EMPLOYING GENERALIZED AUDIT SOFTWARE IN THE FINANCIAL SERVICES SECTOR: CHALLENGES AND OPPORTUNITIES

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ABSTRACT

Computer Assisted Audit Techniques (CAATs) encompass a range of computerized techniques that internal and external auditors use to facilitate their audit objectives. One of the most important CAATs is generalized audit software (GAS), which is a class of packaged software that allows auditors to interrogate a variety of databases, application software and other sources and then conduct analyses and audit routines on the extracted or live data. This study seeks to evaluate the nature and extent of the utilization of Computer Assisted Audit Techniques (CAATs) in financial institutions. In particular, this study establishes the extent and nature of use of GAS by bank internal auditors and their external auditors. The study is conducted with large local and international commercial banks in Singapore, a major financial center.

Given the highly limited base of research on GAS in the financial services sector or other industry, we conduct exploratory qualitative research. We conduct depth interviews with both internal and external auditors. We find that the extent and range of use of GAS varies widely between the institutions in our sample. Internal auditors see GAS primarily as a tool for special investigations rather than as a foundation for their regular audit work.

We establish that external auditors make no use of GAS, citing the inapplicability of this class of tool to the nature of testing the financial statement assertions or the extent or quality of computerized internal controls maintained by the bank. The study opens up a range of research challenges and opportunities.

EMPLOYING GENERALIZED AUDIT SOFTWARE IN THE FINANCIAL SERVICES SECTOR: CHALLENGES AND OPPORTUNITIES

I. INTRODUCTION

Computer Assisted Audit Techniques (CAATs) encompass a range of computerized tools and procedures that are used by auditors in various phases of the financial statement audit and by internal auditors in a wide range of operational and special audits (Boritz 2002; ISACA 1998; Rittenberg and Schwieger 2003, 321-346). Generalized Audit Software (GAS) is a class of CAATs that allows auditors to undertake data extraction, querying, manipulation, summarization and analytical tasks (Boritz 2003).[1] A number of publications and guidance by professional bodies (CICA 1994; EDP Auditors Foundation 1992), audit standards setters (AASB 2001, 2004; IAASB 2003b; ISACA 1998) and regulatory agencies (FFIEC 2003) demonstrate the importance of CAATs and GAS in the conduct of audits. Following the passage of the Sarbanes-Oxley Act in the USA, there has been increased interest in the formal testing of internal controls and recognition of the vital role of information technology in maintaining such controls (ITGI 2004; Stevens 2004). Indeed it is difficult to imagine that the tests described by the Public Company Accounting Oversight Board (PCAOB) in its Auditing Standard No. 2 on the audit of internal controls could be conducted without the benefit of CAATs, GAS or other automated audit support (PCAOB 2004).[2] CAATs and GAS have also been identified as important prerequisites in the building of continuous audit capabilities (Rezaee et al. 2002).

[1] Boritz (2003, Chapter 10) categorizes generalized retrieval software (GRS) along with GAS. Examples of GRS include commercial packages such as commercial databases, report writers and data warehouses. GRS is beyond the focus of this study.

[2] See in particular, Appendix B of Auditing Standard No. 2 – An Audit of Internal Control Over Financial Reporting Performed in Conjunction with An Audit of Financial Statements (PCAOB 2004).

Interestingly, there has been little or no formal research on the application of CAATs in general and GAS in particular to the assurance process (Boritz 2002). This study aims to make a first step in filling this clear gap in the research literature. The study seeks to evaluate the nature and extent of the utilization of GAS in financial institutions. These economically significant entities typically make intensive use of information systems for many business processes. Many financial institutions are of a sufficient size to warrant investment in GAS by internal or external auditors. Financial institutions also are often subject to regulatory regimes that require monitoring of particular risks and potential malfeasance in areas such as money laundering. In particular, this study aims to establish how GAS assists internal auditors within banks and their external auditors in the process of substantive testing in the conduct of both financial statement audits as well as special audits. Second, in the event that banks do not make use of GAS to obtain audit evidence through substantive procedures, the second objective of this study is to examine the reasons for such limited usage. In addition, this study also attempts to examine the possibilities of how banks' internal and external auditors would be able to better exploit GAS if they were given an opportunity to exploit their capabilities to the fullest.

Given the highly limited base of research on GAS in the financial services sector or other industry, we conduct exploratory qualitative research. We conduct depth interviews with both internal and external auditors. We find that the extent and range of use of GAS varies widely between the institutions in our sample. Internal auditors see GAS primarily as a tool for special investigations rather than

We establish that external auditors make no use of GAS, citing the inapplicability of this class of tool to the nature of testing the financial statement

assertions or the extent or quality of computerized internal controls maintained by the bank.

While the sample size for this study is small and only one, albeit significant, industry is chosen we believe that this study opens up a range of research opportunities and questions. We found considerable variation in both overall usage of the tool and in the nature of the tasks undertaken. We found little evidence that GAS is embedded in the day to day work of the internal auditor and no evidence for the external auditor. Survey, case study, focus group and Delphi studies may all be appropriate as this area of research is moved forward.

This paper is organized as follows. The next section covers the background of the nature of GAS and CAATs; introduces the nature of bank audits in a highly intensive computerized information system environment and explores the findings of the limited prior research on GAS and CAATs. This background leads to the development of the three research questions. The third section presents a descriptive analysis of the methods used in this study, while the fourth section provides the detailed findings from the interviews with auditors with respect to each of research question. The final section summarizes the study and presents a set of conclusions, provides implications for future research and sets out the limitations of the research.

II. Background and Development of Research Questions

In this section we set the scene by describing the nature of GAS and CAATs,

Computer Assisted Audit Techniques (CAATs) and Generalized Audit Software (GAS)

CAATs are ‘techniques that use the computer as an audit tool’ which are utilized in application of auditing procedures (Braun and Davis 2003; IAASB 2003b;

ISACA 1998). CAATs include tools that range from basic word processing to expert systems. Computerized audit techniques range from procedures as simple as listing the data in a given file to the use of Artificial Intelligence tools to predict financial failure or financial statement structures. For instance, general productivity software such as Microsoft Word, MS Excel and MS Access can be used to support audit work including text processing, spreadsheet analysis and graphics. MS Access and other general purpose databases and data analysis tools including Oracle, Statistical Analysis Software (SAS), Structured Query Language (SQL), Crystal Report and PowerBuilder can be used as forms of generalized retrieval software (GRS) or for more sophisticated data analysis tools. Embedded Audit Modules (EAMs) are a class of CAATs that are integrated within the entity's application systems and which support realtime or quasi-realtime monitoring of transactions within the accounting information system (Debreceny et al. 2003; Groomer and Murthy 2003).

Arguably the most widely deployed class of CAATs is Generalized Audit Software (GAS). These packages are computer programs that contain general modules to read existing computer files and perform sophisticated manipulations of data contained in the files to accomplish audit tasks. They have a user-friendly interface that captures users' audit requirements and translates those user instructions or queries into program code. This is undertaken by interrogating the client's file systems or database and performing the necessary program steps. As compared to embedded audit modules, they do not require a certain level of programming expertise to design and implement the audit queries. GAS is normally deployed in an ad-hoc rather than realtime fashion (Braun and Davis 2003). In addition, GAS do not require test decks, advanced programming techniques, development of audit-specific applications, each of which can be costly. In summary, the reason for the widespread

usage of GAS is their relative simplicity of use requiring little specialized information systems knowledge and their adaptability to a variety of environment and users. GAS vendors also provide data extraction routines for many different computing environments, meaning that auditors' investment in learning the software can be recovered by utilizing the software in many different production and application software environments. Currently, the latest versions of GAS include the Audit Command Language (ACL), Interactive Data Extraction and Analysis (IDEA) and Panaudit Plus. Each of these GAS packages operates in the personal computer environment. Auditors can interrogate mainframe and networked applications across the firm's local area network.

GAS focuses on the fully exploiting the data available in the entity's application systems in the pursuit of audit objectives. GAS support auditors by allowing them to examine the entity's data easily, flexibly, independently and interactively in what Coderre (1998, 17) refers to as data-based auditing. Using GAS, an auditor can formulate a range of alternative hypotheses for a particular potential misstatement in the subject matter and then test those hypotheses immediately. "What if" scenarios can be developed with the results and the auditors can examine the generated report rapidly.

Nature of Banking Risk and Implications for External and Internal Audit

The focus of this study is on the use of GAS and CAATS within banks. A bank is a type of financial institution whose principal activity is the taking of deposits and borrowings for the purpose of lending and investing. Banks have certain characteristics that distinguish them from most other commercial enterprises (De Lucia and Peters 1993; IAASB 2003a; Rose and Hudgins 2004; Van Greuning and Bratanovic 2003). These characteristics include their custody of large amounts of

monetary items, including cash and negotiable instruments. The value of assets owned by banks can change rapidly and are often difficult to determine. Banks are highly geared with a high proportion of external debt in relation to owners' capital contribution. Banks usually perform a wide variety of significant value transactions as part of their daily activities. Transactions, for example online banking, can often be directly initiated and completed by customers without any intervention from the banks' employees.

There are a number of risks associated with banking activities. The risk profile of banks may generally be categorized as shown in Figure 1:

Insert Figure 1 about here

Many transactions within the financial institution's accounting information system involve more than one of the risks identified above. Furthermore the individual risks are often correlated with one another. Therefore, the auditors need to consider these risk correlations when analyzing the risks to which the institution is exposed. In addition, they have to consider the nature of risks stemming from the bank's operations. Hence, when designing substantive tests, it is important to consider these risks and factors that contribute to the bank's systems of internal control. This is particularly so since bank failures are perceived to have greater adverse effects on the economy than the failure of other firms.

Audit implication of banking risk

The following discusses the classes of key assertions that auditors are concerned with in the banking industry (Kaufman 1996). Banks have:

A low capital-to-assets ratio that increases banks' vulnerability to adverse economic events and increases the risk of failure. Auditors would particularly

examine the liabilities of the banks' balance sheets in order to ascertain the banks' ability to repay the debts when they fall due. The tests of the completeness assertion are also particularly important in respect of liabilities.

A low cash-to-assets ratio that may require the sale of earning assets in order to meet deposit obligations. This would require the auditors to look into the liquidity risk of the banks. Banks must have a portfolio of assets or investments that are both long and short term in nature. Short-term assets, which are usually more liquid, can be sold off as soon as possible without a significant decline in their value.

High demand debt and short-term debt-to-total debt (deposits) ratio, which may result in hurried asset sales of opaque and non-liquid earning assets with potentially large fire-sale losses to pay off depositors. Therefore, auditors would have to ensure that activities that could damage a bank reputation and which might lead to rush on the bank's deposit base are minimized. Two examples are the involvement in the illegal activities such as money laundering and the attempt to cover up losses by the management.

Use of Information Technology by Banks

The high volume of transactions and the short time period in which the transactions must be processed, result in the extensive use of IT in the bank industry. This results in near total reliance on the records maintained and the reports produced by the IT systems. They represent the only readily accessible source of detailed and up-to-date information on the banks' assets and liability positions (IAASB 2003a). This matter is of particular concern to auditors. The audit trail is electronic, making it potentially difficult to trace audit evidence. Business processes and accounting allocations are often embedded in software routines, rather than as the result of

conscious decisions by operational management or accountants. Therefore, the auditor must understand the application of technology in order to identify the risk factors of the banks. These risk factors will subsequently have a direct impact on the audit procedures. The auditors would have to focus their attention on the internal control systems and test the systems for accuracy and completeness of the banking operations (Coderre 1996, 1998). Further, information systems not only bear on the financial reporting systems but also on systems that generate data for regulatory compliance and related issues such as fraud detection (Gerson 2004).

CAATs/GAS can aid in performing substantive tests in banks to obtain audit evidence. Prior research has identified that CAATs/GAS help to improve effectiveness and efficiency of an audit (Braun and Davis 2003; Coderre 1998; Gascoyne 1992; IAASB 2003b). Auditors can use GAS to help detect material misstatements in the financial statements, particularly in substantive tests of details of transactions and balances as part of meeting the general audit objectives of validity, completeness, ownership, valuation, accuracy, classification and disclosure of the data produced by the accounting system to support the financial assertions (Knechel 2001). Table 1 shows the set of management assertions, the relevant audit objective, an example of a relevant account in the banking environment and whether or not GAS might be able to be used to further the particular audit objective.

Insert Table 1 about here.

To address the assertions discussed above, auditors may perform procedures such as inspection, observation, inquiry and confirmation, computation and analytical procedures. In the context of the audit of a bank's financial statements, all the procedures mentioned, except observation, require particular attention to the bank's computerized information systems. These procedures present the auditors the

opportunity to use GAS to obtain the audit evidence. However, as Table 1 presents, GAS can only be used in limited instances to assist in gathering the audit evidence with respect to each audit objective.

Some of the tasks that GAS can perform to facilitate the audit procedures include verifying extensions and footings; re-performing a variety of calculations; exception reporting and identifying unusual transactions; comparing; summarizing or re-sequencing data and performing analysis; duplicating detection; aging analysis of accounts like loans receivables; performing the calculations and comparisons of data lying on separate files used in analytical procedures; selecting audit samples for tests of transactions; preparing and printing confirmation requests, reports or letters (CICA 1994; Gascoyne 1992). Therefore, with these functions, auditors can perform substantive tests within a shorter time frame resulting in overall efficiency yet not compromising on the quality of audit effort.

Development of Research Questions

Given the highly computerized nature of banks and the numerous functions that GAS provide in supporting auditors in their work, it seems that auditors will be interested in using GAS in banks. As revealed by the literature, GAS are used in banks' statutory audits. Little has been said in the literature, however, about the range and extent of its usage and particularly, its usage in substantive testing. In the light of the above discussion, the first research question in this study is:

RQ1: What is the range (RQ1a) and extent (RQ1b) of substantive testing facilitated by GAS?

GAS also has limitations. Firstly, some audit organizations consider that GAS is costly, as it requires site licenses and potentially expensive maintenance contracts

(Coderre 1999). Secondly, it is believed that GAS is too technical and complex for non-IT auditors, even if training is provided (Coderre 1999). Thirdly, auditors may feel that they must conduct reviews manually, physically touching files and reports. As such, GAS may be perceived to fail to provide the level of security auditors need. Lastly, clients are worried that their systems and data will be compromised with the use of GAS. With these limitations in mind, the next research question seeks to find out if bank auditors face such constraints in their audit work:

RQ2: What are the reasons for limited usage if auditors do not use GAS in their substantive testing?

In view of the limitations of GAS as discussed above, the researchers believe that these constraints could be perceived as opportunities for further development of GAS. This could potentially lead to an increase in the utilization of GAS in banks. In response to the increasing demand on auditors to make audit engagements more effective and efficient, this research question was developed to look into two areas. The first area to look into is the alternative ways in which banks could utilize GAS to improve efficiency, using technology already embedded in current versions of GAS. The second area is to discover what present users of GAS would desire in future versions:

RQ3: What are the suggested improvements of GAS in the future?

III. METHODOLOGY

Choice of techniques

Having reviewed the current literature, the researchers found little evidence on the usage of GAS in substantive testing in bank audits. Due to this limited evidence, the research questions developed in this study seek to explore whether banks are using

GAS; what they are using them for and the reasons if they are not using them. To do so, this study was conducted in the form of a mapping exercise and qualitative research employed in this exercise.

Qualitative research was chosen as it typically produces a wealth of detailed data about a defined number of people and cases. The data collected need not fit predetermined response choices. This allows for an in-depth and detailed analysis to be carried out (Bryman and Burgess 1999; Mason 1996). By contrast, quantitative approaches typically allow for large-scale measurement of ideas, beliefs, and attitudes. As such, the set of findings developed is usually generalized. Quantitative approaches require a clear understanding of the issues and research questions. We do not consider that such a common base of understanding exists in this research area. Qualitative research is clearly appropriate in this very early stage of the research process.

There are several qualitative research options in undertaking a mapping exercise, including focus groups (Krueger 1994; Merton 1999), Delphi studies (Dalkey et al. 1969) and depth or long interviews (Jones 1985; McCracken 1988) and group interviews (Hedges 1985). Given the nature of the industry, including regulatory restrictions on sharing of banking information, bank auditors may not wish to share confidential information on how, for example, their bank addresses fraud detection in a focus group made up of auditors from competitor banks or external auditors. We also considered that focus groups would be difficult to organize within a single bank, given the time investment required. Further, given the paucity of research evidence on the use of GAS in banks, we did not feel confident in developing a detailed set of research issues to guide the conduct of the focus group. This has been shown to be an important factor in the successful running of focus groups (Kitzinger

1999; Merton 1999). Delphi studies require development of a clear set of barriers and facilitators of adoption of GAS. Again, for the reasons set out above, we were not confident of being able to develop such a set on the basis of such limited evidence of use or adoption of GAS in the banking environment.

A depth interview is chosen as the primary data collection technique in this study. The depth interview provides an opportunity for the researcher to probe deeply and open up new dimensions of a problem (Jones 1985). It also allows the researchers to appraise the meaning of emerging data and use the resulting insights to phrase questions that further develop the implications of these data. It is also a useful way to get large amounts of data quickly. Although group interviews are often argued to be an even faster and cost-effective avenue of collecting data, they typically provide less opportunity to follow through with an individual subject. In addition, subjects may not be willing to divulge confidential or sensitive company information in group settings. Further, the subjects used in this study are busy professionals and it is difficult to arrange a convenient time and venue for all to meet for the interview. Thus, the depth interview was chosen.

Survey Procedures

For the purposes of the depth interview, skeleton questionnaires are almost indispensable (Brenner 1985). The skeleton questionnaire ensures that the researchers cover all aspects in the same order for each subject. It also contains prompts that are carefully scheduled to assist the researchers in probing into an issue. Its open-ended nature also allows the researcher to elicit information that could be obtained by introspection and verbalizing. Therefore, it protects the larger structure and objectives of the interview so that the researchers can focus entirely on the subject's testimony

(McCracken 1988). Thus, a skeleton questionnaire was designed to guide the structured interviews.[3]

The skeleton questionnaire was tested with a GAS consultant who has over 20 years of experience in the application of GAS. This was to check that the questionnaire would be effective in achieving the research objectives. It was conducted in the form of a mock interview. The consultant offered possible responses from the perspective of banks and professional accounting firms. The skeleton questionnaire was amended in light of the feedback from the expert. A copy of the skeleton was sent to the subjects before each interview. This ensured that they understood our research objectives.

During the interviews, the subjects were allowed to freely respond to each question. No attempt was made to limit their answers, or to lead them to a particular answer. The actual time taken to complete the interviews ranged from 37 to 75 minutes, with an average of 50 minutes. The interviews were taped to enhance the completeness and quality of the information obtained. All the subjects agreed to the request. Given the nature of the industry, confidentiality was promised to the survey participants. Subjects and their institutions are, therefore, identified by codes. Any in-house developed systems or firm-specific details that may identify the subjects or their institutions are also disguised.

Subjects

This study was carried out in Singapore, which is a major Asian financial center with several large, fully diversified local banks that trade in both the retail and

[3] Available on request from the first author.

wholesale sectors[4]. Singapore also hosts a large number of foreign banks Subjects for this study are internal auditors from banks and external auditors from local professional accounting firms. The researchers sought the help of three internal auditors (IA1, IA2, and IA3). The first two IAs are from local Bank A and Bank B respectively. IA3 is from a foreign Bank C with four branches in Singapore. These internal auditors are most likely to be familiar with using any form of CAATs and performing substantive tests in the ordinary course of a bank audit. They are expected to be knowledgeable about the critical elements required of this research.

The external auditors (EA1, EA2, and EA3) approached have audited at least one of the local banks and other foreign banks. These EAs belong to the same professional accounting firm. EA1 and EA2 are from the IT side of the bank audit team, and EA3 is from the financial services group. EA1 and EA2 each focus on the IT issues and implications of using CAATs tools in the performance of an audit. EA3 possesses specialized knowledge on how to carry out the overall audit and substantive testing. Each of them has distinctive expertise and experience in bank audits. Together, their combined expertise enabled the researchers to view the use of GAS in audits of financial institutions from multiple perspectives and in a comprehensive manner.

All of the subjects mentioned above hold relatively senior positions in their respective institutions or CPA firms. IA1 is a senior IT auditor; IA2 and IA3 are both Vice-Presidents in their Banks' Internal Audit Group. As for the remaining EAs, they are all Senior Managers who are involved in bank audits.

[4] For further information on the financial sector in Singapore, see the Website of the Monetary Authority of Singapore (www.mas.gov.sg).

IV. RESULTS

RQ1: What is the range (RQ1a) and extent (RQ1b) of substantive testing facilitated by GAS?

This study found widely varying results between the banks investigated. Of the three banks researched, both Banks A and C use GAS in their substantive testing in their bank audits and in special investigations. In contrast, in Bank B, GAS is mainly used for substantive testing only during special investigations. Substantive testing in bank audits is conducted using the bank's in-house customized global system, Zeus.[5]

Bank A uses ACL as the particular GAS to conduct substantive testing in their bank audits. One of the uses of ACL is the extraction of samples to be used for vouching purposes. Data is first downloaded to the Silverlake Integrated Banking Suite (SIBS), the main software that Bank A is using for its transaction server. The data is then exported to the GAS. When identifying and extracting transactions of a pre-set value, the criteria is then imputed into the GAS. After running through the data, the auditor will use ACL to drill down and select random samples for manual vouching to be carried out.

A practical example of this extraction of data is in the context of the branch audit. Auditors will select a period of few months from the archived system and the data will then be exported to ACL. Auditors will then set a criterion of, for example, 'S$250,000 and greater'.[6] The exceptions will then be picked out by ACL and displayed in a report format for easy identification. This report will include fields such as account name, account number, transaction amount of over S$250,000, currency,

[5] This is a code name used in this study to identify an in-house customized banking system of Bank B.
[6] All examples of use of GAS in this paper are illustrative only.

teller ID, product type, transaction date and transaction description. Based on the report from ACL, the auditors can then narrow the number of samples for vouching to ensure that all forms pertaining to the transactions are properly filled up as per the appropriate MAS regulation. As such, this fulfills the audit objective of existence and occurrence.

Another usage of ACL is to identify the reactivation of dormant accounts. Dormant accounts are deposit accounts on which there has been no activity for an extended period of time, for example, six months. Auditors will then set criteria of 'number of transactions below two during the past six months'. A report of dormant accounts that are reactivated will be displayed. From this report, checks are made to ensure that identification procedures are originally carried out and can still be relied on. If not, new procedures would be initiated to further investigate the unusual transactional patterns. This is important as dormant accounts could be reactivated for fraudulent or criminal purposes (i.e. money-laundering). This fulfills the audit objective of existence and validity.

The entire internal audit department in Bank C uses ACL for their audit work, mainly in branch audit. Criteria on what data are needed are imputed into the software. With these criteria imputed, ACL will download the selected data from the bank server (AS/400 or Mainframe) into ACL. ACL is also used to select samples from the loan accounts and current account to perform audit confirmations. A sample size is selected based on a percentage of the total number of current accounts that the auditors want to verify.

The findings of this study also provide evidence that GAS is being used for special investigation audits. IA3 gave details of how he used ACL in highly suspicious situations. For example, a particular teller making correction transactions

frequently will bring attention to the investigation team. ACL will then be used to perform a trend analysis. The trend analysis command allows the auditor to compare information across time periods. By doing this, unusual fluctuations which may be caused by fraudulent activities will be highlighted.

IA2 specifically stressed that ACL is an enquiry tool used in Bank B, mainly for substantive testing during special investigations. When the auditors need to run a query on a particular month out of the two to three years of data running on the system, they will first extract the necessary data. Criteria are then made before a check is run for the accompanying double entry. In the event that a certain class of liability has an ending debit balance, it would be extracted immediately for further investigation.

EA2 and EA3 both supported the earlier findings from IA2 that they use GAS only in the substantive testing during special investigations when unusual transactions are detected. Exceptions are picked out. Likewise, in branch and departmental audits, minimal substantive testing is conducted unless exceptions or suspicious transactions are detected. EA1 held that “GAS is not usually used in the normal course of a statutory audit”. He then further illustrated through his engagements with two of the local banks. In one, GAS was used to select samples for testing, while in the other engagement; GAS was not used at all. EA2 also added that GAS would be used in substantive testing only in exceptional cases where there are significant changes or incidence. An example of a significant change is when there is an introduction of a new system or software by the client. In the first few years of introduction, substantive testing is conducted to stress test the program logic so as to ensure the system’s quality and accuracy. As EA3 put it, “[t]he stress testing is especially important when the new banking system or software is developed in-house by the

client in contrast to commercially available software that has been tried and tested". Another 'significant incident' is when an accrual or interest rate computation error is detected. The inaccurate data is then exported to GAS and the account balance total is re-computed to determine the materiality and its impact on the financial statements.

The hiring strategies and training programs employed by the banks and CPA firm spoke of the extent of the usage of GAS in the substantive testing in their bank audits. In Banks A and C, ACL is seen as a valuable tool and all employees must be well versed in using the software. As IA3 put it, "[w]e only recruit people who have experience in using ACL." Likewise, "all employees are trained to use ACL" in Bank A. In Bank B and the CPA firm, training is provided only to employees who will be using GAS.

RQ2: What are the reasons for limited usage if auditors do not use GAS in their substantive testing?

Findings from this study provide evidence for the limited usage of GAS in the substantive testing in banks. One reason for the limited usage is that some banks have their own in-house customized banking systems whose capabilities are similar to those of GAS. As a result, these in-house systems would usually be used to conduct substantive testing. This is evidenced by Bank B.

The bank uses its in-house customized global system, Zeus, to perform substantive testing in its bank audits despite the fact that it has an ACL license. Auditors can retrieve data in the form of a 'read-only' file "directly and anytime" from Zeus. It is an archiving system, which can store at least two years data. Its general functions are similar to those of ACL. However, each system has its own unique capabilities that the other cannot match. ACL is superior to Zeus in that it is

able to generate statistics and perform analysis, which Zeus is not capable of. ACL also allows greater flexibility by performing investigation faster. On the other hand, ACL is not able to function as an archiving system, and in order to download the data; it requires ACL to link with the data source. More importantly, because Bank B has already acquired a global license for Zeus and the fact that this system has already been in use for almost three years, IA2 felt that it is not justifiable to buy ACL licenses for everyone in the bank. This explains why Zeus, and not ACL, is used in the substantive testing in bank audits in Bank B.

IA2 further provided us with details of the general uses of Zeus which include calculation, printing confirmation reports (using mail-merge), performing query and stratifying. In addition, bank auditors will send other ad-hoc requests to the IT department (not from the audit department but from the corporation). The IT personnel will run queries based on the auditor's specifications. For instance, when preparing audit confirmations, the auditors will first specify the required data fields such as client's name and address. The IT personnel will then extract and send the data to the auditors. They will then use Microsoft Word to do a mail merge to prepare the confirmation statements. Other requests to the IT department include exception reports which are usually part of daily controls, checking of the accuracy and totals of downloaded data, comparing data obtained through other audit procedures with the company records on another separate file and selecting samples. The reason for not authorizing auditors to extract the data themselves is to maintain data secrecy, thereby reducing the risk of sending information to unauthorized people.

Another reason for the limited usage arises from the fact that little substantive testing is performed as external auditors are often more concerned about testing the compliance and effectiveness of internal controls. As EA1 put it, "[b]anks are very

reliant on the effectiveness of internal controls." EA2 shared the same opinion, citing that, "In banks, a lot of emphasis is placed on controls." IA2 lent his support to the above view as he feels that "it provides more comfort to do compliance testing than substantive testing." In addition, the volume of transactions in a bank is usually very large ranging into the millions of transactions per annum. Hence it is impossible to test all transactions. As such, an external auditor would first need to understand the bank's processes, analyze where the risks are and identify the controls that are in place. The controls are then tested to check if they are able to mitigate the risks (i.e. effective) and thus, achieve the objectives that are designed. Only in instances where the risk level is high and the controls are deemed not to be effective are samples selected to do substantive testing. Hence, as evidenced, the amount of substantive testing done is very little as compared to the whole audit work. As EA1 put it, "[i]nternal auditors do more of substantive testing compared to external auditors. External auditors will try to rely as much as they can on the internal auditors' work."

As EA3 further illustrated, "[t]he usage of GAS in substantive testing in banks is getting lower over the years." There is now more willingness to use it for other different reasons (e.g. ad-hoc testing and detection of fraud) than solely for traditional reasons (i.e. substantive testing).

Another commonly cited reason for the limited usage is the difficulty in using GAS. Bank auditors need to design their own GAS query to pick out the exceptions. This design process is very time consuming, as the auditors need to understand how the system works and how it fits to the bank's data. A lot of time and effort is also needed to ensure that the system is selecting the correct samples and testing the right accounts. System compatibility is often a major concern. In addition, the process is very costly, as experts are often needed in the design phase. Essentially, the use of

GAS involves a cost-benefit analysis – a trade-off between time, cost, effectiveness and efficiency. EA1 quipped, "[i]n a population of millions of transactions, if you use GAS to stratify the sample and pick 20-50 samples, it is not very meaningful." Likewise, EA3 felt that "it is not necessary to use GAS for every single audit work." Besides, the risks in these areas are low. As EA2 stressed, "[t]here is no reason to use GAS until another error or change appears or if the client is a high-risk one."

This finding is further supported by IA2. The nature of Bank B's operations is dynamic due to the large variety of products it offers. As such, the transaction data is large in volume and complex in its interrelationships. Thus, there is a need to invest a lot of time to design the query, download the data from the system and then analyze the data. Extra full time audit staff will have to be employed "just to look at the data". It is not justifiable for the audit department to spend so much time and money when the risk assessment of the foreign branch is not as high as that of its own headquarters in the resident country. Instead, the bank would rather make use of existing resources (i.e. IT personnel) to run the data for the auditors. For example, in the calculation of interest, the IT personnel will first extract and download the requested data in the form of a spreadsheet. The auditors will then run the test.

Another reason suggested by EA2 for the limited usage of GAS is that it is not considered a routine substantive testing procedure. As EA2 put it, "GAS is basically just one technique to manage risk or investigate problems." Often, the use of GAS is considered when the standard substantive testing details do not bring about enough comfort to the auditors.

RQ3: What are the suggested improvements of GAS in the future?

There are several ways which GAS could be used more productively in banks based on its current technology. For example, SIBS is required to download the data from Bank A's server before exporting it to ACL. IA1 instead hoped that ACL could be installed onto the server so that the data could be exported to ACL in one single procedure. One advantage of this installation is that it would reduce the time required to start the auditing process. In addition, less manpower would be needed as the downloading can now be done without the assistance of a technician. However, the security and integrity of the bank's server should not be compromised by this omission.

With the installation of ACL onto the server, "live data", and not historical data, can then be used for testing. Continuous checking of exceptions could then be achieved. Signals will be raised to notify internal auditors of any exception instantaneously. The usefulness of this function can be illustrated in the following situation. Internal auditors will be alerted to check for money laundering risk whenever there is a significant amount of money being deposited or withdrawn. In this aspect, IA3 shared a similar desire. IA3 hoped that these substantive testing, based on the daily transactions of the bank, could be carried out at night.

Apart from the above mentioned applications, IA1 also hoped that ACL could be used to assist the credit cards department in the identification of active customers by checking their banking history.

These users of GAS also gave suggestions on what they would desire to see in the future versions of the program. IA3 expressed his hopes that ACL could be used as a fraud detection system. Ideally, the software can be used to profile a customer's banking habits, process the transactions that he had made and analyze if the transactions are consistent with his usual trends. If it is deemed as unusual or fails to

meet certain criteria that the bank had set, internal auditors would then be alerted and further investigations can then be carried out.

In addition, IA3 hoped that the speed of the downloading of the data from the bank's server to ACL can be increased. It would also be beneficial if the bank could use ACL to automate the manual verification of the customers' signature against the specimen signature card that is being kept. EA1 shared this similar idea. He too, hoped that GAS would be able to verify "imaged" signatures so as to ascertain the identification of bearers.

V. CONCLUSION

Computer Assisted Audit Techniques (CAATs) and Generalized Audit Software (GAS) have been seen as an important element of both the external and internal audit process for many years (Boritz 1978; Cash et al. 1977; Coderre 1993, 1994; Yang 1991). Specific guidance on the use of CAATs is presented by several auditing standards setters (AASB 2001, 2004; IAASB 2003b; ISACA 1998). Yet, as Boritz (2002, 239) notes there is "virtually no research interest" in what Boritz refers to as data analysis. There is little or no published evidence on the manner in which internal and external auditors employ CAATs or GAS in the pursuit of their audit objectives. This study makes a first step to provide evidence on these issues. The study concentrates on Generalized Audit Software, as it provides a focus that would be lacking if we widened our scope to the full range of CAATs. We study the banking industry because it is highly computerized and completely dependent on information systems to support operational management and financial reporting. We examine the range and extent of usage of GAS in substantive testing in bank audits and the reasons if it is found that GAS is in limited usage. We conducted depth interviews with

internal auditors in two large local banks in Singapore and in a major foreign bank operating a commercial and retail bank operation in the country. We found that bank internal auditors use GAS in their audits. We found, however, that the range and extent of such usage varies. The common uses of GAS in bank audits include extraction of samples, identification of reactivated dormant accounts and verification of the completeness and accuracy of data. This study also found that GAS are frequently being used in special investigation audits and exceptional instances. From these findings, it can be concluded that bank auditors do use GAS, but only to a limited extent.

Findings of this study provide some possible reasons for the limited use of GAS. One common reason is that some banks have their own in-house customized banking systems whose capabilities are similar or even more superior to those of GAS. GAS is usually not considered a routine substantive testing procedure. The study also finds that auditors are often more concerned about testing the compliance and effectiveness of internal controls than performing substantive testing. There is also evidence that difficulty in using GAS and the question of cost-effectiveness hindered its usage.

We found that the external auditors from major professional accounting firms make no use of GAS, either in the conduct of the information systems component of the external audit or in the testing of financial statement assertions.

One finding on why GAS is not usually used by bank internal auditors is that they perceive GAS as interrogation tools to perform fraud investigations rather than as general audit tools. Users said that GAS have tools that allow auditors to perform more in-depth and detailed analytic procedures. These findings should be considered

in future discussion by conducting a case study on a particular bank or a CPA firm to discover the extensiveness of their usage of GAS in such fraud investigations.

Another finding on why GAS was not used in the audit of banks is that some of these institutions have their own in-house customized banking systems. These systems have functions that are similar to GAS. With such advance banking systems available, users might find it easier and more efficient to perform audits with their systems. Therefore, a study could be conducted to find out whether auditors of banks would prefer to use their in-house customized systems or GAS as the primary tool for automated substantive testing. In addition, the study could also look at the different types of system used in banks in Singapore, specifically in their audit software, and their impact on GAS.

Furthermore, the research group believes that there might be differences in the level of usage of GAS in banks due to the size of their local operations. In view of the fact that users need a license to run every single copy of GAS, banks with smaller operations in Singapore, for example the foreign banks, might not find it cost effective to use GAS at all. Perhaps, a study of the cost and benefit analysis of using GAS, in a foreign bank with less retail products as compared to a local big bank with a full range of banking services could be carried out.

The major limitation of this study is that the sample size is small. The results of this study cannot, of course, be extrapolated to all banks or financial institutions. Notwithstanding the small sample size, we believe that the views and beliefs of the respondents are likely to be representative of auditors in banks of a similar size and of external auditors. The study was also carried out in Singapore, a major Asian financial hub. Attitudes to the conduct of internal and external audits may differ in other financial centers around the world.

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Credit risk:	The risk that a customer or counterpart will not settle an obligation for full value, either when due or at any time thereafter.
Currency risk:	The risk of loss arising from future movement in the exchange rates applicable to foreign currency assets, liabilities, rights and obligations.
Fiduciary risk:	The risk of loss arising from factors such as failure to maintain safe custody or negligence in the managements of assets on behalf of other parties.
Interest rate risk:	The risk that a movement in interest rates would have an adverse effect on the value of assets and liabilities or would affect interest cash flows.
Liquidity risk:	The risk of loss arising from the changes in the bank's ability to sell or dispose of an asset.
Modelling risk:	The risk associated with the imperfections and subjectivity of valuation models used to determine the values of assets and liabilities.
Operational risk:	The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events.
Reputation risk:	The risk of losing business because of negative public opinion and consequential damage to the bank's reputation arising from failure to properly manage some of the above mentioned risks.
Solvency risk:	The risk of loss arising from the possibility of the bank not having sufficient funds to meet its obligations, or from the bank's inability to access capital markets to raise required funds.

Figure 1: Risk Profile of Banks

Management Assertions	Audit Objectives	Example of bank accounts	Can use GAS?	Examples of substantive procedures
Existence or occurrence	Validity	Balances with other banks, loans, money market instruments	Yes	Prepare the third party confirmations of the account balance.
Completeness	Completeness	Accounts with depositors – savings deposits	Yes	Prepare third party confirmation for the selected sample. Select a sample of deposit account transactions before and after year-end and trace to proper inclusion in the general ledger.
Rights and obligations	Ownership	Financial Assets	No	Not applicable.
Valuation and measurement	Valuation and accuracy	Savings deposits	Yes	Make a bulk proof of interest to determine overall reasonableness: Compute average daily balance for a semi-annual period. Apply the current effective semi-annual rate to the average balance Compare the total computed interest to the semi-annual period to the actual interest accrued.
	Classification	Dormant Account	Yes	Review accounts transferred from dormant status since last audit: Examine approval for removal from dormant status Confirm accounts transferred if unable to examine the transaction releasing the account from dormant status.
Presentation and Disclosure	Disclosure	Capital and reserves	No	Not applicable.

Table 1: Management Assertions and Audit Objectives