Derivative financial instruments, tax aggressiveness and firm market value

Tao Zeng
School of Business and Economics, Wilfrid Laurier University, Waterloo, Canada

Abstract

Purpose – The purpose of this study is to examine the relationship of using derivative financial instruments, tax aggressiveness and firm market value.

Design/methodology/approach – This paper develops analytical models and designs an empirical study.

Findings – Using data from large Canadian public companies, this paper finds that a firm's realized losses or unrealized gains from using derivatives are negatively associated with its effective tax rate, and a firm's realized losses or unrealized gains from using derivatives are positively associated with its market value.

Research limitations/implications – This study simplifies the analytical model by separating the firm's intrinsic market value from the tax-timing option value. In a more general framework, the tax-timing option value could be subsumed in the firm's market value, and the firm's market value would be determined endogenously.

Originality/value – This study develops a framework to show how firms exploit the tax-timing option by using derivatives. It is the first study to conclude that a motive for firms to use derivatives is to exploit the tax-timing option.

Keywords Financial markets, Taxation, Financial economics, Financial institutions and services, Financial markets and institutions, Tax-timing option, Derivatives, Tax aggressiveness Unrealized gains, Realized losses, Firm market value

Paper type Research paper

1. Introduction

The past two decades have witnessed a dramatic increase in the use of derivatives. Academic studies have identified several motives that firms have for using derivatives: to hedge risks, to reduce financial distress costs and other agency costs, to be used as a signal of manager quality and to reduce the volatility of pre-tax income and thereby reduce tax liability (Aretz and Bartram, 2010; Adam and Fernando, 2006; Taylor, 2005; Graham and Rogers, 2002; Allayannis and Weston, 2001; Fok *et al.*, 1997; Geczy *et al.*, 1997; Graham, 1996; Berkman and Bradbury, 1996; Phillips, 1995; Nance *et al.*, 1993; Smith and Stulz, 1985; Stulz, 1984, to name a few). However, there are fewer studies that

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examine the association between derivatives and tax aggressiveness (Donohoe, 2012). As argued by Donohoe (2012), derivatives are an appealing way to avoid taxes because they can replicate economic situations, blur underlying economic substance and introduce ambiguity and complexity in tax reporting. This paper adds to the existing literature on derivatives by suggesting a reason not heretofore considered, that is, why using derivatives might be expected to enhance firm market value. The potential gain for using derivatives lies in a firm's tax circumstances.

This study first develops an analytical framework to show how firms can exploit tax-timing options by using derivatives. Using data from large Canadian public companies, this study finds that:

- a firm's realized losses or unrealized gains from using derivatives are negatively associated with its effective tax rate; and
- a firm's realized losses or unrealized gains from using derivatives are positively associated with its market value.

It is the first study to conclude that one motive that firms have for using derivatives is to exploit the tax-timing option.

The remainder of this paper is organized as follows. In Section 2, I summarize the relevant tax treatment of derivative financial instruments. In Section 3, I develop a theoretical framework based on the Lewellen and Mauer (1988) analysis to show that firms use derivatives to exploit the tax-timing option. A firm's valuation model is developed to show that a tax-timing option can increase firm market value. Hypotheses are also developed in Section 3. In Section 4, I specify the empirical analysis. I design the regression models, define the variables and describe the data collection. In Section 5, the testing results are presented. Finally, a summary and conclusion are provided in Section 6.

2. Tax rules on derivatives in Canada and literature review

The term, "derivatives", is used to describe a wide range of products, such as interest and currency swaps; equity index and commodity swaps and forwards; options on government bonds (domestic and foreign), commodities, equity indices and other underlying interests; warrant products; caps, collars, floors and forward rate agreements; and foreign exchange contracts. Nonetheless, the tax treatments of very few derivatives (such as employee stock options, options, etc.) are specifically provided for in the Income Tax Act. The tax treatment of remaining derivatives is, in the absence of specific rules, based on the general tax rules and the administrative pronouncements of the Canada Revenue Agency (Tennant, 2005; Edgar, 2000). These general tax rules involve two issues:

(1) the type or character of gains or losses from the transactions (is it ordinary income, capital gains or losses, interest, dividends?); and

(2) the timing of the recognition of these amounts.

In general, a derivative is treated as an independent transaction. It is characterized as a business income if it is acquired by a financial institution as part of the business of trading or if it is acquired for the purposes of producing a profit from speculation.

Characterization of other derivatives may also be linked to their underlying assets. For example, foreign exchange gains or losses will be characterized as either business income or capital gains or losses, based on the character of a related transaction. The gains or losses from forwards, futures and options on foreign currencies, shares or share price indexes are generally characterized as capital gains or losses, when these derivative instruments are used to hedge price changes associated with foreign currencies or with shares held as capital assets.

The timing of the recognition of the gains or losses on derivatives is based on the realization principle (Edgar, 2000). The realization principle requires that the gains or losses be recognized when the derivatives mature, are disposed of, sold or closed out. Gains or losses can only be recognized as they are actually realized. Accrued gains or losses are instead an unanticipated gains or losses that cannot be recognized until they are realized.

Tax treatment of derivatives differs substantially from their treatment under general accounting principles. According to the accounting policies, if a company uses derivative financial instruments to hedge its foreign currency, interest rate and commodity price risk (that is, all hedging relationships, risk management objectives, hedging strategies are formally documented and periodically assessed to ensure those changes in the value of these derivatives are highly effective in offsetting changes in the fair values, net investment or cash flows of the hedged exposures), all gains and losses (realized and unrealized, as applicable) on such derivatives are recognized in the same manner as gains and losses on the underlying exposure being hedged (matching principle). There is, however, no similar approach for tax purposes.

Tennant (2005) argues that one purpose of entering into derivatives is to postpone tax by deferring gains to a subsequent year or realizing losses in an earlier year; in other words, to exploit the tax-timing option. Without specific tax rules, income does not need to be recognized until the taxpayer disposes of, or sells, the derivatives. In the Supreme Court of Canada's decision of *The Queen* v. *Friedberg*, the taxpayer took a "spread" position in his trading of gold futures. For each year, the taxpayer actually closed out his losing position and recognized losses immediately. He deferred closing out positions that show profits and deferred recognizing gains until after his taxation year-end. The Supreme Court agreed with the taxpayer and indicated that the mark-to-market accounting method, which would have required the taxpayer to recognize unrealized income in the same year as the realized losses, was not appropriate for tax purposes.

Constantinides (1983, 1984) and Constantinides and Ingersoll (1984) show that, given that capital gains and losses are taxed when realized, optimal tax-trading behaviour in an environment of fluctuating securities prices involves deferring the realization of capital gains indefinitely to avoid paying taxes, while immediately realizing all capital losses to claim the associated tax deductions. The ability to implement such a strategy conveys to investors a valuable tax-timing option that can contribute significantly to the total value of an investment position in a security.

Lewellen and Mauer (1988) argue that the existence of the tax-timing option has given firms an incentive to create complex capital structures. Given two firms whose asset holdings and operating cash flows are identical, but one is levered and the other is not, fluctuations in the total market value of the unlevered firm will permit shareholders to exercise their timing option to take losses and defer gains. Corresponding fluctuations in the market value of the levered firm, however, will present investors in the aggregate

with additional timing opportunities, as long as the prices of the firm's constituent securities do not always change in the same direction. For that reason, the inclusion of debt and equity in a firm's capital structure should raise the total market value of the firm.

Recent evidence provides support to the argument that investors respond to this tax-timing option; for instance, Odean (1998) shows that investors are more likely to sell loss investments in December than in other months. Jin (2006) provides evidence that tax-sensitive investors defer selling stocks that have incurred large capital gains. Chay *et al.* (2006) examine a type of distribution that is taxed as capital gains, rather than as dividends. They find that the ex-day return behaviour reflects the value of tax-timing capital gains. Desai and Gentry (2003) examine how capital gains taxes affect a firm's decision on realizing capital gains. Their time-series analysis of aggregated corporate realization behaviour demonstrates that capital gains taxes are negatively associated with realized capital gains. Their firm-level analysis of realization behaviour finds similar results.

This study incorporates these arguments and develops a model to show how firms exploit the tax-timing options by using derivatives. Using data from large Canadian public companies, this study finds that a firm's realized losses or unrealized gains from using derivatives are negatively associated with its effective tax rate, and that a firm's realized losses or unrealized gains from using derivatives are positively associated with its market value. This is the first study to conclude that one motive for firms using derivatives is to exploit the tax-timing option.

In the next section, I describe a theoretical model to show that firms can exploit the tax-timing option by using derivatives.

3. Analytical framework and hypothesis development

3.1 The tax-timing option and tax aggressiveness

I examine a two-period case. To begin with, there are three assumptions:

(1) Capital market is perfect with zero transaction costs, no information asymmetries and zero bankruptcy costs.

(2) τ is the uniform corporate income tax rate, where $0 < \tau < 1$.

(3) Random end-of-period market value of the firm's asset M is normally distributed, i.e. $M \sim N(\bar{M}, \sigma^2)$.

Given assumption (3), the beginning-of-period market value of the asset is simply $\bar{M}$. To exploit tax-timing option value, firms will realize losses immediately, i.e. when $M \leq \bar{M}$, the tax-timing option is $\tau(\bar{M} - M)$; but will defer gains, i.e. when $M > \bar{M}$, there is no trading, and thus the tax-timing option value is 0. The aggregate one-period tax-timing payoff function for firms, therefore, is equal to τ times that of a put option with exercise price $\bar{M}$ on the random underlying asset value M. Accordingly, the total beginning-of-period firm market value is:

$$V = \bar{M} + E[(\tau)max\,(\bar{M} - M, 0)] \tag{1}$$

where $E[(\tau)max\,(\bar{M} - M, 0)]$ denotes expectation. By the assumption that market value is normally distributed, the firm's market value can also be presented as:

$$V = \bar{M} + (\tau)[f^*(0)]\,\sigma \tag{2}$$

where $f^*(0) = 1/\sqrt{2\pi}$ and σ is the standard deviation of M.

Similarly, suppose that the firm invests in two assets A and B, with the time t + 1 market values normally distributed, i.e. $M_A \sim N(\bar{M}, \sigma^2)$ and $M_B \sim N(\bar{M}_B, \sigma_B^2)$. Their aggregate market value at time t will be the sum of the values of each constituent assets, and (2) can be rewritten as:

$$V_{A+B} = \bar{M}_A + \bar{M}_B + \tau[f^*(0)](\sigma_A^2 + \sigma_B^2 + 2\rho_{AB}\,\sigma_A\,\sigma_B)^{\frac{1}{2}} \tag{3}$$

where ρ_{AB} is the coefficient of correlation between the value of the two assets.

If the firm can trade assets A and B separately with no concurrent change in the market value of either asset, the firm can exploit the tax-timing option value separately. With the separate trading available, the value of these assets to the firm, at time t, will be:

$$V_A = \bar{M}_A + \tau[f^*(0)]\sigma_A \tag{4}$$

$$V_B = \bar{M}_B + \tau[f^*(0)]\sigma_B \tag{5}$$

The tax-timing option value from the separate trading of the two assets can be measured by:

$$V_A + V_B - V_{A+B} = \tau[f^*(0)]\left[\sigma_A + \sigma_B - (\sigma_A^2 + \sigma_B^2 + 2\rho_{AB}\,\sigma_A\,\sigma_B)^{\frac{1}{2}}\right] \tag{6}$$

It is evident that the valuation gain is no less than 0, increasing in the tax rate τ and decreasing in ρ_{AB}. The more correlated the end-of-period values of the two assets are, the smaller the gain from investing in these two assets, and the less correlated the end-of-period values of these two assets are, the greater the gain. Extremely, when ρ_{AB}, the tax-timing option value is maximized.

Derivatives, by their nature, are generally used to hedge the price risk of their underlying assets. The changes in their values are opposed to those of underlying assets. If a firm invests in an underlying asset and holds a derivative security, which hedges the price risk of the underlying asset, the coefficient of correlation between the value of the derivative and the underlying asset will be negative, and the tax-timing option value is thus obtained. Hence, I specify the following conclusion:

> […] a firm will use derivative instruments to exploit the tax-timing option value when the coefficient of the value for the underlying asset and the derivatives, which hedge the price risk of the underlying asset, is negative. Thus, the firm will save on taxes.

A firm's tax aggressiveness or tax savings can be measured by its effective tax rate, as argued in existing studies on tax aggressiveness.

Hence, I generate the first hypothesis:

H1. A firm's net unrealized gains or net realized losses from using derivatives are negatively associated with its effective tax rate.

3.2 The tax-timing option and firm market value

The motive for firms' using derivatives to exploit tax-timing option value fits Constantinides and Scholes (1980) and Bossaerts and Dammon (1994), and implies that this tax-timing option would increase firm market value. Hence, firm market value could be expressed as the present value of future dividend payoffs and tax savings from using derivatives to exploit the tax-timing option.

When I separate the future cash flow on the stock of the firm into dividends and tax benefits resulting from optimal realization of capital losses and deferring capital gains, the firm market valuation function at date 0 could be expressed as:

$$P_0 = \sum_{j=t+1}^{\infty} Em(j,t)\left[d_j + \tau_c (RL_j + UG_j)\right] \tag{7}$$

Where $m(j,t)$ denotes the marginal rate of substitution between consumption at date j and data t;

d is the dividend payoff, τ_c is the corporate tax rate on capital gains, RL is the realized losses and UG is the unrealized capital gains from derivatives.

For a risk-neutral investor, the marginal rate of substitution of consumption is the inverse of riskless discount rate. Therefore, the firm's market value is expressed as:

$$P_t = \sum_{j=t+1}^{\infty} R_F^{-j} E\left[d_j + \tau_c (RL_j + URG_j)\right] \tag{8}$$

The formula is similar to the standard market valuation function (Bossaerts and Dammon, 1994), except that it includes the tax-timing option of realizing capital losses immediately but deferring capital gains. Hence, I generate the second hypothesis:

H2. A firm's net unrealized gains or net realized losses from using derivatives are positively associated with its market value.

4. Empirical analysis

4.1 Hypotheses and regression model

To test the first hypothesis on the association of the tax-timing option from using derivatives and tax aggressiveness, I design the following regression model:

$$ETR_{it} = \gamma_0 + \gamma_1 RL\,\&\,UG_{it} + \sum\nolimits_k \mu_k CONTROL_{it} + (Industry\ dummies) + \varepsilon_{it} \tag{9}$$

Where,

ETR_{it}: annual effective tax rate for firm i in year t.

$RL\,\&\,UG_{it}$: dummy variable, equal to 1 if there are net realized losses (i.e. realized losses net of realized gains), or net unrealized gains (i.e. unrealized gains minus unrealized losses) from derivatives, and 0 otherwise.

$CONTROL_{it}$: a set of control variables.

Annual *ETR*, defined as annual cash tax paid divided by pre-tax income, is generally used as proxy for tax aggressiveness, according to prior studies (Dyreng *et al.*, 2007).

The denominator is the pre-tax income shown on the firm's income statement instead of the taxable income calculated based on tax law. Taxable income is the taxpayer's tax base, on which income tax is taxed. Ideally, the measurement is calculated based on taxable income. However, taxable income is confidential, and this study, as have other studies, uses accounting income. The numerator is cash tax paid shown on firms' statements of change in cash flow. To have *ETR* within [0,1], I set *ETR* to be 0 when cash tax paid is negative (i.e. tax recovery) and set *ETR* to be 1 when it is higher than one. Under a sensitivity test, I delete all the observations with *ETR* outside [0,1]. The results do not change qualitatively.

Following previous studies on *ETR* (Stickney and McGee, 1982; Gupta and Newberry, 1997; Adhikari *et al.*, 2006; Dyreng *et al.*, 2007, to name a few), I choose six control variables that are known to influence ETRs:

- firm size (*SIZE*), measured as log of total assets;
- leverage (*LEV*), measured as the sum of short- and long-term debts over total assets;
- capital intensity (*FIX*), the ratio of fixed assets to total assets;
- inventory intensity (*INV*), the ratio of inventory to total assets; return on assets (*ROA*), measured as profit over total assets; and
- market to book ratio (*MB*), measured as shareholders' equity over market value.

Market value is equal to the year-end share price multiplied by the number of shares outstanding at the end of the year. Industry dummies are included to control for potential industry fixed effects. *H1* predicts $\gamma_1 < 0$.

The second hypothesis is on the association of the tax-timing option from using derivatives and firm market value. Based on Ohlson's (1995) residual model, firm market value can be expressed as book value and earnings. Therefore, I design the following regression model:

$$VAL_{it} = \beta_0 + \beta_1 RL\,\&\,UG_{it} + \beta_2 BOOK_{it} + \beta_3 ROA_{it} + \varepsilon_{it} \quad (10)$$

Where:

VAL_{it}: share price at the end of the year.

$RL\,\&\,UG_{it}$: dummy variable, equal to 1 if there are net realized losses (i.e. realized losses are more than realized gains), or net unrealized gains (i.e. unrealized gains minus unrealized losses is positive) from derivatives, and 0 otherwise.

$BOOK_{it}$: shareholders' equity, deflated by total assets.

ROA_{it}: net income over total assets (return on assets).

H2 predicts $\beta_1 > 0$.

Model 9 is tested using Tobit regression, and model 10 is tested using ordinary least squares regression.

4.2 Data collection and variable definition

The data is obtained from the System for Electronic Document Analysis and Retrieval (SEDAR)[1]. Firms in the sample meet the following two conditions:\

(1) they are Canadian non-financial public companies (they are not income trusts or other types of organizations) on TSX60; and

(2) the firms' audited annual financial statements for any year from 2007 to 2011 are available on SEDAR.

There are 233 firm-year observations from three industries. When I test *H1* under regression model 10, I further delete 10 observations with negative pre-tax income, as the measurement of the effective tax rate is not meaningful for negative pre-tax income (see Table I for a sample selection).

The first condition allows this study to concentrate on large firms, which are more likely to use derivatives. Nelson *et al.* (2005) find that, from 1995 to 1999, 21.6 per cent of publicly traded companies used derivatives instruments, and the use of derivatives was concentrated in larger companies. The second condition is necessary for computing net unrealized gains and realized losses from derivatives, tax paid, total assets, earnings, shareholders' equity and other relevant accounting data.

The use of derivatives and the associated realized/unrealized gains/losses are disclosed in the footnotes of the firms' financial statements. The footnotes of financial instruments show details of how firm uses derivatives. The derivatives normally used by a firm can be classified into three broader classes:

(1) foreign currency exchange derivatives (such as foreign exchange forwards and options);

(2) interest rate derivatives (such as interest rate swaps); and

(3) commodity derivatives (such as commodity contracts and futures).

The footnotes generally disclose the notional value, fair vale and carrying value of each derivative used by a firm. Footnotes also disclose the unrealized gains/losses from the change of the market value (fair value) of the derivatives. In addition, footnotes disclose the realized gains or losses when the derivatives are mature, expired or settled. I further review the footnotes of significant accounting policies, risk management, commitments and contingencies and so on for additional information on how a firm uses derivatives.

In addition, industry dummy variables (there are mainly three industries, energy, materials and consumer discretionary and staples) are added to control for differences across industries and for other omitted variables.

TSX60	310
Less: Financial firms	(50)
Less: Income trusts	(25)
Less: Audited financial statements not available on SEDAR	*(2)*
	233
Less: negative pre-tax income	*(10)*
Sample observations	223

Table I.
Sample selection

5. Empirical results

5.1 Testing results

The main results are presented in Tables II to V. Table II presents the descriptive statistics of the dependent and independent variables. It shows the mean, first quartile, median, third quartile, standard deviation, minimum and maximum value. For example, the mean of *RL & UG* is 0.516, which implies that a bit more than half of the firms have net realized losses or unrealized gains or both from using derivatives. The mean of *ETR* is 0.223. It implies that the average effective tax rate is about 22 per cent, which is less than the statutory tax rate of 30 per cent.

Table III presents the Pearson correlation matrix of dependent and independent variables. The maximum absolute value of the correlation is 0.798, between *BOOK* and *LEV*. The minimum absolute value of the correlation is 0.01, between *VAL* and *INV*. The correlation between *ETR* and *RL & UG* is −0.172, which provides a preliminary support of *H1*. The correlation between *VAL* and *RL & UG* is 0.154, which provides a preliminary support of *H2*.

Table IV presents the results from regression model 9 on the association between *ETR* and *RL & UG*. The coefficient on the realized losses or unrealized gains (*RL & UG*) from the use of derivatives is negative and significant at 0.01 level, which supports *H1* to the extent that a firm's tax-timing option (i.e. realizing losses but deferring gains) is negatively associated with its effective tax rate. The coefficient on *RL & UG* is −0.074, suggesting that firms with a tax-timing option have an *ETR* that is 7.4 per cent lower than firms without such an option.

Some control variables are also relevant. For example, Table IV shows that *LEV* is negative and significant, suggesting that tax deduction of interest expenses from debt

Variables	Mean	1st quartile	Median	3rd quartile	*SD*	Maximum	Minimum
ETR	0.223	0.105	0.204	0.298	0.185	1	0
RL & UG	0.516	0	1	1	0.501	1	0
SIZE	4.017	3.727	4.126	4.359	0.476	4.874	2.201
LEV	0.202	0.078	0.192	0.312	0.142	0.547	0
INV	0.063	0.011	0.036	0.082	0.078	0.345	0
FIX	0.477	0.275	0.49	0.725	0.28	0.939	0
ROA	0.075	0.038	0.06	0.089	0.054	0.341	−0.005
MB	2.629	1.476	2.103	3.084	2.226	25.29	0.264
BOOK	0.502	0.366	0.488	0.644	0.184	0.924	0.028
VAL	35.86	21.33	34.6	45.1	19.02	112.6	3.52

Notes: The sample contains 223 observations for the years of 2007 to 2011; *ETR*: effective tax rate, measures as cash tax paid over pre-tax income; *RL & UG*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains), or net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *SIZE*: firm size, measured as log of total assets; *LEV*: leverage, measured as the sum of short and long term debts over total assets; *FIX*: capital intensity, the ratio of fixed assets to total assets; *INV*: inventory intensity, the ratio of inventory to total assets; *ROA*: return on assets, measured as profit over total assets; *MB*: market to book ratio, measured as shareholders' equity over market value. Market value is equal to year-end share price multiplied by number of shares outstanding at the end of the year; *BOOK*: book value, measured as shareholders' equity deflated by total assets; *VAL*: share price at the fiscal year end

Table II.
Descriptive statistics of dependent and independent variables

Variables	*ETR*	*RL & UG*	*SIZE*	*LEV*	*INV*	*FIX*	*ROA*	*MB*	*BOOK*	*VAL*
ETR	1									
RL & UG	−0.172	1								
SIZE	−0.014	0.262	1							
LEV	−0.202	0.187	0.443	1						
INV	0.085	0.052	−0.224	−0.209	1					
FIX	−0.035	0.144	0.363	0.14	−0.316	1				
ROA	−0.081	−0.05	−0.272	−0.362	0.119	−0.054	1			
MB	−0.029	−0.038	−0.237	−0.171	0.166	−0.134	0.369	1		
BOOK	0.083	−0.101	−0.53	−0.798	0.017	−0.116	0.37	0.067	1	
VAL	−0.022	0.154	0.165	0.07	0.01	0.081	0.169	0.268	−0.021	1

Notes: The sample contains 223 observations for the years of 2007 to 2011. Table II shows the pearson correlations of the dependent and independent variables; *ETR*: effective tax rate, measures as cash tax paid over pre-tax income; *RL & UG*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains), or net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *SIZE*: firm size, measured as log of total assets; *LEV*: leverage, measured as the sum of short and long term debts over total assets; *FIX*: capital intensity, the ratio of fixed assets to total assets; *INV*: inventory intensity, the ratio of inventory to total assets; *ROA*: return on assets, measured as profit over total assets; *MB*: market to book ratio, measured as shareholders' equity over market value. Market value is equal to year-end share price multiplied by number of shares outstanding at the end of the year; *BOOK*: book value, measured as shareholders' equity deflated by total assets; *VAL*: share price at the fiscal year end

Table III.
Pearson correlation matrix of dependent and independent variables

Parameter	Estimate value	*SD*	*t* student	*P* (> t)
Intercept	0.082	0.144	0.57	0.571
RL & UG	−0.074	0.028	−2.62***	0.009
SIZE	0.056	0.037	1.54	0.126
LEV	−0.326	0.12	−2.73***	0.007
INV	0.112	0.198	0.56	0.573
FIX	−0.024	0.058	−0.41	0.681
ROA	−0.479	0.273	−1.76*	0.08
MB	0.0002	0.006	0.04	0.97
Log likelihood	21.21			
Obs	223			

Notes: Regression model: $ETR_{it} = \gamma_0 + \gamma_1 RL\,\&\,UG_{it} + \Sigma_k \mu_k CONTROL_{it} +$ (*Industry dummies*) + ε_{it} ***significant at 0.01 level; **significant at 0.05 level and *significant at 0.1 level based on two-tailed *t*-test; *RL & UG*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains), or net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *SIZE*: firm size, measured as log of total assets; *LEV*: leverage, measured as the sum of short and long term debts over total assets; *FIX*: capital intensity, the ratio of fixed assets to total assets; *INV*: inventory intensity, the ratio of inventory to total assets; *ROA*: return on assets, measured as profit over total assets; *MB*: market to book ratio, measured as shareholders' equity over market value. Market value is equal to year-end share price multiplied by number of shares outstanding at the end of the year

Table IV.
Results from regression on the association between tax-timing option and tax aggressiveness

Parameter	Estimate value	*SD*	*t* student	*P* (> t)
Intercept	31.595	4.007	7.886	1.47E-13
RL & UG	5.913	2.501	2.365**	0.019
BOOK	−8.481	7.323	−1.158	0.248
ROA	72.939	24.799	2.941***	0.004
Residual St dev	18.564			
R2	0.061			
R2(adj)	0.048			
F	4.72			
Prob (> F)	0.003			

Table V.
Results from regression on the association between tax-timing option and firm market value

Notes: Regression model: $VAL_{it} = \beta_0 + \beta_1 RL\ \&\ UG_{it} + \beta_2 BOOK_{it} + \beta_3 ROA_{it} + \varepsilon_i$ ***significant at 0.01 level; **significant at 0.05 level and *significant at 0.1 level based on two-tailed *t*-test; *RL & UG*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains), or net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *BOOK*: book value, measured as shareholders' equity deflated by total assets; *ROA*: return on assets, measured as profit over total assets

financing reduce tax liability. This finding is consistent with the finings from prior studies including Stickney and McGee (1982), Porcano (1986) and Zeng (2010, 2011). The coefficient in *ROA* is negative, which is consistent with Dyreng *et al.* (2007), Zeng (2010, 2011).

Table V presents the results from regression model 10 on the association between *VAL* and *RL & UG*. The coefficient on the realized losses or unrealized gains (*RL & UG*) from the use of derivatives is positive and significant at the 0.01 level, which supports *H2* to the extent that a firm's tax-timing option (i.e. realizing losses but deferring gains) enhances its market value. The coefficient on *RL & UG* is 5.913, suggesting that firms using a tax-timing option enhance their market value by $5.913, as opposed to firms without such an option.

Consistent with Ohlson (1995), the coefficient on *ROA* is positive, suggesting that profitability is positively associated with a firm's market value.

5.2 Robust tests

First, I measure effective tax rate as tax payable over pre-tax income, which is called Generally Accepted Accounting Principles (GAAP) measurement. Tax payable includes both current and future tax payable, and can be collected on income statement. The results do not change qualitatively.

Second, I measure realized losses and unrealized gains as the sum of the actual amount of realized losses (absolute value) and the unrealized gains, deflated by revenue (to control for size effect). The results do not change qualitatively.

Third, I delete 17 observations with *ETR* outside [0,1]. The results do not change qualitatively.

Finally, I add year dummy variable to the market valuation model to control for potential year effects since the global economy slowed down in 2008 due to the US financial crisis. The results do not change qualitatively.

5.3 Supplementary tests

To further investigate whether realized losses or unrealized gains, or both, contribute to tax savings and firm market value, I separate *RL & UG* into the two variables *RL* and *UG* in regression models 9 and 10. The results are presented in Tables VI and VII, which show that unrealized gains significantly contribute to tax savings and increase firm market value. On the other hand, realized losses also contribute to tax savings and increase the firm's market value. However, the results are not statistically significant. One reason why realized losses are not significant is that some firms do not provide data about realized losses from derivatives. Those firms generally combine realized losses with other expenses; for example, some firms combine losses from interest rate swaps with interest expenses.

6. Summary and conclusion

While it is well-known that firms use derivative financial instruments to manage risk and to reduce agency costs and other transaction costs, this study shows that firms also use these financial instruments for saving taxes and hence enhancing their market value.

In this paper, an analytical framework is developed to show that firms can exploit the tax-timing option (i.e. realizing losses immediately but deferring gains indefinitely) through the use of derivatives. This paper also develops a modified firm valuation model showing that the tax-timing option increases firm market value.

Meanwhile, this paper provides empirical tests, which generally support the theoretical conclusion. The empirical tests using data from large Canadian public companies show that a firm's realized losses or unrealized gains from using derivatives

Parameter	Estimate value	*SD*	*t* student	*P* (> t)
Intercept	0.089	0.145	0.62	0.538
RL	−0.025	0.031	−0.83	0.409
UG	−0.060	0.029	−2.06**	0.041
SIZE	0.054	0.037	1.46	0.145
LEV	−0.333	0.12	−2.78***	0.006
INV	0.054	0.202	0.27	0.791
FIX	−0.025	0.058	−0.43	0.671
ROA	−0.478	0.274	−1.75*	0.082
MB	0.000	0.006	0.01	0.992
Log likelihood	20.55			
Obs	223			

Notes: ***significant at 0.01 level; **significant at 0.05 level and *significant at 0.1 level based on two-tailed *t*-test; *RL*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains) from derivatives, and 0 otherwise; *UG*: dummy variable, equal to 1 if there are net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *SIZE*: firm size, measured as log of total assets; *LEV*: leverage, measured as the sum of short and long term debts over total assets; *FIX*: capital intensity, the ratio of fixed assets to total assets; *INV*: inventory intensity, the ratio of inventory to total assets; *ROA*: return on assets, measured as profit over total assets; *MB*: market to book ratio, measured as shareholders' equity over market value. Market value is equal to year-end share price multiplied by number of shares outstanding at the end of the year

Table VI.
Results from regression on the association between tax-timing option and tax aggressiveness

Parameter	Estimate value	*SD*	*t* student	*P* (> t)
Intercept	31.147	3.949	7.887	1.48E-13
BOOK	−8.639	7.309	−1.182	0.238
ROA	75.13	24.69	3.043***	0.003
RL	3.596	2.829	1.271	0.205
UG	6.329	2.587	2.447**	0.015
Residual St dev	18.469			
R2	0.075			
R2(adj)	0.058			
F	4.392			
Obs	223			

Table VII.
Results from regression on the association between tax-timing option and firm market value

Notes: *** significant at 0.01 level; ** significant at 0.05 level and * significant at 0.1 level based on two-tailed *t*-test; *RL & UG*: dummy variable, equal to 1 if there are net realized losses (i.e., realized losses net of realized gains), or net unrealized gains (i.e., unrealized gains minus unrealized losses) from derivatives, and 0 otherwise; *BOOK*: book value, measured as shareholders' equity deflated by total assets; *ROA*: return on assets, measured as profit over total assets

are negatively associated with its effective tax rate. It also shows that a firm's realized losses or unrealized gains from using derivatives are positively associated with its market value.

This study is of interest to policy makers, corporate managements and academics who wish to examine corporate income tax burdens and factors associated with tax rates. Given the fact that the use of derivatives by a firm has attracted attention from academics, businesses, governments and other bodies, future studies could be conducted to explore the reason why the use of derivatives differs considerably across firms and why some firms use derivatives to save taxes but others do not.

However, this study simplifies the model by separating a firm's intrinsic market value from the tax-timing option value. In a more general framework, the tax-timing option value should be subsumed in the firm's market value, and the firm's market value should be determined endogenously.

Note

1. SEDAR is the system used for electronically filing most securities-related information with the Canadian securities regulatory authorities. Filing with SEDAR started on 1 January 1997, and is now mandatory for most reporting issues in Canada. The SEDAR system allows users to access public company and mutual fund securities-related information (e.g. annual financial reports).

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About the author

Tao Zeng is an associate professor and Certified General Accountants (CGA). She obtained her PhD degree at Queen's University in 2001. She has many publications in academic journals including *Canadian Tax Journal, Asian Review of Accounting, Accounting Perspective*, etc. She is an Academic Editor of *British Journal of Economics, Management and Trade*. She is on Editorial Board of *Journal of Economic and Administrative Sciences* and *Journal of Financial Studies and Research*. Tao Zeng can be contacted at: tzeng@wlu.ca