Property Rights, Resource Access, and Long-Run Growth

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In this article we use four Canadian Supreme Court decisions that have substantively contributed to the constitutional recognition of aboriginal rights to assess the impact that changes in the security of commercial property rights have had on long-run macroeconomic performance. We use a series of event studies to measure the extent to which each court decision had an effect on the common share prices of Canadian forestry firms. These share price effects reflect investors' perception of the decisions' impact on forestry firms' contemporaneous access to resource stocks and uncertainty surrounding the security of their access into the future. A simulation model based on a resource industry's dynamic optimization problem links the stock access and uncertainty effects implied by our event studies to the commercial producers' economic fundamentals. Changes in the resource industry's simulated profits can be used in a general equilibrium framework to estimate the effect that the Court's decisions had on Canadian real GDP per capita growth during the 1970–2005 period. Our methodological approach allows us to estimate the aggregate, long-run macroeconomic effects that resulted from the Court's recognition of aboriginal rights, and also trace the channels through which these changes in the distribution of property rights influenced performance; we assess the relative importance of the current access and future uncertainty components of these changes.

I. Introduction

Economists have increasingly emphasized the role stable and secure property rights can play in promoting economic growth.1 It is argued that the quality of institutions, particularly

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1Some widely cited examples include de Soto (2000), Acemoglu et al. (2002), and Acemoglu and Johnson (2005).
property rights, plays an important role in facilitating transactions, encouraging investment, and promoting the efficient use of resources. In the theory of natural resource exploitation, secure property rights play a particularly important role in creating incentives for optimal investment and harvesting. Natural resource endowments themselves have been identified as a significant contributor to successful economic growth, when combined with the “right” institutional environment.

Empirically establishing the importance of property rights is challenging. Much of the evidence linking secure property rights to macroeconomic performance is based on the estimation of aggregate cross-country growth equations. This growth equation approach, even with appropriate controls for endogeneity, fails to provide a detailed description of the link between secure property rights, resource use, and investment decisions. Comparative measures of the security of property rights often include confounding events that are associated with broader social disruption, making it difficult to isolate the effect of property rights alone. To better understand how property rights affect economic growth, we need to trace the channels through which changes in property rights can affect decisions regarding resource use in specific contexts.

Theories linking secure property rights to efficient resource use abound, but empirical literature on this connection is relatively sparse. A number of studies have identified positive effects on investment and the use of specific resources when security is provided through the formal protection of property rights, but for the most part this literature does not attempt to empirically assess the macroeconomic implications of these property rights effects. An exception is Bohn and Deacon (2000). These authors find that insecure property rights decreased investment in oil exploration and production, and accelerated deforestation, in a cross-section of countries. However, their study does not examine specific changes to formal legal rights, but relies instead on an index that

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2Seminal references include North (1990), Coase (1960), and Demsetz (1967).
3See Hardin (1968), Gordon (1954), Scott (1955), or Alston et al. (1999).
4See Wright (1990) on the contribution of resources to U.S. industrial success, Sokoloff and Engerman (2000) on the importance of resource endowments and their interaction with institutions, and Bhattacharya and Lucek (2009) on the relationship between resources and income, taking into account property rights and other aspects of the institutional context.
5See Kormendi and Meguire (1985), Grier and Tullock (1989), Barro (1991), and Bohn and Deacon (2000), which considers cross-country results for specific resource industries.
6See Bohn and Deacon (2000:535–40) for a description of the construction of their “ownership security” measure, which is based on political stability variables including: the risk of revolution, major constitutional change, political assassination, and purges and guerrilla warfare.
7Alston et al. (1996) find that formal title is associated with increased land values and land-specific investments on the Brazilian frontier. Besley (1995) finds evidence of increased investment with the transition to more formal, individualized land rights in Ghana. Grafton et al. (2000) find that the introduction of property rights produces increased value and decreases inefficiency from the race to exploit in the British Columbia halibut fishery.
is primarily driven by variables reflecting political instability. Another body of literature examines the effect of strong formal property rights relative to informal norms for the efficient use of resources. Significant attention has been devoted to the establishment of mineral rights in the United States. Much of the research suggests that informal norms provided the basis for efficient resource use. Another focus of attention has been the role of property rights in use of western range lands in the United States. Well-known work by Elinor Ostrom (1990) also provides empirical support for the potential efficiency of norms and informal controls as a means of resource governance. A shortcoming in this literature is that the particular contexts that allow informal norms to develop make it difficult to draw more general conclusions about the importance of stable formal property rights for resource exploitation. The literature does not typically provide quantitative evidence related to the impact of changes in formal rights on resource exploitation, and there is a lack of explicit discussion of the implications for long-run economic growth.

This article contributes to the literature by examining changes in formal rights related to the security of resource tenure in a setting that allows us to empirically identify both industry-specific effects and long-run macroeconomic growth implications, while tracing the channels through which these effects operate. More specifically, our study focuses on the impact that a series of landmark cases recognizing aboriginal rights has had on Canada’s forest industry and aggregate economic growth. Although the Canadian economy is both structurally diverse and wealthy, throughout its history it has consistently specialized in the extraction and processing of its natural resource endowments, particularly forest resources. This resource intensity, coupled with stability in the institutions, endowments, and culture that contribute to the domestic economic environment, makes Canada ideal for an investigation of the economic consequences of changes in the security of formal resource rights.

The recognition of aboriginal rights has been a shock to the security of formal legal rights for Canada’s resource industries. A series of Supreme Court cases significantly transformed the legal status of aboriginal land and resource claims. Because these claims have been closely tied to land and particular natural resource stocks, the Canadian Supreme Court’s decisions have substantially altered the legal regime securing resource access for commercial interests. Participants in Canada’s resource industries have argued that the judgments undermined the security of their present resource rights and created a “cloud of uncertainty” over the legal environment regulating resource operations more.

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8Umbeck (1977) and Libecap (2007) argue that the incorporation of informal norms into formal law governing mineral extraction was efficient. Clay and Wright (2005) argue that the imposition of secure private property rights would have been even more efficient.

9See literature review in Libecap (2007), arguing that informal norms played an important role and may have been more efficient than the formal titling provisions eventually adopted. For other prominent work on the importance of informal norms in the governance of U.S. rangelands, see Ellickson (1991), also arguing for the more general importance of social controls as opposed to formal legal institutions in resource regulation.

10For more detail, see Keay (2007).
generally. The purported economic costs have the potential to undermine investment incentives, constrain industry profitability, and consequently slow aggregate Canadian economic growth.

In this article, we use the Canadian forestry sector between 1970–2005 as a case study to empirically establish the economic importance of the costs that have been associated with changes in the security of property rights. Our objective is narrow in relation to the legal recognition of aboriginal rights—it is only to investigate the direct impact of these developments in relation to the commercial exploitation of forest resources for the industry and macroeconomy. Recognition of aboriginal rights involves other important social and economic objectives, including distributional and social justice concerns, that would be important to a social welfare assessment of these decisions. Our methodological approach and empirical evidence do not allow us to address the broader social implications of the decisions. However, we believe that our approach and our results provide a theoretical framework and quantitative evidence that can move us toward a better understanding of the exact nature of the connection linking property rights to resource exploitation and economic performance.

We begin with a series of event studies in which we estimate financial market participants’ responses to four landmark Canadian Supreme Court judgments recognizing aboriginal rights. We test for abnormal returns in the forestry sector’s common share prices on Canada’s largest formal equity market, the Toronto Stock Exchange (TSX), immediately following the Calder decision (January 31, 1973), the Sparrow decision (May 31, 1990), the Van der Peet decision (August 21, 1996), and the Delgamuukw decision (December 11, 1997). Significant abnormal returns in response to these decisions indicate that financial markets perceived measurable economic effects stemming from unanticipated changes to the security of forestry firms’ property rights. However, differences in the size and direction of these effects preclude any simplistic conclusions about the impact of insecure resource rights.

To better understand how changes in the security of property rights affected the industry, in the second stage of our analysis we construct a partial equilibrium simulation model based on the forest industry’s dynamic optimization problem. In the model, we specify two channels through which the legal changes may have operated—a direct, short-run effect on resource access and a more general uncertainty effect. This characterization reflects the fact that the decisions not only had direct and fairly immediate cost implications associated with physical access to forest resources, but also generated general uncertainty about the legal environment facing the industry. We use our partial equilibrium industry model to identify the combination of changes in uncertainty and contemporaneous stock access that could account for the abnormal returns in share prices that we estimate with our event studies. This model also allows us to then assess the longer-run impact of the shocks to stock access and uncertainty on the performance of the forestry

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sector in Canada during the post-1970 period. We find that the economic fundamentals characterizing performance among Canada’s forestry producers appear to have been quite sensitive to both the stock access and uncertainty effects embodied in the legal decisions. We also find that the impact on the industry’s fundamentals varies, depending on the channel through which changes in property rights operate. Another important insight is that changes in formal legal rights can generate effects with off-setting economic consequences, again conditional on the relative importance of the access and uncertainty channels. The net economic impact of any changes in formal property rights is subtle and complex. This precludes direct, unequivocal conclusions based on a simple assessment of the “stability” of property rights.

In the final stage of our investigation, we use a simplified general equilibrium model to estimate the long-run real GDP per-capita growth effects resulting from the simulated changes in the forestry sector’s economic fundamentals that we derived in the second stage of our study. While the model requires a number of restrictive, and likely unrealistic, assumptions, these should work to make our estimates of the macroeconomic consequences a lower bound. Our findings indicate that under some circumstances, the long-run macroeconomic effects of the formal recognition of aboriginal rights may have been substantial. However, we cannot provide anything like unambiguous support for claims that the Court’s decisions imposed significant costs on the domestic economy. As with the industry’s fundamentals, the impact of shocks to the security of legal resource rights on aggregate growth depends on the channel through which these shocks operate. The empirical results again suggest that general conclusions linking the stability of property rights to the efficiency of resource exploitation and economic growth are unlikely to be robust. Our results imply that the impact of changes to property rights depends on the precise nature of these changes and the institutional setting within which they occur.

II. Aboriginal Rights and the Security of the Forestry Sector’s Resource Rights

Since the turn of the 20th century, Canada has not experienced instability in its property rights regime as a result of political, social, or military upheaval—variables commonly used to measure the security of property rights in cross-country studies.12 Particularly since 1970, changes in the domestic economic environment have been evolutionary, rather than revolutionary. However, in this environment of stable, successful resource-based economic development, the Supreme Court of Canada issued four landmark rulings that fundamentally altered the legal status and potential scope of aboriginal land and resource claims, with consequent implications for the formal, legal regimes that guaranteed and managed stock access for Canada’s resource industries.13 It is the lack of

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12For example, see Bohn and Deacon (2000).

13For more on the resource intensity of Canadian development, see Keay (2007).
potentially confounding general instability, combined with these significant, but identifiable, changes in the formal law affecting resource rights, that makes Canada ideal for an empirical investigation of the economic consequences following from changes to the stability and security of property rights.

The existence of potential legal claims to land and resources by aboriginal people has a long history in Canada. Although initially these claims appeared to have legal status, the perceived strength of aboriginal rights rapidly waned, and by the 20th century they were regarded as being merely political grievances. Resource development and the allocation of access rights proceeded in much of the country without regard to any prospective aboriginal claims, at least up until the early 1970s.

This convenient disregard ended on January 31, 1973 when the Supreme Court of Canada released the first of our landmark decisions, *Calder v. British Columbia (Attorney General)*, [1973] S.C.R. 313. In the *Calder* case, the Nisga’a people of the Nass Valley in northwestern British Columbia were seeking a declaration that they held unextinguished aboriginal title to their traditional lands. An unusual split decision did not give the Nisga’a the declaration they were seeking, but a majority of the Court regarded aboriginal title as a continuing legal interest in traditional lands. The *Calder* case was a landmark ruling, as it definitively rejected the idea that unsettled aboriginal land and resource claims lacked legal status.

Because the Supreme Court majority decision upheld decisions below dismissing the claim, the direct, immediate effect of *Calder* was to preserve contemporaneous stock access in the Nass Valley. However, the decision also prompted a shift in perceptions about aboriginal claims, requiring them to be considered legal rights, and thus introducing uncertainty with respect to the scope of these rights that might conflict with other property interests the government had created in lands and resources, including the
security of stock access for forestry firms. Extensive areas of Canada with forestry operations were now subject to prospective aboriginal title claims. We expect that Calder should have had a slight positive effect on the security of contemporaneous access, at least for the Nass Valley, but the decision would also have increased general uncertainty surrounding the security of resource industry rights in general. However, since aboriginal title was a common-law right, government retained the ability to override it with clear legislation. Perhaps most importantly, the decision indicated that some action would be required to address aboriginal legal claims in the future.

The remaining three cases we consider deal with the legal understanding of aboriginal claims as constitutional rights. In 1982, the Canadian Constitution was “repatriated” from Britain and a new provision on aboriginal rights was included. Section 35(1) announced that “the existing aboriginal and treaty rights of the aboriginal people of Canada are hereby recognized and affirmed.” The precise nature of this constitutional commitment was to be fleshed out in future negotiated provisions—a process that has failed. Instead, the Supreme Court has stepped in to provide the legal content for this spare provision.

The Supreme Court first considered Section 35(1) in R. v. Sparrow, [1990] 1 S.C.R. 1075. The claimant, Sparrow, was charged with a regulatory offense for fishing with an illegal net. He argued that the fisheries regulations under which he was charged did not apply to him because he was exercising a constitutional aboriginal right. While the case itself was returned for a new trial, the legal framework it established makes Sparrow a critical judgment for our study.

First, although the Court did not articulate a formal test for Section 35(1) aboriginal rights in Sparrow, the decision established some key principles. The Court held that aboriginal rights protected by Section 35(1) were affirmed in an unregulated form and, unlike common-law claims, not limited by the existence of a regulatory regime that governed potentially competing and conflicting claims to lands and resources. Aboriginal rights, while apparently anchored in historic practice, were not to be affirmed in a “frozen” form but could evolve to be exercised in a “modern” form. While rights could potentially have been extinguished prior to 1982, the Court imposed a strict requirement for a “clear and plain intention,” again rejecting a test based on the existence of inconsistent claims or regulations. Second, once established, the Court held that aboriginal rights could not be interfered with in the absence of constitutional justification. The Court set out a two-pronged approach, requiring that government pursue permissible objectives, and that the government do so in a way that respected the special fiduciary relationship between the Crown and aboriginal peoples. The Court took a narrow

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19Almost all of BC and the Maritime provinces have been the subject of prospective claims, including areas making up approximately 40 percent of the active timber harvesting operations. See Wilson and Graham (2005:5).

20See “Indians Have More Rights than He Thought, Trudeau Says,” Globe and Mail (Feb. 8, 1973). Prime Minister Pierre Trudeau admits that the Calder decision led him to modify his views, and that there will soon be action on claims.
approach to valid purposes, accepting limitations for resource conservation or to protect aboriginal rights holders, but rejecting those in pursuit of “the public interest.” The fiduciary relationship was also described as requiring priority be given to aboriginal rights—in the case itself priority was interpreted as a first claim to the resource. The implication was that aboriginal rights could take precedence over competing (commercial) rights to harvest and use resources, even if the government allocations of those commercial rights could be justified.

The potential scope of Section 35(1) aboriginal rights prior to Sparrow was unclear. Possible interpretations ranged from there being no substantive content to the provision, to constitutionalization of common-law rights, to some other, unclear novel approach. Sparrow appeared to stake out a generous approach to Section 35(1) rights, presumptively rendering government regulatory regimes that interfered with these rights unconstitutional, and setting out a narrow test for constitutional limits that focused on prioritizing aboriginal rights and subordinating conflicting resource claims. Although the decision itself did not involve any claims to forest lands, it was clear that observers understood the decision to have direct implications for title claims and forestry access rights. As a result, we expect that Sparrow should have had a negative impact on the security of contemporaneous stock access. However, the provision of an explicit legal framework in Sparrow, even if it might limit access to resources, did significantly fill the legal vacuum on the meaning of Section 35(1). This in turn implies that while uncertainty about the precise test for establishing aboriginal rights may have remained, the Court ruling resolved much general legal uncertainty.

On August 26, 1996, the Court released another key decision, R. v. Van der Peet, [1996] 2 S.C.R. 507. Dorothy Van der Peet, a member of the Sto:lo nation, claimed an aboriginal right to harvest and sell salmon, and immunity from regulatory restrictions limiting her to fishing for food and ceremonial purposes. The Court rejected her claim. Again, the importance of the decision for resource producers and the forest industry rests with the new law the Court established.

In Van der Peet, the Court set out the test for establishing an aboriginal right under Section 35(1). The Court anchored the purpose of Section 35(1) in an effort to “reconcile” the prior existence of aboriginal peoples as distinctive communities with the assertion of Crown sovereignty. This proved important for two reasons. First, it led the Court majority to structure the test for aboriginal rights around the culture of aboriginal societies in the precontact period, restricting rights to those “practices, customs or traditions” that were “integral to the distinctive culture” at that time. This was a relatively narrow

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21For discussion of possible approaches to interpretation of s. 35(1), see Slattery (1987).

22For example, see “Provinces Must Respect Native Rights Judges Rule,” Globe & Mail (June 1, 1990), in which the BC provincial government indicates that it will have to reassess its position on land claims, admitting that there will be huge ramifications. Aboriginal parties argue that the decision strengthens claims, with specific reference to the Stein Valley and logging operations there. In “Natives Say Fishing Rights Victory Will Help with Land Claims,” Ottawa Citizen (June 1, 1990), aboriginal leaders say that the decision will help with hunting and trapping rights, and help to set up possible roadblocks to industrial projects.
view of the scope of aboriginal rights. Also, while the Van der Peet test does not preclude claims for commercial aboriginal rights, the need to show that rights claimed were culturally distinctive precontact makes it very difficult to establish rights to harvest resources commercially. In Van der Peet itself, the Court found that while the Sto:lo had traditionally exchanged salmon for other goods, the practice was incidental and not culturally integral to Sto:lo fishing. The majority also rejected the claim that the right to fish for subsistence in precontact times could translate into a modern right to harvest and sell fish for the contemporary equivalent to precontact subsistence: a “moderate livelihood.”

The second implication of Van der Peet’s focus on reconciliation became clear in the companion case, R. v. Gladstone, [1996] 2 S.C.R. 723. The Court relied on the reconciliation purpose articulated in Van der Peet to lay out a more flexible test for constitutionally permitted limits to aboriginal rights. The Court indicated that constitutional purposes consistent with “reconciliation” could extend to the “pursuit of economic and regional fairness” and recognition of historic reliance on and participation in a commercial resource industry by nonaboriginal groups. In addition, the Court held that when aboriginal rights with commercial dimensions were established, the meaning of “priority” for aboriginal rights changed—instead of placing aboriginal claims ahead of other commercial users, justified limits would require that government take account of the rights in allocating the resource, possibly offering compensation and consultation, or facilitating aboriginal participation.

Van der Peet was an important decision for Canada’s resource industries. Aboriginal rights could potentially be established across the country. Sparrow had suggested a broad scope for these rights, and a restrictive ability to justify limits if commercial resource regimes conflicted. In Van der Peet, the Court established a relatively clear test for aboriginal rights, taking a much narrower approach. The test was novel, in that it departed from any common-law precedent and was much more restrictive than possible alternatives.

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23 Dissenting opinions by Justices L’Heureux-Dube and McLachlin in Van der Peet made this point. See also “Landmark Ruling Limits Indian Rights—Government Can Restrict Fishing Commercially, Court Decides,” Toronto Star (Aug. 22, 1996), in which legal experts argue that by adopting a narrow definition of aboriginal rights, the judgment affects more than fishing rights. For an academic criticism of the test on similar grounds, see Cheng (1997).

24 A successful claim to harvest herring roe on a commercial scale was made by the Heiltsuk in the companion case, R. v. Gladstone, [1996] 2 S.C.R. 723.

25 The Supreme Court of Canada often hears “companion cases” that raise complementary or similar issues on important points of law, particularly in its aboriginal rights cases. The decisions are released simultaneously and intended to be linked as a set of coherent and unified statements on the law. We have referred to the “event” in terms of the primary decision, Van der Peet.

26 Even in areas covered by treaties, aboriginal people often retained the right to exercise aboriginal rights, such as hunting, trapping, fishing, and other activities. For example, see Mikisew Cree First Nation v. Canada, [2005] 3 S.C.R. 388.

27 The dissent in Van der Peet by Justice McLachlin argues for an approach more similar to common law, while Justice L’Heureux-Dube favors a “dynamic rights” approach.
resource rights very unlikely, and suggested greater deference to government limits on any commercial rights aboriginal people might establish.\textsuperscript{28} Although cases following \textit{Van der Peet} have shown that aboriginal rights can impose significant restrictions on commercial resource operations, including forestry operations,\textsuperscript{29} we expect that the dominant effect of \textit{Van der Peet} was to both increase the security of contemporaneous commercial resource rights, and to reduce the general legal uncertainty associated with aboriginal rights for the resource sector as a whole.

The final landmark decision we consider is \textit{Delgamuukw v. British Columbia}, [1997] 3 S.C.R. 1010. In this case, the Gitskan and Wet’suwet’en aboriginal peoples claimed “ownership and jurisdiction” over their traditional lands in British Columbia, arguing that their title had never been extinguished.\textsuperscript{30} The Supreme Court ultimately returned the case for a new trial, so did not resolve the claim itself. However, again, the decision was vital in setting out new legal principles important to Canada’s forest industry.\textsuperscript{31}

\textit{Delgamuukw} established the test for aboriginal title as a distinct Section 35(1) right. To establish title, aboriginal claimants must prove exclusive use and occupancy of their land prior to the assertion of Crown sovereignty, with a degree of continuity up to present occupation. The Court identified aboriginal title as a sui generis legal right. Drawing on the reconciliation purpose underlying Section 35(1), the Court held that title must incorporate perspectives from both cultures. This meant that the key concept of exclusive occupancy would not be defined by application of either exclusively common-law or aboriginal-law concepts. Both aboriginal law and physical occupation might be relevant to meeting the test for title. In \textit{Delgamuukw}, the Court also addressed the application of the “hearsay” rule to aboriginal oral history, holding that this rule should be approached with sensitivity and flexibility in the context of aboriginal rights claims. The Court held that oral history could be admitted as evidence of historic use and occupation.\textsuperscript{32} Once established, the Court held that title gave aboriginal people the exclusive right to use and occupy the land for purposes that need not be in themselves aboriginal

\textsuperscript{28}For example, in “Fish Ruling ‘Opens Door’ to infringement of Rights,” \textit{Vancouver Sun} (Aug. 23, 1996), legal experts say that the decision gives government more power to limit aboriginal rights.

\textsuperscript{29}In \textit{Haida Nation v. B.C. (Minister of Forests)}, [2004] 3 S.C.R. 511, the Court invalidated the transfer of a long-term commercial timber license due to a failure to consult with the Haida regarding the impact on their claim to an aboriginal right to the monumental cedars that were covered by the license.

\textsuperscript{30}The area covered by the claim itself encompassed 58,000 square kilometers, an area roughly the size of Connecticut, Vermont, and New Hampshire combined.

\textsuperscript{31}The decision to send the case back for a new trial was significant in reversing decisions below that had denied the claim.

\textsuperscript{32}This effectively overturned the rulings from the courts below that dismissed the claim on the basis of insufficient evidence of occupation. The Supreme Court held that the lower courts should have considered the claimants’ oral traditions as evidence.
Title could thus support a constitutional right to engage in commercial resource exploitation. As with other Section 35(1) rights, once made out, title was protected against any unjustified government interference. However, *Delgamuukw* also incorporated an expanded test for justified infringement of aboriginal rights based on reconciliation, with some important modifications. *Delgamuukw* included an even broader range of permissible objectives, explicitly recognizing the commercial development of mining or forest resources. The modified concept of priority was applied to title, so that the process by which a resource is allocated, and the actual allocation, had to reflect the prior interest of aboriginal rights holders. The Court was unclear about exactly how this might be achieved. An example in the decision suggests that commercial resource exploitation might be justified, with title holders participating somehow in resource development. The participation of rights holders as an element of justified interference with title was also emphasized in *Delgamuukw* through a requirement for consultation. The Court held that there was “always” a duty of consultation, although its content would vary on a spectrum ranging from provision of notice to a possible veto, depending on the nature of the interference with aboriginal title. The Court further held that the “inescapable economic” aspect of title meant that justified infringement could require compensation.

The *Delgamuukw* decision was greeted with dismay by Canadian resource producers and industry observers. Both the approach to establishing title through occupancy and the evidentiary rulings suggested the potential for fairly expansive title claims and, once proven, title was constitutionally protected against any unjustified government infringement. Government-regulated commercial access to resource stocks that overlapped with aboriginal title claims could potentially be deemed unconstitutional. Government-regulated commercial access to resource stocks that overlapped with aboriginal title claims could potentially be deemed unconstitutional. To make matters worse, despite the fact that the test for justified infringement of title appeared permissive in some ways, it was disconcertingly vague. The *Delgamuukw* decision rendered existing commercial resource rights more fragile in areas subject to title claims, and created a complex, obscure, and contextual test for justified infringement. Because the decision itself made security of tenure over an enormous area a live issue, and in principle the decision undermined the security of forest access rights in all areas of Canada without treaties, we expect that *Delgamuukw* reduced the security of contemporaneous

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33 Title is also characterized by special features that distinguish it from *fee simple* title: it is held by the collective, cannot be alienated except by surrender to the Crown, and cannot be put to uses that are irreconcilable with the inherent cultural ties to the land that are subsumed in the historic occupation of the land by aboriginal people. The latter “internal limit” precludes some resource harvesting that might otherwise conflict with other users’ claims—commercial forestry that relied on extensive clear-cutting, for example.

34 See, for example, “Natives Win Land Rights: Top Court Rules that Oral History Gives Bands Constitutional Claim in Absence of Treaties,” *Globe & Mail* (Dec. 12, 1997), which reports on a cloud of uncertainty over BC logging and mining industries, or “Ruling Extends Aboriginal Rights,” *Financial Post* (Dec. 12, 1997), which claims that vast areas of territory are at stake, particularly in BC, and again reports that a “cloud of uncertainty” hangs over BC, with more than $1 billion in investment withheld because of aboriginal claims.
access for the forest industry.\textsuperscript{35} The decision quickly spawned actions for injunctions to stop resource exploitation until consultation with aboriginal claimants was undertaken.\textsuperscript{36} Moratoria on new leases were adopted, then relaxed.\textsuperscript{37} It seems that the vague nature of many aspects of the decision also increased the general level of uncertainty facing Canadian resource industries, including forestry.\textsuperscript{38}

These four decisions are a small subsample of the Supreme Court’s aboriginal rights jurisprudence.\textsuperscript{39} However, \textit{Calder, Sparrow, Van der Peet,} and \textit{Delgamuukw} are uniquely relevant for our study because of the impact they have had on the security of property rights for Canada’s commercial resource industries, particularly the forestry sector. They represent the first precedents on the critical issues of the existence and scope of aboriginal rights, the implications for government-granted access, the regulation of potential conflict with aboriginal rights, and the extent to which aboriginal rights holders need to be directly involved in decision making about resource use. These decisions established legal standards in previously uncharted territory, and the Court’s approach often departed from any common-law precedent, in effect crafting a unique and novel body of law. These features diminished the degree to which the results could have been anticipated. Their abrupt impact on the security of property rights, both through contemporaneous stock access and uncertainty surrounding future stock access, makes them ideal candidates for the empirical identification of industry and macroeconomic effects linking property rights to performance.

III. \textbf{Valuing the Impact of the Court’s Decisions: Event-Study Analysis}

The efficient markets hypothesis and firm valuation theory suggest that financial market participants acquire and efficiently use all available information to anticipate and value changes to industries’ and/or firms’ economic environments that affect their performance.

\textsuperscript{35}In “The Land-Claims Ruling is a Breath Taking Mistake,” \textit{Globe & Mail} (Dec. 16, 1997), the judgment is described as undermining all Crown title in BC, freezing investment, and increasing uncertainty by an order of magnitude.


\textsuperscript{37}See “Native Grievances Need to be Heard,” \textit{Financial Post} (Feb. 7, 1998), which reports on a temporary moratorium on new leases for resource development, and “BC Favours Industry over Native Land Claims,” \textit{Globe & Mail} (Mar. 14, 1998), which states that BC continues to hand out licenses to the forest and mining industries while negotiations to settle aboriginal land claims continue.

\textsuperscript{38}The President of the Canadian Mining Association described the decision to the Standing Committee on Aboriginal Affairs two years after the judgment: “[\textit{Delgamuukw}] has cast a dark shadow of uncertainty on resource investment and development in British Columbia and elsewhere in Canada . . . .”

into the indefinite future. To assess Canadian financial market participants’ perception of
the overall effect of our landmark Supreme Court decisions for the forest industry, we
perform a series of event studies. The impact of the unanticipated changes in the security
of forest resource rights resulting from the decisions should be reflected in these partici-
pants’ willingness to supply investment funds to forestry firms through Canada’s largest
formal equity market—the Toronto Stock Exchange (TSX).

A. Event Study: Methodology

Event studies are commonly used as a means of empirically estimating the economic
consequences of legal and/or policy discontinuities. Here we discuss only those aspects of
the standard methodological approach that require some comment due to their specific
application in our study. In particular, we use a capital asset pricing model (CAPM) to
estimate expected returns, such that abnormal returns may be calculated as:

\[ AR_t = R_t - \hat{\alpha} - \tilde{\beta}(R_{mt} - rf), \]

where \( R_t \) is the realized forest industry return at time \( t \); \( R_{mt} \) is the composite market return
at time \( t \); and \( rf \) is the risk-free return on one-year government treasury bonds at time \( t \). The
CAPM model has often been used in the literature and it is consistent with the structure of
the financial constraints we employ in our partial equilibrium simulation model. The
parameters in the CAPM equation are estimated by OLS, and they are assumed to be
consistent, unbiased, and efficient under the maintained assumptions of the model. We
make the standard assumptions regarding the calculation and distribution of cumulative
abnormal returns in our tests for the presence of significant abnormal returns over our
event windows.

B. Event Study: Data and Estimation

Using the methodological approach described above, we measure market participants’
valuation of the net economic impact of the changes to the security of forest resource rights
caused by the legal recognition of aboriginal rights in our landmark cases. We have argued
that the decisions represented significant changes in the law that would have been largely

---

40 In their development of the event-study methodology, Fama et al. (1969) describe in detail the relationship between
the required assumptions and the results.

41 See Fama (1991:1599–1602) for a review of literature dealing with the efficient markets hypothesis. See Perman et al.
(2003:366–67) for a review of recent literature dealing with discounted cash-flow valuation techniques. A broader
literature review is provided by MacKinlay (1997). See Bhagat and Romano (2002:141) for a review of the appropriate
application of the methodology.

42 A more detailed discussion of our event-study methodology is available in our working paper, available upon request
from the authors.


44 See MacKinlay (1997).
unanticipated—the cases were first precedents, mostly in new areas of the law, and they generally departed from any status quo or common-law approach. However, it is important to note that our event studies only capture the impact of the decisions where they depart from anticipated or expected results. It is not the legal changes represented in the decisions per se, but the extent to which they were shocks to the expectations of market participants that is captured by the estimates.

Beginning the event studies at the time the new information became available is critical to an accurate assessment of the market’s valuation of the economic impact of changes in the security of resource rights. The deliberation process of Canada’s Supreme Court is highly confidential and judgments are released under tightly controlled circumstances at a clearly identifiable point in time. It is extremely unlikely that information about the judgments could have been available to market participants in advance of the formal release dates. We use the date that each judgment was formally released by the Court to identify the four event dates.

Event studies also require a decision about the length of the event window: How long did market participants take to process the information embodied in the decisions? With strongly efficient markets and more conventional information, event windows are generally kept very short to increase the power of estimates for cumulative abnormal returns. However, Supreme Court judgments relating to constitutional rights, particularly judgments that provide landmark rulings relating to uncharted legal territory, are unlikely to have been fully disseminated and understood without opinions from legal experts. We believe that the response time is likely longer than the window of one or two days typically associated with the release of information more accessible to financial market participants, such as earnings forecasts, mergers, regulatory actions, or tort suits. We consider event windows from one to five days in length, defining the date on which each judgment was released.


The Calder decision was released on Jan. 31, 1973; the Sparrow decision was released on May 31, 1990; the Van der Peet decision was released on Aug. 21, 1996; and the Delgamuukw decision was released on Dec. 11, 1997. Decisions are always released at 09:45 EST, so that closing prices for the release date are the relevant measure of the decisions’ immediate impact. As a robustness check we perform media searches surrounding the release dates for the lower court and court of appeal judgments for each of our four cases. There is virtually no media coverage of these lower court decisions, with the exception of Delgamuukw and to a lesser extent Van der Peet. We perform event-study analysis on the release dates for all levels of court for these decisions. There are no abnormal returns for the initial decisions. We do find significant abnormal returns for the court of appeal release, but this exception poses difficulty for any empirical analysis. The BC Court of Appeal released eight aboriginal rights cases simultaneously on June 25, 1993, including its decisions in both Delgamuukw and Van der Peet. While the (limited) media response on this date focused on the decision in Delgamuukw, we cannot separate out the impact of any single decision empirically. The abnormal returns we find for June 25, 1993 were negative and significant (over some windows). In conjunction with the negative media response to the court of appeal’s Delgamuukw decision, we interpret the Supreme Court decision for that case as building on earlier uncertainty and so our event-study effects are likely to be a lower-bound estimate of the aggregate impact of Delgamuukw. In our simulation exercise, we limit our empirical analysis to the Supreme Court decisions alone.

Bhagat and Romano (2002) discuss the choice of event windows in detail.
released as the event day [0]. Therefore, we estimate cumulative abnormal returns over
five event windows: [0,0] [0,1] [0,2] [0,3], and [0,4].

To confidently ascribe any significant abnormal returns to the impact of the judg-
ments, we use several strategies to rule out the possibility of confounding events that may
have affected the forestry sector within our event windows. We test for the presence of
significant abnormal returns one and two days prior to the release of all our decisions.
Abnormal returns during these windows would introduce the possibility that a different,
slightly earlier event was triggering the share price response we attribute to our Supreme
Court decisions. We do not find significant returns in either the one- or two-day windows
prior to any of the decisions. To further rule out confounding events that might explain our
significant abnormal returns, we also perform media searches in eight major Canadian
newspapers, including the principal business media, looking for mention of the forestry
sector or any of the firms included in the TSX forestry and paper products index.48 We find
media coverage of our landmark cases, but we cannot identify any other news relevant to
the economic environment for the forestry sector.49 As a final strategy, for Van der Peet and
Delgamuukw, the decisions that generate the significant abnormal returns that form the
basis for the second and third steps in our analysis, we disaggregate the TSX forestry and
paper products index into its individual firms and perform event studies on each firm. We
consistently find that a large majority of firms have abnormal returns that mirror the
sector’s index.50 This disaggregate approach guards against the possibility that our signifi-
cant industry results are driven by unrelated events for a single firm, or small group of firms.
The absence of confounding events revealed by these checks suggests confidence in ascrib-
ing the results of our event studies to the impact of the cases.

To implement the methodology and calculate abnormal returns, we use a sample
period of 200 trading days prior to each of the judgments’ formal release dates to estimate
the relevant parameters for our CAPM equations.51 For the Calder decision, daily informa-
tion on the TSX’s Forest Products Common Share Price Index was taken from the Globe and
Mail’s Report on Business, the Composite Market Common Share Price Index was derived
from the daily values of the Industrial Composite Common Share Price Index published in
the Toronto Stock Exchange Monthly Review, and the risk-free rate of return was constructed
from weekly long-term federal government bond yields and the Bank of Canada’s daily
90-day treasury bill rate. For the Sparrow, Van der Peet, and Delgamuukw decisions, daily values

48The newspaper search included the Vancouver Sun, The Province, The Globe & Mail, The Financial Post, The National
Post, The Toronto Star, The Ottawa Citizen, and The Victoria Times Colonist.

49Our search covered one calendar week: two days prior to release date, the release date itself, and four days following
the release.

50For the Van der Peet decision, we can assess 17 of the 22 firms in the sector index: 13 produce positive returns and
only four are negative (over some windows). For Delgamuukw, we can assess 16 firms: 13 produce negative returns, and
only three are positive.

51As a robustness check we also perform the estimation over a calendar year, to guard against possible seasonal effects.
This does not meaningfully change any of our results.
for the TSX’s Paper and Forestry Products Common Share Price Index, Composite Market Common Share Price Index, and one-year treasury bond yields were all accessed from the Canadian Financial Markets Research Centre (CFMRC) Summary Information Database.52

C. Event Study: Results

The cumulative abnormal returns derived from our event studies are presented in Table 1. In general, the results conform to our expectations based on the analysis of the judgments above. We expected Calder to have a slight positive effect on the security of contemporaneous access, due to the dismissal of the claim over the Nass Valley, but to increase general uncertainty surrounding the security of the forest industry’s resource rights. The results from our event study seem to reflect these conflicting effects on the security of the firms’ contemporaneous access and future property rights. In Table 1 we can see that the cumulative abnormal returns in the days immediately following January 31, 1973 were positive, reflecting the most obvious “good news” (at least with respect to the commercial resource firms’ contemporaneous stock access) interpretation of the Court’s decision. However, only the cumulative abnormal returns from the two-day event window [0,1] are statistically distinguishable from zero, and even these significant results amount to a return in excess of expectations of less than 2.7 percent over two trading days. The relatively modest positive abnormal returns from Calder may reflect off-setting access and uncertainty effects, or they may indicate that the legal uncertainties involved were not yet taken particularly seriously by industry participants. This insensitivity to uncertainty could be a reflection of the decision’s common-law status and the ability government retained to legislate and override title claims.

The Sparrow decision is the first of our three significant judgments interpreting constitutional aboriginal rights. The net response to Sparrow is also difficult to interpret, as we expected Sparrow to have a negative impact on the security of contemporaneous stock access because of its generous approach to the scope of aboriginal rights, but potentially resolve general uncertainty by beginning to fill the legal vacuum on the meaning of Section 35(1). From Table 1 we can see that there is little evidence of any market reaction to the decision—the cumulative abnormal returns from all five event windows are small, positive, and statistically indistinguishable from zero. These results suggest a number of possible interpretations: market participants may not have known how to interpret a decision that so radically altered the legal recognition of aboriginal rights, at least within the first five days following its release, so reactions could have been muted. Alternatively, the muted response could reflect the fact that the decision again had off-setting access and uncertainty effects. Any instability in the contemporaneous and future security of resource rights created by the decision did not generate a significant net reaction by the market.

52For additional information on the construction and composition of these indices, see Computing in the Humanities and Social Sciences, University of Toronto (CHASS) Data Centre at <http://ww.chass.utoronto.ca/cgi-bin/chassnew/display.pl?page=index>. Because the forest sector index is a subset of the composite market index, there may be some possibility of endogeneity in our CAPM estimates. Even though forestry firms have traditionally played an important role on the TSX, after 1970 the composite market was strongly dominated by other resource, manufacturing, and service sector components. As a result, we do not attempt to adjust our market index or estimation strategy to account for any endogeneity that may be present.
We expected Van der Peet to generate a positive market response, as it both improved the security of contemporaneous access and reduced uncertainty. The case revealed a relatively clear, narrow test for aboriginal rights that would limit commercial claims and it also displayed a flexible approach to justifying limitations on aboriginal rights. Van der Peet departed from the generous approach to rights and strict approach to justification that the industry might have expected following from Sparrow. The results are consistent with our expectations: the cumulative abnormal returns reported in Table 1 are positive, relatively large, and three of the five are statistically distinguishable from zero. The largest cumulative abnormal return we estimate for any of the four decisions comes from the Van der Peet decision’s [0,3] event window—a return in excess of expectations of 3.1 percent. The stronger quantitative and statistical market responses we observe for the Van der Peet decision may reflect either increased attention being paid to the Court’s judgments regarding aboriginal rights, or a new degree of legal sophistication on behalf of those individuals supplying investment funds to Canada’s forestry firms. The response to Van der Peet appears to confirm that when resource rights are strengthened through more secure contemporaneous access and reduced uncertainty, markets respond by bidding up the value of forestry firms’ common share prices.

### Table 1: Event-Study Results, Cumulative Abnormal Returns in Response to Supreme Court Decisions

<table>
<thead>
<tr>
<th>Window</th>
<th>Calder</th>
<th>Sparrow</th>
<th>Van der Peet</th>
<th>Delgamuukw</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0,0]</td>
<td>0.014</td>
<td>0.006</td>
<td>0.010</td>
<td>-0.013**</td>
</tr>
<tr>
<td></td>
<td>1.388</td>
<td>1.163</td>
<td>1.279</td>
<td>-2.008</td>
</tr>
<tr>
<td></td>
<td>(0.165)</td>
<td>(0.245)</td>
<td>(0.201)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>[0,1]</td>
<td>0.027**</td>
<td>0.006</td>
<td>0.017</td>
<td>-0.028***</td>
</tr>
<tr>
<td></td>
<td>1.961</td>
<td>0.808</td>
<td>1.549</td>
<td>-3.078</td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
<td>(0.419)</td>
<td>(0.121)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>[0,2]</td>
<td>0.020</td>
<td>0.009</td>
<td>0.023*</td>
<td>-0.025**</td>
</tr>
<tr>
<td></td>
<td>1.163</td>
<td>0.978</td>
<td>1.773</td>
<td>-2.241</td>
</tr>
<tr>
<td></td>
<td>(0.245)</td>
<td>(0.328)</td>
<td>(0.076)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>[0,3]</td>
<td>0.021</td>
<td>0.015</td>
<td>0.031**</td>
<td>-0.025**</td>
</tr>
<tr>
<td></td>
<td>1.069</td>
<td>1.380</td>
<td>2.075</td>
<td>-1.985</td>
</tr>
<tr>
<td></td>
<td>(0.285)</td>
<td>(0.168)</td>
<td>(0.038)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>[0,4]</td>
<td>0.022</td>
<td>0.018</td>
<td>0.030*</td>
<td>-0.024*</td>
</tr>
<tr>
<td></td>
<td>1.003</td>
<td>1.495</td>
<td>1.801</td>
<td>-1.675</td>
</tr>
<tr>
<td></td>
<td>(0.316)</td>
<td>(0.136)</td>
<td>(0.072)</td>
<td>(0.094)</td>
</tr>
</tbody>
</table>

**Note:** CAR = cumulative abnormal returns, as defined in text; $Z_{stat}$ $[T_1, T_2]$ $\sim N(0, (T_2 - T_1 + 1)^{1/2}s_e)$; $p$ value = probability that CAR cannot be statistically distinguished from zero. *, **, *** indicate statistical significance with 90 percent, 95 percent, 99 percent confidence, respectively.

**Source:** Globe and Mail: Report on Business; Toronto Stock Exchange Monthly Review; Canadian Financial Markets Research Centre (CFMRC) Summary Information Database. A complete Data Appendix with source and compilation information is available at [http://www.econ.queensu.ca/ikeay/dataapp5.pdf].
The results for *Delgamuukw* are again consistent with our expectations. We predicted that *Delgamuukw* likely reduced the security of contemporaneous access both through the direct effect of reviving the specific claim and by undermining the security of title in significant areas of Canada, and the vague nature of the decision, particularly its consultation obligation, should have produced significant uncertainty for the forest industry into the indefinite future. From Table 1 we can see that participants on the TSX had a very strong, negative reaction to the *Delgamuukw* decision—all five event windows have negative cumulative abnormal returns that are statistically distinguishable from zero. During the first two days following the release of the decision [0,1], the forestry sector experienced an unanticipated reduction in its common share prices of more than 2.8 percent. *Delgamuukw* opened up the potential for aboriginal title to directly overlap with the commercial exploitation of domestic resources, including forest stocks.53 This potential direct conflict and uncertainty regarding the decision’s impact on the industry in the future generated economically and statistically significant negative effects.

Our event-study results suggest that the release of the Canadian Supreme Court’s decisions in *Calder, Sparrow, Van der Peet*, and *Delgamuukw* triggered measurable responses from financial market participants who were supplying investment funds to domestic forestry firms through the TSX, at least for the *Van der Peet* and *Delgamuukw* decisions. These responses, though, were varied. “Instability” in the security of property rights does not necessarily produce a unified, unambiguous market response; instead, our event studies indicate that the impact of any changes in the security of resource rights depends on the particular way in which security is affected. A muted response may result if there are off-setting access and uncertainty effects, but where legal changes strengthen both dimensions of security, we see a positive market response, and when legal “instability” undermines both dimensions, investors respond negatively. Overall, our estimates of the market’s cumulative abnormal returns seem consistent with the conclusion that shocks to the security of the forestry sector’s rights resulting from the landmark cases produced significant economic effects. However, measuring the value of the net impact of these stock access and uncertainty effects on forestry firms’ common share prices tells us little about exactly why these effects matter to the financial market participants, or the economy, as a whole. To better understand the channels through which stock access and uncertainty affect industry and aggregate economic performance, we need to identify the ways they influence forestry firms’ economic fundamentals.

IV. TRACING THE IMPACT ON THE FORESTRY SECTOR’S ECONOMIC FUNDAMENTALS: PARTIAL EQUILIBRIUM SIMULATION MODEL

A partial equilibrium simulation model can help us trace the channels through which stock access and uncertainty affect the economic fundamentals that characterized the Canadian

53Areas subject to potential title claims cover 40 percent of current forest-harvesting operations (Wilson & Graham 2005:5).
forestry sector during the 1970–2005 period. We perform a series of simulation exercises that allow us to identify the set of coincident changes in stock access and uncertainty that can account for the investment supply effects measured with our event studies. We then assess the impact of these coincident changes on the forestry sector’s production decisions, demand for reproducible and natural capital, and profitability.

A. Simulation Model: Renewable Resource Theory

Virtually all theories of optimal renewable resource extraction assume that resource industries choose their production levels to maximize the present value of the stream of expected profits. Decisionmakers within the resource industry face a series of constraints when seeking to maximize profits, including a technological constraint described by a standard production function, a reproducible capital accumulation constraint described by an investment demand function, and a natural capital accumulation constraint described by both investment demand determinants and biological determinants. To facilitate the exploitation of the information we have derived from our event studies, we augment a standard dynamic optimal resource extraction model, which includes an objective function and three constraints, with an additional multifactor CAPM external investment supply constraint. The theoretical structure underlying our simulation model takes the form:

Objective Function: \( \text{Max}_q \int_{0}^{T} E(\Pi) e^{-rf} dt \)

Definitions:

(i) Profit Function: \( \Pi_t = p_t q_t - C(q_t, w_{kt}, w_{lt}) \)

(ii) Production Function: \( q_t = f(a_t, k_t, l_t, b_t) \)

Constraints:

(i) Reproducible Capital Accumulation: \( \Delta k_{t+1} = h(q_t, p_t, \sigma_{pt}, w_{kt}, w_{lt}, R_t) \)

(ii) Natural Capital Accumulation: \( \Delta b_{t+1} = g(\Pi_t, \sigma_{pt}, R_t, \text{temp}_t, p_{crt}, q_t) \)

(iii) Investment Supply: \( R_t = m(rf, R_m, \Delta E(\Pi_t), \sigma_{pt}) \)

In the decisionmaker’s objective function, expected industry profits are discounted by a risk-free interest rate \( rf \). The choice of optimal production levels \( q \), and the resultant industry profits \( \Pi \), hinge on the tradeoff between extraction costs \( C(\ldots) \) and output prices \( p \). Extraction costs are typically considered to be dependent on standard cost determinants, which include input prices \( wk \) and \( wl \), and the scale of production \( q \).56

54For a detailed description of the theoretical foundations and construction of this model, see Keay (2010).

55For a more detailed description of optimal extraction theory, see Neher (1990:ch. 17) or Hartwick and Olewiler (1998:ch. 10).

56For a detailed discussion of the standard cost determinants and their inclusion in resource-extraction models, see Varian (1992:ch. 5) and Neher (1990:ch. 6).
Productivity \((a)\), capital intensity, and access to the resource stock in situ (biomass, \(b\)) affect costs through their impact on \(q\). Access restrictions and biological depletion of the in situ stock is expected to be positively related to extraction and processing costs, hence negatively related to profits.

The technological environment faced by forestry firms is simply modeled as a production function in which output is determined by productivity, capital intensity, and the resource stock. No returns to scale constraints are imposed on this technology. Labor in this model is assumed to be supplied elastically at an exogenously determined price.

To link the economic fundamentals that characterize forestry firms’ production, cost, and profit functions to the determinants of investment demand and supply, three constraints are imposed on the resource industry’s decisionmakers. First an investment demand, or reproducible capital accumulation function, assumes that the desire to accumulate machinery and equipment for next period \((\Delta k_{t+1})\) will be determined by the industry’s output levels and output prices in the current period, uncertainty—measured as output price volatility \((\sigma_p)\)—an exogenously determined wage rate for labor \((w_l)\), an exogenously determined average user cost for capital \((w_k)\), and an endogenously determined cost for investment funds raised on the domestic equity market \((R)\).\(^{57}\) The investment demand function for natural capital assumes that the firm’s financial incentive to augment resource stock levels for next period \((\Delta b_{t+1})\) will vary with this period’s profits, uncertainty, and the cost of external investment funds, but these incentives will operate in concert with biological determinants of natural growth rates, including past extraction rates \((q)\), average temperatures \((\text{temp})\), and average precipitation levels \((\text{pcip})\).\(^{58}\)

The final constraint imposed in the model is the multifactor CAPM investment supply function that endogenously determines the cost of acquiring investment funds from the domestic equity market. Equity market performance is included in the model because increases in common share prices imply a reduction in the cost associated with raising investment funds from formal capital markets. If we assume that forestry firms treat investment supply sources as close substitutes (capital is fungible), then rising share prices may be considered representative of a more general increase in investment supply from external sources. The basic CAPM approach used in our event studies depicts the evolution of equity prices on formal stock exchanges as a function of nothing more than the risk-free rate of return \((r_f)\) and the market average rate of return \((R_m)\). This basic approach is theoretically justified and empirically appropriate in the event-study stage of our investigation.\(^{59}\) However, in the construction of our simulation model, which focuses

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\(^{57}\)The investment demand function for reproducible capital is based on the application of Sheppard’s Lemma to a standard, well-defined cost function, as described in Varian (1992:ch. 5).

\(^{58}\)There is a vast literature on natural capital accumulation functions (biological growth functions) for forest resources. For surveys of this literature, see Pearce (1990) or Statistics Canada (1993).

\(^{59}\)By moving to a multifactor CAPM specification, we can relax our assumption that all traders exhibit quadratic preferences, or all risky assets have normally distributed returns. See Ross (1976) for a discussion of the theoretical implications associated with the movement from the basic CAPM approach to the multifactor arbitrage pricing theory approach.
on longer-run movements in the forestry sector’s economic fundamentals, a multifactor CAPM that includes controls for unanticipated changes in industry profits ($\Delta E(P)$) and changes in the effect of uncertainty on the formation of expectations regarding the path of future profits ($\sigma\nu$) allows us to formally model the links connecting endogenously determined investment supply decisions to investment demand incentives, output decisions, and, ultimately, industry profits.\textsuperscript{60}

Drawing on our analysis of the Calder, Sparrow, Van der Peet, and Delgamuukw decisions, and the results from our event studies, our focus in the employment of this model is on shocks to contemporaneous stock access and uncertainty that trigger investment supply effects. Contemporaneous stock access is captured in the model through the natural capital accumulation constraint, while uncertainty appears in all three of the model’s investment constraints. Of course, reproducible and natural capital accumulation also determine output levels and extraction costs, which in turn determine profitability and subsequent investment supply costs. The simultaneous nature of the model implies that the cumulative impact of any stock access and/or uncertainty shocks will defy any simplistic characterization because of their dependence on the specific structure and calibration of the model’s equations.

B. Simulation Model: Calibration and Diagnostics

After making a series of assumptions about functional forms and choosing appropriate parameters, we could derive a set of first-order conditions that characterize the dynamic optimal extraction path that solves the model described above. However, the data to fit these dynamic paths empirically simply do not exist. Instead, we assume that the underlying structure of the model captures the objectives and constraints faced by decisionmakers in Canada’s forestry sector, and we apply the available data for the forest industry from 1970–2005 to estimate the direction and strength of the relationships implied by this structure. The evidence will then tell us about the time paths actually taken by the endogenous variables, and these time paths will allow us to trace out the channels linking the stock access and uncertainty effects that were triggered by changes in the security of property rights to profits, output decisions, and investment incentives.

To calibrate the model, we use parameters derived from an econometric estimation of a system of five equations based on the optimal resource extraction model’s objective function and constraints. We make two changes to the variables specified in the theoretical model to make the empirical estimation feasible and appropriate. First, because we are interested in the Canadian forestry sector’s responses to shocks in the security of property

\textsuperscript{60}In an efficient competitive equity market, anticipated changes in profitability should already be fully reflected in equity prices. This implies that changes in equity market performance should be related to deviations from expected profitability rather than aggregate changes in profits. Although there are an infinite number of ways to model expectations (or deviations from expectations), we simply assume that investors on the TSX expected changes in forestry profits to be determined by last year’s profits. This implies that all the annual change in forestry profits may be considered unanticipated. Sensitivity tests reveal that our qualitative conclusions are unaffected by our assumption regarding the anticipation of expected profits, and the iterative solutions for the simulation model are simplified by the use of the more basic “consecutive year” expectations formation model.
rights, we must isolate deviations that are sector specific from movements in the macro-

economy that are unrelated to the legal recognition of aboriginal rights. To do so, we

measure all our variables relative to similarly defined national aggregates. Second, because

our ultimate goal is to estimate the long-run growth effects resulting from the Supreme

Court’s interpretation of aboriginal rights, we measure all variables as log-differences over
time.\footnote{61} Following these two adjustments, the five equations that make up our estimation
(and simulation) model take the form:

Profit Function:

\[
\pi_t = \alpha_0 + \alpha_1 q_t + \alpha_2 p_t + \alpha_3 w kl + \epsilon_t
\]  

(1)

Production Function:

\[
q_t = \beta_0 + \beta_1 a_t + \beta_2 k_t + \beta_3 b_t + \epsilon_t
\]  

(2)

Reproducible Capital Accumulation Function:

\[
k_{t+1} = \gamma_0 + \lambda_1 q_t + \gamma_2 (R_t - r_f) + \gamma_3 p_t + \gamma_4 \sigma_{\mu t} + \gamma_5 w kl + \epsilon_t
\]  

(3)

Natural Capital Accumulation Function:

\[
b_{t+1} = \eta_0 + \eta_1 \pi_t + \eta_2 \sigma_{\mu t} + \eta_3 (R_t - r_f) + \eta_4 t e m p + \eta_5 p c i p + \eta_6 q_t + \epsilon_t
\]  

(4)

Investment Supply Function:

\[
(R_t - r_f) = \lambda_0 + \lambda_1 (R m_t - r_f) + \lambda_2 \pi_t + \lambda_3 \sigma_{\mu t} + \epsilon_t
\]  

(5)

The endogenous variables in the system include:\footnote{62}:

- $\pi_t = \% \Delta$ forestry economic profits (measured as value added less the opportunity
cost of labor and the opportunity cost of capital)\footnote{63} divided by GDP.
- $q_t = \% \Delta$ real output of forestry sector (measured as value added deflated by an
industry-specific output price index) divided by aggregate Canadian real GDP.

\footnote{61}{Reinterpreting the variables as log-differences also ensures stationarity over the 1970–2005 period.}


\footnote{63}{We assume that the opportunity cost of labor is total employment multiplied by the average annual labor income
earned in nonresource-intensive manufacturing. We assume that the opportunity cost of capital is the nominal value
of net fixed capital times Moody’s AAA industrial bond yields. Note that we have not calculated marginal scarcity rents
(or shadow prices) for the forestry sector. Scarcity rents have an impact on extraction decisions, but they do not
directly determine aggregate profitability. For a detailed discussion of the derivation of scarcity rents in a Canadian
context, see Livernois et al. (2006).}
• $k_l = \% \Delta$ reproducible capital intensity of forestry sector (measured as nominal value of net fixed capital stock divided by an industry-specific fixed capital price index and total employment) divided by aggregate Canadian reproducible capital intensity.

• $b_n = \% \Delta$ stock of natural capital in forest sector (measured as merchantable timber volume in situ).$^{64}$

• $(R_t - r_f) = \% \Delta$ forestry common share prices (measured as the TSX Annual Review’s forestry and paper products share price index) less a risk-free rate of return (measured as Government of Canada long-term bond yields).$^{65}$

The exogenous variables in the system include:

• $a_t = \% \Delta$ forestry TFP (measured as a Tornqvist-weighted average of partial factor productivities, with value added used as the output measure and average income shares used as weights) divided by aggregate Canadian TFP.

• $p_t = \% \Delta$ forestry output price index divided by GDP deflator.

• $w_{kil} = \% \Delta$ user cost of reproducible capital (measured as value added less wages and salaries paid to labor divided by real gross reproducible fixed capital employed) relative to an index of hourly wages in forest and wood products industries divided by aggregate Canadian user cost of reproducible capital relative to aggregate Canadian hourly wage index.

• $\text{temp}_t =$ deviations from linear trend in average annual North American air temperature (measured across monitoring stations in the contiguous United States).

• $\text{precip}_t =$ deviations from linear trend in average annual volume of North American precipitation (measured across monitoring stations in the contiguous United States).

• $(R_{mt} - r_f) = \% \Delta$ composite market common share price index (measured as the TSX Annual Review’s composite share price index) less a risk-free rate of return.

• $\sigma_{pt} = \% \Delta$ standard deviation in forestry output price index over previous 15 years divided by standard deviation in GDP deflator over previous 15 years.$^{66}$

The econometric estimation of the parameters included in Equations (1)–(5) uses annual data covering the years 1970–2005 from the extraction, primary processing, and secondary processing industries that comprise the Canadian forestry sector.$^{67}$ 

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64Note that valuing the timber stock would require the estimation of scarcity rents or shadow prices for all forest stands. The calculation of these values is, if not impossible, certainly impractical. No estimates of aggregate natural capital exist for Canada until the very end of our sample period.

65Information on Canadian government bond yields for the earliest part of the 20th century is scarce. We have used the series compiled by McInnis <http://library.queensu.ca/webdoc/ssdc/cbdksnew/HistoricalMacroEconomicData>.

66Fifteen years has been chosen as the period over which standard deviations have been calculated in an effort to span business cycles in both the forestry sector and the aggregate economy.

67Identification of Canada’s forestry industries follows the North American Industrial Classification System (NAICS) definitions used by Natural Resources Canada in 2004.
and standard deviations for the variables included in the model are reported in Table 2. These summary statistics represent differences in growth rates, with negative values—for example, economic profits, output, or share prices—indicating that the aggregate economy grew faster than the forestry sector over the post-1970 period, and positive values—for example, reproducible capital intensity, natural capital stock, or uncertainty (output price volatility)—indicating more rapid forestry sector growth.

To implement an estimation strategy, we assume that the decisionmakers within the Canadian forestry sector made joint investment and production decisions, which leads us to estimate the system of five equations using an iterative seemingly unrelated regressor technique that generates estimates equivalent to maximum likelihood estimation.68 This technique corrects the standard errors reported for each parameter estimate to account for correlation across the error terms from each equation.

In Table 3 we report the parameter estimates (and their \( p \) values) that characterize the fully calibrated simulation model described by Equations (1)–(5). The parameter estimates are used with the observed (or counterfactual) exogenous variables to iteratively solve for each of the five endogenous variables over 35 consecutive periods. From the parameter estimates reported in Table 3 we can see that shocks to contemporaneous stock access have a significant and positive effect on production decisions. The point estimate on \( b \) in the production function (Equation (2)) indicates that, holding all else constant, a

### Table 2: Summary Statistics, Forestry Sector Simulation Model’s Endogenous and Exogenous Variables, 1970–2005

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>Average Annual % Δ</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic profits ((\pi_t))</td>
<td>-0.003</td>
<td>0.343</td>
</tr>
<tr>
<td>Real output ((q_t))</td>
<td>-0.016</td>
<td>0.123</td>
</tr>
<tr>
<td>Reproducible capital intensity ((k_{lt}+1))</td>
<td>0.016</td>
<td>0.101</td>
</tr>
<tr>
<td>Natural capital stock ((b_{lt}+1))</td>
<td>0.011</td>
<td>0.042</td>
</tr>
<tr>
<td>Forestry share price premium ((R_t-r_{ft}))</td>
<td>-0.025</td>
<td>0.194</td>
</tr>
</tbody>
</table>

**Exogenous Variables**

| Total factor productivity \((a_t)\)        | 0.011              | 0.128 |
| Relative output price \((p_t)\)           | 0.001              | 0.083 |
| Capital: Labor costs \((wkw_l)\)           | 0.024              | 0.303 |
| Deviant temperature \((temp_l)\)           | 0.001              | 0.018 |
| Deviant precipitation \((pchip_l)\)        | 0.001              | 0.091 |
| Composite market premium \((Rm_t-r_{ft})\) | -0.009             | 0.163 |
| Output price volatility \((\sigma_{pe})\)  | 0.019              | 0.134 |

**Note:** Specific data definitions provided in text. Access is measured through the natural capital stock; uncertainty is measured through output price volatility. Standard deviation calculated as: \(\sigma = \left[\sum (x_i - \mu)^2 / (n-1)\right]^{\frac{1}{2}}\).

**Source:** See Data Appendix at <http://www.econ.queensu.ca/ikeay/dataapp3.pdf>.

68 Before estimating Equations (1)–(5), the time-series properties of the data were explored using Phillips-Perron unit root tests. Nonstationarity can be rejected with at least 99 percent confidence for all the log-differenced series employed.
reduction in stock access equivalent to a 1 percent change in the average annual biomass growth rate can be associated with a reduction in the growth rate of production levels of over 0.5 percent. Increases in uncertainty, captured in our simulation model in the form of output price volatility relative to the volatility of the GDP deflator, suppressed the incentive to supply investment funds through the Toronto Stock Exchange, and reduced the forestry firms’ incentive to accumulate both reproducible and natural capital. However, relative to stock access, these effects appear small and they are statistically insignificant when estimated over the post-1970 period. The point estimates on $\sigma_p$ in the investment demand Equations (3) and (4) indicate that a 1 percent increase in uncertainty has been associated with a 0.01 percent decrease in the intensity of reproducible capital use, and a 0.1 percent decrease in the accumulation of in situ timber volumes. The forestry firms’ share prices appear to have been slightly more sensitive to output price fluctuations, although the estimated coefficient is statistically insignificant—the CAPM equation indicates that a 1 percent increase in uncertainty has been associated with a 0.2 percent decrease in the forestry firms’ share prices since 1970.

Of course, production decisions, reproducible capital intensity, natural capital stocks, and the cost of raising investment funds on external financial markets have subsequent and, in many cases, statistically significant indirect effects on the forestry sector’s economic fundamentals. There is a substantial degree of persistence implied by the size and significance of the interactions among the endogenous variables that are documented in Table 3. To trace out the cumulative long-run effect that stock access and uncertainty shocks can have on the fundamentals describing the profitability, investment, and production decisions being made by a resource-intensive industry, we must conduct a series of simulations using our fully parameterized model.

However, before discussing our simulation results, we need to consider the ability of the underlying model to replicate the observed endogenous variables. How well does the model reflect the actual performance of the industry? We have used the parameter estimates reported in Table 3 with the observed exogenous variables describing the Canadian forestry sector over the 1970–2005 period to simulate the five endogenous variables over 35 periods. We have then compared the distribution of each of the simulated endogenous variables to the distribution of each of the observed endogenous variables. For simplicity, we confine our attention to the first two moments of these distributions.

From Table 4 we can see that the mean simulated endogenous variables differed from the mean observed endogenous variables by less than 0.5 percentage points in every

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69 There is a much stronger statistical connection between uncertainty and equity market performance over the first half of our sample period relative to the second half. The large standard errors for the uncertainty parameters would be a cause for concern if our objective was to use these parameters for statistical inference. However, we use these parameters as equivalent to maximum likelihood estimates to calibrate our simulation model, and we rely on this model to determine their economic significance. We test the model’s validity through its ability to replicate observed endogenous variables.

70 The comparisons reported in Table 4 are not equivalent to the $R^2$ values reported in Table 3 because the simulation model uses lagged simulated endogenous variables on the right-hand-side of Equations (1)–(5), rather than the observed lagged endogenous variables used to derive the $R^2$. 

816 Keay and Metcalf
Table 3: Econometrically Estimated Parameters Used to Calibrate Forestry Sector Simulation Model

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>Profit Function ($\pi_t$)</th>
<th>Output Function ($q_t$)</th>
<th>Reproducible Capital Demand ($k_{t+1}$)</th>
<th>Natural Capital Demand ($b_{t+1}$)</th>
<th>Investment Supply Function ($R_t - rf_t$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic profits ($\pi_t$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real output ($q_t$)</td>
<td>1.304***</td>
<td></td>
<td>0.994***</td>
<td></td>
<td>0.064**</td>
</tr>
<tr>
<td>Reproducible capital intensity ($k_{t+1}$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural capital stock ($b_{t+1}$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.336***</td>
</tr>
<tr>
<td>Forestry share price premium ($R_t - rf_t$)</td>
<td></td>
<td></td>
<td></td>
<td>0.160***</td>
<td></td>
</tr>
<tr>
<td>Exogenous Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity ($\alpha_t$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.930***</td>
</tr>
<tr>
<td>Relative output price ($\beta_t$)</td>
<td>2.982***</td>
<td></td>
<td>0.642**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital: Labor costs ($w_k w_l$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output price volatility ($\sigma_p$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviant temperature ($l_{temp}$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviant precipitation ($l_{prec}$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite market premium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>($R_m - rf$) Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.675</td>
<td>0.588</td>
<td>0.187</td>
<td>0.165</td>
<td>0.338</td>
</tr>
<tr>
<td>$N$</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>

Note: Equation structure, estimation procedure, and specific data definitions are provided in text. P-values reported in parentheses represent probability that parameter estimates cannot be statistically distinguished from zero. *, **, *** indicate statistical significance with 90 percent, 95 percent, 99 percent confidence, respectively.

case. Even for the CAPM and production functions, which generated simulated values that deviated the farthest from the observed variables, the differences in growth rates are small and statistically insignificant. We can also see that, with the exception of the reproducible capital demand function, the simulation model captures much of the volatility in the observed endogenous variables. Aside from the simulated \( k_l \) series, which is dramatically less volatile than the observed series, the standard deviations among the four remaining simulated series relative to the observed series vary from a high of 108.5 percent for the \( p \) series, to a low of 83.5 percent for the \((R - r_f)\) series. We are confident in claiming that our model fits the observed variables quite well.

### C. Simulation Model: Results

We have argued that our event-study results for the Calder, Sparrow, Van der Peet, and Delgamuukw decisions reflect a combination of reactions to the contemporaneous stock access and uncertainty effects embodied in each decision. Our simulation model includes contemporaneous stock access and uncertainty effects, and explicitly links these effects to long-run equity market performance and profitability, production decisions, and reproducible and natural capital investment decisions. This lets us identify the combinations of stock access and uncertainty shocks that could have produced the equity price responses we measure with our event studies, while also allowing us to track the longer-run, cumulative changes in all the forestry sector’s key economic fundamentals that result from these shocks. In the model, reductions in contemporaneous stock access decrease output levels and increase extraction costs, both of which drive down profits and equity prices in future

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Table 4: Model Diagnostics, Comparing Observed Endogenous Variables to Simulated Endogenous Variables

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>Profit Function (( \pi_t ))</th>
<th>Output Function (( q_t ))</th>
<th>Reproducible Capital Demand (( k_{l,t+1} ))</th>
<th>Natural Capital Demand (( b_{t+1} ))</th>
<th>Investment Supply Function (( R_t - r_{ft} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Mean</td>
<td>-0.003</td>
<td>-0.016</td>
<td>0.016</td>
<td>0.011</td>
<td>-0.025</td>
</tr>
<tr>
<td>SD</td>
<td>0.343</td>
<td>0.123</td>
<td>0.101</td>
<td>0.042</td>
<td>0.194</td>
</tr>
<tr>
<td>Simulated Mean</td>
<td>-0.006</td>
<td>-0.020</td>
<td>0.016</td>
<td>0.013</td>
<td>-0.030</td>
</tr>
<tr>
<td>((p\text{ value}))</td>
<td>(0.969)</td>
<td>(0.845)</td>
<td>(0.925)</td>
<td>(0.830)</td>
<td>(0.861)</td>
</tr>
<tr>
<td>SD</td>
<td>0.372</td>
<td>0.126</td>
<td>0.043</td>
<td>0.037</td>
<td>0.162</td>
</tr>
</tbody>
</table>

Note: Equation structure provided in text. Simulated means are calculated over 35 iterations. \( P \) values reported in parentheses represent results from a mean equivalence test of the null hypothesis that simulated means are equal to observed means. Inability to reject this null indicates that the simulated means cannot be distinguished from the observed means with any standard level of statistical confidence. \( SD = \text{standard deviation, calculated as: } \sigma = \left[ \frac{1}{n-1} \sum (x_i - \mu)^2 \right]^{1/2} \). 


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71A Cook’s distance test identifies 1974 as a statistical outlier within the profit function. As a result, the means and standard deviations reported in Table 4 have been calculated after dropping 1974 from the \( \pi \) equation in the simulation. Although the inclusion of 1974 decreases the simulated mean for \( \pi \), the simulated and observed means remain statistically indistinguishable \((p\text{ value on the test for common means drops to 0.612})\).
periods. *Increases* in uncertainty, on the other hand, directly and immediately reduce equity prices and the incentive to accumulate both reproducible and natural capital. These investment effects decrease output levels and increase extraction costs in subsequent periods, again reducing profits and further lowering equity prices. Constraining stock access and fostering uncertainty, therefore, both exert downward pressure on profits and equity market performance, and this pressure accumulates over time as the direct and indirect effects filter through the model. As this suggests, any given change in common share prices may be triggered by a combination of coincident stock access and uncertainty shocks.

To identify the stock access and uncertainty shocks that can produce equity price effects equivalent to those estimated from our event studies, and to establish the impact of these effects on a resource industry’s economic fundamentals, we begin by setting all exogenous variables in the model at their long-run means, calculated over the 1970–2005 period. We then iteratively solve the model’s five equations through 35 periods, generating a series of simulated endogenous variables that are constant and equal to their long-run means. After imposing a shock to contemporaneous stock access at an arbitrary date \( t = 0 \), we can measure the initial equity price response to this shock through the investment supply function \((R - rf)\). By simultaneously adjusting the level of uncertainty \( \sigma_p \) at \( t = 0 \), the equity price response can be varied until it matches the results from our event studies. By repeating this process we can identify a range of uncertainty-stock access combinations that generate each of the equity price responses we measure with our event studies. To complete the exercise, for each of the uncertainty-stock access pairs we run the simulation model forward a minimum of 10 additional periods \( t = 10 \) to track the long-run, cumulative effects of these coincident shocks on all five of the endogenous variables.

We could report a set of uncertainty-stock access shocks that are capable of producing each of the equity price responses measured by the event studies reported in Table 1. However, we limit our analysis to *Van der Peet* and *Delgamuukw*. These decisions produced the largest positive and negative statistically significant cumulative abnormal returns from our event studies, thereby forming an estimated range over which shocks to the security of legal rights from the decisions may have affected the performance of the industry.

In Figure 1 we illustrate the combination of stock access and uncertainty shocks that generate an equity price response in \( t = 1 \) equal to the upper bound established in our event studies: +3.1 percent from *Van der Peet* \([0,3]\). Changes in uncertainty are measured as a fraction of one standard deviation in the observed relative output price volatility series \( \sigma_p \). A value of 1.0 on the horizontal axis in Figure 1, therefore, represents an increase in uncertainty equivalent to the uncertainty generated by a one standard deviation increase in the volatility of forest product prices relative to the GDP deflator. Changes in contemporaneous stock access are measured as a fraction of one standard deviation in the observed growth rates of in situ Canadian timber volumes \( b \). A value of 1.0 on the vertical axis in Figure 1 represents an increase in stock access equivalent to one standard deviation in the long-run annual average growth rate in natural capital within the forestry sector.

In Figure 1 we can see that if financial market participants had attributed no uncertainty effects to the *Van der Peet* decision in August 1996, then the estimated +3.1 percent equity market response would have required a substantial shock to stock access, equivalent
to just less than 3.2 standard deviations in the long-run growth rate of in situ biomass. In contrast, the forestry sector’s equity prices appear to have been considerably more sensitive to changes in uncertainty, at least in the short run. If financial market participants had attributed no contemporaneous stock access effects to the Van der Peet decision, then the +3.1 percent equity market response would have required a shock to uncertainty equivalent to just a 1.0 standard deviation increase in the relative volatility of Canadian forest product prices.

The simulation results depicted in Figure 1 reveal the relative sensitivity of our investment supply function to stock access and uncertainty shocks; however, they do not reveal the cumulative impact of these shocks on the sector’s other economic fundamentals. The line in Figure 1 represents an infinite number of stock access and uncertainty combinations that could have triggered Van der Peet’s +3.1 percent equity price shock in $t = 1$. For each of these possible combinations there is a different long-run profit,

\[ \text{CAR}[0,3] = 0.031. \]

Figure 1: Uncertainty and stock access combinations that generate largest positive estimated cumulative abnormal returns for Van Der Peet, CAR[0,3] = 0.031.


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Note that shocks in our simulation model are defined as fractions of a standard deviation in the observed stock access and uncertainty variables. As such, “sensitivity” does not refer to an absolute level, but it is defined relative to the frequency of observing movements of the required magnitude. Recall from Table 2: $\sigma_{\text{stock access}} = 0.042$, $\sigma_{\text{uncertainty}} = 0.154$. 
production, and investment outcome for the forestry sector. To fully characterize the performance implications stemming from Van der Peet, we must narrow our focus by considering only the uncertainty-stock access combinations that seem consistent with our legal interpretation of the content of the decision.

In our discussion of the Van der Peet decision, we argued that the Court’s decision likely had the effect of improving the security of the industry’s current rights to forest resources, and decreasing the uncertainty in the legal environment that would impact future operations. This implies that the combination of stock access and uncertainty effects stemming from Van der Peet probably fell within the northwest quadrant of Figure 1, which in turn implies a maximum uncertainty effect of -1.02 standard deviations if the stock access channel was closed, and a maximum stock access effect of +3.19 standard deviations if the uncertainty channel was closed.

In Table 5 we report the cumulative impact that these upper and lower bounds on contemporaneous stock access and uncertainty shocks have on the forest sector’s economic fundamentals. We can see that although both the “no stock access shock” and the “no uncertainty shock” scenarios trigger an immediate +3.1 percent equity price response, the cumulative equity price effect after 10 periods are higher still: 3.6 percent and 5.7 percent, respectively. The movements in share prices during simulation periods \( t = 1 \rightarrow t = 10 \) reflect the lagged impact that cheaper external investment funds (higher common share prices) have on the incentive to invest in reproducible and natural capital, which encourages production, reduces extraction costs, and eventually

<table>
<thead>
<tr>
<th></th>
<th>Van der Peet (( \Delta )Uncertainty, ( \Delta )Stock Access)</th>
<th>Delgamuukw (( \Delta )Uncertainty, ( \Delta )Stock Access)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta ) Economic profits (( \pi_t ))</td>
<td>0.024</td>
<td>-0.022</td>
</tr>
<tr>
<td>( \Delta ) Real output (( q_t ))</td>
<td>0.019</td>
<td>-0.017</td>
</tr>
<tr>
<td>( \Delta ) Reproducible capital intensity (( k_{lt} ))</td>
<td>0.018</td>
<td>-0.016</td>
</tr>
<tr>
<td>( \Delta ) Natural capital stock (( b_{lt} ))</td>
<td>0.017</td>
<td>-0.015</td>
</tr>
<tr>
<td>( \Delta ) Forestry share price premium (( R_t - r_f t ))</td>
<td>0.036</td>
<td>-0.032</td>
</tr>
<tr>
<td>( \Delta ) GDP/capita</td>
<td>0.0005</td>
<td>-0.0004</td>
</tr>
</tbody>
</table>

**Note**: Maximum CAR from Van Der Peet \( [0,3] = 0.031 \); minimum CAR from Delgamuukw \( [0,1] = -0.028 \). \( \Delta \) Uncertainty and \( \Delta \) Stock access defined as a fraction of one standard deviation in observed series. \( \Delta \) Economic fundamentals defined as change in the long-run simulated growth rates 10 periods after uncertainty and stock access shocks imposed on model.


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73The cumulative impact is assessed 10 simulation periods after the imposition of our uncertainty and stock access shocks. After seven periods, the annual changes in the model’s five endogenous variables are less than 1 percent of the preshock values for all the simulation exercises reported here.
improves profitability, further contributing to subsequent improvements in equity market performance.

If Van der Peet triggered no uncertainty effects in its immediate aftermath but dramatically increased stock access \((0, +3.19)\), our simulation model illustrates the dramatic effect this outcome would have had on the long-run profitability, production, and capital intensity of the forest sector—increasing the growth rate of economic profits by 17 percent, production by 13 percent, and reproducible capital accumulation by 12 percent—but perhaps most surprising is the slight reduction in the accumulation of natural capital following this short-run shock to stock access. The 1 percent reduction in long-run timber volume growth rates simply reflects the very large impact that this scenario has on our simulated production decisions. Increasing average annual commercial extraction rates by 13 percent swamps any positive effect that increased investment incentives might have on the sector’s desire to accumulate natural capital. These large cumulative effects on the sector’s economic fundamentals indicate that the performance of Canada’s forestry firms was very sensitive to changes in the costs and incentives associated with contemporaneous stock access, even if traders on the TSX were largely insensitive to current access.

In contrast, when we can consider a scenario in which Van der Peet triggered only uncertainty effects in its immediate aftermath \((-1.02, 0)\), the impacts are smaller for long-run profitability, production, capital intensity, and stock accumulation in the forestry sector. The decision increases the growth rate of economic profits by just 2.4 percent, production by 1.9 percent, reproducible capital accumulation by 1.8 percent, and natural capital accumulation by 1.7 percent if the channel through which Van der Peet affected forestry firms’ market values was confined to changes in general, longer-run legal uncertainty.\(^74\)

The cumulative effects of the Van der Peet decision set out in Table 5 indicate that the investment supply function is more sensitive to uncertainty shocks than any of the other equations in the model. This sensitivity reflects the responsiveness of Canadian financial market participants to perceived changes in the risks associated with the long-run security of property rights for resource-intensive industries. Investors on the TSX appear to crave certainty, and are quick to react to any new uncertainty introduced through changes in property rights provisions embodied in aboriginal rights decisions released by the Supreme Court. However, the impact of these shocks appears to be less severe for the industry’s long-run fundamentals than when the shocks are realized through direct effects on the security of current resource access.

Turning to our lower-bound estimate of the equity market response to the decisions—Delgamuukw’s \([0, 1] -2.8\) percent cumulative abnormal return—we find more evidence that the external suppliers of investment funds seem very sensitive to uncertainty shocks, while the forestry sector’s other fundamentals appear much more sensitive to stock access shocks. In Figure 2 we illustrate the combination of stock access and uncertainty

\(^74\)The growth rate of the forest sector’s in situ biomass rises in the “no stock access shock” scenario because the improvement in investment demand incentives associated with the reduction in uncertainty more than offsets the small increase in the rate of extraction.
shocks that generate an equity price response in $t = 1$ equal to the boundary on negative returns established in our event studies: $Delgamuukw$$[0,1]$. We can again see that this equity price effect can be achieved through an infinite number of combinations of off-setting increases in stock access and uncertainty. We argue that $Delgamuukw$ took a relatively generous approach to recognizing aboriginal land rights, increasing the potential for conflict with commercial rights holders, and the decision contributed significantly to general uncertainty about future operations, in particular due to the vague and complex nature of the justified infringement test and its requirements for consultation and compensation. This interpretation implies that the combination of stock access and uncertainty effects stemming from $Delgamuukw$ probably fell within the southeast quadrant of Figure 2—increasing uncertainty and reducing contemporaneous stock access. This would produce a maximum uncertainty effect of $+0.90$ standard deviations (if the stock access channel was closed) and a maximum stock access effect of $-2.81$ standard deviations (if the uncertainty channel was closed). Again, we can see that for any given equity price effect, the investment supply function is less sensitive to stock access shocks than it is to uncertainty shocks.\footnote{Sensitivity is defined relative to the observed variation in the timber volume and output price volatility series.}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Uncertainty and stock access combinations that generate largest negative estimated cumulative abnormal returns for $Delgamuukw$, $\text{CAR}[0,1] = -0.028$.}
\end{figure}
In Table 5 the cumulative impact of Delgamuukw’s maximum and minimum contemporaneous stock access and uncertainty shocks on the forestry sector’s economic fundamentals can be identified. Our qualitative conclusions are very similar to those for the Van der Peel decision. The cumulative impact of the uncertainty and stock access shocks on equity prices is higher than the initial impact as a result of the suppression of investment demand and eventually profitability, which further undermines equity market performance. The large cumulative output effect following a negative stock access shock offsets the investment demand effect, such that the rate at which firms accumulate natural capital actually rises slightly in the long run in the “no uncertainty shock” scenario. The forestry sector’s fundamentals are considerably more responsive to the contemporaneous access effect required to produce the Delgamuukw \([0,1] \sim 2.8\) percent equity price shock, relative to the required uncertainty effect. In the stock-access-only simulation, the model generates a cumulative profit effect of \(-15\) percent, a reduction in output growth of \(-11.5\) percent, and a slow down in reproducible capital accumulation equal to \(-10.4\) percent. In contrast, an uncertainty-only shock triggers a cumulative profit effect of just \(-2.2\) percent, a reduction in output growth of \(-1.7\) percent, and a reduction in reproducible capital accumulation equal to \(-1.6\) percent.

The results from our simulation model suggest some important conclusions with respect to our understanding of the economic consequences of “instability” in the formal, legal rights relevant to commercial resource development. The model indicates that investment supply is most sensitive to shocks to property rights that operate through the uncertainty channel. This result is consistent with other literature linking the security of property rights with the provision of investment funds for resource-intensive economies. However, the results from the model also indicate that the industry’s fundamentals appear to be more sensitive to changes in the security of legal rights when they have a direct and immediate impact on the costs associated with physical access. The results, therefore, suggest that any conclusions about the impact of changes in the structure of formal legal resource rights must be conditional on an understanding of the precise way in which the shocks operate. The aggregate consequences may vary, depending on the relative importance of the access and uncertainty channels.

V. THE IMPACT ON MACROECONOMIC PERFORMANCE: A GENERAL EQUILIBRIUM EXTENSION

To model the forestry sector’s role in the Canadian economy between 1970–2005, we adopt a very simple, static general equilibrium approach. If we assume perfectly elastic labor and

\(^{76}\)For an example, see Bohn and Deacon (2000).

\(^{77}\)Our general equilibrium exercise is similar to that of Chambers and Gordon (1966), estimating the net contribution made by western wheat production to Canadian economic performance in 1911. McCloskey (1972) also uses a similar model to estimate the macroeconomic impact of a reorganization of agricultural property rights in Britain during the late 18th and early 19th centuries.
capital supplies within the resource sector and we ignore any externalities that may spill over from forestry into other less-resource-intensive activities, the net impact of a “resource shock” on real Canadian GDP per capita can be fully captured by measuring the impact of the shock on the returns paid to the fixed factor in production—in our case, forestry resource profits. These assumptions are unrealistic; however, they likely work to make our estimates conservative.78

The structure of this simple general equilibrium model implies that the key endogenous variable from our simulation model is the growth rate of the forest sector’s economic profits. Forestry generates economic profits because extraction and processing activities earn a return off the fixed factor of production—forests—without paying a market price for this factor. If we accept that the profits earned by the forestry sector contribute directly to income per capita, and GDP growth is a weighted average of sectoral growth rates (including forestry), then we can calculate a counterfactual change in the average growth rate of real Canadian GDP per capita between 1970–2005 that may be attributed to the cumulative change in forestry profits triggered by the Van der Peet and Delgamuukw decisions.

In the last row of Table 5 we report the results from four counterfactual experiments. In these experiments we ask what the change in Canadian income per-capita growth would have been in the absence of any changes in the security of commercial property rights (and the resultant uncertainty and stock access shocks) associated with the Supreme Court’s Van der Peet and Delgamuukw decisions. We can see that an increase in the rate of growth of forestry profits of 2.4 percent (Van der Peet [0,3], no stock access-maximum uncertainty shock) would have led to an increase in long-run intensive growth in Canada equal to 0.05 percentage points. In the no uncertainty-maximum stock access shock scenario, Van der Peet would have increased the rate of growth of forestry profits by 17 percent, which would have improved long-run intensive growth over the post-1970 period by 0.41 percentage points.

These estimates show that the extent to which shocks to property rights affect macroeconomic performance depends critically on the exact combination of uncertainty and access effects embodied in these changes. Equity market participants may be very sensitive to changes in uncertainty, but aggregate economic performance appears much more responsive to changes in contemporaneous stock access. The macroeconomic consequences we estimate for Delgamuukw reinforce this result: the counterfactual real GDP per-capita growth rate effects fall between –0.04 percentage points and –0.26 percentage points, corresponding to the “no stock access shock” and “no uncertainty shock” scenarios, respectively. If we estimate the cumulative income per-capita impact of all four of the landmark aboriginal land rights cases we consider with our event studies by repeating our simulation exercises and counterfactual experiments using the upper and lower bounds on the uncertainty and stock access effects associated with the Calder and Sparrow decisions, we find that the property rights changes embodied in these decisions contributed between 0.07 (no stock access shock) and 0.72 (no uncertainty shock) percentage points to long-run Canadian real GDP per-capita growth over the 1970–2005 period.

78Lewis (1975) shows that relaxing assumptions of perfectly elastic labor and capital supplies has a significant (positive) effect on the net impact of resource shocks and Keay (2007) provides evidence of significant (positive) spillovers from resource industries.
These estimates may not seem large, given that we have argued above that the decisions were significant shocks to the security of resource rights for an important part of Canada’s economy, and given the importance that has been placed on the connection between property rights and performance in the literature. However, the small numbers reported on the last line of Table 5 do not necessarily imply that these counterfactual growth effects were unimportant. On average, Canadian income per capita grew at 1.97 percent per year after 1970. This implies that our counterfactual estimates of the aggregate counterfactual growth effect of all four Supreme Court decisions may have accounted for as much as 37 percent (or as little as 4 percent) of the observed income per-capita growth in Canada. These estimates should be interpreted with great caution. Not only have we constructed our simulation exercises and counterfactual experiments on the basis of a set of assumptions that are very restrictive, we also consider only four of the Supreme Court’s most important and highly publicized aboriginal rights decisions. Other judicial decisions and processes in other forums, such as land claims negotiations and lower court decisions, may have contributed significantly to the cumulative uncertainty and stock access effects associated with the Constitution Act’s Section 35(1). In addition, we have also confined our attention exclusively to the forestry sector in Canada. Forestry firms have comprised a large and important part of the Canadian economy since 1970, but other resource sectors such as mining and energy have been even larger, they have been growing faster, and they may have been even more sensitive to property rights discontinuities.79

Our general equilibrium results support our conclusions from the simulation model regarding the nature of the property rights-economic performance connection. Our counterfactual macroeconomic growth rates vary widely, depending on the channel through which shocks to the security of property rights in the forest industry are realized. Again, simple “instability” is not the key to assessing the effect of property rights changes. Results depend on the nature of the shock (improving vs. reducing security) and the distribution of effects across channels. The aggregate results from our general equilibrium model show that the relative sensitivity of investment and industry fundamentals is also important in establishing aggregate growth implications. While investment may be very sensitive to uncertainty, shocks to the security of short-run access appear to be more important for industry, and they ultimately generate larger macroeconomic effects in our counterfactual experiments.

VI. CONCLUSIONS

The need for stable and secure property rights to encourage efficient resource use and promote investment in reproducible and natural capital is a common theme both in economic growth literature and literature on the theory of resource exploitation. It is also

79Between 1970–1999, 4.5 percent of Canada’s GDP originated in forestry, 5.3 percent came from mining, and energy contributed 4.6 percent. Energy was the only Canadian resource sector to experience an increase in its GDP share after 1970. For a more detailed comparison of the resource industries’ contributions to aggregate economic activity in Canada, see Keay (2009).
a theme that has appeared in industry and media discussion in response to the judicial recognition of aboriginal rights in Canada since 1970. In this article, we set out to estimate the consequences of the Supreme Court’s landmark judicial decisions recognizing aboriginal rights for Canada’s forestry sector and macroeconomic performance. We characterize changes in the security of Canadian resource property rights flowing from the decisions as involving changes in both the immediate, short-run security of forestry firms’ contemporaneous stock access, and the general legal uncertainty surrounding the access regime faced by firms in the future. Using an event-study approach, we find evidence that the Supreme Court’s decisions generated measurable economic effects, particularly for Van der Peet and Delgamuukw. Market participants do appear to have considered the decisions relevant in their valuation of forestry firms. However, it is not possible to draw simple conclusions about the importance of “stable” property rights for these investors; instead, their perception of the net economic impact depends on the direction of changes in the security of the rights, the distribution of these effects across channels, and the context in which they arise. Our partial equilibrium simulation model allows us to trace the effects of the decisions through two channels for both investment and industry fundamentals. Again we find that the performance effects stemming from changes in the security of property rights for the forestry sector are not uniform. The economic fundamentals that determine industry performance appear to respond to access and uncertainty shocks differently. Our simple general equilibrium model indicates that the aggregate growth effects that result from these shocks can be substantial but, again, conclusions must be nuanced and subtle.

The idea that the Supreme Court’s recognition of aboriginal rights has been costly for Canada’s resource industries is pervasive. Addressing the accuracy of these claims can help policymakers gauge the importance of trying to clarify and streamline the process of incorporating aboriginal rights into the fabric of Canadian resource law. Our results suggest that while industry investors may be sensitive to general uncertainty, focusing on improving the security of contemporary access for producers may have greater economic impact. The results also show that the Court’s decisions have not uniformly produced negative consequences for industry and aggregate growth performance. In particular, the results from Van der Peet show that changes brought about by the Court that clarify the legal environment and reduce insecurity of industry’s short-run access rights can have positive effects on industry performance and overall economic growth.

References


