Impact of timber-fee increases on British Columbia forest products companies: an economic and policy analysis

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Abstract: On 14 April 1994, the British Columbia government announced a new stumpage formula that, at then-expected product prices, increased the average charge by about $12/m^3 and more than doubled the rate at which stumpage fees change when lumber prices change. Most of the increased revenues are reinvested in the forest sector by a new organization, Forest Renewal British Columbia (FRBC), created specifically for that purpose. Using standard event-study methodologies, this paper documents the net effect of the fee increases and new policy direction on British Columbia forest products companies. After controlling for firm-specific risk and the decline in the Toronto Stock Exchange that occurred at about the same time, the new stumpage policy extracted about $1.0 billion from shareholders of the firms studied, and perhaps $2.4 billion from all licencees (an amount roughly equal to the capitalized after-tax cost of the higher fees). The impact on individual firms is highly correlated with the allowable annual cut (AAC) in replaceable licenses each holds, with an average impact of about $33.3/m^3 of AAC. The market appears to have discounted both the good news about offsets in impending timber-supply reductions that the creation of FRBC implies and the reductions in earnings risk that the new stumpage system provides. When added to the increased regulatory costs associated with the new provincial Forest Practice Code, the timber-fee increases appear to have fully depleted the value of holding British Columbia timber quotas.

Résumé : Le 14 avril 1994, le gouvernement de la Colombie-Britannique annonçait une nouvelle formule de redevances qui augmentait le coût moyen d'environ 12 $/m^3 par rapport aux prix des produits anticipés à ce moment et faisait plus que doubler le taux de variation des redevances lorsque les prix du sciage changent. La majorité de ces nouveaux revenus sont réinvestis dans le secteur forestier par une nouvelle organisation, le Renouveau forestier de la Colombie-Britannique (FRBC), créée spécifiquement à cette fin. À l'aide de méthodes standards d'études d'évènements, cet article documente l'effet de l'augmentation des droits et de l'orientation de cette nouvelle politique sur les compagnies de produits forestiers de la Colombie-Britannique. Après avoir tenu compte du risque spécifique à chaque entreprise et de la baisse de l'indice boursier du TSE qui s'est produite à peu près au même moment, la nouvelle politique de redevances a soutiré environ 1 milliard de dollars aux actionnaires des entreprises étudiées, et peut-être 2,4 milliards de dollars à tous les détenteurs de contrats (un montant grossièrement égal au coût capitalisé après impôt des droits plus élevés). L'impact sur les firmes individuelles est fortement corrélé avec la possibilité annuelle de coupe (PAC) que chacun détient sous forme de licences remplaçables avec un impact moyen d'environ 33,3 $/m^3 de la PAC. Le marché ne semble pas avoir tenu compte des bonnes nouvelles au sujet des compensations qu'implique la création du FRBC face à la réduction imminente de l'approvisionnement en bois et au sujet de la réduction du risque sur les gains que le nouveau système de redevance provoque. Additionnés aux coûts accrus engendrés par les règlements associés au nouveau Code de pratique forestière, les augmentations de droits de coupe semblent avoir complètement anéanti la valeur associée au fait de détenir des quotas d'approvisionnement en bois en Colombie-Britannique. [Traduit par la Rédaction]

Introduction

The forest sector is critical to British Columbia's economy, especially (although by no means exclusively) in nonmetropolitan areas where alternative sources of economic activity are largely absent. As one of the world's largest softwood lumber exporters, changes in the British Columbia forest sector can have major impacts on other regions of the world, as the recent trade disputes between Canada and the United States concerning this product attest. The provincial government owns and controls over 95% of the forest land in the province, so the details of provincial policies can affect the lives of people both in the province and, as a result of trade linkages, in distant localities.

The provincial government implements forest policy through a broad array of tools, including designation of forest land for parks and other uses, the various forms of tenure that convey harvesting rights to private firms, forest practice regulations, and timber pricing policy. Two of these, tenure rights and timber pricing, interactively comprise the core of provincial industrial policy for the forest sector.

The provincial government conveys timber harvesting rights to companies through various forms of licences.[2] In return for the guaranteed timber supply, licencees must fullfil certain obligations negotiated with the government at the time

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of licence issue. The most important of these are (*i*) establishment and operation of processing facilities to use the provincially supplied timber (sometimes called appurtenancy), (*ii*) management, at licencee cost, of the forests (including reforestation after logging), and (*iii*) payment of timber fees.

This paper examines in detail the effect of changes in one of these policy tools, timber pricing, on the firms participating in the sector. The first section below provides some background on timber-pricing policy in the province. The second outlines the event-study data and methodology. The third discusses the statistical results, and the final section draws out the implications of these results for forest policy, specifically for British Columbia but also for the many other jurisdictions where the public sector sets timber prices.

The contributions of this paper are twofold, both empirical and methodological. Concerning the former, we show that the creation of Forest Renewal British Columbia (FRBC) did not make additional capital available to the British Columbia forest sector, but simply redistributed capital from the licencees to the government, with attendant changes in capital allocation that such a change would probably imply. The stock market apparently fully discounted any of the potential positive aspects of FRBC. Concerning the latter, we add to a growing literature that uses changes in securities markets to estimate the impact of government policies. While such impacts are usually only one part of the story, they may be an interesting and important one.

Timber pricing and forest policy

The high degree of public control over forest resources combined with the large social, economic, and environmental effects of the forest sector imply that partisan politics inevitably plays a large role in provincial forest policy. Higher stumpage fees and timber royalties (collectively called "timber fees" below) were widely anticipated with the 1991 election of a Social Democratic government in British Columbia. The new government brought with it high-level officials whose advocacy for higher stumpage fees and other resource royalties was widely known (e.g., Gunton and Richards 1987). Environmental groups had also urged the government to increase timber fees (Vancouver Sun 1994*a*, 1994*b*). At the same time, industry profits rose on the back of higher lumber prices. For example, due to supply shortages in the U.S. Pacific Northwest and a resurgent North American housing market, lumber prices realized by British Columbia Interior mills increased from an annual average of $US 235/mbf (thousand board feet) in 1992 to $US 340/mbf in 1993 (various issues, Madison's Canadian Lumber Reporter, Box 2486, Vancouver, BC V6B 3W7, Canada). Reductions in the value of the Canadian dollar against the U.S. dollar meant that domestic currency mill realizations for British Columbia producers rose even more dramatically. The resulting increases in profitability were simply too great for a Social Democratic government, or perhaps any government, to overlook.

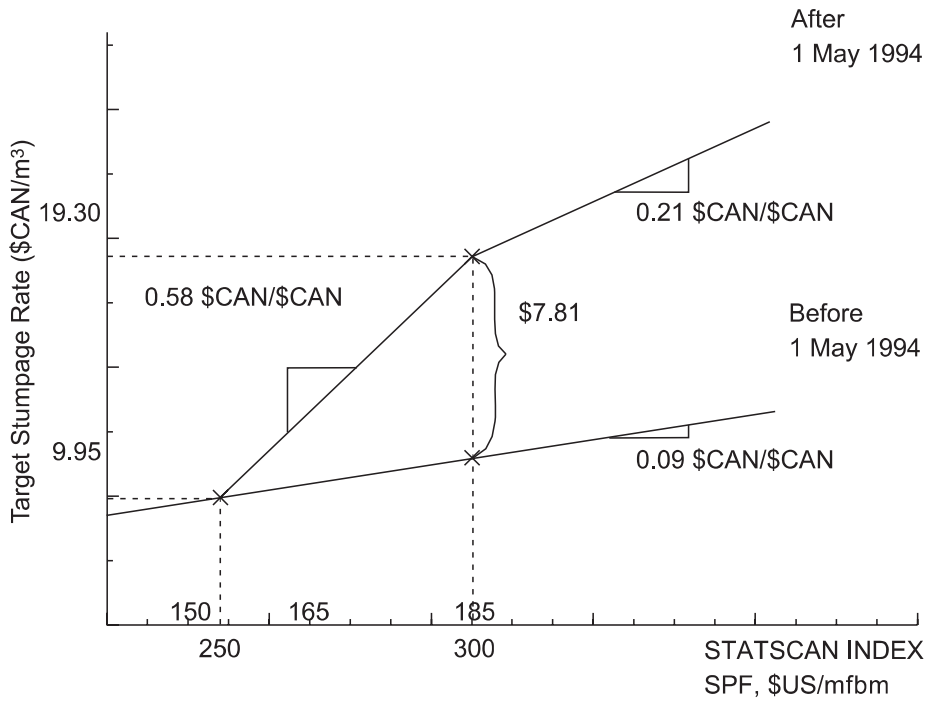
The government was privately discussing the possibility of increased timber fees in early 1994 and, on 14 April 1994, publicly announced a new schedule to become effective on 1 May 1994. At then-current lumber prices, the policy change increased the target stumpage and royalty payments by $12.30/m^3 for Interior producers (81.1%) and $10.83/m^3 for those on the Coast (64.4%) (British Columbia Ministry of Forests 1994). At a price of $US 350/mbf for the bellwether softwood lumber product SPF (i.e., dimension lumber manufactured in the Interior of the province from spruce, pine, or fir) and with the then-current allowable annual cut (AAC), the increase would amount to $562.5 million/year. Because of seasonal patterns of logging and the one-quarter lag between increases in product prices and increases in timber fees, many firms did not feel the full effect of these increases until the third quarter of 1994.[3]

Because timber fees are deductible for the purposes of federal and provincial income taxation, the costs and revenues from the new fees were shared among the licencees, the provincial government, and the federal government. Assuming a 40% corporate tax rate, equally divided between the federal and provincial governments, and SPF prices at $US 350/mbf, the after-tax impact on licencees would be $337.5 million/year ($0.6 \times$ $562.5 million). The provincial government would gain $450 million/year ($562.5 million of additional timber-fee revenue minus $0.2 \times$ $562.5 million, the reduction in provincial taxes due to the deductibility of stumpage fees). Interestingly, because stumpage payments are deductible for federal income tax purposes, part of the burden of increasing provincial stumpage fees was passed on to the federal government (the provincial government constructed the increase so that the after-provincial-income-tax revenues would meet the levels targeted for FRBC and the provincial Ministry of Forests). Under these assumption, the federal government would lose $112.5 million/year ($0.2 \times$ $562.5 million).

The policy to increase timber fees was innovative in two respects. In the first place, a new, independent provincial agency, FRBC, was created to return most of the additional revenue back to various forest sector activities. The Ministry of Forests receives $50 million/year off the top to fund compliance and enforcement activities associated with the new Forest Practice Code, but the remaining incremental revenue (nominally about $400 million/year) goes directly to FRBC without the necessity of regular legislative appropriation. FRBC's government-appointed Board of Directors allocates these funds to investments in silviculture, watershed restoration, employment adjustment, education, community development, and research activities that enhance the economic, social, and environmental values of the forest sector. The briefing documents on this new agency explicitly mentioned that the creation of a permanent source of capital for silvicultural investment should help reduce or eliminate anticipated reductions in timber supply. Funds derived from the forest sector would be returned directly to it. This kind of direct linkage between timber revenues and expenditures on forest management is unusual for publicly owned forests anywhere in the world.

Secondly, the new rules altered the formula for calculating timber fees. The new formula not only increases the level of payments, but also changes the variability of payments in response to changes in product prices. Figure 1 shows both the old and new formulas for the British Columbia Interior plotted with the Statistics Canada Softwood Lumber Index (which is actually used in the calculation) along with approximate SPF lumber-price benchmarks. For ease of exposition, the following narrative refers to SPF prices alone, although the actual policy is more complex.[4] At prices below $US 250/mbf, the old

Fig. 1. Formula for target stumpage rates, before and after 1 May 1994.



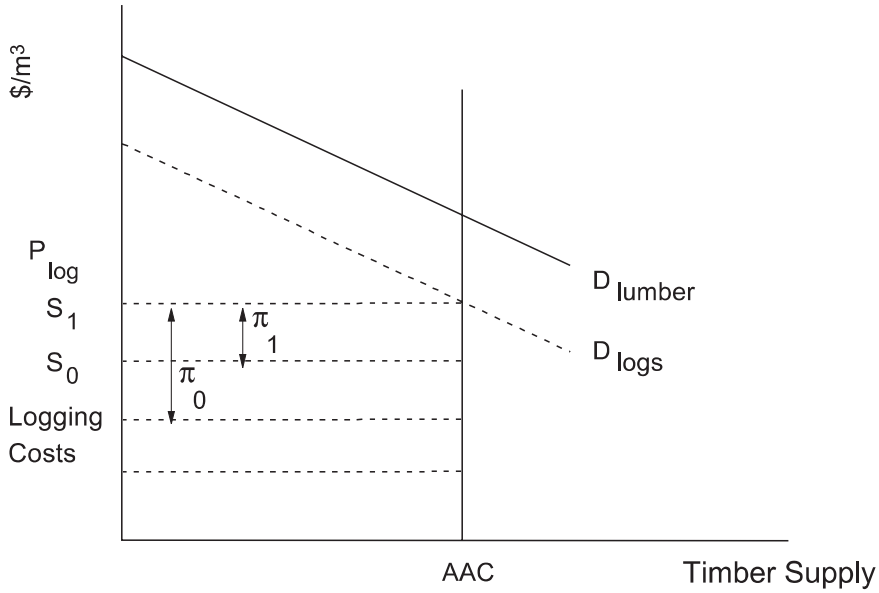
and new formulas are identical. At prices above $US 250/mbf, the changes came in two parts. To set the stumpage fees at prices equal to $US 300/mbf and above, the new formula is anchored at an incremental payment of $562 million (pretax) at an SPF price of $US 350/mbf. In addition, for lumber prices beyond $US 300/mbf the government doubled the market sensitivity so that each $1.00 increase in product prices yields an additional $0.21 in stumpage payments. To complete the formula, the government simply connected the line from the old formula at $US 250/mbf to the new formula at $US 300/mbf; within this range, each $1 change in product prices yields $0.58 of stumpage.[5] As a result, for a given variation in product prices, the variation in stumpage fees has more than doubled and has become asymmetric around the $US 300/mbf and $US 250/mbf breakpoints in the formula. Since stumpage is a production cost that is highly correlated with product prices, this change in the formula will decrease earnings variability for firms with replaceable licenses (but would probably leave the correlation with returns on other assets unchanged).

These changes in the stumpage system probably had little impact on log or lumber markets in British Columbia or on aggregate levels of production in the province.[6] Figure 2 shows the situation. AACs fix timber supply at the point labeled "AAC" in the diagram. While implementation of FRBC might be expected to alter this level in the long run, it is most appropriately considered fixed in the short term. Willingness to pay for logs, the value of products produced by mills minus their manufacturing costs, remains unchanged by the increased timber fees. Log prices are set by the intersection of the derived-demand function for logs and the inelastic log supply curve defined by the AAC constraint. The new formula affected neither timber supply (as long as the stumpage fee on zero-margin wood remains at the negligible statutory minimums) nor harvest and delivery costs. As long as no firm ceases operations as a result of the increase, equilibrium prices for logs and products as well as trade flows should remain unchanged. The main result is to reduce the quasi-rents gained from the harvest of public timber from π_0 to π_1. At least in the short run, the log- and product-market effects of the change in the stumpage formula are apt to be small.

The impact of the change in timber fees on British Columbia forest products firms is not straightforward to assess. Any uncollected timber rents should be capitalized into the stock prices of firms holding replaceable licenses or timber licenses. Increases in timber fees for these tenures reduce uncollected rents and should therefore depress stock prices for the relevant firms. As noted above, the increased timber fees lead directly to a $337.5 million/year reduction in after-tax earnings (assuming that product prices remained constant at the SPF equivalent of $350/mbf and a 40% combined federal and provincial corporate tax rate) for the sector as a whole. Since the cost of capital for the British Columbia forest sector is 11%/year (McCallum 1997), the capitalized cost of the stumpage fee increases to all holders of replaceable licences taken together would be about $3.1 billion.[7] We might anticipate an equivalent reduction in the market value of the affected British Columbia firms.

Because the government now shares more of the risk in holding stumpage, there are more subtle effects as well. For example, the right to cut standing timber is, in essence, a modified European call option (within the limits of the AAC rules, the company has the right to select the timing of its timber harvests). Following standard Black–Scholes options-pricing theory, by reducing the exposure of companies to market variability, the change in the stumpage formula should reduce the underlying option value of the timber licenses to the firms holding them. In contrast, by reducing the variability of earnings, the financial risk of forest products company stocks

Fig. 2. Impact of timber-fee increases on British Columbia log markets.



should fall, partially offsetting the impact of reductions in mean earnings and in the option value of timber licences. The individual effect of each of these factors is difficult to assess, but the net effect can be estimated from the changes in the stock prices of forest products companies around the time that the new policy was implemented.

An event study of stock price changes in 1994

Financial economists use event studies to determine the impact of specific financial decisions on shareholder returns (e.g., Desai and Stover 1985; Zinkhan 1988) and to analyze the impact of regulatory changes on the expected profits of firms (e.g., Schwert 1981; Binder 1985*a*, 1985*b*; Boardman et al. 1992; Zhang and Binkley 1995). In event studies related to the forest sector, Zhang and Binkley (1995) found little impact of the 1987 changes in British Columbia's forest policy, and Zinkhan (1988) showed that forest-land divestitures generally increased the value of forest products companies' stocks.

There are two general approaches to event studies. The older, more common residual-analysis method (mainly applied to mergers and acquisitions) assumes that there are no firm-to-firm correlations among the impacts of the event. This assumption clearly is questionable for the kinds of regulatory change discussed in this paper and can have serious practical consequences if the underlying assumptions of equal variances across firms and no contemporaneous covariances among firms are invalid (Collins and Dent 1984; Binder 1985*a*, 1985*b*). These shortcomings of residual analysis can be overcome by using a one-step multiple regression analysis method that simultaneously estimates an asset pricing model and the effect of the event.

This study uses the latter technique. A multiple regression analysis begins by parameterizing the abnormal return γ_i (positive or negative) due to the event in an asset-pricing model using the dummy variable D_t that takes on the value of 0 prior to the beginning of the event and 1 afterwards[8]:

$$[1] \quad R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i D_t + \mu_{it}$$

where R_{it} is the rate of return for stock i on day t, including price change plus dividends paid, R_{mt} is the rate of return on the market portfolio on day t, D_t is 0 prior to the event and 1 in the postevent period, α_i, β_i, and γ_i are regression parameters, and μ_{it} is a random disturbance term, assumed to be normally distributed as $N(0, 1)$, independent of the explanatory variable R_{mt}.

When the explanatory variables in the return-generating process are the same for each of the N firms, the multiple equations below can be estimated jointly as a seemingly unrelated regression model (SUR; Zellner 1962; Theil 1971):

$$[2] \quad \begin{aligned} R_{1t} &= \alpha_1 + \beta_1 R_{mt} + \gamma_1 D_t + \mu_{1t} \\ R_{2t} &= \alpha_2 + \beta_2 R_{mt} + \gamma_2 D_t + \mu_{2t} \\ &\vdots \\ R_{Nt} &= \alpha_N + \beta_N R_{mt} + \gamma_i D_t + \mu_{Nt} \end{aligned}$$

This approach allows individual abnormal returns and residual variances to differ across firms. It also incorporates the cases where the contemporaneous covariances of the disturbances across equations $E(\mu_{it}, \mu_{jt})$ are nonzero whereas the noncontemporaneous covariances $E(\mu_{it}, \mu_{j,t-k})$ all equal zero. Note that estimating eq. 2 as a system gains no efficiency in either the coefficients or the residual variances and produces estimates that are identical to those obtained from ordinary least squares (OLS) estimation of the individual equations (Theil 1971, chap. 7).[9] The advantage of this approach over residual analysis comes in testing the joint hypotheses posed below, since the heteroscedasticity across equations and contemporaneous dependence of the disturbances are explicitly incorporated in the statistical tests (Collins and Dent 1984; Binder 1985*a*, 1985*b*).

Two hypotheses are of interest. The first (H_1) is that the sum of the abnormal returns (called the "aggregate abnormal return" below) across the N equations equals zero (i.e., $\sum \gamma_i = 0$). This test measures the impact on the sector as a whole. The

Table 1. Parameter estimates using the multiple regression model (*t*-statistics in parentheses).

Firm	R_{mt}	R_{mt-1}	R_{mt+1}	Constant	Dummy[a]	R^2
Ainsworth	1.0793**		–0.3448**	0.0019	–0.0045	0.1014
	(4.5819)		(–1.6374)	(1.1452)	(–0.9613)	
Canfor	0.8737**			0.0004	–0.0033	0.1586
	(6.0018)			(0.3570)	(–1.1245)	
Crestbrook[b]	0.7334**			0.0022	–0.0070	0.0342
	(2.3147)			(0.9800)	(–1.0899)	
Doman	0.4232**		0.2686*	0.0018*	–0.0060*	0.0623
	(2.2695)		(1.5280)	(1.3613)	(–1.6253)	
Interfor	1.0162**			0.0021	–0.0093**	0.1438
	(5.0970)			(0.7749)	(–2.2831)	
MB	1.0981**	–0.2207**		–0.0004	–0.0020	0.2408
	(8.1400)	(–1.7834)		(–0.4099)	(–0.7444)	
Primex	0.7147**			–0.0018	0.0054	0.0337
	(2.7087)			(–0.9369)	(0.9999)	
Riverside	0.4917**			0.0017*	–0.0045*	0.0496
	(2.8343)			(1.3572)	(–1.2836)	
Scott	0.4879**			–0.0004	0.0034	0.0248
	(2.3274)			(–0.3016)	(0.7816)	
Slocan	1.0041**			0.0019*	–0.0101**	0.1406
	(4.9272)			(1.3384)	(–2.4278)	
Weldwood	0.1261			0.0011	–0.0065**	0.0195
	(0.6621)			(0.8088)	(–1.7190)	
West Fraser	0.2877**			0.0009	–0.0052**	0.0366
	(1.9480)			(0.8264)	(–1.7303)	

Note: *, significant at the 20% level; **, significant at the 10% level.
[a]Daily abnormal return.
[b]Durbin–Watson = 2.43.

second (H_2) is that some (possibly all) of the abnormal returns equal zero (i.e., $\gamma_i = 0$, for some i), with the impact of the event being systematically related to the characteristics of the individual firms. Tests of H_2 are more informative than tests of H_1 if an event affects the sample firms but the effects differ in sign.

The main null hypothesis of this paper is that the stock prices of British Columbia's forest products firms are not affected by the new timber fees and associated changes in forest policy. In other words, the aggregate abnormal return for these firms during the event period equals zero. A rejection of this hypothesis would mean that shareholders of the forest industry suffered from the policy change. The second null hypothesis is that the impact of the event for some firms equals zero. A rejection of this hypothesis would mean that shareholders in at least some firms were hurt. The effect of the policy changes might differ among firms, since the value of the stock is a function of both the content of the regulation and the circumstances of each firm. While the new timber prices might harm firms heavily dependent on Crown timber, they will benefit those that own rights to private lands or, since, in theory, increases in timber fees would not affect log prices, those that purchase logs on the open market. Firms that have diversified themselves by operating in other provinces would be in a better position than those that have all of their forest operations in British Columbia. In addition, the policy changes may have different impacts on firms with different proportions of assets in the solid wood sector and pulp and paper sector, since timber fees are generally paid by the initial processor, usually a sawmill.

The initial sample consisted of 17 firms that had operations in British Columbia and were on the TSE/Western Data Base of the Toronto Stock Exchange. We excluded four firms with operations in British Columbia, Avenor Limited, Fletcher Challenge of Canada Limited, Pacific Forest Products Limited, and TimberWest Forest Products Limited, because they were involved in major mergers or divestitures within a year prior to the event date. The other firms had not been. Another firm, Taiga Forest Products Limited, was excluded because it is a lumber wholesaler. The 12 firms used in the event study are Ainsworth Timber Company Limited (Ainsworth), Canadian Forest Products Limited (Canfor), Crestbrook Forest Industries Limited (Crestbrook), Doman Forest Products Limited (Doman), International Forest Products Limited (Interfor), MacMillan Bloedel Limited (MB), Primex Forest Products Limited (Primex), Riverside Forest Products Limited (Riverside), Slocan Forest Products Limited (Slocan), Scott Paper Limited (Scott), Weldwood of Canada Limited (Weldwood), and West Fraser Timber Co. Limited (West Fraser). These firms collectively control harvesting rights to 32.7×10^6 m^3 of replaceable licenses, or about 45.7% of the provincial total (K. Baker, B.C. Ministry of Forests, Victoria, B.C., personal communication).

Equation 2 was estimated by seemingly unrelated regression for a system of 12 equations using 218 daily observations, beginning on 10 June 1993 and ending on 20 April 1994. The TSE 300 index was used as a market return index. To control for thin trading (Scholes and Williams 1977), one lead and one lag of the market return index were added to each of the original equations. However, only four (three leads and one lag) were significant at the 20% level. Following the Scholes–Williams

Table 2. Selected characteristics and estimated impact of timber-fee increases for 12 british columbia forest products companies.

		Distribution of assets		Source of timber supply			
Firm	Assets in British Columbia (%)	Wood product (%)	Pulp and paper (%)	Private land (%)	Replaceable tenures (mm/m^3)[a]	Net purchase (%)	Estimated impact ($ millions)[b]
Ainsworth	100	100	0	0	1.044	20	–23.6
Canfor	70	80	20	3	4.784	30	–137.6
Crestbrook	85	62	38	0	1.321	14	–32.8
Doman	100	73	27	40	2.547	Seller	–93.9
Interfor	100	100	0	0	2.968	0	–134.7
Mb	67	61	39	13	6.248	Seller	–248.0
Primex	100	100	0	0	0	85	2.7
Riverside	100	100	0	0	1.806	25	–21.4
Scott	30	0	100	0	0.057	2	7.9
Slocan	100	90	10	0	4.754	38	–143.6
Weldwood	80	60	40	1	3.081	24	–107.5
West Fraser	80	65	35	5	4.177	15	–109.0
Total							1040.8

Note: Source: Timber Harvesting Branch, Ministry of Forests, and the 1993 annual report of individual companies.

[a]As of 1 June 1994 (Baker, personal communication). Timber harvested from these tenures is affected by the timber-fee increases.

[b]Impact after adjusting for changes in the TSE Index. Calculated as $n_i(p_i^1 - p_i^1)$ where n_i is the number of shares for firm i, p_i^1 is the price of stock i on 21 April 1994 (after the event), and $p_i^1 = p_i^0 \exp[\alpha_i + \beta_i \ln(\mathrm{TSE}^1/\mathrm{TSE}^0)]$ where p_i^0 is the average share price for 28 February – 11 March 1994, 10 days prior to the event.

methodology, they were included in the final regression and the rest were dropped. Because the British Columbia government was reported to have been consulting interest groups about the new plan 1 week prior to its announcement (Vancouver Sun 1994*c*), the event window was set at 27 days, starting 1 month prior to the announcement date (i.e., the event "window" opened 14 March 1994, day –22) and ending on 20 April 1994 (day +5). While the choice of window is largely arbitrary, the empirical results reported below are not significantly affected by the choice.[10] Observations prior to June 1993 were excluded to eliminate the impact of a lumber price surge in late 1992 and early 1993.

Results and discussion

Table 1 reports the results. The Breusch–Pagan Lagrange-multiplier test statistic for the diagonal covariance matrix for these equations is 342.2 with 66 degrees of freedom. Based on this statistic, the null hypothesis of no contemporaneous correlation across equations is rejected at the 5% level. Thus, the multiple regression method gains efficiency in hypothesis testing by accounting the contemporaneous dependence of errors across equations. The Durbin–Watson statistics suggest the absence of serial correlation in the residuals at the 5% level for 11 of the 12 equations and at the 10% level for all of them. The low R^2 values for the equations are characteristic of CAPM models because a single-factor model of firm returns ignores a plethora of macroeconomic and firm-specific risk factors (Roll 1977; Ross 1978).

Ten of the 12 dummy variables are negative and the remaining two are positive. Of those negative, four are significantly different from zero at the 10% level. We therefore reject H_2 that none of the firms were affected by the policy change. Neither of the two positive dummy variables is significantly different from zero.

The impacts differed among the individual firms. Six companies, Doman, Interfor, Riverside, Slocan, Weldwood, and West Fraser, suffered statistically significant losses. Stock prices of four other companies, Ainsworth, Canfor, Crestbrook, and MB, fell but the decline was not statistically significant. The remaining two firms, Primex and Scott, enjoyed small, but not statistically significant gains in stock price.

The results might be explained, at least in part, by the characteristics of the individual firms. Table 2 presents some information on the distribution of assets and sources of timber supply for the 12 British Columbia companies. First, Primex holds no replaceable tenures and purchases all of its logs on the open market or through log-supply agreements. Scott is well diversified outside of British Columbia, holds only a very small quantity of the replaceable tenures that carry the higher costs, and concentrates on hardwoods which were not affected by the higher fees. MB has a significant quantity of private land unaffected by the change in stumpage fees, had diversified outside of British Columbia to a larger degree than the other British Columbia based firms, and derives a large share of its sales from the distribution of products manufactured by other firms. As a result, MB was somewhat insulated from the increased timber fees. Similarly, Canfor had, at this time, diversified outside of British Columbia more than the remaining firms. Both MB and Canfor support significant pulp and paper operations whose principal input is byproduct chips that do not carry any stumpage at all. However, other firms with significant pulp and paper operations, West Fraser, Weldwood, and Doman, all suffered statistically significant losses.

The impact of the timber-fee increase is highly correlated with the amount of timber a firm has available to harvest under replaceable licenses. Regressing the stock market impact for individual firms (the last column in Table 2) on the AAC in replaceable licenses (the third from last column in Table 2) implies an impact per cubic metre of AAC equal to $33.3/m^3

with a very small standard error (t = 14.5, R^2 = 0.853, no constant). The stock market apparently differentiated among firms with good precision.

The null hypothesis (H_1) that the aggregate abnormal return is zero is rejected at the 5% level (the Wald χ^2 test statistic has the value 6.1741 with 1 degree of freedom). This result indicates that the increase in stumpage fees was a statistically significant negative event for shareholders in British Columbia firms as a whole. After adjusting for the 5.8% decline in the TSE that occurred over the event period, the market capitalization of the 12 forest products firms taken as a whole fell by $1.0 billion (see Table 2). These firms collectively hold about 45.7% of the replaceable licenses, so the total impact on the British Columbia forest sector was about $2.4 billion.[11]

How does this decline in stock value compare with the increased after-tax cash cost to the licencees? Recall that the after-tax cost of the stumpage increases to the licencees would be $337.5/year (assuming an SPF price of $350 and combined federal and provincial income taxes of 40%). The share-price impact and annual after-tax cash costs are equivalent at a capitalization rate of 14.0%, a figure that lies within the range of the cost of equity to forest products companies (13–16%; Price Waterhouse 1997). Since SPF traded below this level at the time the new timber fees were announced, one can conclude that the stock market's reaction to the new timber fees is at least as large as the capitalized after-tax cost to the firms involved.

Conclusions

On 14 April 1994 the provincial government announced the new stumpage formula, primarily to fund a new agency, FRBC, dedicated to investing in the forest sector, broadly defined. On that day, the stock prices of publicly traded British Columbia forest products companies fell. The total decapitalization of the industry amounted to about $2.4 billion, roughly the capitalized after-tax cost of the higher stumpage fees. Hence, the capital investments made by FRBC do not represent new capital to the sector, but rather a shift of capital from private investors to public ones, no doubt directed towards different purposes. By shifting the timber rent from companies to FRBC, the government eliminated from the forest sector an amount of private capital roughly equal to the then-current market capitalization of the province's leading forest products company, MB.

The change in stock prices suggests that the market does not anticipate any efficiency gains from FRBC activities (such as positive changes in AACs), at least in the short term. Said another way, the market apparently gave the British Columbia government no credit for dedicating some of the increased stumpage fees to activities that might offset planned harvest reductions.

Although timber quota (in the form of either forest licences or tree farm licences) cannot be formally bought or sold, security analysts commonly decompose forest-sector transactions into a value for mills (and any other assets) and a residual amount putatively assignable to the associated timber quota. Prior to the imposition of the new timber fees, this methodology commonly produced values of quota in the range of $100–150/m^3 (this is the capitalized value of the uncollected rents plus the value of any "convenience yield" associated with the operational benefits of being able to plan and schedule one's own harvests). Recall that the average increase in timber fees was about $12/m^3 (the actual increases have been much higher, but product prices have been higher as well). At capitalization rates relevant for timber investments, these new fees would arguably deplete the total value of an average licence (the added cost of $12/m^3 capitalized at 11% (the estimated weighted average cost of capital for the forest products industry in British Columbia; McCallum 1997) equals $109/m^3). Added to the new stumpage fees are increased logging and forest management costs associated with the Forest Practice Code (recently estimated at about $12/m^3 for the entire province; KPMG et al. 1997). Hence, replaceable licences in British Columbia may no longer have any economic value, aside from their convenience yield. The resource rent has, on average, been fully extracted from licences, either by the higher timber fees, increased regulatory costs, or such policy constraints as appurtenancy and log-export restrictions.

Some economists and other policy analysts commonly argue that governments should collect the full rent associated with natural resources. Collecting the resource full rent from standing timber, and thereby eliminating the value of licences, greatly changes the context for forest policy in the province. For example, doing so resolves for the government the problem of compensation due under the British Columbia Forest Act: even if compensation is legally due, its value may now be negligible. But this policy approach raises other policy problems. Marginal operators will, by definition, no longer be profitable and the government may face massive costs, economic and political, of industry restructuring. Licencees will be far more reluctant to accept costly new policy initiatives and may begin to question the value of holding licences altogether. This may open the field for new entrepreneurs without specific connection to the processing sector: First Nations, small holders, and institutional investors such as the Hancock Timber Resource Group that already holds about 30 000 ha on Vancouver Island. These developments, of course, greatly diminish government's control over the sector and its capacity to implement forest policy. The next decade offers a large-scale experiment on the effects of full collection of resource rents, a conventional forest policy prescription in countries where public ownership of forest land is prominent.

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Footnotes

[2] The two major forms, tree farm licences and forest licences, provide what amounts to a perpetual supply of timber through a chain of long-term agreements (15–25 years) that may be replaced every 5 years (hence the term replaceable licences). The two forms differ in the nature of the timber supply, with tree farm licences conveying rights over a fixed area of forest land, and forest licences conveying rights to a fixed volume of timber. In contrast, nonreplaceable timber licences (an old form of tenure that is no longer issued) convey the rights to cut all of the standing timber in a prescribed area with the land returning to provincial government management after the initial logging.

[3] On 20 May 1994, after consultation with licensees, the government deferred $30 million of the increased timber license royalties. This change could not, of course, have been anticipated by financial markets in early April.

[4] The estimated relationship between the Statistics Canada Index (I) and commercially reported $US SPF prices (pspf) is (Fletcher 1994) $I = 37.8 + 0.380 \cdot \text{pspf} \cdot \$\text{CAN}/\$\text{US}$. Figure 1 is plotted with an exchange rate of CAN $1.30/US $1.00. The stumpage fee formula as well as the relationship between product prices and the s Canada Softwood Lumber Index differ for the Coast, but the principles are the same as those discussed here for the Interior.

[5] Between SPF prices of $US 250 and $US 300, the target stumpage rate increases $9.35. Therefore the slope of the line, expressed in $CAN of incremental timber fees collected per $CAN of change in product price, is 9.35/(LRF·$CAN/$US·$US 50) where LRF is the lumber recovery factor, assumed to be 0.250 mfbm/m^3 (thousand feet board measure/cubic metre of log input; about the current average for mills in the British Columbia Interior) for the slopes plotted in Fig. 1. Note that if the LRF is poor enough, or the Canadian dollar adequately strong, within this range the new stumpage system could extract more than the incremental value of the higher product price.

[6] Large volumes of timber are now coming into British Columbia from Alberta, the U.S. Pacific Northwest, and the Yukon Territory as a result of higher increased domestic log prices. The increase in domestic log prices has resulted from regulatory restrictions on timber supply in British Columbia and robust product demand, not from higher stumpage fees.

[7] The accounting effects of these increases in timber fees depend on how the firm acquired its licenses. When the government initially grants a license, it has no book value. Unless the uncollected rent is somehow dissipated by the firm (a not-implausible possibility given such policy restrictions as appurtenancy), it flows through the firm's income statement directly to its operating earnings. The firm will have a relatively high return on capital employed, and its stock price should rise until the capitalized value of the uncollected rents has been fully reflected in stock markets. When a license is transferred from one firm to another, the purchasing firm recognizes on its balance sheet the market value of the license. In theory, this market value reflects the capitalized value of any uncollected rents from the license. Until recent changes in the federal tax laws defined replaceable timber licenses as depreciable assets for tax purposes, firms had an incentive to state the value of any such licenses they acquired at the lowest possible level. Tax law changes in the early 1990s that permitted tax depletion of replaceable licenses eliminated this incentive. As a result, the imputed values of replaceable licenses reported in recent transactions probably more closely reflect their true market values. The value of the licenses become part of the firm's capital base. An unanticipated increase in timber fees reduces the value of these licenses, and, to the extent that they were correctly valued on the firm's balance sheets, will reduce the return on capital employed for British Columbia firms. This accounting effect will be greater for firms that have recently acquired their timber licenses than for those that obtained them directly from the government or through market transactions many years ago.

[8] This is a variation of the capital asset pricing model (CAPM) by Sharpe (1964) and Lintner (1965). The CAPM specifies a linear relationship between the returns of an individual asset (R_{it}) and the returns to a value-weighted portfolio of all assets (R_{mt}). The CAPM is the most common, simple, and robust method to control for financial risk and marketwide effects, although it is not without critiques (Roll 1977; Ross 1978).

[9] Note that the off-diagonal elements of the variance–covariance matrix could be directly estimated from the OLS estimates of the individual equations without resort to SUR. SUR simply offers a convenient computational framework for doing so.

[10] There is little agreement in the literature regarding when the event window should start and for how long it should last. Therefore, a trial-and-error method is often used to choose the starting date. Desai and Stover (1985) started the window at –20 (20 days before event); Dann and James (1982) started at –10. Zinkan (1988) and Boardman et al. (1992) used –5 as the starting day. In addition, eq. 2 was also estimated by using days –24, –20, –18, –16, and –14 as the starting date and days +5, +7, +11, and +21 as the ending date. The results do not significantly differ from those reported here.

[11] Calculated as 1.041/0.453 plus an estimate of the equivalent effect on timber licences held by firms other than those in the sample. Data from K. Baker (B.C. Ministry of Forests, Victoria, B.C., personal communication) indicate that these amount to 60 013 ha. Assuming that these lands carry the same stocking as the average hectare harvested in 1994–1995 (411.3 m^3/ha; British Columbia Ministry of Forests 1995, tables C-2*b* and C-2*d*) and a 14.5% capitalization rate (see main text) for the measured impact associated with replaceable licences, the impact on timber licences would be about $111 million. This calculation results in a total impact of $2.409 billion. Another way to estimate the impact associated with replaceable licences is to multiply total AAC in these licences (71.6 mm/m^3) by the average impact per cubic metre ($33.3/$m^3$). This results in a slightly larger estimate of the total impact ($2.495 billion).