An Analysis Of Using Time-Series Current And Deferred Income Tax Expense To Forecast Income Taxes Paid

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ABSTRACT

Prior research, using cross-sectional data, concluded that interperiod income tax allocation is useful in forecasting income tax payments (Murdoch, Costa, & Krause, 1994 and Cheung, Krishnan, & Min, 1997). Both these articles suggested that future research should focus on investigating whether time-series data are also useful in forecasting income tax payments. This paper uses time-series data from 235 Compustat firms over a 20-year period to evaluate whether income tax expense is useful in forecasting one-, two-, and three-year ahead income tax payments. We conclude that firms' predictions are more accurate for shorter forecast horizons. Additionally, we determine that deferred income tax expense enhances the ability of current income tax expense to predict future tax payments for approximately 40% of firms across all three forecast horizons. Furthermore, we find that the prediction accuracy of a firm's one-year ahead forecasts is significantly related to the prediction accuracy of its two- and three-year ahead forecasts.

Keywords: Current Income Tax Expense; Deferred Income Tax Expense; Forecasting Income Tax Payments

INTRODUCTION

Ever since the FASB (1978) argued that earnings and its components constitute a basis for assessing a firm's future cash flow prospects, researchers have employed this connection for the purpose of evaluating different types of accounting information (see, for example, Barth, Cram, & Nelson, 2001; Finger, 1994; Greenberg, Johnson, & Ramesh, 1986; Waldron & Jordan, 2010). We employ a similar methodology by examining the ability of income tax expense to forecast income tax payments or benefits. Generally accepted accounting principles require firms break total income tax expense for each period into two components—current income tax expense and deferred income tax expense.

Current income tax expense is defined as the "amount of income taxes paid or payable (or refundable) for a year as determined by applying the provisions of the enacted tax law to the taxable income or excess of deductions over revenues for that year" (Financial Accounting Foundation, 2014). Deferred income tax expense is defined as the "change during the year in an entity's deferred tax liabilities and assets" (Financial Accounting Foundation, 2014). Although, typically, income tax expense relates to future income tax payments, income tax expense can be negative and can result in refunds of prior income taxes paid. Accrual accounting requires that firm's recognize income taxes in the period these taxes are incurred rather than waiting until the payment is made or the benefit is received. Consequently, this temporal relationship is such that the preceding accrual likely contains information that can be used to predict future payments or benefits. Heretofore, we refer to both income taxes paid and benefits received as *income tax payments.*

RELATED LITERATURE

Murdoch, Costa, and Krause's (1994) research established the effectiveness of current income tax expense to predict future income tax payments for one-, two-, and three-year ahead forecasts. The authors employed current income tax expense as the independent variable in simple regressions using cross-sectional data. Subsequently, the effect on forecast ability of adding deferred income tax expense as a second independent variable to the original simple regressions was evaluated. Murdoch, Costa, and Krause (hereafter MCK) conclude that deferred income tax expense enhances the ability of current income tax expense to predict income tax payments when making two- and three-year ahead forecasts, but results were inconclusive for one-year ahead forecasts.

Cheung, Krishnan, and Min (1997) also investigated the effectiveness of income tax data to forecast income tax payments. Initially, a methodology of employing income tax payments as the independent variable to predict future values of itself in a simple regression was used. Then, to evaluate the ability of deferred income tax expense and the change in the deferred tax liability to enhance prediction, first one, and then both of these additional independent variables were included in two multiple regressions. That is, the first regression used only income tax payments as the independent variable (i.e., a simple regression). The second (multiple) regression used income tax payments and deferred income tax expense as independent variables. The third (multiple) regression used income tax payments, deferred income tax expense, and the change in the deferred tax liability during the year as independent variables. All regressions used cross-sectional data. Cheung, Krishnan, and Min (hereafter CKM) concluded that "consideration of deferred tax information leads to superior forecasts of future tax payments…" (p. 14).

While MCK (1994) rejected a time-series approach because there were insufficient prior years' data available from Compustat to use it at the time of their study, CKM (1997) also rejected this approach because it would reduce sample size and generalizability. Both of these studies acknowledge the limitations of using cross-sectional data. MCK (1994) state that a "longer time-series method may be more appropriate" (p. 36) while CKM (1997) acknowledge that their "cross-sectional methodology is based on the assumption that all model parameters are constant across firms and time" and is "clearly a limitation" (p. 14).

RESEARCH ISSUES

CKM's (1997) concerns regarding the generalizability of a time-series methodology are legitimate. It is very likely that income tax expense is useful in forecasting income tax payments for some firms and not for other firms. Consequently, this research hopes to answers questions such as:

1. What proportion of the variance in income tax payments is explained by current and by deferred income tax expense?
2. For what proportion of firms does deferred income tax expense enhance forecasts made by using only current income tax expense?
3. Are firms for which more accurate forecasts can be made for one time horizon (e.g., one-year ahead forecasts) likely to be able to make more accurate forecasts for other time horizons (e.g., two-year and three ahead forecasts)?

RESEARCH METHOD

The research method employed requires that sample firms have complete data for total assets, deferred income tax expense, total income tax expense, and income taxes paid from Compustat for the 20 years, 1994-2013. Since total income tax expense is the sum of current income tax expense and deferred income tax expense, current income tax expense is derived by subtracting deferred income tax expense from total income tax expense. Deferred income tax expense, total income tax expense, current income tax expense, and income taxes paid are all deflated (divided) by total assets to control for serial correlation and heteroscedasticity. Each sample firm has 20 annual observations from Compustat for each of these deflated variables. For each sample firm, there are three simple and three multiple regressions, as shown below:

$$ITPd_t = a + b(CITExp_{t-i}) \quad (1)$$

$$ITPd_t = a + b_1(CITExp_{t-i}) + b_2(DITExp_{t-i}) \quad (2)$$

Where:

ITPd = income taxes paid (or benefits received) deflated by total assets
CITExp = current income tax expense deflated by total assets
DITExp = deferred income tax expense deflated by total assets
t = year variable (CITExp and/or DITExp) is measured
i = 1, 2, or 3, designating the lag for a 1-, 2-, or 3-year ahead forecast.

For each sample firm, three simple regressions (1) and three multiple regressions (2) are employed. Therefore, each sample firm has six regressions in total. Regression statistics from the simple regression forecasting income tax payments for one-year ahead forecasts are compared to the regression statistics from the multiple regression forecasting one-year ahead income tax payments. Similarly, regression statistics from the simple regressions are compared to those from the multiple regressions for the two- and three-year ahead forecasts.

To evaluate, for each firm, whether deferred income tax expense enhances one-, two-, and three-year ahead forecasts of income tax expense, the *adjusted* r^2 from a firm's simple regression is compared to the *adjusted* R^2 from that firm's multiple regression. If including deferred income tax expense enhances prediction for a specific firm, the adjusted R^2 from its multiple regression will be greater than the adjusted r^2 from its related simple regression. However, if adjusted r^2 from its simple regression is greater than the adjusted R^2 from its related multiple regression, it indicates including deferred income tax expense as an independent variable is detracting from the firm's prediction of income tax payments.

The adjusted, rather than the unadjusted, r-squared values must be compared because the unadjusted R^2 (multiple regression) will always exceed the unadjusted r^2 (simple regression) regardless of whether the additional independent variable enhances or detracts from forecast efficacy. Adjusting each firm's r-squared values from the simple regression's r^2 and from the multiple regression's R^2 allows for comparisons of regressions that contain different numbers of predictors. Adjusted r-squared modifies unadjusted r-squared for the number of independent variables in each regression. By comparing these adjusted r-squared values, we can generalize about the proportion of firms for which using deferred income tax expense as an aid in forecasting income tax payments is useful.

SAMPLE SELECTION

We employ Compustat data from the years 1994-2013 (Standard and Poor's, 2014) to investigate the ability to forecast income tax payments for one-, two-, and three-years ahead. We use a "survivorship" sample. Initially, the 895 firms with complete variables for each of the 20 years of Compustat data required by the research methodology were included in the sample (see Table 1). Eight of these firms were eliminated because they had zero deferred income tax expense for all 20 years. For these firms, current income tax expense and total income tax expense are equal and can provide no insight into the different capacities of current and deferred income tax expense to predict income taxes payable.

Table 1. Selection Data for Survivorship Sample

Number of firms with no missing data for required Compustat variables for all 20 years	895
Number of firms with zero deferred income tax expense for all 20 years	(8)
Number of firms for which the absolute value of the sum of *Deferred income Tax Expense* over the 20-year test period ÷ the absolute value of the sum of *Total Income Tax Expense* over the 20-year test period < 25%	(652)
Number of sample firms	235

However, it is not only firms with zero deferred income tax expense that inhibit the investigation of the capacity of income tax expense to predict future income tax payments. CKM (1997) excluded firms "for which the impact of deferred taxes on the income statement is small" and concluded "deferred tax information is more useful in firms with larger amounts of deferred taxes" (p. 12). Consequently, our study eliminates firms for which the absolute value sum of deferred income tax expense constituted less than 25% of the absolute value sum of total income tax expense over the 20-year test period, eliminating 652 firms. The foregoing eliminations left 235 firms with 20 years of complete data required for the sample. Since there are six regressions for each sample firm (see RESEARCH METHOD section), there are 705 simple regressions (235 firms x 3 simple regressions) and 705 multiple regressions (235 firms x 3 multiple regressions), or 1,410 total regressions.

The sample includes firms from seven of nine 4-digit Standard Industrial Classification (SIC) codes. The seven industries represented range from a high of 40.9% (Transportation and Communication) to a low of 4.7% (Wholesale and Retail Trade) of the entire sample (see Table 2).

Table 2. Numbers of Sample Firms by Four-Digit SIC Classifications

4-digit SIC Code	Industry	No. of firms
0100-0999	Agriculture	0
1000-1999	Mining and Construction	19
2000-2999	Light Manufacturing	22
3000-3999	Heavy Manufacturing	46
4000-4999	Transportation and Communication	96
5000-5999	Wholesale and Retail Trade	11
6000-6999	Finance, Insurance, and Real Estate	19
7000-8999	Services	22
9000-9999	Public Administration	0
	Total	**235**

RESULTS

Descriptive Statistics for Compustat Data Items

Table 3 provides descriptive statistics for sample firms. Initially, each of the 235 firm's mean for the five variables listed in in Table 3 was computed over the 20-year test period. Subsequently, the grand mean of the individual firm means was computed. Observing the grand means, standard deviations, and minimum and maximum values for each of these Compustat Data Items in Table 3, one might conclude that there is substantial variation among these variables. While this is true, one may conclude that the largest variation is for total assets, since total assets has the largest standard deviation and greatest difference between its minimum and maximum values. However, when means vary so substantially, standard deviations are not comparable. Consequently, we compute the coefficients of variation (standard deviation divided by the mean) for each item, which correctly indicates that the greatest dispersion occurs for income taxes paid and the smallest for total income tax expense.

Table 3. Compustat Data Items Statistics in Millions of Dollars for 235 Firm Sample Across 20 Years

Compustat Data Item	Grand Mean	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Total assets	23,401.4	86,578.8	3.7	13.3	860,944.9
Current income tax expense	123.7	313.2	2.5	(124.5)	2,610.7
Deferred income tax expense	26.2	193.1	7.4	(1,107.8)	1,390.2
Total income tax expense	149.9	358.0	2.4	(485.9)	3,240.9
Income taxes paid	262.3	2,287.0	8.7	(134.0)	34,912.8

Of course, since the sum of current income tax expense and deferred income tax expense is equal to total income tax expense, the grand means of current income tax expense and deferred income tax expense sum to the grand mean of total tax expense. As previously mentioned, all variables other than total assets can be negative, as can be seen from observing the minimum values for these variables.

Descriptive Statistics from Simple and Multiple Regressions

Table 4 displays descriptive statistics from the 235 simple and multiple regressions used to predict income tax payments for each time horizon. The Simple Regressions column, Panel A, indicates that an average of 35.2% (0.352) of the variation in income tax payments is explained by the prior year's current income tax expense. Panels B and C specify that averages of 15.1% (0.151) and 10.3% (0.103) of the variation in income tax payments are explained by current income tax expense from two years and three years prior. The Multiple Regressions column, Panels A, B, and C, provide similar information (0.403, 0.223, and 0.169) for the average variation in income tax payments explained by both current and deferred income tax expense as independent variables.

Table 4. Descriptive Statistics for 235 One-, Two-, and Three-Year Ahead Forecasts of Income Tax Payments Employing Simple (CITExp) and Multiple (CITExp & DITExp) Regressions

Description	Simple Regressions	Multiple Regressions
Panel A: One-year ahead forecasts		
Mean coefficients of simple (r^2) and multiple (R^2) determination	0.352	0.403
Mean coefficients of variation (CVs) of r^2 and R^2 values	0.677	0.576
Mean ***adjusted*** coefficients of simple (r^2) and multiple (R^2) determination	0.314	0.328
No. (%) of firms for which the simple vs. multiple regression was superior	137 (58.3)	98 (41.7)
Panel B: Two-year ahead forecasts		
Mean coefficients of simple (r^2) and multiple (R^2) determination	0.151	0.223
Mean coefficients of variation (CVs) of r^2 and R^2 values	1.077	0.808
Mean ***adjusted*** coefficients of simple (r^2) and multiple (R^2) determination	0.098	0.120
No. (%) of firms for which the simple vs. multiple regression was superior	139 (59.1)	96 (40.9)
Panel C: Three-year ahead forecasts		
Mean coefficients of simple (r^2) and multiple (R^2) determination	0.103	0.169
Mean coefficients of variation (CVs) of r^2 and R^2 values	1.278	0.886
Mean ***adjusted*** coefficients of simple (r^2) and multiple (R^2) determination	0.043	0.050
No. (%) of firms for which the simple vs. multiple regression was superior	146 (62.1)	89 (37.9)

To evaluate dispersion of r^2 relative to R^2 for different forecast horizons, the coefficients of variation (CVs) are displayed. Once again, because there are substantial variations in the r^2 and R^2 means, both among the simple and multiple regressions and across forecast horizons, we show CVs, rather than standard deviations. R-squared means (r^2 and R^2) with smaller CVs are less dispersed than r-squared means with larger coefficients of variation. Observing CVs in Table 4, it is clear that sample firms' r-squared values are more dispersed for longer, versus shorter, forecast horizons and less dispersed for multiple, compared to simple, regressions.

To determine whether deferred income tax expense improves the prediction of income tax payments, beyond that provided by current income tax expense, we compare the individual firms' *adjusted* r-squared values from simple and multiple regressions. These mean adjusted r-squared values are displayed in Table 4. Although, the mean adjusted R^2 exceeds the mean adjusted r^2 for each forecast horizon, the simple regressions are superior to the multiple regressions in 58.3%, 59.1%, and 62.1% of the 235 comparisons, respectively.

Incremental Improvement of Adding Deferred Income Tax Expense as an Independent Variable

If deferred income tax expense improves a firm's prediction of income tax payments more than would be expected by chance, its adjusted R^2 (multiple regression) will be greater than its adjusted r^2 (simple regression). If deferred income tax expense improves a firm's prediction of income tax payments less than would be expected by chance, its adjusted r^2 will be greater than its adjusted R^2. As one can observe in Table 5, out of the 235 firms analyzed, including deferred income tax expense as an independent variable improves one-year ahead forecasts for 98 firms, improves two-year ahead forecasts for 96 firms, and improves three-year ahead forecasts for 89 firms. Of course, the complementary statement is that deferred income taxes expense fails to improve the forecasts for 137, 139, and 146 one-, two-, and three-year ahead forecasts, respectively.

Previous cross-sectional studies investigating the ability of current and deferred income taxes to predict income tax payments concluded that such information was useful in predicting income tax payments (MCK, 1994 &

CKM, 1997). Time-series research, however, can result in different conclusions for each specific firm. Consequently, we do not make a general inference whether deferred income tax expense improves the ability of current income tax expense to predict income tax payments. Our conclusion is these variables possess information to predict income tax payments for some firms and not for others.

Proportion of Firms for Which Deferred Income Tax Expense Improves Forecasts

Table 5 shows the lower and upper 95% confidence limits regarding the proportion of firms for which adding deferred income tax expense to current income tax expense as an independent variable improves the forecast for each of the three time horizons analyzed. These confidence limits are calculated using the exact binomial (Clopper-Pearson) method (Sergeant, ESG, 2014). Results indicate that we can be 95% confident that adding deferred income tax expense as a second independent variable to current income tax expense in a regression will improve prediction of one-year ahead income tax payments for between 35.3% and 48.3% of sample firms. Similarly, our 95% confidence limit for improving two- and three-year ahead predictions is between 34.5% and 47.4%, and between 31.9% and 44.2%, of firms, respectively.

Table 5. Confidence Limits for The Proportion of Forecasts for Which Deferred Income Tax Expense Enhances Forecasts of Income Tax Payments

Forecast Horizon	No. of Firms (out of 235) for which DITExp Enhanced Forecast	Percentage of Firms for which DITExp Enhanced Forecast	Lower 95% Confidence Limit	Upper 95% Confidence Limit
One-year ahead	98	41.7%	35.3%	48.3%
Two-year ahead	96	40.9%	34.5%	47.4%
Three-year ahead	89	37.9%	31.9%	44.2%

Consistency of Firms' Ability to Forecast Income tax payments

Is a firm's ability to forecast income tax payments from income tax expense consistent across time horizons? In other words, is the ability to use a specific firm's data to predict one-year ahead income tax payments related to the same firm's ability to forecast two- and three-year ahead income tax payments, or is this ability random among firms over forecast horizons?

To address this issue, we observe the rank order (Spearman) correlations among the three forecast horizons. Each firm's r^2 from each of its simple regressions, and each firm's R^2 from each of its multiple regressions, over the three time horizons is ranked from 1 to 235 against each other firm's related r^2 (and R^2) values. If there is no association between firms' rankings among the three forecast horizons, the rank order correlation coefficient equals zero. On the contrary, if the firm with the highest r^2 (or R^2) for one-year ahead predictions also has the highest (lowest) r^2 (or R^2) for both its two- and three-year ahead predictions, and the firm with the second highest r^2 (or R^2) for one-year ahead predictions, also has the second highest (lowest) r^2 (or R^2) for both two- and three-year ahead predictions, and so on, for all 235 firms, the rank order correlation coefficient will equal one (minus one). That is, the rank order correlation coefficient can vary from minus one to positive one.

Table 6. Rank Order (Spearman Rho) Correlations for Simple and Multiple Regressions for One-, Two-, and Three-Year Ahead Forecasts of Income Tax Payments

	One-Year Compared to Two-Year Ahead Forecasts	One-Year Compared to Three-Year Ahead Forecasts	Two-Year Compared to Three-Year Ahead Forecasts
Panel A: Simple Regressions			
Rank order (Spearman) correlation coefficient	0.545	0.321	0.497
t-value	9.93	5.18	8.73
p-value	< .0001	< .0001	< .0001
Panel B: Multiple Regressions			
Rank order (Spearman) correlation coefficient	0.487	0.303	0.494
t-value	8.507	4.860	8.676
p-value	< .0001	< .0001	< .0001

Table 6 (see bottom of prior page) presents the rank order correlation coefficients just described, and their related *t*-values and *p*-values. These results are extremely significant. Therefore, we conclude that the accuracy with which a firm's one-year ahead income taxes payments can be forecasted is related to the accuracy with which the same firm's two- and three-year ahead income taxes payments can be forecasted. That is, a firm's forecast accuracy tends to be consistent across all three time horizons.

LIMITATIONS

The conclusions reported herein and summarized below are limited to the population of firms that are represented by the sample. Because our sample consists of firms for which the absolute value sum of deferred income tax expense was at least 25% of the absolute value sum of total income tax expense over the 20-year test period, we cannot generalize results to firms with smaller such ratios. Also, there are no firms from the Agriculture or Public Administration industries included in this sample and we do not generalize our results to these industries.

Additionally, we use a predictive model that, other than being based on time-series data rather than cross-sectional data, is similar to that employed by the two income tax prediction studies cited extensively herein. Conclusions from other predictive models might differ with respect to the ability of times-series income tax data to predict income tax payments.

SUMMARY OF CONCLUSIONS

Prior research, based on cross-sectional data, found that current and deferred income tax data are useful in forecasting income tax payments. This prior research suggested that inquiry into similar efforts employing time-series data would add to knowledge about the ability of forecasting income tax payments. This research addresses these issues suggested by the authors of these prior studies (Murdoch, Costa, & Krause; 1994 and Cheung, Krishnan, & Min; 1997).

We analyzed 235 firms over the 20-year period from 1994-2013 to improve knowledge regarding the ability of time-series accounting data to predict future income tax payments. Some of the conclusions supported by this research are:

1. Firm's time-series predictions are more accurate for shorter forecast horizons.
2. Deferred income tax expense can improve forecasts of income tax payments made by using only current income tax expense, for a substantial minority (approximately 40%) of firms.
3. Forecasts for firms that are more accurate (or inaccurate) for one-year ahead forecasts tend to be more accurate (or inaccurate) for that firm's two- and three-year ahead forecasts as well.

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REFERENCES

Barth, M. E., Cram, D.P., & Nelson, K.K. (2001). *Accruals and the prediction of future cash flows. The Accounting Review*, 76 (1) 27-58.

Cheung, J.K., Krishnan, G.V., & Min, C. (1997). *Does Interperiod Income Tax Allocation Enhance Prediction of Cash Flows? Accounting Horizons*, 11 (4) 1-15.

Financial Accounting Foundation. (2014) *Accounting Standards Codification*, Retrieved from: https://asc.fasb.org/glossary

Financial Accounting Standards Board. (1978). *Objectives of Financial Reporting by Business Enterprises*, Statement of Financial Accounting Concepts No. 1, Stamford, Conn: FASB.

Finger, C.A. (1994). *The Ability of Earnings to Predict Future Earnings and Cash Flows*. *Journal ofAccounting Research,* 32 (2) 210-223.

Greenberg, R.R., Johnson, G.L., & Ramesh, K. (1986). *Earnings Versus Cash Flow as a Predictor of Future Cash Flow Measures. Journal of Accounting, Auditing & Finance,* 1986, 1 (4) 266-277.

Murdoch, B., Costa M., & Krause, P. (1994). *An Empirical Investigation of the Usefulness of Deferred Income Taxes in Forecasting Income Tax Payments*. *Midwestern Journal of Business and Economics,* 8 (3) 21-40.

Sergeant, ESG. (2014). *Epitools epidemiological calculators. AusVet Animal Health Services and Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease*. Retrieved from: http://epitools.ausvet.com.au/content.php?page=CIProportion

Standard and Poor's Compustat. (2014). *Compustat North America Data Files, 1984-2013,* New York: Standard & Poor's.

Waldron, M., & Jordan, C. (2010). *The Comparative Predictive Abilities of Accrual Earnings and Cash Flows in Periods of Economic Turbulence: The Case of the IT Bubble. Journal of Applied Business Research,* 26 (1) 85-97.