A TIMBER PRODUCER'S ENTRY, EXIT, MOTHBALLING, AND REACTIVATION DECISIONS UNDER MARKET RISK

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ABSTRACT

decisions of a timber producer when the output price follows a continuous-time stochastic process. We find that these decisions take the form of a set of trigger prices. While the optimal entry price exceeds its static counterpart -the long-run average total cost, the optimal exit price is less than its static counterpart – the short-run average variable cost. Further, as market conditions evolve, the producer has other decisions like mothballing or reactivation to consider before abandoning production. Our empirical example illustrates how these decisions may vary even with a moderate degree of price volatility, a small amount of sunk costs, and changes in other parameters. Our work gives better explanations to some important issues in forest investment.

Keywords: Timberland investment, real options, valuation.

INTRODUCTION

Similar to investments in other industries, forest investments demonstrate two important characteristics. First, investment expenditures are largely irreversible. Once an investment is made, it becomes more or less a sunk cost that can not be fully recovered. Second, options exist for an investment to be made now or later; postponing an investment gives the investor an opportunity to wait for new information to arrive about prices, costs, and other market conditions before she commits resources. It is the presence of irreversibility that makes investments more sensitive to various forms of uncertainty, and it is the combined effect of uncertainty and irreversibility that makes an option to invest more valuable (McDonald & Siegel, 1985; Pindyck, 1991; Dixit 1992).

Existing forest investment analyses largely ignore the implications of these characteristics for management decisions. As a result, the investment behavior of timber pro-

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ducers remains poorly understood. For example, the decision regarding when a producer should invest in or abandon a forest project may depend on whether it operates in a deterministic setting or in a stochastic setting. Forest economists generally follow the textbook rule that if the market price falls short of short-run average variable cost (SAVC), then the producer should exit from, or abandon, her business; if the price exceeds long-run average total cost (LATC), then she should enter into the business (Johansson & Löfgren, 1985). In other words, LATC and SAVC act as the producer's entry and exit thresholds. We define entry to be the point of time at which the producer is engaged in not only various management activities but timber harvesting. It is known that there can be a time lag between her initial acquisition of land and/or premerchantable trees and the formal entry. Exit refers to the action of going out of production by liquidating her stands and/or selling her land and other related assets.

Implicit in the above rule. is the assumption of static expectations in that current prices will prevail forever. In most real-world situations, however, the demand and supply conditions facing a timber producer change and she must make decisions by taking into account that the future is and will always be uncertain. Thus, for a timber producer with rational expectations about her uncertain economic environment, it is logical to conjecture that the optimal investment and abandonment thresholds may be quite different from the LATC and SAVC.

Of course, a timber producer has other options before permanently abandoning an operating forest project. When the market price of timber falls, the producer may operate at a loss and thus, she can temporarily suspend her production by postponing harvesting and/or lowering the intensity of management. The temporary suspension of production is called "mothballing" in the literature (Dixit and Pindyck, hereafter D&P, 1994). Caution should be taken when we apply this concept to forestry. This is because, unlike a paper mill or a ship, a forest is a biological asset which continues to grow after production is suspended. Therefore, it seems awkward to talk about mothballing timber production. However, this by no means implies that a timber producer does not opt to temporarily suspend her production. In fact, it is this biological feature of forestry that gives a timber producer decision flexibility and thus makes it particularly relevant, though difficult, to consider postponing the harvest and/or lowering the intensity of management.

Once her production is mothballed, the producer will face the option of either reactivation or abandonment. If the price of timber goes up, then she can reactivate her production by resuming all the normal harvesting, management, and planting activities; otherwise, if the price of timber continues to fall, then she may have to exit from timber production. When the option to abandon is exercised, her business goes back to an idle state-no longer pursuing timber production-and she obtains a new asset, the option to invest. If market conditions sufficiently improve later such that this option is exercised in turn, it will lead her back into timber production.[1]

This discussion provides direct insights into forest management. Previous studies indicate that, in historical terms, the average rate of return from forest investments is seemingly low (Berck, 1979; Zinkhan et *al.*, 1992). If this is the case, why then do people continue timber production? Some analysts believe that it may be related to provision of nontimber services, which increases the economic rate of return from forestry investments (e.g., Hartman, 1976; Binkley, 1981; Newman & Wear, 1993). However, if timber and nontimber uses are not jointly produced everywhere, then we may need to search for an alternative explanation to the situation where the economic rate of return in timber production is low. Even if both timber and nontimber outputs are produced together, there may exist other reason(s) than jointness to justify production, such as asset fixity (Vasavada & Chambers, 1986). However, asset fixity is probably not unique to any industry, and the varying degrees of fixity are not closely correlated with rates of return. Therefore, it is imperative to incorporate various practical situations into our analysis for explaining the producer's behavior.

Forestry also presents a situation of high opportunity costs of capital in the form of standing inventory (Binkley,

[1] In special cases where the price of timber is so low and/or the alternative uses of the land is so limited, a producer may abandon timber production even if the trees and/or land are retained.

1987). High capital costs affect investment decisions. So far, however, we have not been able to reasonably assess the impacts that capital intensity imposes on investment decisions and dynamic adjustments in forest management. As discussed later, this may have to do with our analytic tradition of the stand-level Faustmann formula, which is unable to reveal the cost structure of timber production. Thus, a clear forest-level model of entry, exit, and other related decisions is needed to shed light on this issue as well.

The primary objective of this paper is to empirically estimate the entry, exit, mothballing, and reactivation threshold values for a representative timber producer and to use the estimated results to interpret some peculiar issues in timber production. To that end, we apply the options approach developed by D&P (1994). This approach holds great promise for improving our knowledge of firm's investment behavior in a stochastic setting. In order to make the options approach fit forest investment analysis, however, a substantial expansion of the analytic scope and conceptualization of the subject matter is warranted. The remainder of the paper is organized as follows. A model of entry, exit, mothballing, and reactivation under uncertainty is presented first. Then we report these estimated price thresholds for a representative timber producer, and show how they will change as the underlying market conditions evolve. A discussion of the implications of our work follows.

THE BASIC MODEL

Modeling af the Forest-Level

Forest investment has been widely analyzed within the Faustmann framework in which a landowner is assumed to maximize the present value of a stream of timber revenues net of planting and management costs from an infinite series of rotations (Samuelson,1976). Recently, research along this line has advanced into the stochastic domain, but there are shortcomings associated with this type of model.* Yin & Newman (1996) addressed some of the short-

* To name a few, analyses of the tree-cutting problem under uncertainty include Haight & Reed (1996), Reed & Ye (1994), Thompson (1992), Reed & Clarke (1990), Morck *et* al. (1989), Clarke & Reed (1989), Brazee & Mendelsohn (1988), Lohmander (1987), and Norstrom (1975).

comings in their study of the effect of catastrophic events on forest investment. Two important aspects pertaining to the current study are its point-input/point-output nature (Conrad & Clark, 1987) and the blurring of contributions from different production factors (Comolli, 1980). The point-input/point-output problem, resulting from modeling at the stand-level, implies a pulse process of timber production. This pulse process, however, conceals the sustained-yield feature of timber production. The blurring of contributions from various production factors makes it difficult to allocate them efficiently and analyze them effectively.

Using Smith's (1961) and Samuelson's (1976) ideas, Comolli (1980) transformed the stand- level Faustmann formulation into a forest-level profit function. With further modifications by Yin & Newman (1997), this profit function takes the form of:

$$\pi(t) = P_t F(t) - i_t P_t I(t) - W_t K(t) - R_t L(t). \qquad (1)$$

This profit function describes that a producer incurs an initial investment expense of M dollars at time $t = 0$ in establishing forest inventory I(t); thereafter, facing market prices of P_t, unit operating costs of W_t, land rental costs of R_t, and an interest rate of i,, she produces a flow of outputs F(f) into the future as operating inputs K(f) and land acreage L(t) are committed.[3] With such a formulation, the unit production cost at t is defined to be

$$C_t = \left[iP_t I(t) + W_t K(t) + R_t L(t) \right] / F(t).$$

The timber price is modeled as a stochastic variable following a geometric Brownian motion:

$$dP = \alpha P dt + \sigma P dz. \qquad (2)$$

where α and σ are a constant drift and standard deviation

[3] It is true that NIPF landowners with small holdings do not manage on a sustained-yield basis, and their harvesting is infrequent at best. However, there do exist producers who manage on a sustained-yield basis. Further, as long as the manufacturing of forest products goes on, timber must be supplied continuously. Thus, forest-level analysis is relevant for certain situations. Of course, we do not rule out the possibility for even typical producers to suspend operations temporarily.

of prices, and dz is the increment of a standard Wiener process with $E(dz) = 0$ and $E(dz^2) = dt$ (E denotes expectation).

Determination of Entry and Exit Thresholds

For ease of exposition, we start our model development from the case where only entry and exit options are involved. Mothballing and reactivation options will be considered later. Intuitively, the optimal strategy for investment and abandonment takes the form of two threshold prices, say, P_h and P, $(P_h>P_l)$. An idle firm will find it optimal to remain idle as long as P remains below P_h and will invest as soon as P reaches P_h. On the other hand, an active firm will remain active as long as P remains above *P,,* but it will abandon if P falls below P_l . In the range of prices between P_h and P_l , the optimal policy for a firm is to continue with the status quo.

The procedure for determining P_h and P_l can be summarized as follows. First, we calculate the value of an idle firm or the value of the option to invest, *V,(P),* and the value of an active firm or the sum of the entitlement to the profit . flows from the operation and the option to abandon, *V,(P).* Then; we use the "value-matching" and "smooth-pasting" conditions for optimization at both P_h and P_l to formulate four equations, which are the function of P_h and P_l. Finally, we obtain P_h and *P,* by solving this equation system (pp. 215-218, D&P 1994). We know that at the investment threshold, *P,,* the firm pays a lump-sum cost, *M,* to exercise its entry option by giving up an asset of value, $V_0(P_h)$, to begin an active project worth of $V_1(P_h)$. For this, we have the optimal conditions $V_0(P_h)=V_1(P_h)-M$ and $V_0'(P_h)=V_1'(P_h)$. Likewise, at the abandonment threshold, *P,, we* have $V_1(P_l)=V_0(P_l)-S$ and $V_1'(P_l)=V_0'(P_l)$, where S denotes the abandonment cost, which might include the expenses of equipment and material disposal, compensations to employees, and other contract liabilities. S can be negative if the salvage value (namely, the value of the remaining timber and land) is greater than the expenses.

The four conditions can be written as

$$-A_1P_h^{\beta_1}+B_2P_h^{\beta_2}+P_h/\delta-C/i=M, \tag{3}$$

$$-\beta_1A_1P_h^{\beta_1-1}+\beta_2B_2P_h^{\beta_2-1}+1/\delta=0, \tag{4}$$

$$-A_1 P_l^{\beta_1} + B_2 P_l^{\beta_2} + P_l/\delta - C/i = -S, \tag{5}$$

$$-\beta_1 A_1 P_l^{\beta_1 - 1} + \beta_2 B_2 P_l^{\beta_2 - 1} + 1/\delta = 0, \tag{6}$$

where

$$S = i - a,$$

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left(\frac{\alpha}{\sigma^2} - \frac{1}{2}\right)^2 + \frac{2i}{\sigma^2}}, \text{ and}$$

$$\beta_2 = \frac{1}{2} - \frac{\alpha}{\sigma^2} - \sqrt{\left(\frac{\alpha}{\sigma^2} - \frac{1}{2} + \frac{2i}{\sigma^2}\right)}.$$

A_1 and B_2 are the other two unknowns. Since the equations are linear in A_1 and B_2, (3) and (5) can be solved for these two option coefficients. They are then substituted into (4) and (6) to solve for P_h and P_l.

Decisions Related to Suspension

Let us introduce the option of temporary suspension into our model now. Starting from scratch, the firm will invest in timber production with a cost of *M*, if the price of timber reaches P_h. The firm will mothball timber production if the price of timber falls to P_m. Mothballing entails a cost of Q, which consists of consultant fees and disposal of equipment and materials. Further, maintaining a mothballed project requires a cost flow, *N*, which includes land rent, tax, and expenses on oversight, fire prevention, pest control, and other activities. Note that the firm's asset appreciation (net value increment of the trees) may not be used to offset this cost because the value gained from postponing the harvest will be realized in the future. For mothballing to make sense, *N* must be less than the actual production cost C; otherwise, the firm might find it better to abandon the production directly.

If the price of timber rises to P_r, the mothballed timber production will be reactivated at a cost *R*, which represents expenditure on repairing equipment, acquiring materials and employees, sales bidding, and other items. Note that $P_r < P_h$ given $R < I$. If the price of timber continues to fall, making reactivation unlikely, there exists a P, at which the mothballed timber production will be abandoned at a cost of S as before. Then the firm will go back to its original idle state. Again, by formulating the "value-matching" and "smooth-pasting" conditions at each switching point, we have a system of eight equations.[4] Solving this system, we can determine the thresholds P_h, P_m, P_r and P_l as well as the four option value coefficients. Now, let us turn to a numerical example.

A NUMERICAL EXAMPLE

We take a no-thin, old field, loblolly pine plantation in north Georgia as our example. The site index is 65, the number of trees planted is 705, and the rotation length is 28 years. Products per acre are made up of 28.8 cords of pulpwood and 24.3 cords of chip-n-saw (Bailey & Ware, 1983). Prices, representing those of first quarter of 1994 (Timber Mart-South, 1994), are $25.00 per cord for pulpwood and $62.50 per cord for chip-n-saw. The drift and variance parameters of pulpwood and chip-n-saw prices are estimated based on the quarterly price series from the first quarter in 1986 to the first quarter in 1994. Data prior to 1986:1 are removed to more accurately reflect current trends in price movements. We use the Consumer Price Index as our deflator. The annual growth rate of pulpwood price is 0.0075 with a variance of 0.0825; and the annual growth rate of chip-n-saw price is 0.0293 with a variance of 0.0264. Therefore, the average price is $42.16 per cord, with an annual growth rate of a = 0.02 and a variance of $\sigma^2 = 0.048$. In other words, the average price grows at 2% annually with a volatility (standard deviation) of roughly 20%.

The following cost-related parameters are derived for a regulated forest based on information provided by a local forestry extension specialist (Dangerfield, 1992). Given the choice of outputs and associated rotation, the minimum acreage to be considered is 28 acres with an inventory of 760 cords. The annual operating cost is $226.00, which includes site preparation ($25.00/ac), planting ($50.00/ac), fire prevention, pest control and other management practices ($2.00/ac), ad valorem taxes ($2.50/ac), and prescribed

[4] The interested reader is referred to D&P's 1994 book (p. 233).

burning ($25.00/ac) for five times in a rotation. The annual land rental cost is $246.40, which is determined as a product of market rate of annual land rent $8.80/ac (land price $220.00/ac times the interest rate of 4%) times 28 acres. The opportunity cost of capital in the form of standing timber stock is $1281.69, which results from a stumpage price of $42.16/cord multiplied by 760 cords and 4%. The unit cost is thus $34.93/cord—the sum of operating cost, land rental cost, and capital cost ($226 + $246.4 + $1281.69) divided by the total output (53.1 cords). Clearly, capital cost is the dominant component of the total cost, accounting for more than 73%.

Based on parameters specified above, the investment cost (accumulated land and operating costs prior to the first harvest) for establishing a forest of different ages is $231.31/cord. That is, to acquire a production capacity of one cord a year in the long-run, a producer needs to invest about $231 now. The abandonment cost, representing the possible salvage value of timber liquidation and land sales, is negative. Due to wide variation in salvage values, however, the abandonment cost is hard to estimate with any accuracy. Therefore, we assume it to be 1/3 of the investment cost in our base case—$77.10/cord. Timber production generally does not require heavy mothballing and reactivation expenses. We assume the former to be zero and the latter to be $1.00/cord for our base case. However, maintaining a -mothballed project is costly, even though the growth of timber asset can offset part of this maintenance cost, which is set at $5.00/cord in our base case. Table 1 summarizes these parameter values.

Our numerical results for the simplified case of entry and exit are reported in Table 2. First, if the price volatility is ignored, the static entry price (LATC) is the sum of the production cost and the interest on the sunk cost of investment ($C + iM$), which equals $42.28; the static exit price (SAVC) is simply the subtraction of interest on the lump-sum abandonment cost (negative as salvage value) from the production cost ($C - iS$), which is $36.11. However, if the average stumpage price grows at an annual rate of 2% with a volatility of 20%, then the optimal entry price is $63.30, and the exit price is $21.98. Under uncertainty, the optimal entry price increases, while the optimal exit price decreases. Moreover, the more volatile the market price, the higher

TABLE 1. A SUMMARY OF SPECIFIED PARAMETERS.

Parameter Definition	Notation & Value
Rotation	T = 28 years
Inventory	I(f) = 760 cords
Production	$F(t)$ = 53.1 cords
Timber price	P = $42.16/cord
Investment cost	M = $231.31/cord
Abandonment cost	S = -$77.10/cord
Variable cost	C = $33.03/cord
Mothballing cost	Q = $0.0
Maintenance cost	N = $5.0
Reactivation cost	R = $1.0
Discount rate	i = 0.04
Price trend	α = 0.02
Price volatility	σ = 0.20
Static entry threshold	$C + iM$ = $42.28/cord
Static exit threshold	$C - iS$ = $36.11/cord

the entry price and the lower the exit price are (see Case I of Table 2). These results indicate that, if a landowner is considering getting into the timber business, she will require a higher market price to do so in order to assure a reasonable profit flow in an uncertain world. On the other hand, if she is already involved in timber production, then a low market price will not necessarily drive her out of the market since she can hope that the price will bounce back to a higher level in the near future.

As the price growth rate increases, a producer becomes willing to lower both her entry and exit thresholds in timber production (see Case II of Table 2). If price rises faster, then she is less worried about a low level of the current price, anticipating that it will soon be higher. As price gets higher, the current sacrifice of operating profits becomes more important. Also note that if the price growth rate become negative, the resultant entry and exit levels both go up.

Both investment and abandonment thresholds rise in an uncertain world as production costs increase. These changes (see Case III of Table 2) show that, given increased production cost?, a potential investor will demand a higher market price to make an investment in timber production; and

TABLE 2. ENTRY AND EXIT PRICES FOR A TIMBER PRODUCER.

Case	i	S	C	α	σ	P_h	P_l
I. Changes in price volatility	0.04	77.10	33.03	0.02	0.00	42.28	36.11
					0.10	50.63	24.62
					0.20	63.30	21.98
II. Changes in price growth rate	0.04	77.10	33.03	-0.10	0.10	58.45	29.43
				0.01		52.88	26.32
				0.03		48.86	22.95
III. Changes in production cost	0.04	77.10	26.42	0.02	0.10	42.83	19.62
			33.03			50.63	24.62
			36.03			54.49	27.19
IV. Changes in salvage value	0.04	19.28	33.03	0.02	0.10	50.92	21.91
		38.55				SO.84	22.79
		77.10				50.63	24.62
V. Changes in interest rate	0.03	77.10	33.03	0.02	0.10	41.11	19.07
	0.04					50.63	24.62
	0.05					60.07	30.31

Note: i = interest rate, S = salvage value, C = production cost, α = price growth rate, σ = price volatility, P_h = entry price, P_l = exit price. Except for interest rate, the unit of other parameters is $/cord.

if the investment is already made, then she cannot tolerate a very low market price. Our results also suggest that the effect of an interest rate rise is similar to that of an increase in the production cost (see Case V of Table 2). In addition, if the salvage value is high, or the abandonment cost low, then a relatively low market price can induce a producer to enter into timber production. On the other hand, if the salvage value is low or the abandonment cost high, then a higher market price is needed to attract investment. However, the producer becomes more willing to tolerate a low market price (see Case IV of Table 2).

Table 3 depicts cases associated with mothballing. In our base case with mothballing cost Q = 0, maintenance cost N = $5.0, and reactivation cost R = $1.0, we find that the mothballing price is $26.12/cord, two dollars higher than the abandonment price. When the price rises to $29.82/cord, the normal production of timber will be resumed.

TABLE 3. PRICE THRESHOLDS ASSOCIATED WITH MOTHBALLING. ($\alpha = 0.02$, $\sigma = 0.20$, $i = 0.04$, $S = 77.10$, $C = 33.03$)

Cases	R	Q	N	P_h	P_r	P_m	P_l
I. Changes in maintenance cost	1.0	0.0	3.0	50.57	31.90	28.03	23.02
			5.0	50.62	29.82	26.12	24.19
II. Changes in suspension cost	1.0	0.0	5.0	50.62	29.82	26.12	24.19
		1.0		55.66	30.43	25.28	24.26
III. Changes in reactivation cost	1.0	0.0	5.0	50.62	29.82	26.12	24.19
	2.0			50.69	30.21	25.69	24.28

Note: α = price growth rate, σ = price volatility, i = interest rate, S = salvage value, C = production cost, P_h = entry price, P_r = reactivation price, P_m = mothballing price, P_l = exit price. Except for interest rate, the unit of other parameters is B/cord.

Further, if N increases, both P_r and P_m fall. This indicates that a landowner will mothball production less readily, and reactivate the mothballed production more readily. However, both P_h and P_l rise slightly, suggesting that the owner will be more reluctant to make the investment in the first place but will get out of production more readily. Next, we see that when Q or R increases, P_m declines but P_r rises; the producer will be less willing to mothball or reactivate her production. Again, P_h and P, rise. We also find that changes in the production cost have greater impact on mothballing and reactivation than on entry and exit.

To sum up, our analysis shows that when the timber price is high, more producers tend to enter into the business of timber production, and the existing producers tend to not only harvest more but also do more planting and management. On the other hand, when the timber price goes down to a certain level, producers may temporally suspend their harvesting and/or cutting back their management activities. If the timber price continues to drop to a very low level, then producers may decide to go out of business by abandoning timber production. Otherwise, if the timber price bounces back to a higher level, then producers may reactivate their mothballed timber production.

CONCLUDING REMARKS

In this paper, we first introduced a model for various investment decisions (entry, exit, mothballing, and reactivation) under market risk and then empirically determined these thresholds for a representative timber producer. We found that, with uncertainty, a higher market price is required to induce an investor to enter into timber production, but the price to trigger an existing producer to exit from timber production lowers. If timber prices are rising over time, then a producer will systematically lower her entry and exit thresholds. On the other hand, increases in the interest rate and variable costs will cause a timber producer to raise both her entry and exit thresholds. Finally, decreases in the salvage value will raise the entry trigger but lower the exit trigger.

Due to the harvest flexibility and relatively low costs associated with temporary suspension of production, mothballing enters the producer's choice set as a critical management. decision. Our estimation showed the variations of mothballing and reactivation thresholds induced by changes in the mothballing cost, maintenance cost, and reactivation cost. We also found that in a stochastic world, it is possible for both the mothballing and reactivation threshold to be lower than the unit variable cost. This result contradicts our knowledge in a static setting. The temporary suspension of production, in response to market dynamics, is a common phenomenon. Unfortunately, it has largely been ignored in the literature. Our work has illustrated that once this option is incorporated, we will be able to obtain more realistic results.

Our analysis can contribute to our understanding of some nontrivial questions in forestry: Why do timber producers tolerate a low rate of economic return? What are the causes for timber producers to constantly adjust their production behavior? How does the intensive capital deployment affect management decisions? For instance, even today timber may still be produced on marginal land. This implies that the value of liquidating the timber and selling the land is usually low, should a producer decide to get out of timber production. With a low salvage value and a small likelihood to allocate the land to other profitable enterprises, a producer may prefer to stay in timber production even though the market price is lower but more volatile than desired. This presents a rational interpretation for timber production in spite of relatively low economic rates of return.

Likewise, because an overwhelming cost component is the opportunity cost of timber inventory, a producer would adjust her cost structure by lowering inventory levels. In doing so, it becomes possible not only to accept a lower market price, but also to induce opportunities for various intensive management practices which would bring about improved productivity (Yin et *al.* 1998). In practice, declining inventory relative to removal has often been interpreted as a detrimental change to forestry. Here, our analysis gives an alternative explanation to the dynamic adjustments the forest sector has witnessed.

In short, our treatment'of timber production as a continuous process involving multiple decisions in response to changing market conditions have enabled us to examine a producer's behavior under market uncertainty in a more systematic fashion. In contrast, the stand-level analysis is centered on rotation determination. This also highlights the fact that arguing for government intervention based on misinterpretations to the above questions may result in unexpected landowner responses (Adams *et al.*, 1982).

As to policy implications, it can be generally stated that public actions that increase the cost of timber production will raise both investment and abandonment thresholds for a landowner. As a result, fewer investors will consider investing in timber production, and fewer existing producers will stay in production. On the other hand, instruments and programs that reduce production cost incurred by a producer will lower the investment, mothballing, and abandonment thresholds, giving rise to more investment in timber production. Certainly, measures which alleviate the volatility and enhance the stability of stumpage markets should be encouraged.

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