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An event analysis of industrial timberland sales on shareholder values of major U.S. forest products firms ☆

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ABSTRACT

We used an event study to investigate the impact of industrial timberland sales from 1997 to 2007 on shareholder values of major U.S. forest products firms. Cross-sectional regression analysis and Capital Asset Pricing Model were used to examine factors influencing changes in market capitalization and systematic risk before and afterward. The average cumulative abnormal rates of returns associated with the timberland sales were found to be positive for all firms, and the resulting change in capitalization was related to these firms' total asset and debt. The systematic risk for these firms changed little or increased slightly after the timberland sales.

1. Introduction

Forest products firms collectively owned some 70 million acres or 14% of timberland in the United States in the 1980s that contributed nearly 30% of timber supply in the country (Waddell et al., 1989). This industrial timberland ties large amounts of capital (Jones and Ohlmann, 2008). As timberland became an established class of investment asset in the last decades, these firms have gradually divested their timberland. Most of the industrial timberland was sold to institutional investors who either hire Timberland Investment Management Organizations (TIMOs) to manage their lands or directly put their lands in Real Estate Investment Trusts (REITs). Between 1996 and 2009, some $28 billion of industrial timberland was sold, and $25.8 billion of them went to institutional investors (Fig. 1).

This change of industrial timberland ownership may be related to forest products firms' need to raise capital to pay off their debt incurred from mergers and acquisitions, the institutional investors' desire for portfolio diversification, and the tax advantage of institutional timberland ownership over industrial timberland ownership (Binkley, 2007). Originally, forest products firms acquired timberland to control the supply of raw materials for their manufacturing plants. As focus of these firms was on manufacturing, it is argued that they might not be able to capture the true value of their timberlands for shareholders. Further, these firms as a group was underperform the market. For example, stockholder returns over the 10-year period from 1995 to 2005 averaged 6.2% for the “Forestry and Paper Group” as compared to 12.1% for the S&P 500 (Clutter et al., 2007). To enhance returns, these firms started to merge and acquire each other, which resulted in significant debt. To pay off debt, they began restructuring timberlands into separate holdings or divesting timberlands. This perhaps explains the supply side of industrial timberland sales in the last two decades. However, it is unclear, empirically, if industrial timberland sales indeed increased shareholder values and if industrial timberland sales have any long-term impacts on these firms' ability to raise capital.

The purpose of this paper is to investigate whether industrial timberland sales have increased the shareholder values in the short term and potentially changed the systematic risk of forest products firms in the long run. A few studies have looked at the impact of industrial timberland ownership restructuring (Zinkhan, 1988) and public policy changes (Zhang and Binkley, 1995; Boardman et al., 1997; Binkley and Zhang, 1998). Other forestry studies use event analysis to examine mergers and acquisitions (Mei and Sun, 2008), and forest products trade dispute (Zhang and Hussain, 2004). This study differs from other investigations insofar as it looks into the short-term benefits (an increase in shareholder value) as well as possible long-term costs (an increase in the systematic risk) for U.S. forest products firms which have conducted major industrial timberland sales in the last decade. Our results show that industrial timberland sales bring short-term benefits, but do not increase the long-term costs for forest products firms.

2. Methodology

Event analysis provides evidence of market efficiency following an event in capital market research (Brown and Warner, 1980; Fama,

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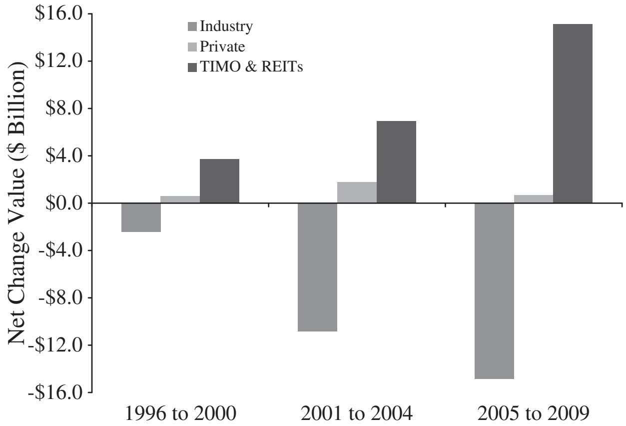

Fig. 1. Net change of timberland value in different ownership types during three phases. Source: R&A Investment Forestry (2010).

1991). It is based on the assumption that an abnormal return will occur if new information (an event) communicated to the market is useful. The methodology implicitly assumes that the event is exogenous with respect to the change in a firm's market rate of return (Rucker et al., 2005). By assuming that capital markets are sufficiently efficient to evaluate the impact of the event on expected future profits of forest products firms, we measure an abnormal rate of return to evaluate the impact of industrial timberland sale events, both announcements and actual sales, on shareholder values.

2.1. Event analysis

In this study, we use the market model that relates the rate of return of a given forest products firm to the overall market rate of return. Fig. 2 shows the time line associated with an event. Rate of return is indexed in event time as τ. Defining $\tau=0$ as the event date, $\tau=T_0$ to $\tau=T_1-1$ constitutes the estimation window that generally ends before the event, $\tau=T_1$ to $\tau=T_2$ represents the event window, and $\tau=T_2+1$ to $\tau=T_3$ represents the post-event window. Correspondingly, $L_1=T_1-T_0$, $L_2=T_2-T_1+1$, and $L_3=T_3-T_2$ define the length of the estimation window, the event window, and the post-event window respectively. Often, an event study is conducted using the five steps (MacKinlay, 1997) described below.

2.1.1. Identifying events and defining event window

A few methods have been developed to identify specific width of event window. Here, a Chow test is used to determine the presence of structural break, where the estimated coefficient shows if there are different impacts between event days and nonevent days (Greene, 2003). When this structural break corresponds to a discrete event, the Chow test is useful to investigate the variability of the rate of return surrounding an event. Unlike regulatory changes, there are no firm-to-firm correlations among industrial timberland sale events. Therefore, we could simultaneously conduct a Chow test along the time line for all timber sale events.

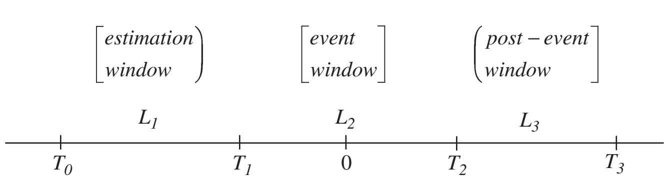

Fig. 2. Estimation, event, and post-event window on a timeline.

The Chow test is a common application of F test mathematically expressed as follows:

$$F = \frac{SSE_{all}-(SSE_{event}+SSE_{nonevent})}{df(n)} \Big/ \frac{SSE_{event}+SSE_{nonevent}}{df(d)} \quad (1)$$

where SSE_{all}, SSE_{event}, and $SSE_{nonevent}$ are the estimated sum of squared errors on pooled nonevent and event days, event days, and nonevent days, respectively; $df(n)$ and $df(d)$ are the numerator and denominator degrees of freedom, respectively. Consequently, alternative event windows are selected based on Chow test in this study: $[T_1, T_2]$.

To obtain efficient estimates, the estimation window (L_1) should be sufficiently long so that it is free from any effects related to the event of interest (MacKinlay, 1997). We chose L_1 to be approximately 80 trading days prior to L_2 to reduce the impact of announcement events on parameter estimates of the sale events for specific forest products firms.[1] Finally, the post-event window (L_3) covering 100 and 150 days after L_2 is only used in risk analysis.

2.1.2. Estimating the parameters of the market model

A linear relationship is specified between the return rate of an individual firm (R_{it}) and the return rate of market portfolio each day (R_{mt}) (Campbell et al., 1997). It is assumed that asset rates of return are jointly normal and independently and identically distributed through time. Mathematically, this is expressed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \mu_{it}, \quad (2)$$

where $R_{it}$is the rate of return for firm i on date t, calculated as ln $[(P_{it}+DIV_{it})/P_{i\ t-1}]$ with P_{it} equal to the ith firm close price on date t, $P_{i\ t-1}$ to ith firm close price on date $t-1$, and DIV_{it} to ith firm dividend on date t; R_{mt} is the rate of return on a value-weighted portfolio of all firms; μ_{it} is a random disturbance term, assumed to be normally distributed as $N(0, 1)$; α_i and β_i are parameters to be estimated.

Generally, consistent estimators for the market-model parameters are obtained using ordinary least squares (OLS) procedures (Campbell et al., 1997). Given $E[\mu_i]=0$ and $Var[\mu_i]=\sigma_i^2$, OLS is efficient (Greene, 2003).

2.1.3. Predicting a normal return rate in the event window

Once the parameters in Eq. (2) are estimated, a normal return rate over L_2 can be predicted using

$$\hat{R}_i = X^*_i \hat{\theta}_i \quad (3)$$

where X^*_i is a matrix with a vector of ones in the first column and the vector of market rates of return R^*_m over the event window in the second column and $\hat{\theta}_i = \left[\hat{\alpha}_i \ \hat{\beta}_i\right]'$ is the(2×1) parameter estimate vector.

2.1.4. Calculating the abnormal return rate over the event window

Using measured normal rate of return from Eq. (3), the abnormal rate of return defined as the difference between the actual and normal rate of return can be measured as:

$$\hat{\mu}^*_i = R^*_i - \hat{R}_i = R^*_i - X^*_i \hat{\theta}_i \quad (4)$$

where R^*_i is a vector of actual rates of return over L_2 for firm i. Conditional on the market rate of return over L_2, the abnormal rate of

[1] There is little agreement in the literature regarding when the event window should start and how long the estimation period should last. Therefore, four trial estimation periods were used in preliminary test: 100 days, 150 days, 200 days, and 250 days before event window. Although the results from these four trial periods did not significantly differ from the result from 80 days, the magnitude of t value increases a little for cumulative abnormal rate of return of sale event when estimation period increases.

return is jointly distributed with a zero conditional mean and conditional variance with two parts. The first part is the variance due to the disturbances and the second part is the additional variance due to the sampling error in $\hat{\theta}_i$. As L_1 increases, the second term will approach zero. Hence, the expectation value of abnormal return rate across time is unbiased and asymptotically independent (Campbell et al., 1997).

2.1.5. Aggregating the abnormal rate of return and testing for statistical significance

As the abnormal rate of return is the actual return rate of an individual firm minus the rate of return that would be expected if the event did not take place, a nonzero significant abnormal security return rate would suggest that an event influenced the financial performance of individual firm over L_2. The sum of abnormal rates of return (CAR_i) is used to estimate the performance of $\overline{AR}_{L_2}$ (aggregated abnormal rate of return across all events) over a given L_2 (the length of the event window). The CAR_i starting at time T_1 through time T_2 for an individual firm i can be defined as:

$$CAR_i(T_1,\ T_2) = \sum_{T_1}^{T_2} \hat{\mu}^*_i; \tag{5a}$$

$$Var[CAR_i(T_1, T_2)] = \sigma^2(T_1, T_2) = L_2\sigma^2_{\mu_i} \tag{5b}$$

where CAR_i is normally distributed with mean 0 and variance $\sigma^2(T_1, T_2)$,

$$CAR_i \sim N\left(0,\ \sigma^2(T_1,\ T_2)\right). \tag{5c}$$

If the event did not influence the rate of return for an individual firm, the expected value of CAR_i (Eq. (5a)) should be zero, which implies H_0:$CAR_i = 0$(MacKinlay, 1997). Eq. (5b) suggests that the longer L_2, the higher the variance of CAR_i.

An individual firm's abnormal rates of return can be aggregated using Eq. (5a) for each L_2. Aggregating all abnormal rates of return over L_2 across all relevant events allows us to test if the aggregated abnormal rate of return $\overline{AR}_{L_2}$ over L_2 is equal to zero. Assuming there are no firm-to-firm correlations among all N individual events, the aggregated abnormal rate of return for L_2 is given by:

$$\overline{AR}_{L2} = \frac{\sum_{i=1}^{N} CAR_i}{N}. \tag{5d}$$

Its variance can be expressed as:

$$Var(\overline{AR}_{L2}) = \frac{\sum_{i=1}^{N} Var[CAR_i(T_1,\ T_2)]}{N^2}. \tag{5e}$$

Since CAR_i is normally distributed with mean 0, it follows that $\overline{AR}_{L_2}$ is normally distributed and we can test the null hypothesis H_0:$\overline{AR}_{L2} = 0$. A standard t-test can be used to detect the presence of abnormal performance:

$$t = \frac{\overline{AR}_{L2}}{\sqrt{Var\left(\overline{AR}_{L2}\right)}}. \tag{5f}$$

The t-statistic tests the effect of major industrial timberland sales on shareholder wealth of forest products firms.

2.2. Capitalization analysis

The change in a firm's shareholder wealth due to industrial timberland sales is often associated with its financial characteristics (Mei and Sun, 2008). We used a cross-sectional regression to analyze the market impact of abnormal rate of return and the characteristics of forest products firms. Our regression equation is

$$AC_{iL_2} = \kappa_0 + \kappa_1 TIME_i + \kappa_2 TA_i + \kappa_3 TD_i + \varepsilon_i \tag{6}$$

where AC_{iL_2} is the average change in market capitalization per acre of timber sale in dollar for firm i over event window L_2, calculated as $\frac{CAR_{iL_2} \times SHARE_{iL_2} \times P_{i0}}{SIZE_i}$ where CAR_{iL_2} is the sum of abnormal rates of return for firm i over event window L_2, $SHARE_{iL_2}$ is firm i's number of outstanding shares over event window L_2, P_{i0} is the average closing firm price for 10 days prior to firm i's event window, and $SIZE_i$ is firm i's total acreage of transaction land for sale; ε_i is a disturbance term with mean zero; κ's are parameters to be estimated. $TIME$ is the interval length in years between the event year and 1996 (e.g., $TIME = 1$ for 1997 and 11 for 2007). TA_i is firm i's total asset, a measure of firm size and TD_i is total debt, both in million dollars.

2.3. Risk analysis

In this study we use the Capital Asset Pricing Model (CAPM) to study the possible long-term cost associated with industrial timberland sales. The application of CAPM implies that the expected rates of return of an event must be linearly related to the covariance of return rates of market portfolio (Jensen, 1969). The mathematic expression of CAPM can be represented as:

$$R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \mu_{it} \tag{7a}$$

where R_{it} and R_{mt} are the realized rates of return on date t for firm i and the market portfolio m; R_{ft} is the rate of return on a risk-free asset on date t; μ_{it} is an error term that is normally and independently distributed with mean zero and constant variance; β_i is firm i's beta representing systematic risk. β_i is a well-known measure of systematic risk for firm i, whose rise and fall often influence the long-term cost of capital for firm i.

In this study, it is useful to compare the statistical estimates of beta values before and after industrial timberland sales for any given forest products firm. Thus, a dummy variable is introduced into Eq. (7a):

$$R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \gamma_i D_i\left(R_{mt} - R_{ft}\right) + \mu_{it} \tag{7b}$$

where D_i is set equal to 0 for the days before the sale events and 1 otherwise; γ_i is the parameter for the interaction term, capturing the difference in the systematic risk for a firm i after industrial timberland sale events. Should the systematic risk of a forest products firm rise after it sells its timberlands, the cost of capital for the firm is likely to rise in the future. Thus, an increase in beta values after the timberland sales indicates a likely increase in the long-term cost for the firm.

3. Data

In this study, the events of interest were major industrial timberland sales of more than \$100 million from 1997 to 2007. Industrial timberland sales were collected from online newspaper databases (e.g., LexisNexis Academic), major daily news outlets (e.g., New York Times, Wall Street Journal), and news releases from major forest products firms. For each event, there were six items collected: seller, buyer, event date, sale price in billion dollars, transaction land size in million acres, and a brief event description. The date of each event was based on the date of announcement by forest products firms, i.e., the first day the announcement appeared in the newspapers or company homepages.

For the event and risk regression analysis, daily historical closing prices on a firm were obtained from *Center for Research in Security Prices* (CRSP) and dividends were obtained from CRSP Distribution Array, indicating ordinary cash dividends, splits, and exchanges. Dividends were based on the record date, on which shareholders must register as holders of records on the firm transfer record of the firm in order to receive a particular distribution directly from the firm (Center for Research in Security Prices, 2007). A value-weighted market portfolio index (NYSE + NASDAQ + AMEX) including dividend distribution was collected from CRSP database.

For the capitalization regression, the numbers of shares outstanding for each firm were obtained from CRSP. Total asset (*TA*) and total debt (*TD*) of each firm at fiscal year-end preceding industrial timberland sales were collected from the financial database COMPUSTAT. Finally, for the risk analysis, the risk-free rate of return was measured by the secondary market rate of 3 month U.S. T-bills (Federal Reserve Bank, 2006).

4. Results

We found 32 large (more than $100 million) industrial timberland sale events (Table 1). Eleven firms (i.e., Boise Cascade Corp., Georgia Pacific Corp., International Paper Co., Kimberly Clark Corp., Louisiana Pacific Corp., Meadwestvaco Corp., Potlatch Corp., Smurfit Stone Container Corp., Temple Inland Inc., Weyerhaeuser Co., and Willamette Industries Inc.) were included in eleven announcement events of industrial timberland sales and twenty-one sale events. Sale prices varied from $101 million to $5 billion and transaction land size ranged from 0.1 million acres to 6.8 million acres. The average time elapsed between the announcement and actual sale was 8.5 month. The publicly-traded shares of all firms included in this study were highly liquid.

The Chow test statistics for different event widths are presented in Table 2. For all the announcement and sale events as a group, the variation of abnormal rates of return was largest for the event period that covered the day of the event and one day after the event ($F = 6.42$, $p = 0.002$). The Chow tests show that all event windows that included the event day and up to 4 days after the day of the event (i.e., a 5-day event window) were significant. However, as the event window widened, the F value gradually decreased. The Chow test statistic was insignificant in other windows. For sale events, the Chow test statistics for testing the structural break was largest for event day plus one day after the event day (i.e., a 2-day event window) and also significant in a 3-day window (0, 2). Similarly, for the announcement events, the Chow test statistics was largest and significant at the 10% significance level only for a 2-day (0, 1) event window.

Therefore, a 2-day (0, 1) event window was selected for all three groups of events. Nonetheless, we report, in Table 3, the aggregated abnormal rates of return for each event group in three windows, (0, 1), (0, 2), and (0, 3). For all the 32 events as a group, the aggregated abnormal rates of returns were significant at the 1% and ranged from 1.46% to 1.78%, with an average of 1.59%. For the 21 sale event group, the average cumulative abnormal rates of returns were positive and significant at the 5% significance level or better, with an average of 1.30%. The aggregated abnormal rate of returns was the largest in a 4-day window (0, 3). For the 11 announcement event group, the aggregated abnormal rates of return were statistically significant at the 10% significance level with an average value of 2.14%. In comparison with sale group, as the width of event window become broader, the average cumulative abnormal rates of returns for announcement group was the largest in a 2-day window (0, 1), gradually decreased, and became less

Table 1
Major industrial timberland sale events from 1997 to 2007.

N	CUSIP	Date	Seller	Event	Payment[a]	Size[b]
1	67622P10	2004-07-26	Boise Cascade Corp.	Sale	3700	2.3
2	37329810	1999-06-17	Georgia Pacific Corp.	Announcement	–	0.196
3	37329810	1999-12-16	Georgia Pacific Corp.	Sale	397	0.194
4	37329810	2000-07-20	Georgia Pacific Corp.	Sale	4000[c]	4.7
5	46014610	2001-02-15	International Paper Co.	Sale	500	0.265
6	46014610	2002-01-03	International Paper Co.	Sale	101	0.145
7	46014610	2003-03-28	International Paper Co.	Announcement	–	1.5
8	46014610	2004-11-09	International Paper Co.	Sale	250	1.1
9	46014610	2005-07-19	International Paper Co.	Announcement	–	6.8
10	46014610	2006-03-28	International Paper Co.	Sale	300	0.218
11	46014610	2006-04-04	International Paper Co.	Sale	1130	0.9
12	46014610	2006-04-04	International Paper Co.	Sale	5000	4.64
13	46014610	2006-04-11	International Paper Co.	Sale	137	0.275
14	49436810	1998-05-05	Kimberly Clark Corp.	Announcement	–	0.5
15	49436810	1999-10-01	Kimberly Clark Corp.	Sale	400	0.46
16	54634710	2002-05-09	Louisiana Pacific Corp.	Announcement	–	0.935
17	54634710	2003-07-10	Louisiana Pacific Corp.	Sale	285	0.465
18	58333410	2003-05-15	Meadwestvaco Corp.	Announcement	–	0.636
19	58333410	2003-10-01	Meadwestvaco Corp.	Sale	125.8	0.629
20	58333410	2007-01-31	Meadwestvaco Corp.	Announcement	–	0.3
21	58333410	2007-08-06	Meadwestvaco Corp.	Sale	400	0.323
22	73763010	2006-12-12	Potlatch Corp. [d]	Announcement	–	0.275
23	83272710	1999-07-30	Smurfit Stone Container Corp.	Sale	725	0.98
24	87986810	2007-02-26	Temple Inland Inc.	Announcement	–	1.8
25	87986810	2007-08-06	Temple Inland Inc.	Sale	2380	1.55
26	96216610	2002-01-16	Weyerhaeuser Co.	Sale	185	0.1
27	96216610	2003-03-11	Weyerhaeuser Co.	Sale	185	0.104
28	96216610	2003-05-21	Weyerhaeuser Co.	Announcement	–	0.344
29	96216610	2003-12-13	Weyerhaeuser Co.	Sale	140	0.16
30	96216610	2004-06-30	Weyerhaeuser Co.	Sale	404	0.304
31	96913310	1998-09-04	Willamette Industries Inc.	Announcement	–	0.117
32	96913310	1998-11-13	Willamette Industries Inc.	Sale	234	0.117

[a] The unit of Payment is million dollars.
[b] The unit of Size is million acreages.
[c] On Jul. 20, 2000, Georgia-Pacific Corp. announced to sell 4.7 million acres for $3 billion in stock and $1 billion in debt.
[d] Potlatch Corp., incorporated in September 2005, is a REIT.

Table 2
Chow test for examining variability of the rate of return surrounding event for various window widths.

Days of window	*F* value	*df(n)*	*df(d)*	*p* statistic
All events (N = 32)				
2 days: (0, 1)	6.42	2	2620	0.002
3 days: (0, 2)	3.67	2	2652	0.026
4 days: (0, 3)	2.99	2	2684	0.051
5 days: (0, 4)	2.36	2	2716	0.095
Sale events (N = 21)				
2 days: (0, 1)	3.80	2	1718	0.022
3 days: (0, 2)	2.53	2	1739	0.080
4 days: (0, 3)	2.04	2	1760	0.130
Announcement events (N = 11)				
2 days: (0, 1)	3.82	2	898	0.022
3 days: (0, 2)	2.01	2	909	0.135

magnitude of *t* statistic value. This concluded that market efficiency would be the most reflected over post-announcement one day. However, the new information would be gradually absorbed by the market on the several days following the sale event date. In general, systematically nonzero and statistically significant abnormal returns following industrial timberland sale events provide profitable wealth to industrial shareholders following the event date.

For the capitalization change analysis, we focused on all the 32 events and the 21 sale events only. We omitted the 11 announcement event group because none of the explanatory variables is significant. Our results are presented in Table 4. Since the regression was cross-sectional, White's heteroscedastic consistent standard errors were used in the evaluation. The model had a relatively good fit, given that the values of R^2 are 0.23 and 0.37, compared to values around 0.10 in previous studies (Mei and Sun, 2008).

The parameter estimates for all 32 events and 21 sale events were comparable. *TIME*, *TA*, and *TD* contributed most to the variations of market impact of abnormal rates of return. Specifically, *TD* had a negative impact on capitalization change per transaction land acreage while *TA* had a positive contribution towards capitalization change. The coefficients for these variables were significant at 10% level or better. These results imply that firms with high levels of debt may not benefit much from timberland sales and large firms may benefit more from timberland sales.

For risk analysis, the beta values (systematic risk) for each firm before and after the announcement and sale events are reported in Table 5. For 100 days before and after the timberland sales, the systematic risk of two out of eleven announcement events increased at the 10% significant level while one of the announcement events decreased significantly. For 150 days before and after the timberland sales, the systematic risk of one firm increased and that of another firm decreased significantly out of the announcement event group. In terms of the sale event group, the increases in systematic risk were related to two sale events (i.e., Meadwestvaco Corp. in 2007 and Weyerhaeuser Co. in 2003), and the decrease was related to Weyerhaeuser Co. when sale events occurred respectively in 2002 and in 2004. Generally, the systematic risk for forest product firms that sold timberlands did not change much or increased slightly, indicating that the long-term cost associated with these sales are minimal.

Table 3
Average cumulative abnormal rates of return for *N* industrial timberland sale events as a group over an event window from 1997 to 2007.

Event window	Average cumulative abnormal rates of returns	*t* statistic
All events (N = 32)		
2 days: (0, 1)	1.78%	3.50 [a]
3 days: (0, 2)	1.46%	3.04 [a]
4 days: (0, 3)	1.52%	3.08 [a]
Sale events (N = 21)		
2 days: (0, 1)	1.40%	3.23 [a]
3 days: (0, 2)	1.08%	2.38 [b]
4 days: (0, 3)	1.41%	2.42 [b]
Announcement events (N = 11)		
2 days: (0, 1)	2.51%	2.03 [c]
3 days: (0, 2)	2.18%	1.98 [c]
4 days: (0, 3)	1.74%	1.83 [c]

[a], [b], and [c] indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Capitalization changes associated with all events and sale events for all firms.

Variable	All events (N = 32)		Sale events (N = 21)	
	Coefficient	*t*-value	Coefficient	*t*-value
Constant	825.10	2.16 [b]	1193.26	3.33 [a]
TIME	−132.46	−2.62 [b]	−198.48	−3.01 [a]
TA	0.11	2.17 [b]	0.15	2.53 [b]
TD	−0.19	−1.98 [c]	−0.26	−2.31 [b]
R^2	0.23		0.37	
F-value	2.87 [c]		3.38 [b]	

[a], [b], and [c] indicate significance at the 1%, 5%, and 10% levels, respectively.

5. Conclusions and discussion

We found that industrial timberland sales have positive impacts on shareholder values of major U.S. forest products firms. In addition, the change in market capitalization per unit of land sale of these firms is

Table 5
A comparison of 32 forest products companies before and after the announcement using the Capital Asset Pricing Model using two alternative post-event windows (100, 150).

Company	Date	β_i		γ_i	
		100	150	100	150
Boise Cascade Corp.	2004-07-26	1.512 [a]	1.550 [a]	−0.038	−0.015
Georgia Pacific Corp.	1999-06-17	0.587 [b]	0.476 [b]	0.227 [c]	0.208 [b]
Georgia Pacific Corp.	1999-12-16	0.932 [a]	0.563 [a]	0.077	0.050
Georgia Pacific Corp.	2000-07-20	0.283	0.387 [a]	−0.076	−0.041
International Paper Co.	2001-02-15	0.808 [a]	0.732 [a]	−0.033	−0.027
International Paper Co.	2002-01-03	1.002 [a]	1.058 [a]	0.025	−0.054
International Paper Co.	2003-03-28	0.947 [a]	1.024 [a]	0.214 [c]	0.086
International Paper Co.	2004-11-09	0.975 [a]	1.052 [a]	−0.019	0.007
International Paper Co.	2005-07-19	1.110 [a]	1.255 [a]	−0.117 [c]	−0.155 [a]
International Paper Co.	2006-03-28	1.254 [a]	1.247 [a]	−0.002	−0.014
International Paper Co.	2006-04-04	1.225 [a]	1.264 [a]	−0.006	−0.013
International Paper Co.	2006-04-04	1.234 [a]	1.270 [a]	−0.022	−0.022
International Paper Co.	2006-04-11	1.225 [a]	1.264 [a]	−0.006	−0.013
Kimberly Clark Corp.	1998-05-05	1.000 [a]	0.915 [a]	−0.012	−0.025
Kimberly Clark Corp.	1999-10-01	0.600 [a]	0.487 [a]	−0.004	0.089
Louisiana Pacific Corp.	2002-05-09	1.210 [a]	1.434 [a]	0.076	0.022
Louisiana Pacific Corp.	2003-07-10	1.425 [a]	1.573 [a]	−0.015	−0.168
Meadwestvaco Corp.	2003-05-15	1.167 [a]	1.109 [a]	−0.151	−0.057
Meadwestvaco Corp.	2003-10-01	0.888 [a]	0.993 [a]	−0.180	−0.081
Meadwestvaco Corp.	2007-01-31	1.060 [a]	1.121 [a]	0.012	−0.007
Meadwestvaco Corp.	2007-08-06	1.183 [a]	1.186 [a]	0.037	0.068 [c]
Potlatch Corp.	2006-12-12	1.433 [a]	1.408 [a]	−0.035	0.008
Smurfit Stone Container Corp.	1999-07-30	0.711 [b]	0.531 [b]	0.121	0.175
Temple Inland Inc.	2007-02-26	0.938 [a]	1.096 [a]	0.067	0.047
Temple Inland Inc.	2007-08-06	1.216 [a]	1.200 [a]	0.070	0.296
Weyerhaeuser Co.	2002-01-16	1.039 [a]	1.113 [a]	−0.105	−0.213 [b]
Weyerhaeuser Co.	2003-03-11	1.041 [a]	1.214 [a]	0.070	−0.084
Weyerhaeuser Co.	2003-05-21	1.099 [a]	1.060 [a]	−0.196	−0.035
Weyerhaeuser Co.	2003-12-13	1.140 [a]	1.115 [a]	0.077	0.225 [b]
Weyerhaeuser Co.	2004-06-30	1.391 [a]	1.413 [a]	−0.263	−0.191 [b]
Willamette Industries Inc.	1998-09-04	0.950 [a]	0.970 [a]	−0.092	−0.060
Willamette Industries Inc.	1998-11-13	0.775 [a]	0.880 [a]	0.012	−0.057

[a], [b], and [c] indicate significance at the 1%, 5%, and 10% levels, respectively.

positively related to their size and negatively to their total debt as well as the time of sales. Finally, the systematic risk of firms that sold their timberlands did not change much or only increased slightly.

The economic and policy implications of this study are three fold. First, since industrial timberland sales increase shareholder values and do not impose long-term cost of capital financing, it is logic that forest products firms have sold their timberlands in the first place. These results explain industrial timberland sales or the supply side of the institutional timberland ownership as we know of today. This indicates that the recent structural change in industrial timberland ownership is perhaps going to stay for a while.

Second, just because industrial timberland sales have all the benefits and little costs, a possible change in U.S. tax code that attempts to level the playing field in timber sales tax treatment between industrial and institutional timberland owners may not bring back large scale industrial timberland ownership in the United States. In the 2008 Farm Bill, U.S. Congress temporally changed the corporate tax code and given industrial timberland owners the same treatment as REITs and TIMOs. It was speculated that, this change, if made permanent, could help stabilize and possibly bring back the industrial timberland owners in the U.S. This study shows that changing tax code alone is unlikely to reshape the current mixture of industrial and institutional timberland ownership in the country. Weyerhaeuser Company, the last large industrial timberland owner in the U.S., announced in February of 2010 to convert itself to a REIT. Perhaps it does not see a permanent change in the corporate tax code coming any time soon. More likely, these vertically integrated forest products as an industrial organization is less efficient than two separate organizations (timberland owners and forest products manufacturers) that transact through markets.

Finally, as institutional timberland ownership has now reached a high level, it is time for researchers to study this class of timberland owners. Do institutional timberland owners behave similarly as forest products firms with respect to supplying timber and environmental goods? In most cases forest products firms that sold their timberland have retained a long-term timber supply agreement with buyers based on some kind of price index. Will these agreements distort timber markets or the supply of non-timber products? Further research in forest economics could look into these issues.

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