adjusted R^2: 0.233	Yes	Multicollinearity (VIF) Sensitivity analysis	
No information	No information	No information	257 usable questionnaires were received	R^2	$R^2 = .17$	Yes	Sensitivity analysis	

Tabel 3. Review Result of Research Articles fromThe European Accounting Review Journal

Journal	European Accounting Review
Published by:	European Accounting Association
Periods	1980 -

No.	Article	Definition of Audit Quality	Measure-ment of Audit Quality	Data Analysis Technique	
				1. How frequently has the technique been used?	*2. How were the variables select-ed?*
1.	*Evidence on (the Lack of) Audit-quality Differentiation in the Private Client Segment of the Belgian Audit Market* Heidi Vander Bauwhede and Marleen Willekens Vol. 13, No. 3, 2004 pp. 501–522	No information	audit-firm size	Multiple regression analysis	Adopted from prior studies
2.	*Earnings Management and Audit Quality in Europe: Evidence from the Private Client Segment Market* Brenda Van Tendeloo and Ann Vanstraelen Vol. 17, No. 3, 2008 pp. 447–469	audit quality depends on (1) the probability that material misstatements and signals of financial distress are discovered and (2) the probability that the auditor will report these misstatements and signals	audit-firm size	Multiple regression analysis	Adopted from prior studies
3.	*Impact of renewable long-term audit mandates on audit quality* Ann Vanstraelen Vol. 9, No.3, 2000 pp. 419-442	the market-assessed joint probability that a given auditor will both discover a breach in the client's accounting system and report the breach	audit opinion	Logistic regression analysis	Adopted from prior studies
4.	*Non-audit fees, disclosure and audit quality* Clive S. Lennox Vol. 8, No.2, 1999 pp. 239-252	on the joint probability of an auditor discovering and disclosing a problem in an accounting system	auditor size audit qualifications	Multiple regression analysis	Adopted from prior studies
5.	*Audit Quality and the Going-concern Decision-making Process: Spanish Evidence* Emiliano Ruiz-Barbadillo, Nieves Gomez-Aguilar, Cristina De Fuentes-Barbera and Maria Antonia Garcia-Benau Vol. 13, No. 4, 2004 pp. 597–620	No information	auditor competence auditor independence	Multivariate analysis	Adopted from prior studies
6.	*The Impact of Audit Quality on Earnings Rounding-up Behaviour: Some UK Evidence* Tom Van Caneghem Vol. 13, No. 4, 2004 pp. 771–786	No information	Industry expertize Firm size		Adopted from prior studies

Data Analysis Technique								Oth-ers
3. Were the assumptions of the technique tested?	*4. What data screening efforts were conducted?*	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	No information	No information	1,302 of privately held Belgian industrial and commercial companies	Adjusted R^2	0.07	Yes	Sensitivity analysis	
No information	No information	No information	113 industry–country observations	Adjusted R^2	0.36	Yes	Sensitivity analysis	
No information	Filtering our irrelevant data	No information	796	Model chi-square	34.971 (Sig. 0.000) Prediction accuracy: 76.29%	Yes	No information	
No information	Filtering our irrelevant data	No information	5,572	Pseudo R^2	$0.070 - 0.072$	Yes	No information	
No information	Filtering our irrelevant data	No information	3,119 observations	the likelihood ratio test, the pseudo-R^2 and the percentages of concordant pairs	Pseudo-R^2 is 0.227 79.4% predicted correctly	Yes	No information	
No information	Filtering our irrelevant data	No information	1,256 companies	χ^2 test	26.48	Yes	Sensitivity analyses	

No.	Article	Definition of Audit Quality	Measurement of Audit Quality	Data Analysis Technique	
				1. How frequently has the technique been used?	2. How were the variables selected?
7.	*Audit quality, auditor behaviour and thepsychological contract* Olivier Herrbach Vol. 10, No. 4, 2001 pp. 787–802	No information	audit quality reduction behaviour	Multiple regression analysis	Adopted from prior studies
8.	*Agency costs and audit quality: evidence from France* Charles Piot Vol. 10, No. 3, 2001 pp. 461–499	the market-assessed joint probability that the auditor discovers an anomaly in the financial statements, and reveals it.	Perceived auditor reputation Firm size	multivariate logistic analysis	Adopted from prior studies
9.	Quality dimensions in external audit services – an external user perspective Bent Warming-Rasmussen and Lars Jensen Vol. 7, No. 1, 1998 pp. 65-82	No information	15 attributes concerning quality and confidence	Factor analysis	in-depth dialogues with four individuals, representing external user groups

Data Analysis Technique								Oth ers
3. Were the assumptions of the technique tested?	*4. What data screening efforts were conducted?*	*5. How were the missing data treated?*	*6. Were the sample sizes adequate?*	*7. How was the fit of the models assessed?*	*8. How much variation did the models explain?*	*9. Were the models interpreted correctly?*	*10. What model validation procedures were used?*	
No information	No information	No information	170 questionnaires	R^2	0.30	Yes	No information	
No information	Filtering our irrelevant data	Elimination	285 observations	Chi-square Correct predictions	$13.82 - 36.68$ $62.04 - 74.74$	Yes	No information	
No information	No information	No information	262 questionnaires	overall degree of explanation	69.5%	Yes	No information	