ANALYSIS OF THE

STATISTICS CANADA DATABASE

ON PUBLISHERS AND EXCLUSIVE AGENTS

# Background Study

# Etude de base

PROGRAM EVALUATION DIVISION/ DE L'EVALUATION DES PROGRAMMES

ANALYSIS OF THE

'STATISTICS CANADA DATABASE

ON PUBLISHERS AND EXCLUSIVE AGENTS

JULY 30, 1984

DOC

PROGRAM EVALUATION SERIES

This is one of ten Background Studies on the Canadian book publishing industry that form part of the evaluation of the Book Publishing Development Program (BPDP).

The study was conducted by RES Policy Research Inc. for the Program Evaluation Division of the Department of Communications, Canada. The views expressed herein are those of the author and do not necessarily represent the views or policies of the Department of Communications.

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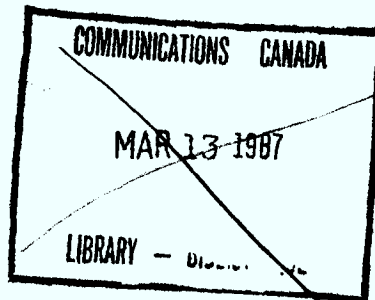/, / ANALYSIS OF STATISTICS CANADA

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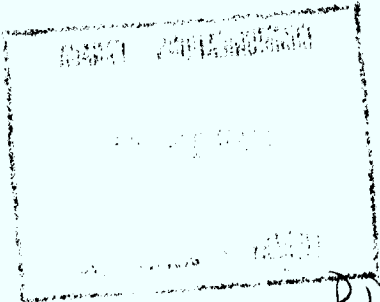
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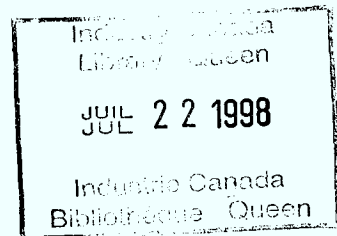
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## 1. INTRODUCTION: Objectives, Approach and Results

### 1.1 Objectives and Constraints

This report presents results of an analysis of data from the database of Applicants to the Book Publishers' Development Program (BPDP) held by the Department of Communications, and data from the Statistics Canada Survey of Publishers and Exclusive Agents. The objectives of the analysis were as follows:

- To conduct an accounting review of the STC data on grant recipients against the DOC data to assess comparability of both datasets.

- To identify any discrepancies and where agreed to by STC, assist in creating a dataset suitable for analysis, for example, by installing the DOC grants variable.

- To calculate eighteen defined operating ratios from these data and analyse any effects of the BPDP program as per the evaluation issues adopted for the project.

It was a major assumption of this study that data comparability could be examined in cooperation with STC both by EDP methods and at the micro level. The object of this work was to develop common subsets of data with complete response and without abnormal outliers in the data such that reliable measures of potential program effects could be derived despite the fact that no such analysis had been attempted on either set of data. Unfortunately, it was not possible to conduct detailed data preparation for this purpose.

Therefore the project had to be re-designed so as to accommodate indirect methods of analysis based on grouped data which had to be acquired from STC by means of special requests for data extraction. It was not possible to contribute to the improvement of either dataset by correcting errors or non response.

It was decided to conduct an extensive survey of variables from grouped data supplied with the cooperation of STC, and then analyse selected variables from an accounting point of view as well as by statistical means. Revised objectives of the study may be summarized as follows:

- To review aggregate data supplied by STC so as to derive an opinion on their suitability for an accounting analysis and quantitative assessment of program effects if they were sufficiently compatible with DOC data.

- To analyse and document any problems with data comparability.

- To conduct a secondary quantitative study so as to isolate any program effects which might be found on a comparative basis both over time and across sectors.

It will be clear that the present study was severely constrained and that therefore its results must be used with caution. The following factors stand out.

- The STC data are affected by non-response, and we do not know how partial non-response affects reported ratios for groups of firms.

- Both databases seem to have improved over time, however, the degree of error in either could not be checked against the other, much less corrected.

- Very little is known about the statistical behaviour of operating ratios, especially for a heterogeneous industry such as publishing.

- By virtue of the criteria for admission to BPDP, the supported sector differs systematically from the non-supported sector. This restricts the value of an inter-sector comparison even if data can be checked for consistency at the firm level, but much more so if comparisons are based on aggregates. Accounting identities do not necessarily hold in aggregates.

- The time series for an internal analysis of DOC data for effects of grants on the financial health of firms is too short, and its most recent data show the effect of the recession.

We hope that despite these necessary disclaimers, the methods and tentative results of this study will contribute to the learning process among all concerned on how to assess effects of cultural policy from diverse, evolving business statistics.

## 1.2    Analytical Approach

The logic of this analysis is summarized as follows.

We cannot establish the quality of data on publishers not supported by DOC grants by direct examination of data held by STC. Therefore, it was decided to compare the data from DOC files and the STC files for the supported sector, so as to derive an indirect assessment of the utility of any comparative analysis. However, in examining key ratios for both groups of firms over time, we found considerable variation both within groups and between groups. There are no guidelines or standards available by which we could judge whether a ratio is within a reasonable range, or must be considered suspect as such. Therefore, we prepared a general preliminary review of key ratios over time drawn from the DOC file and the non-supported subset of the STC file. This review supports some general statements about ranges of ratios for grouped data, their behaviour over time, and their relationship within a group and a given year. There should also be a pattern between ratios in a group over time. To illustrate this type of accounting use of the data, one would expect that an increase of the current ratio for a group of firms over a number of years should be accompanied by some improvement of the profit for that group. Patterns such as this should hold even in the face of significant data problems, for example, different reporting methods of the supported and non-supported group, or misattribution of

financial years. It should be kept in mind that we are looking at ratios, of grouped data, over time -- three factors which act to smooth the data.

If the accounting review indicates that key ratios are indeed behaving in a reasonable, and expected way, then a specific comparison of data makes sense. The logic of this step is that large differences between the DOC data and those held by STC would inhibit a detailed analysis of comparative performance of supported and non-supported firms; at best a general comparison with statistical tools might be undertaken.

The quantitative analysis employed three methods, as follows:

1.    Comparability of DOC and STC Data

In view of discrepancies between both datasets observed in the accounting review of grouped data, it was decided to examine the comparability of both datasets directly and by calculating correlations and measures of variance for groups of firms over time.

2.    Analysis of Variance of STC Data

This analysis which was performed by STC at the request of DOC was an attempt to isolate any differences of financial ratios associated with the contrast of recipient versus non-recipient status after controlling for factors such as firm size or year. This approach sought to discover program effects within the STC dataset, in effect avoiding problems of comparability of different datasets. A test for significance of differences of means was prepared to further pinpoint whether the past-grant period was associated with a significant improvement in certain ratios for recipients as compared to others.

3.   Regression Analysis of Time Series Data for Recipients Only

This econometric approach took the amount of grants as a quantity, as against simple recipient status, and attempted to establish whether the supported sector of the industry as such had seen an improvement in certain financial variables over time that was associated with the amount of federal funds received. In view of insufficient length of the DOC time series, and because the STC data do not contain the DOC grants variable, data from both files were used. The purpose of this analysis was for data checking as well as substantive.

In view of data problems discovered in the regresssion analysis, its entire presentation has been removed into Appendix 4. In fact, the correlation analysis (1 above) was performed after the regression results were available.

Therefore, the outline of the report is as follows. The general accounting review of data from both sources is followed by the correlation analysis of comparability of datasets. Then the analysis of variance of STC data is reported. All technical sections and tables are in Appendices 1-4.

A separate volume contains a compendium of 200 graphs and tables of STC data on cultural and financial variables by language and size group of firm, for the year 1975 to 1981. These displays were prepared for reference and as an aid to others in getting to know the data.

## Summary of Results

1. In place of the proposed comparison of data from the DOC file and the STC file at the micro level, a general accounting review of seven average ratios for groups of firms has been conducted. THe data are sufficiently discrepant to not warrant a further analysis of grouped data across both datasets from an accounting point of view. No pattern has been found in the DOC data to support the conclusion that the availability of grants had a favourable effect over time upon the cash status, return on investment or profits of the supported sector. Key financial ratios for the supported sector have been less favourable than those for the non-supported sector.

2. The correlation of related ratios calculated from both datasets is too low to support further quantitative analysis across both sets of data. Without an edit at the micro level, the DOC and STC data are not comparable enough for reliable analysis of aggregate data.

3. The analysis of variance of the contrast between supported and non-supported firms within the STC data shows that the grants program had no consistent effects up to 1981.

## 2.   ACCOUNTING REVIEW

### 2.1   Introduction

In a previous report submitted to Statistics Canada (RES, March, 1983) it was observed that we do not yet know how financial ratios should behave in an industry such as publishing and particularly, how the impact of a grants program might express itself over a period of time in ratio analysis. This section presents an exploratory analysis of selected ratios for two datasets which are best suited for a general review of the supported and non-supported sectors of the industry. The DOC data were chosen because they are more complete than their counterparts in the STC file, contain one more year of data, and contain the correct DOC grants. Their counterpart consists of the common subset of the STC data on non-recipient firms.

We will first introduce key operating ratios, explain how they are linked in business analysis, and suggest several standard values of such ratios. Then limitations of the reliability of data available for this part of the study are summarized, followed by a discussion of average ratios for different groups of firms. Weaknesses and strengths of this method are discussed.

In the interest of simplicity of discussion and in view of data problems, the accounting review was limited to the following three types of variables:

a)    Two ratios representing the ability of a firm to meet its short term financial obligations.

b)    Two ratios representing management's ability to control inventory and assets.

c)    Three ratios representing the short and long-term profitability.

These key ratios are grouped in four tables (attached as Appendix 1), as follows:

Table 1:    English Language Recipients (DOC Data)
Table 2:    English Language Non-Recipients (STC Data)
Table 3:    French Language Recipients (DOC Data)
Table 4:    French Language Non-Recipients (STC Data)

## 2.2    Accounting Rationale

For purposes of financial analysis four types of ratios - liquidity, debt, profitability and coverage ratios, are considered the key ratios. The first two types of ratios are computed from the balance sheet; whereas the last two are computed from the income statement. Each of the four groups of ratios are described below.

### Liquidity Ratios

These are used to judge a firm's ability to meet short-term obligations. One of the most general and frequently used ratio is the current ratio. It is calculated as:

$$\frac{\text{Current assets}}{\text{Current liabilities}}$$

The higher the current ratio, greater the ability of the firm to pay its bills. It is difficult to suggest a reasonable range of the current ratio, since it varies by industry and within an industry with the size of a firm. A rule of thumb suggests that a range between 1-3 is acceptable. If it is larger than this, it means the company in question is not using its liquid resources economically. In other words, its cash is lying idle.

The quick ratio is a finer version of liquidity measurement. It is calculated as:

$$\frac{Cash+Marketable\ Securities+Receivables}{Current\ Liabilities}$$

Inventories are considered current assets, however, these cannot be converted to cash readily. Exclusion of inventories from this calculation, therefore, enables us to examine liquidity of a firm more critically. Once again, the normal level of quick ratios varies between and within an industry, however, a ratio of less than two is considered more than adequate.

## Debt Ratios

This group of ratios indicates the percentage of assets financed through borrowing and the extent of trading on equity. An analyst will want to investigate the reason for an above-average debt since excessive debt might create difficulties in meeting fixed obligations like interest expense, sinking fund payments, etc. This ratio is calculated as:

$$\frac{Total\ liabilities}{Total\ assets}$$

Again it is not easy to suggest when a debt ratio should be considered excessive. Usually a ratio of less than one half is considered safe.

## Profitability Ratios

These ratios tell us about the earning power of an investment. Three such ratios are included in this analysis. These are calculated as follows. Return on investment (ROI) which is calculated as:

$$\frac{\text{Net income}}{\text{Total assets}}$$

This ratio expresses the relationship between income and invested capital. This ratio is usually judged against the cost of capital to the firm. For example, if a company borrows at 10 percent and its tax rate is 40 percent, its cost of capital net of taxes is 6 percent. If its return on investment is less than 6 percent, it should refrain from further investment, all other factors being equal.

Another measure of profitability is the gross profit margin. It is calculated as:

$$\frac{\text{Sales - Cost of Goods Sold}}{\text{Sales}}$$

This is an indication of profit per sales dollar. Its normal level varies within an industry. For example, larger firms exist on lower margins whereas smaller firms with lower sales have to have higher gross margins for survival. A margin of about 25 percent is considered almost adequate, however, it could be as large as 100 percent. Still another measure of profitability is the earning power ratio. It is a much refined measure compared to the gross margin ratio and is calculated as follows:

$$\frac{\text{Sales}}{\text{Total Tangible Assets}} + \frac{\text{Net Profit After Taxes}}{\text{Sales}}$$

This ratio roughly indicates net profitability of assets after taxes. For example if the earning power ratio is 4, the tax rate is 40 percent, and other expenses are 10 percent of sales revenue, the company's net profit margin is nearly 10 percent. If the interest rate is 10 percent and tax rate 40 percent a company with a 10 percent earning power can productively utilize additional investment.

# CHART 1

```
                    ┌─────────────────┐
                    │   Increase in   │
                    │   demand for    │
                    │     books       │
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────┐          ..increase in current ratio
                    │   Increase in   │          ..increase in inventory turnover
                    │   Investment    │
                    └────────┬────────┘
                             │
                             ▼
        ┌────────────────────────────────────────────────────┐
        │        ..Increase Quick Ratio for current year      │
        │        and current ratio for subsequent year        │
        │  ┌───────────────┐ ┌──────────────┐ ┌─────────────┐ │
..decrease in  │ Investment    │ │ Investment   │ │ Investment  │  ..increase in
Quick ratio    │increase through│ │financed through│ │financed through│  Debt ratio
..increase in  │   internal    │ │   Grants     │ │ borrowings  │  ..increase in
Current ratio  │   sources     │ │              │ │             │  Current ratio
        │  └───────────────┘ └──────────────┘ └─────────────┘ │
        └────────────────────────┬───────────────────────────┘
                                 │
                                 ▼
                    ┌─────────────────┐          If Current ratio is low:
                    │   Increase in   │
                    │     Sales       │          ..Inventory turnover ratio will increase
                    └────────┬────────┘          ..Asset turnover ratio will increase
                             │
                             ▼
                    ┌─────────────────┐          ..ROI will increase
                    │   Increase in   │          ..Gross Profit Margin may or may not
                    │  Profitability  │          increase
                    └─────────────────┘          ..Earning Power Ratio will
                                                  increase
                                                  ..Debt ratio will decline
```

## Turnover Ratios

Turnover ratios indicate the relative efficiency with which a firm utilizes its resources to generate output. We are considering two such ratios -asset turnover and inventory turnover. The asset turnover is as follows:

$$\frac{\text{Net Income} \quad + \quad \text{Interest Expense}}{\text{Average investment in assets}}$$

This ratio measures productivity of assets in terms of income as a multiple of assets. For example an asset turnover ratio of 2 means that income was twice the value of assets. Depending upon the industry, an asset turnover ratio in excess of 1 is considered adequate.

Inventory turnover is calculated as:

$$\frac{\text{Cost of goods sold}}{\text{Average inventory}}$$

It indicates managements' ability to control the investment in inventory. The higher the ratio the shorter the time between investment in inventories and sales transactions. High inventory turnover ratios, however, are not in themselves desirable. Every time stock is replenished it means additional order cost. Higher tunover is an indicator of higher order cost, less use of volume discounts, and may show a weak working capital position. Depending upon the industry, an inventory turnover higher than three indicates that the company in question is experiencing working capital difficulty, unless other ratios indicate good coverage.

## Inter-Relationship of Financial Ratios

No single ratio, on its own, is adequate to attest to the financial health of a company. The accounting ratios are, in fact, indicators of various aspects of the financial behaviour. The key accounting ratios are inter-related to each other in such a way that a variation in one generally affects some other ratio either positively or negatively.

The schematic (chart 1) is an attempt to inter-relate the key ratios we have chosen for this analysis. Beginning at the top of chart 1, if there is an increase in demand, it normally lends to an increase in investment. The investment increase is either financed internally, or externally - from borrowings or in this case from grants. Each of these three ways of financing investment affect different combinations of ratios. If investment can be financed internally, the quick ratio, which is a measure of internal liquidity has to be high to begin with. Investment will decrease the quick ratio, however, since inventory will increase, it will normally improve both the current ratio as well as inventory turnover ratio. If on the other hand, investment is financed through borrowings, the debt to asset ratio rises as well. This may not happen,however, if grants are used instead. In the next round sales increase, improving the investment turnover ratio. As a result, profitability will improve, influencing the earning power ratio and return on investment. Gross profit margin may improve for smaller companies, however for larger companies even if it remains low a substantial increase in sales may lead to higher profit. As a result of improved overall profits, the debt ratio should decline in the longer run.

discussed below. The DOC data were chosen for this accounting review, instead of their STC counterparts so as to benefit from the presumed high quality of the DOC data; because the DOC data extend to 1982 as compared to those from STC which presently end in 1981; and so as to subject the DOC data to a first general accounting review, something that had not been done before. On the cost side of this procedure, there are unknown discrepancies in the data and a loss of cases from both files -- we are dealing with 41 and 60 cases, respectively. The data are grouped by language and company size. The data are averages of ratios, and should not be highly sensitive to changes in total cases. It was decided to not collapse groups further since this breakdown was the most detailed one supplied by STC. Also, we have seen that many ratios showed characteristic differences by firm size.

The method was basically an examination of the face validity of the data, over time and between ratios. The strength of this approach lies in the fact that the ratios selected should have a specific relationship at a point in time and over time. If such relationships had shown up consistently we would have strong evidence for a) the quality of data from both sources, which would warrant further analysis of the other ratios, and b) the direct comparability of the supported and non-supported sectors, and c) the overall compatibility of data from two independent sources.

The results are disappointing on all three counts. Even the aggregate data presented in Tables 1-4 above are sufficiently erratic so that we cannot recommend a broader analysis of ratios from an accounting point of view. Despite a number of similarities, a comparison of the ratios for both sectors, especially those describing profitability and liquidity, shows that both sectors are quite dissimilar, or that the data in both files are not generally compatible. Both sets of tables

contain a number of outliers, numbering about six, depending on our judgment on what is a range of an acceptable ratio. A brief examination of their origin in the DOC data and a check of extreme range values in the STC data (reported previously) indicate that these values are probably coming from the data and are not artifacts. This fact points to a need for further data editing in both files.

In assessing this result, the following points should be kept in mind:

- Neither dataset had previously been used for a quantitative assessment of accounting relationships over time.

- The DOC file had not been used for any overtime analysis of business ratios. It was created retroactively without the benefit of concurrent edits as was the case with the STC data.

- We have no experience with the incidence of relative reporting biases between grant applicants and respondents to an STC survey form.

- Both files are affected by a significant forms redesign, the effects of which show in the DOC data; surprises from the 1982 STC data have yet to appear in the file.

- The STC data are affected by substantial non-response, particularly among non-recipients. To our knowledge, the problem of non-response bias over time has not been analysed by STC.

To conclude the methodological discussions, we can point to some favourable factors: the ratios in several size categories make sense from a point of view of business analysis and appear to be stable over time, for example in the data for large English non-recipients. Some ratios, especially that for inventory turnover, seem to be stabilising over time; the extreme values of the series, whether high or low, are often found at the beginning. Thus we may expect a continuing improvement of both data sources. Finally, external shocks such as the recession in the case of 1982 DOC data, are reflected in a fairly

consistent way in a change of most ratios in an adverse direction. Thus policy analysts can begin to use the present review as a point of reference on what might be considered as normal operating ratios for certain groups of firms in publishing.

## Conclusions

Turning to substantial results of the accounting review with respect to the industrial and cultural goals of the program, we find that the effect of the grants program is not easily seen in the present comparison. There ware only three effective program years, considering that financial results of grants might show first in 1979 and that 1982 was perhaps an unusual year. There is some indication that smaller English publishers (sizes 1 and 2) derived financial benefits from the grants. More generally, one may say that the firms in the supported group under analysis (that is, excluding late entries and those who did not respond to the STC survey) stayed in business and contributed to the cultural objectives of BPDP. However, the non-recipients as a group showed a stronger cash position and, except for the smallest firms, much higher profits.

3.   QUANTITATIVE ANALYSIS

3.1   Introduction

This section is comprised of two main analyses. The first part compares data from DOC and STC to establish comparability of datasets. The direct comparison and correlation analysis employed for this purpose is not capable of establishing which dataset is more accurate: it simply ascertains how similar or dissimilar they are.

The second part reviews an analysis of variance carried out on STC data for both recipient and non-recipient groups. This is followed by a difference of means test to determine if significant differences exist between the two groups in the recipient by year interaction terms, comparing the before and after grant periods.

3.2   Comparison of Data from DOC and STC

During this evaluation project, significant effort has been devoted to examination of the comparability of data held by DOC and STC. Unfortunately, this work had to be done indirectly; for example, due to conditions on disclosure, we were not in a position to verify whether all firms receiving grants had been correctly identified in the STC file. Comparability of STC and DOC data is a pre-condition for any attempt to determine whether the supported and the non-supported sectors of the industry developed differently after the Federal Government program took effect.

Appendix 2 contains results of a first attempt to compare both datasets on the basis of coverages of a number of financial ratios for groups of firms. Ratios for the years 1978-1981 were compared

visually, and a number of time series for 1975-1981 were examined with respect to their variances, covariances and correlations. As was reported in the previous section many financial ratios differed greatly by size and language groups of firms. Therefore, this comparison was performed within these groups, rather than by collapsing groups of companies further.

## Results of Visual Comparison

1.  Both series of data are generally plausible. That is, the orders of magnitude are comparable across datasets; a fact which makes systematic errors in calculation very unlikely. Further, the time series for large firms are more stable, and their discrepancies are generally smaller than those for small firms. Simple ratios such as inventory turnover, show a consistent bias in addition to variable discrepancies. More complex ratios show inconsistent discrepancies. This points to cumulative errors on a questionnaire.

2.  Some data problems must exist in the DOC data as is evidenced by three outlier values. The DOC data show a significantly lower profit figure, a fact that may point to some purposeful reporting by applicants. By contrast, the gross profit reported from STC data is entirely too high; especially when compared to the two other measures of earnings which are in range. Therefore, gross profit should not be compared between recipients and non-recipients across the datasets.

In summary, the data from both files are highly discrepant. Non-response in the STC data is probably the single most important problem. The background material for this report contains tabulations of the incidence of non-response by recipeint status,

language, size of firm and year (1975-1981). The present comparison covers the years 1978-1981. That portion of the non-response tables shows that non-response ranges from zero to about fifty percent of a cell. However, the reported non-responses for non-recipients, that is that part of the STC file which we cannot examine for quality against other data, is generally twice as high as that for recipients. Therefore we must conclude that the non-recipient portion of the STC survey file is probably less suitable for a quantitative analysis of financial operating results than the portion examined here.

Results of Correlation Analysis

1.  No operating ratio shows high correlations between both datasets for all groups of firms.

2.  Some high correlations were obtained for some groups of firms, in particular on debt ratios, current ratios, return on equity, and net sales figures. Thus it is very unlikely that there are problems with the calculation of ratios or data extraction in either dataset.

3.  Results for a groups which contains only one firm are generally better than those for average ratios for groups of firms. Even here, however, it appears that the cash status (as shown in the quick ratio) and profit has been reported differently to DOC and STC.

4.  Hypothesis tests on differences of coefficients between both datasets were negative throughout.

We conclude that the DOC and STC databases are not sufficiently similar to warrant a statistical analysis of operating ratios of groups of firms across datasets.

In evaluating this result, it should be kept in mind that no previous comparison of operating ratios between the DOC and STC data has been performed. The facts that ratios for more recent years and those for large companies show less erratic behaviour suggest that we may expect an improvement of the comparability of the DOC and STC data in future years.

The analysis of variance to be reviewed next is not affected by problems of comparability of databases; it examines potential effects of having become a grant recipient firm in comparison with non-recipients, without any recourse to applicant data held by DOC.

## 3.3    Analysis of Variance

This section evaluates the results of an analysis of variance carried out by STC on STC data with the Statistical Analysis System (SAS). The data include both recipients and non-recipients of grants for a period of six years. Results are listed in tabular form for selected accounting and cultural variables, followed by a differences of means test (Appendix 3).

The analysis of variance tests variables for effects due to recipient-non-recipient status, firm size and time. Effects are tested both individually and in nested and interaction factorial combinations. The analysis is performed using a general linear models procedure (GLM) that permits both continuous and discrete variables. Also, the GLM may be applied to unbalanced data situations where observations vary from variable to variable.

The GLM procedure includes specifications to control; four standard hypothesis tests, a least-squares means option, a random effects

option, and a test statement. Each of these specifications requires certain assumptions and implications associated with the model.

The first stage of the GLM procedure requires a multiple regression statement, and a list of four standard hypothesis tests. This is followed by a least-squares mean option. These means are estimators for unbalanced data designs, showing expected means by class and subclass (Appendix 3, pp. 1-2).

A random statement is included to specify effects in the model to be designated as random. In this analysis, firms nested within the interaction between recipients status and firm size are assumed to be random. This randomization process is used to validate restrictions placed on hypothesis tests by inspecting the expected mean-squares.

A detailed explanation of this analysis of variance can be found in "SAS User Guide: Statistics", 1982 Edition. However, to gain a general understanding, an example is presented below.

Example

The enclosed output (Appendix 3, p. 3) applies to the quick ratio for English companies. Referring first to the F value, as a test for the model as a whole, and its ability to account for the dependent variable's behaviour, a critical value must be assigned. At a five percent level of confidence, with 121 degrees of freedom in the model, and 367 degrees of freedom from error, a critical value of 1.30 is obtained from an F-statistics table. Therefore, by referring to the value derived in the model (2.86) the test of the overall model is accepted. The small significance probability, PR F, indicates that some linear functions of the parameters are significantly different from zero.

The four types of tests correspond to a random effect in repeated-measures with an unbalanced design. Type I sum of squares (SS) test for the incremental improvement in error SS as each effect is added to the model. However, it does not offer any information because it does not test the hypothesis with respect to the fixed effects. As well, type IV tests are not appropriate because the coefficients for the variances of the expected mean squares are too inconsistent. Given that the randomized nested variable is the denominator of an F test, the variation found in the expected mean square shows that type IV is inappropriate.

The relative similarity of coefficients of variance from expected mean squares in type II and type III (sample print-out) allows these models to be considered. Type II tests give the reduction in error SS from inclusion of the effect after all other effects have been added to the model. From the print-out of type II SS, two effects are found to be significant.

Recipient status, with an F value of 3.89, once all other effects have been included, significantly reduces error in sum of squares. Therefore, it may be inferred that recipient status contributes significantly to the variance of quick ratios within the entire population. As well, firm size contributes to explained variance with an F value of 3.45. The interaction of recipient status and firm size with an F value of 1.47 is not considered here because with fewer degrees of freedom a higher critical value is required, at least greater than 2. The firm nested random effect is significant with an F value at 4.41, this is to be expected though from the expected mean square because the "source" corresponds directly with the variance. This is an artifact of the output.

Type III SS is a partial sum of squares test. It estimates a hypothesis matrix L and then computers the SS associated with the hypothesis Lb = 0. This requires that the matrix solve the equation using the b coefficients of the design matrix. From the print-out it is evident that both the effects of firm size and recipient status are significantly different from zero.

The test hypotheses where the pre-selected numerators are listed under "source", and the denominator is the nested firm variable, there are no significant F values. This was the case for most variables listed in Table 3.3 and therefore, these tests of hypotheses are only reported when significant.

The total variance explained by the models of interest was high enough so that we can say that these models were not trivial.

In Table 3.3, each variable is listed with the calculation used to obtain it from information contained in the STC questionnaire. No calculations are given for the last three variables, as they were obtained from a special questionnaire on Canadian content.

Significant effects for each variable are listed by language groups where the appropriate test applies.

Obviously, the main factors in this analysis are not of interest for the purpose of program evaluation. For example, we would be surprised if recipient status did not show up as a significant effect on most financial variables. Similarly, the factors time and firm size are best considered as controls, as are certain interactions. The recipient status by year interaction could, however, be due to a program effect. For example, recipient firms might have reported a significantly higher quick ratio in the post-grant period, in comparison to non-recipients and after the effect of time alone is

removed. If this were the case, preferably supported by similar effects for related measures, we would conclude that there has been a specific program effect.

A small number of such effects were found in the many analyses under review (i.e., 28). However, anlaysis of variance says nothing about the direction of an effect or whether its pattern had any relation to the grant period at all. As a final check on this front a difference of means test was performed.

## 3.4    Differences of Means Test

A difference of means test was performed on the Quick Ratio (French), Net Sales (French), Total Assset Turnover (French) and Return on Equity (English).

The test results are shown in Table 3.4. These tests conform to the procedure outlined in Morris H. DeGroot, Probability and Statistics, 1979, on two-way layouts. As well, this test is referenced in Henry Scheffé, The Analysis of Variance, 1959. The hypothesis tests and formulae are included in Table 3.4. The means were calculated using the three years prior to the grant period, and the three years after, resulting in balanced cells.

Results are shown in the Appendix. They do not require discussion since they are inconsistent. Two of the four tests were negative, that is, recipients did not differ significantly from non-recipients after the grants began as compared to before that period. Of the two significant tests, one concerns a case where the trend is contrary to that which we would expect, showing a decline in the grant period.

Overall, the analysis of variance of STC data shows no effects of the program.

# APPENDIX 3

## ANALYSIS OF VARIANCE FOR STC DATA

CONTENT:

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: Y

| SOURCE | TYPE I EXPECTED MEAN SQUARE |
|---|---|
| REC | VAR(ERROR) + 6.76764344 VAR(NEW(REC*NSIZE)) + Q(REC,NSIZE,REC*NSIZE,YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| NSIZE | VAR(ERROR) + 6.77772641 VAR(NEW(REC*NSIZE)) + Q(NSIZE,REC*NSIZE,YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE | VAR(ERROR) + 6.72005877 VAR(NEW(REC*NSIZE)) + Q(REC*NSIZE,YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| NEW(REC*NSIZE) | VAR(ERROR) + 6.59036288 VAR(NEW(REC*NSIZE)) + Q(YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| YEAR | VAR(ERROR) + Q(YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*YEAR | VAR(ERROR) + Q(REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| NSIZE*YEAR | VAR(ERROR) + Q(NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE*YEAR | VAR(ERROR) + Q(REC*NSIZE*YEAR) |

| SOURCE | TYPE II EXPECTED MEAN SQUARE |
|---|---|
| REC | VAR(ERROR) + 6.6860964 VAR(NEW(REC*NSIZE)) + Q(REC,REC*NSIZE,REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE | VAR(ERROR) + 6.7755918 VAR(NEW(REC*NSIZE)) + Q(NSIZE,REC*NSIZE,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE | VAR(ERROR) + 6.70478183 VAR(NEW(REC*NSIZE)) + Q(REC*NSIZE,REC*NSIZE*YEAR) |
| NEW(REC*NSIZE) | VAR(ERROR) + 6.56060606 VAR(NEW(REC*NSIZE)) |
| YEAR | VAR(ERROR) + Q(YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*YEAR | VAR(ERROR) + Q(REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE*YEAR | VAR(ERROR) + Q(NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE*YEAR | VAR(ERROR) + Q(REC*NSIZE*YEAR) |

WARNING: THIS VERSION OF SAS IS NOT SUPPORTED.

CONTACT YOUR LOCAL COMPUTING REPRESENTATIVE TO OBTAIN THE SUPPORTED VERSION OF SAS.

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: Y

| SOURCE | TYPE III EXPECTED MEAN SQUARE |
|---|---|
| REC | VAR(ERROR) + 6.38086487 VAR(NEW(REC*NSIZE)) + Q(REC,REC*NSIZE,REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE | VAR(ERROR) + 6.36751387 VAR(NEW(REC*NSIZE)) + Q(NSIZE,REC*NSIZE,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE | VAR(ERROR) + 6.36192217 VAR(NEW(REC*NSIZE)) + Q(REC*NSIZE,REC*NSIZE*YEAR) |
| NEW(REC*NSIZE) | VAR(ERROR) + 6.56060606 VAR(NEW(REC*NSIZE)) |
| YEAR | VAR(ERROR) + Q(YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*YEAR | VAR(ERROR) + Q(REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE*YEAR | VAR(ERROR) + Q(NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE*YEAR | VAR(ERROR) + Q(REC*NSIZE*YEAR) |

| SOURCE | TYPE IV EXPECTED MEAN SQUARE |
|---|---|
| REC | VAR(ERROR) + 3.72129254 VAR(NEW(REC*NSIZE)) + Q(REC,REC*NSIZE,REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE | VAR(ERROR) + 4.64364374 VAR(NEW(REC*NSIZE)) + Q(NSIZE,REC*NSIZE,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE | VAR(ERROR) + 6.36192217 VAR(NEW(REC*NSIZE)) + Q(REC*NSIZE,REC*NSIZE*YEAR) |
| NEW(REC*NSIZE) | VAR(ERROR) + 6.56060606 VAR(NEW(REC*NSIZE)) |
| YEAR | VAR(ERROR) + Q(YEAR,REC*YEAR,NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*YEAR | VAR(ERROR) + Q(REC*YEAR,REC*NSIZE*YEAR) |
| NSIZE*YEAR | VAR(ERROR) + Q(NSIZE*YEAR,REC*NSIZE*YEAR) |
| REC*NSIZE*YEAR | VAR(ERROR) + Q(REC*NSIZE*YEAR) |

WARNING: THIS VERSION OF SAS IS NOT SUPPORTED.

CONTACT YOUR LOCAL COMPUTING REPRESENTATIVE TO OBTAIN THE SUPPORTED VERSION OF SAS.

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: Y

| SOURCE | DF | SUM OF SQUARES | MEAN SQUARE | F VALUE | PR > F | R-SQUARE | C.V. |
|---|---|---|---|---|---|---|---|
| MODEL | 121 | 3412.48915695 | 29.20238973 | 2.86 | 0.0001 | 0.485184 | 204.6230 |
| ERROR | 367 | 3620.89829806 | 9.86620787 | | STD DEV | | Y MEAN |
| CORRECTED TOTAL | 488 | 7033.38744491 | | | 3.14105203 | | 1.53504334 |

| SOURCE | DF | TYPE I SS | F VALUE | PR > F | DF | TYPE II SS | F VALUE | PR > F |
|---|---|---|---|---|---|---|---|---|
| REC | 1 | 7.49080023 | 0.76 | 0.3841 | 1 | 38.33062906 | 3.89 | 0.0495 |
| NSIZE | 3 | 102.52720802 | 3.46 | 0.0164 | 3 | 102.05399521 | 3.45 | 0.0168 |
| REC*NSIZE | 3 | 45.87046352 | 1.55 | 0.1997 | 3 | 43.52120636 | 1.47 | 0.2208 |
| NEW(REC*NSIZE) | 66 | 2863.91652520 | 4.40 | 0.0001 | 66 | 2868.82553200 | 4.41 | 0.0001 |
| YEAR | 6 | 67.32565783 | 1.14 | 0.3399 | 6 | 67.32565783 | 1.14 | 0.3399 |
| REC*YEAR | 6 | 82.38799489 | 1.39 | 0.2168 | 6 | 53.64273332 | 0.91 | 0.4904 |
| NSIZE*YEAR | 18 | 174.86608816 | 0.98 | 0.4767 | 18 | 174.86608816 | 0.98 | 0.4767 |
| REC*NSIZE*YEAR | 18 | 68.20441900 | 0.38 | 0.9902 | 18 | 68.20441900 | 0.38 | 0.9902 |

NOTE:

| SOURCE | DF | TYPE III SS | F VALUE | PR > F | DF | TYPE IV SS | F VALUE | PR > F |
|---|---|---|---|---|---|---|---|---|
| REC | 1 | 60.56875817 | 6.14 | 0.0137 | 1 | 17.10525850 | 1.73 | 0.1898 |
| NSIZE | 3 | 71.84616931 | 2.43 | 0.0640 | 3 | 39.77612839 | 1.34 | 0.2589 |
| REC*NSIZE | 3 | 47.53387353 | 1.61 | 0.1859 | 3 | 47.53387353 | 1.61 | 0.1859 |
| NEW(REC*NSIZE) | 66 | 2868.82553200 | 4.41 | 0.0001 | 66 | 2868.82553200 | 4.41 | 0.0001 |
| YEAR | 6 | 37.55282670 | 0.63 | 0.7028 | 6 | 37.55282670 | 0.63 | 0.7028 |
| REC*YEAR | 6 | 41.22189006 | 0.70 | 0.6527 | 6 | 41.22189006 | 0.70 | 0.6527 |
| NSIZE*YEAR | 18 | 136.32835573 | 0.77 | 0.7383 | 18 | 136.32835573 | 0.77 | 0.7383 |
| REC*NSIZE*YEAR | 18 | 68.20441900 | 0.38 | 0.9902 | 18 | 68.20441900 | 0.38 | 0.9902 |

TESTS OF HYPOTHESES USING THE TYPE IV MS FOR NEW(REC*NSIZE) AS AN ERROR TERM

| SOURCE | DF | TYPE IV SS | F VALUE | PR > F |
|---|---|---|---|---|
| REC | 1 | 17.10525850 | 0.39 | 0.5326 |
| NSIZE | 3 | 39.77612839 | 0.31 | 0.8232 |
| REC*NSIZE | 3 | 47.53387353 | 0.36 | 0.7815 |

## TABLE 3.3.

1. **QUICK RATIO** = (cash + (securities, advances, deposits) + net accounts receivables)/current liabilities

**English Firms; F Value of Model 2.86**

| Type II SS | F Value |
|---|---|
| recipient status | 3.89 |
| firm size | 3.45 |

| Type III SS | F Value |
|---|---|
| recipient status | 6.14 |
| firm size | 2.43 |

**French Firms; F Value of Model 2.51**

| Type II SS | F Value |
|---|---|
| firm size | 6.25 |
| firm size, recipient status interaction | 9.55 |
| year, recipient status interaction | 3.00 |

| Type III SS | F Value |
|---|---|
| recipient status | 2.53 |
| firm size | 8.14 |
| firm size, recipient interaction | 9.42 |
| recipient status, year interaction | 3.29 |

| Test of Hypotheses | F Value |
|---|---|
| recipient status, firm size interaction | 3.07 |

2. **CURRENT RATIO** = Total Current Assets/Total Current Liabilities

### English Firms; F Value of Model 2.65

| Type II SS | F Value |
|---|---|
| recipient status | 2.47 |
| firm size | 3.87 |

| Type III SS | F Value |
|---|---|
| recipient status | 4.98 |
| firm size | 2.94 |

### French Firms; F Value of Model 2.10

| Type II SS | F Value |
|---|---|
| firm size | 2.94 |
| recipient status, firm size interaction | 3.13 |
| year, firm size interaction | 2.60 |

| Type III SS | F Value |
|---|---|
| firm size | 3.31 |
| recipient status, firm size interaction | 3.07 |
| year, firm size interaction | 2.83 |

3. **RETURN ON INVESTMENT** = Profit for Total Operation/Total Assets

### English Firms; F Value of Model 9.30

| Type II SS | F Value |
|---|---|
| recipient status | 41.20 |
| firm size | 29.23 |
| recipient status, firm size interaction | 8.71 |

| Type III SS | F Value |
|---|---|
| recipient status | 25.65 |
| firm size | 12.11 |
| recipient status, firm size interaction | 8.15 |

### French Firms; F Value of Model 6.30

| Type II SS | F Value |
|---|---|
| recipient status | 65.07 |
| firm size | 14.67 |
| recipient status, firm size interaction | 22.52 |

| Type III SS | F Value |
|---|---|
| recipient status | 17.15 |
| firm size | 9.44 |
| recipient status, firm size interaction | 19.35 |

4.  **DEBT RATIO** = (Total Current Liabilities + Total Long-term Liabilities)/Total Assets

### English Firms; F Value of Model 8.68

| Type II SS | F Value |
|---|---|
| recipient status | 17.27 |
| firm size | 23.10 |
| recipient status, firm size interaction | 16.64 |

| Type III SS | F Value |
|---|---|
| recipient status | 14.23 |
| firm size | 11.91 |
| recipient status, firm size interaction | 13.39 |

### French Firms; F Value of Model 12.51

| Type II SS | F Value |
|---|---|
| firm size | 63.55 |
| recipient status, firm size interaction | 2.65 |
| year | 6.07 |

| Type III SS | F Value |
|---|---|
| firm size | 53.10 |
| recipient status, firm size interaction | 2.83 |
| year | 6.46 |

5.  **GROSS PROFIT MARGIN ON PUBLISHING AND AGENCY BOOK SALES AND SALE OF RIGHTS** = ((Net Book Sales + Sale of Rights) - (Cost of Books Sold + Royalties Payable from Sale of Books + Operating Expenditures for Editorial and Design Production + Royalties Payable from Sale of Rights + Agent Fees + Purchase Rights)/(Net Book Sales + Sale of Rights))

### English Firms; F Value of Model 17.45

| Type II SS | F Value |
|---|---|
| recipient status | 11.29 |
| firm size | 157.81 |
| recipient status, firm size interaction | 9.41 |

| Type III SS | F Value |
|---|---|
| recipient status | 9.12 |
| firm size | 98.74 |
| recipient status, firm size interaction | 9.38 |

| Test of Hypotheses | F Value |
|---|---|
| recipient status | 2.54 |
| firm size | 2.48 |

### French Firms; F Value of Model 13.11

| Type II SS | F Value |
|---|---|
| recipient status | 48.13 |
| firm size | 90.52 |

| Type III SS | F Value |
|---|---|
| recipient status | 41.74 |
| firm size | 89.20 |

6. **GROSS PROFIT MARGIN ON PUBLISHING AND AGENCY BOOK SALES ONLY** = (Net Book Sales - (Cost of Books Sold + Royalties Payable from Sale of Book + Operating Expenditures for Editiorial and Design Production))/Net Book Sales

### English Firms; F Value of Model 16.86

| Type II SS | F Value |
|---|---|
| recipient status | 10.34 |
| firm size | 151.16 |
| recipient status, firm size interaction | 9.61 |

| Type III SS | F Value |
|---|---|
| recipient status | 8.25 |
| firm size | 93.36 |
| recipient status, firm size interaction | 9.56 |

### French Firms; F Value of Model 13.79

| Type II SS | F Value |
|---|---|
| recipient status | 48.80 |
| firm size | 93.25 |

| Type III SS | F Value |
|---|---|
| recipient status | 43.46 |
| firm size | 92.16 |

7.  **NET SALES** = Net Book Sales

**English Firms; F Value of Model 23.96**

| Type II SS | F Value |
| --- | --- |
| recipient status | 8.61 |
| firm size | 239.99 |
| recipient status, firm size interaction | 4.64 |
| year | 8.44 |
| firm size, year interaction | 3.38 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 5.84 |
| firm size | 178.78 |
| recipient status, firm size interaction | 4.64 |
| year | 2.58 |

**French Firms; F Value of Model 157.04**

| Type II SS | F Value |
| --- | --- |
| recipient status | 188.58 |
| firm size | 2592.23 |
| recipient status, firm size interaction | 570.67 |
| year | 30.47 |
| recipient status, year interaction | 4.70 |
| firm size, year interaction | 21.87 |
| recipient status, firm size, year interaction | 42.59 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 504.44 |
| firm size | 2947.48 |
| recipient status, firm size interaction | 570.67 |
| year | 107.25 |
| recipient status, year interaction | 30.05 |
| firm size, year interaction | 40.55 |
| recipient status, firm size, year interaction | 42.50 |

| Test of Hypotheses | F Value |
| --- | --- |
| firm size | 157.78 |
| recipient status, firm size | 30.02 |

8.  **EARNING POWER RATIO** = (Profit for Total Operation + Bank Charges and Interest)/Total Assets


**English Firms; F Value of Model 6.76**

| Type II SS | F Value |
|---|---|
| recipient status | 19.93 |
| firm size | 16.24 |
| recipient status, firm size interaction | 4.49 |

| Type III SS | F Value |
|---|---|
| recipient status | 18.82 |
| firm size | 7.26 |
| rcipient status, firm size interaction | 5.75 |


**French Firms; F Value of Model 1.83**

| Type II SS | F Value |
|---|---|
| recipient status | 6.91 |
| recipeint status, firm size interaction | 9.64 |

| Type III SS | F Value |
|---|---|
| firm size, recipient status interaction | 8.56 |

9. **TOTAL ASSET TURNOVER** = Total Revenue/Total Assets

**English Firms; F Value of Model 14.03**

| Type II SS | F Value |
| --- | --- |
| recipient status | 3.79 |
| firm size | 111.00 |
| recipient status, firm size interaction | 24.01 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 4.61 |
| firm size | 67.48 |
| recipient status, firm size interaction | 27.54 |
| year | 3.00 |

**French Firms; F Value of Model 16.29**

| Type II SS | F Value |
| --- | --- |
| recipient status | 28.34 |
| firm size | 71.02 |
| recipient status, firm size interaction | 139.82 |
| recipient status, year interaction | 2.95 |
| firm size, year interaction | 3.36 |
| recipient status, firm size, year interaction | 6.68 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 87.16 |
| firm size | 109.11 |
| recipient status, firm size interaction | 128.58 |
| year | 6.02 |
| recipient status, year interaction | 5.05 |
| firm size, year interaction | 5.69 |
| recipient status, year, firm size interaction | 6.68 |

| Test of Hypotheses | F Value |
| --- | --- |
| recipient, firm size interaction | 5.20 |

10. **INVENTORY TURNOVER** = Cost of Books/((Total Cost of Books Sold Beginning Inventory + Total Cost of Books Sold at End of Inventory)1/2)

**English Firms; F Value of Model 9.47**

| Type II SS | F Value |
|---|---|
| recipient status | 45.93 |
| firm size | 38.38 |
| recipient status, firm size interaction | 28.50 |

| Type III SS | F Value |
|---|---|
| recipient status | 42.49 |
| firm size | 61.46 |
| recipient status, firm size interaction | 55.11 |

**French Firms; F Value of Model 2.88**

| Type II SS | F Value |
|---|---|
| firm size | 8.33 |
| firm size, year interaction | 4.22 |

| Type III SS | F Value |
|---|---|
| firm size | 9.57 |
| year | 4.05 |

## II. RETURN ON EQUITY = Profit for Total Operation/Total Equity

### English Firms; F Value of Model 4.00

| Type II SS | F Value |
|---|---|
| recipient status | 5.09 |
| firm size | 3.96 |
| recipient status, firm size interaction | 12.32 |
| recipient status, year interaction | 5.61 |
| firm size, year interaction | 3.89 |
| recipient status, year, firm size interaction | 13.64 |

| Type III SS | F Value |
|---|---|
| recipient status | 22.77 |
| firm size | 18.91 |
| recipient status, firm size interaction | 20.50 |
| year | 19.89 |
| recipient status, year interaction | 19.46 |
| firm size, year interaction | 13.74 |
| recipient status, year, firm size interaction | 13.64 |

| Test of Hypotheses | F Value |
|---|---|
| firm size | 6.84 |
| recipient status, firm size interaction | 19.39 |

### French Firms; F Value of Model 2.20

| Type II SS | F Value |
|---|---|
| recipient status | 11.74 |
| firm size | 3.98 |
| recipient status, firm size interaction | 5.66 |

| Type III SS | F Value |
|---|---|
| recipient status | 4.00 |
| firm size | 3.26 |
| recipient status, firm size interaction | 6.37 |

## 12. CANADIAN AUTHORED TITLES

### English Firms; F Value of Model 6.36

| Type II SS | F Value |
| --- | --- |
| recipient status | 41.89 |
| firm size | 59.50 |
| recipient status, firm size interaction | 6.88 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 22.66 |
| firm size | 58.58 |
| recipient status, firm size interaction | 5.81 |

### French Firms; F Value of Model 10.55

| Type II SS | F Value |
| --- | --- |
| recipient status | 182.82 |
| firm size | 73.44 |
| recipient status, firm size interaction | 43.25 |
| firm size, year interaction | 3.23 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 224.01 |
| firm size | 76.69 |
| recipient status, firm size interaction | 42.89 |
| year | 4.61 |
| firm size, year interaction | 3.49 |

| Test of Hypotheses | F Value |
| --- | --- |
| firm size | 10.66 |

13. **RATIO OF SALES OF CANADIAN TO TOTAL TITLE SALES =**

### English Firms; F Value of Model 5.44

| Type II SS | F Value |
|---|---|
| recipient status | 22.16 |
| firm size | 9.14 |
| recipient status, firm size | 2.89 |
| year | 3.19 |

| Type III SS | F Value |
|---|---|
| recipient status | 36.69 |
| firm size | 3.17 |

### French Firms; F Value of Model 3.49

| Type II SS | F Value |
|---|---|
| recipient status | 23.48 |
| firm size | 7.05 |

| Type III SS | F Value |
|---|---|
| recipient status | 17.05 |
| firm size | 8.55 |

14.   NET SALES OF CANADIAN AUTHORED TITLES

### English Firms; F. Value of Model 2.92

| Type II SS | F Value |
| --- | --- |
| firm size | 20.16 |

| Type III SS | F Value |
| --- | --- |
| firm size | 15.69 |

### French Firms; F Value of Model 6.10

| Type II SS | F Value |
| --- | --- |
| recipient status | 34.29 |
| firm size | 29.11 |
| recipient status, firm size interaction | 82.59 |

| Type III SS | F Value |
| --- | --- |
| recipient status | 78.03 |
| firm size | 47.43 |
| recipient status, firm size interaction | 82.59 |

| Test of Hypotheses | F Value |
| --- | --- |
| firm size | 18.57 |
| recipient staus, firm size interaction | 28.90 |

## TABLE 3.4

## DIFFERENCE OF MEANS TEST

$H_0$:  $a_i = 0$ for $i = 1,\ldots,I$

$H_1$:  the hypothesis $H_0$ is not true

critical value for $F_{1,3} = 10.13$ at .05% significance

$$F = \frac{J(J-1) \sum_{i=1}^{I} (\overline{Y}_{i\cdot} - \overline{Y}..)^2}{\hat{\sigma}^2}$$

$$\hat{\sigma}^2 \quad \sum_{i=1}^{I} \sum_{j=1}^{J} (Y_{ij} - \overline{Y}_{i\cdot} - \overline{Y}_{\cdot j} + \overline{Y}..)^2 / IJ$$

<u>OR</u>

$$\sum_{i}^{I} \sum_{j}^{J} (\overline{Y}ij - u - a_i - B_j)^2 / IJ$$

where;  $a_i = \overline{Y}_{i\cdot} - \overline{Y}..$ for $i = 1,\ldots,I$

$B_j = \overline{Y}_{\cdot j} - \overline{Y}..$ for $j = 1,\ldots,J$

$u = \overline{Y}..$

# TABLE 3.4 cont'd.

## QUICK RATIO (French)

|  | MEAN PRIOR TO GRANTS | MEAN AFTER GRANTS |
|---|---|---|
| recipient | 2.3534 | 3.7492 |
| non-recipient | 3.5016 | 3.0526 |

row average     $\overline{Y}_{1.} = 3.0513$  ,  $\overline{Y}_{2.} = 3.2771$

column average     $\overline{Y}_{.1} = 2.9275$  ,  $\overline{Y}_{.2} = 3.4009$

total average     $\overline{Y}_{..} = 3.1642$

$\hat{u} = 3.1642$  ,  $a_{1.} = -.1129$  ,  $a_{2.} = .1129$  ,  $B_{.1} = -.2367$  ,  $B_{.2} = .2367$

$\hat{\sigma}^2 = .2127$  ,  $F = .2397$

Therefore accept $H_O$ that there is no significant difference between recipients and non-recipients.

TABLE 3.4 cont'd.

## NET SALES (French)

|  | MEAN PRIOR TO GRANTS | MEAN AFTER GRANTS |
|---|---|---|
| recipient | 7,715,713.9 | 12,243,222.5 |
| non-recipient | 5,044,466.9 | 6,845,313.8 |

row average $\qquad \bar{Y}_{1.} = 9,979,468.2$ , $\bar{Y}_{2.} = 5,944,891.35$

column average $\qquad \bar{Y}_{.1} = 6,380,090.4$ , $\bar{Y}_{.2} = 9,544,268.15$

total average $\qquad \bar{Y}.. = 7,962,179.3$

$\hat{u} = 7,962,179.3$, $\hat{2}_{1.} = 2,017,288.9$, $\hat{2}_{2.} = -2,017,287.95$

$\qquad \hat{B}.1 = -1,582,088.9$ $\qquad \hat{B}._{2} = 1,582,088.85$

$\hat{\sigma}^2 = 448,900$ , $F = 36.2678$

Therefore reject $H_o$, recipients and non-recipients are significally different.

# TABLE 3.4 cont'd

## TOTAL ASSET TURNOVER (French)

|  | MEAN PRIOR TO GRANTS | MEAN AFTER GRANTS |
|---|---|---|
| recipient | 6.8704 | 4.6198 |
| non-recipient | 3.3786 | 3.1906 |

row average $\bar{Y}_{1.} = 5.7451$ , $\bar{Y}_{2.} = 3.2846$

column average $\bar{Y}_{.1} = 5.1245$ , $\bar{Y}_{.2} = 3.9052$

total average $\bar{Y}.. = 4.5149$

$\hat{u} = 4.5149$ , $\hat{\alpha}_{1.} = 1.2302$ , $\hat{\alpha}_{2.} = -1.2303$ , $\hat{B}.1 = .6906$ , $\hat{B}.2 = -.6907$

$$\hat{\sigma}^2 = .266 \quad , \quad F = 22.75$$

Therefore reject $H_o$, recipients and non-recipients are significantly different

TABLE 3.4 cont'd

## RETURN ON EQUITY (English)

|  | MEAN PRIOR TO GRANTS | MEAN AFTER GRANTS |
|---|---|---|
| recipients | 1.7378 | 2.9866 |
| non-recipient | .7409 | 3.1765 |

row average $\qquad \bar{Y}_{1.} = 2.3623$ , $\bar{Y}_{2.} = 1.9587$

column average $\qquad \bar{Y}_{.1} = 1.2394$ , $\bar{Y}_{.2} = 3.0816$

total average $\qquad \bar{Y}.. = 2.1605$

$\hat{u} = 2.1605$ , $\hat{2}_{1.} = .2018$ , $\hat{2}_{2.} = .2018$ , $\hat{B}.1 = -.9211$ , $\hat{B}.2 = .9211$

$\hat{\sigma}^2 = .088$ , $F = 1.85$

Therefore accept $H_o$, no significant difference between recipients and non-recipient.

ANALYSIS OF STATISTICS CANADA
DATABASE : REPORT

| DUE DATE | | | |
|---|---|---|---|
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| JUIL | | | |
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