Evolutionary Geography of a Mature Resource Sector: Shakeouts and Shakeins in British Columbia’s Forest Industries 1980 to 2008

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ABSTRACT This study examines the evolutionary geography of British Columbia’s forest industries during a period marked by volatility and decline. Conceptually, the study draws upon the industrial life cycle model, identifying the distinctive characteristics of resource industries during the transition to maturity and beyond. Empirically, the study focuses on industry population dynamics and employment change at a meso-scale, to reveal changing organizational, industrial, and geographical structures of BC’s forest industries during the study period. There are high levels of plant exits and in some sub-industries also of entry, a decline in large integrated firms, and important shifts in core-periphery characteristics.

Introduction

Within economic geography’s recent embrace of evolutionary-institutional approaches the industry life cycle model (ILCM) and related concepts have been a central theme. As Frenken et al.’s (2011: 3) recent insightful review indicates, this literature remains largely concerned with secondary manufacturing and tertiary activities at urban-metropolitan scales, in which “the central question” is how clustering and agglomeration (dis)economies shape and are shaped by the population dynamics and especially the entry, exit and growth (and decline) of firms. However, Schamp’s (2005) stimulating paper emphatically extends this focus to address the long-term trajectories of mature industries and the relationships between industry fortunes and surviving firms in a broader “meso-scale” regional context (see also Hatch 2013; Potter and Watts 2011). This paper seeks to further contribute to the evolutionary geographies of mature industries by consideration of the population dynamics of a resource sector at a meso scale, namely British Columbia’s forest industries.

The ILCM is the conceptual point of departure for this analysis. The model is well-known, extensively explored in business and economics for its implications for market structures, competition, profitability, and forms of industrial organization (Peltoniemi 2011) and in economic geography for its implications for location dynamics, in relation to dispersal and especially clustering (Frenken et al. 2011). Both literatures recognize that the ILCM idealizes evolution in terms of the stages of birth, growth, maturity, and decline. However, as Marshall (1920: 263) came to recognize, the linking of industry (or firm) evolution with biological life and death processes is not straightforward. In this regard, the value of the ILCM is to highlight population dynamics that are driven by the changing number and size distribution of firms or plants within industries as a result of the entry, exit and differential growth (decline) of firms over time and space. Long-term industrial trajectories can be
destroyed, modified, or rejuvenated by endogenous or exogenous forces in the form of Schumpeterian (entrepreneurial-driven) Type 1 and (corporate-driven) Type 11 innovations, business crises of varying severity, and competition. Indeed, Abernathy and Utterback’s (1978) pioneering study of the ILCM, was stimulated by the goal of rejuvenating the U.S. auto industry. Further, the temporal or spatial morphologies of ILCMs during maturity and post-maturity can be extremely long and highly variegated for particular regional industries (Li and Bathelt 2011; Potter and Watts 2011), and for the same industry in different places (Belussi and Sedita 2009; Immarino and McCann 2006; Martin and Sunley 2011; Ter Wal and Boschma, 2011; see also Harrigan and Porter 1983).

Studies of resource industries can extend the appreciation for the variegated nature of post-maturity behaviour. In addition to the forces of technological change, competition, crisis, and lock-ins that affect all industries, resource activities are subject to the peculiarities of resource cycle dynamics in which resource depletion relentlessly increase raw material costs, implies distinct interpretations of maturity, and exerts harmful impacts on the environment (Clapp 1998). Indeed, public policy profoundly shapes resource use, and in recent decades in association with widespread conflicts over industrial exploitation (Ballard and Banks 2003; Hayter 2003), policies have increasingly sought to protect environmental and related values, significantly changing the “rules of the game” (North 1990) for resource firms. For renewable resources, the potentials for alternative industrial and non-industrial strategies are particularly obvious. Further reference to meso-scales is vital in the context of resource industries that typically evolve regionally within a common governance framework and in association with strong functional relations that incorporate core-periphery interdependencies. Note also that while most secondary manufacturing categories are defined broadly by product orientation resource industries are classified by common or related use of raw materials that feed into highly divergent products.

This paper’s general objective is to urge for greater attention to resource industries from an (evolutionary) economic geography perspective. Its specific objective is to explain the broad spatial implications of the population dynamics of BC’s forest industries between 1980 and 2010. 1980/81 marked the onset of a severe recession that severely impacted BC’s forest industries and their portrayal as a sunset sector, thus ending the prior Fordist “long boom”, and a declining period of post-maturity. This period is marked by secular decline in main commodity forest industries, by extraordinary volatility in the population dynamics of all sub-industries, and by fundamental changes in provincial forest policy and social license (Edenhoffer and Hayter 2013a). Indeed, the study period conforms to what Freeman and Perez (1988) label a lengthy “crisis of structural adjustment” during which “shakeouts,” broadly conceived as periods of “mass extinctions” of firms and plants in the economics literature, especially in relation to growth stages (Klepper and Miller 1995: 567; Krafft 2004), have been significant. In economic geography, while this term has not been popular, there are related studies of the localized restructuring of mature industries (Clark 1986), plant closures (Stafford and Watts 1991), and the nature of job loss (Healey and Clark 1984). In addition, although a scarcely used term, we recognize possibilities for “shake-ins” or mass entries of firms and plants, even during mature, decline phases of industry evolution.

The construction of a unique plant level data base for 1980 and 2008, and an updating of corporate structures, underlies the analysis. Analytically, we calculate entry, exit and survival rates, and employment changes among failed, surviving and new plants, between 1980 and 2008 for individual forest industries for the province as a whole, and between coastal and interior forest regions. The spatial classification is crude but roughly corresponds to a core-periphery distinction and by differential entry and exit rates among industry sub-components. Attention to individual forest industries, rather than treating them in an aggregate manner further enriches the analysis. Using a template model of the ILCM as a starting point, this paper first explores aspects of the geography of mature industries
that embraces the resource cycle. The second part is a comparative static analysis of population dynamics of plants and firms among BC’s forest industries since 1980.

**Resource Industry Evolution after Maturity: Decline and/or Renewal?**

As a summary temporal idealization the template model of industrial evolution is expressed as a simple S-shaped curve of birth and slow growth at first, rapid growth, maturity, and levelling off of growth, and finally a post-maturity stage that may entail rapid or slow decline, possibly death, or alternatively some form of rejuvenation (Figure 1). Since the original formulations (Abernathy, Clark and Kantrow 1983; Klepper 1997; Utterback and Abernathy 1975), explanations of ILCMs have been strongly Schumpeterian in nature, emphasizing innovation and learning processes, especially in relation to secondary manufacturing activities, and have drawn upon the evolutionary theory of the firm and product life-cycle literatures (Frenken et al. 2011; Peltoniemi 2011). In essence, the template model anticipates that as industries mature the underlying nature of innovations change from a focus on new product development and diversity organized by flexible entrepreneurial firms in small factories to one of process optimization and cost reduction largely organized by dominant large-scale corporations in capital intensive factories.

In the template ILC model maturity is defined by technological and organizational change. Thus in an early view Abernathy, Clark and Kantrow (1983: 27) saw maturity as “a process by which competition becomes progressively immune to technology-based change from within the industry,” that is when technologies and markets are generally well known to surviving firms. In a related way, Krafft (2004: 5) sees the transition to maturity when major product innovations and entrepreneurial firms that draw upon largely external sources of information are replaced by incremental process innovation with fewer large firms that rely on experience (internal knowledge). In tandem, maturity is heralded by the massive exit and oligopolistic consolidation of firms. In this regard, Klepper and Miller (1995: 567) offer the conventional view of shakeouts within economics as a “persistent fall in the number of firms” with a sustained net exit of at least 30 percent of peak numbers over a “lengthy period” with any recovery not reaching 90 percent of former levels (although Bergek et al. (2008: 4)

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**Figure 1. Template Model of Industry Evolution.**
Source: Author’s representation.
refer to shakeouts over “short time periods”). These early shakeouts (and associated corporate consolidations) have been related to three main temporally-driven hypotheses related to the emergence of dominant design, technology shocks, and early mover advantages rooted in the dynamic returns to R&D (Klepper and Simmons 2005; Krafft 2004).

Significantly, the implications of the template ILCM should be seen, not for insistence on a simple morphological stylization of industry evolution, but for encouraging analyses of population dynamics in particular empirical contexts. After all, this model evolved in a Schumpeterian spirit of creative destruction and appreciation for evolutionary discontinuities in which alternative futures are evident during post-maturity. Indeed, over time industrial trajectories are profoundly (exogenously) affected by crises, such as major wars and deep-seated recessions or depressions, and by periodic paradigmatic technological and institutional changes that by definition exert pervasive effects throughout the economy. In the latter context, for example, the related concepts of techno-economic paradigms (Freeman and Louça 2001) and general purpose technologies (Lipsey and Sjöholm 2005) highlight the paradigmatic innovations that create new industries and stimulate the restructuring of existing activities, including resource sectors. Freeman (2008) and Perez (2009) further argue that crises and paradigmatic change are interwoven within lengthy periods of ‘crises of structural adjustment’. At a point in time, mature industries may have become immune from radical internal (intra-industry) technological and institutional change, as implied by Abernathy’s definition of maturity, but not from exogenous sources of paradigmatic innovation.

Further, evidence from longitudinal and cross-sectional studies reveals that the entry and exit rates of firms are positively correlated over time for two main reasons (Chang and Janosko 2012; Geroski 1995: 423; Geroski and Mazucato 2001). First, according to the “revolving door” metaphor, “the bulk of new entrants subsequently exit the industry within a short period” (Audretsch 1995: 590), a process that reflects high infant mortality rates among new entrants (Caves 2007: 9f). Second, the “replacing forest” metaphor relates to Marshall’s perspective in which old firms are replaced by new ones as “volatility exists even within individual industries within a particular state — new seedlings arise in the very same parts of the forest in which old trees are dying” (Brown et al. 1990: 263). The implications of these hypotheses are that entries feature small firms, at least raising the possibility of shakeins involving “significant” increases in plant numbers in post-maturity as well as in early stages. Moreover, industry’s evolutionary trajectories vary across space. In this regard, within economic geography recent attention has especially focused on the discontinuous and variegated nature of the evolutionary geographies of secondary manufacturing and service activities especially in relation to various forms of clustering and de-agglomeration (Frenken et al. 2011). The embrace of resource industries and peripheries can further the understanding of the geographically differentiated nature of industrial evolution. Resource industries are subject to forces of dispersion, and their evolution is characterized by resource cycle dynamics that both overlap with and differ from the implications of the ILCM.

As articulated by Edenhoffer and Hayter (2013a), the template temporal model of resource cycle exploitation proposed by Clapp (1998) is similar to the ILCM (see Mather 1992). Thus in Clapp’s basic scenario resource exploitation over time follows the S-shaped curve in four stages starting with an period of exploration and initial discovery, rapid “booming” growth, a plateau stage when growth levels off, followed by decline, possibly collapse. In the transition to maturity, shakeouts occur and numerous entrepreneurial activities (farmers, loggers, miners, fishermen) are replaced by corporate consolidation and oligopolistic (and oligopsonic) structures. In tandem, corporations become increasingly concerned with cost-saving technological change in increasingly large-scale operations. Moreover, Grabher’s (1993) functional, cognitive, and political lock-ins are so powerful in resource
sectors they have produced their own metaphors as staple traps (Watkins 1963), resource addictions (Freudenburg 1992) and resource curses (Auty 2001). Thus resource corporations have long been recognized for their conservatism, locked into large-scale commodity production by their know-how, the size of capital investments, and competitive pressures (Rumelt 1974). In association, the development ideologies of regions and communities typically reinforce support for large-scale resource exploitation, which is given tangible expression in the form of dedicated massive infrastructures, rights to resource access, and closely allied trade, investment and training policies. In association, unionized well-paid labour with specialized skills further engrains resource dependency attitudes. There is also appreciation for the volatile nature of resource production, driven by business cycles of varying severity and by the implications of technological and price changes over long time horizons.

Given the overlap with the ILCM, the economic geographies of resource industry trajectories are nevertheless shaped by distinctive processes related to the role of technology and dependency upon natural resources that has important public good features and whose values are ultimately socially defined. These differences may be summarized in terms of the nature of technological change, the competitive advantages of resource firms, the meaning of maturity, location dynamics, booming, and busting, and the role of public policy.

First, in the conventional ILCM, technology change shifts from a product- to a process-focus, and from endogenous to exogenous sources. However, in resource sectors among the primary producers the product-process distinction is blurred while exogenous technological changes are important throughout life cycles. Innovation typically also has strong geographical implications and is often geographically targeted. Thus, in many resource industries and peripheries (e.g., oil, iron, aluminium, forest products) economically valuable commodities have been initially created by the innovation of new processes. In pulp and paper, for example, new process-based technologies in the early nineteenth century created the wood-based pulp industry specifically with respect to the use of softwoods across northern Boreal regions, while in the twentieth century technological innovation permitted use of hardwood pine forests, initially in the Southern U.S. More recently, possibilities for the use of recycled paper have given location advantages to major metropolitan areas. In (solid) wood manufacturing, new process technologies stimulated plywood, particleboard and more recently the engineered wood industries, the latter involving relatively sophisticated R&D. Moreover, during maturity innovations in resource sectors need to address resources that are lower quality, less accessible and/or different in some way. In terms of the sources of technologies while processing firms engage in in-house R&D, sometimes on a significant scale, specialized equipment manufacturers dominate supply of new processing technologies while in some industries such as agriculture where there is a proliferation of small firms public sector institutions are important.

Second, given appropriate technologies, resource booms depend upon the size and scale of regionally defined resource endowments. For resource firms competitive advantages relate to their production know-how and ability to establish export markets in relation to access and control of this resource. Even in early stages commodification and standardization among competing firms is widespread in resource cycles, in comparison to competition driven by product innovation and differentiation in the ILCM.

Third, in resource cycle contexts, the idea of maturity is not simply based, if at all, on a switch from product to process technological change, but on the extent of resource exploitation. Thus, maturity in resource activities occurs when so-called “extensive” growth embracing all or most available desired supplies have been exploited. In forest peripheries, this stage implies the harvesting of “old” or first growth forests which when exhausted leads to the plateau stage, or maturity. At this time, or really period, a “fall-down” effect is expected as yields from secondary growth timber are inevitably
lower than first growth, more so if re-forestation has not been well-planned. Further, this transition
implies both that established operations that exploited the initial resource have become technologi-
cally obsolescent and that different types of (lower quality) resources require new processing meth-
ods (possibly with product innovation implications). Following maturity, the implications of shifting
resource supply-technology dynamics for “late” shakeouts (or entries for that matter) are further com-
pli cated should they be associated with paradigmatic technological and institutional change.

Fourth, evolutionary economic geographies have focused on clustering processes with recognition
given to dispersal tendencies in mature or declining stages. However, the location dynamics of
resource industries feature powerful forces of dispersal, as well as concentration, throughout the
resource cycle. Thus, on global continental and national scales the industrialization demands of core
countries and regions implies the dispersed exploitation of resources wherever they can be found and
profitably exploited. On meso or regional scales resource cycles may be associated with (intra-indus-
try) core-periphery relations while dispersal to remote parts within regions may feature clustering at
particular sites that provide access to markets as well as to resources. In maturity and declining stages
the rationalization of industry and late shakeouts can be especially problematical for remote, special-
ized communities.

Fifth, booming and busting is a key feature of the evolutionary trajectories of resource industries,
recognized formally in Clapp’s (1998) original temporal template model of the resource cycle,
including in post-maturity. In contrast, template representations of the ILCM ignore business cycles
(Figure 1), presumably because, rightly or wrongly, their evolutionary (long-term) implications are
not deemed significant enough. On geographical margins, remote from markets and facing high lev-
els of (local and distant) competition, the vulnerability of resource industries to price and demand
fluctuations is visceral, part of their psyche of addiction and (en)trap(ment). Thus, booms lead to
rapid growth, high incomes, increasing costs and strong inflationary tendencies leading to at least
localized Dutch disease effects (Polèse and Shearmur 2006). During boom times, there is little or no
incentive for by firms, workers or communities to diversify. Meanwhile during downturns, how to
“suddenly” diversify is not readily apparent, especially if reinforced by “pragmatic” tendencies to
wait for the next up-turn. Indeed, the onset of severe recessions that mark long-term structural crises
and late shakeouts are likely to be unanticipated and not even recognized for some time. Moreover,
for various reasons, the abilities of capital intensive, commodity-driven resource firms and plants,
specialized workers, and remote communities to diversify is typically limited.

Sixth, resource cycle dynamics are profoundly shaped by public policy with respect to the allocation
of access rights, rules governing use, ownership and control, and rent calculations. Significantly, in
recent decades “resource wars” have proliferated around the globe among resource peripheries, to
involve arguments over the expropriation of resource rents, trade policies especially of importing coun-
tries and, increasingly, demands that the non-industrial (environmental, cultural and aesthetic) benefits
of resources be given more priority (Affolderbach 2012; Ballard and Banks 2003; Le Billon 2008). In
this latter regard, environmental opposition to vested resource-industrial interests are virtually systemic
while Aboriginal rights and land claims in resource peripheries are widespread. For mature resource
industries these conflicts complicate the forces shaping late shakeouts (and shakeins) by creating uncer-
tainty over resource rights and placing pressure to “remap” or “re-territorialize” resource regimes in
ways that reduce industry’s access to resources and/or require adjustments in operations.

These highly generalized distinctions of resource cycles from the ILCM template can be further
extended to incorporate variations among resource industries, in the first instance on the basis of
renewability. Renewable resources, such as forests and fisheries, imply that depletion rates can be
sustained, even if not at the same high levels permitted by exploitation of virgin endowments. Thus,
after maturity, in comparison to their non-renewable counterparts, renewable resources inherently imply a wider range of potentials for sustaining production in some form. Yet even renewable resources are not easy to count, and the onset of fall down that begins with declining yields from original species, not straightforward to specify. Further, renewable resources are subject to natural forces and events that may not be properly understood or readily controlled; in broad terms, for example, climate change has considerable implications for fish life and forest ecosystems. In addition, renewing resources is costly, requires long time horizons, and involves choices that are controversial, as indicated by long standing debates over fish farming and reforestation strategies that feature the planting of exotic tree species. Needless to say, such choices have important implications for forms of industrial adjustment.

In general, the interpretation of template life cycle models and the examination of population dynamics, as measured by entry, exit, survival rates and the behaviour of incumbents (firms and plants), requires reference to specific temporal and geographic as well as industry contexts. Existing models and their applications explicitly account for the distinguishing characteristics of individual industries. However, although evolutionary perspectives emphasize the importance of long-run perspectives lasting decades, there is less discussion about the identification of appropriate time periods. Ideally the time periods chosen should be coherent or make sense in terms of underlying technological, market and geopolitical conditions. Choice of geographic scale needs to make similar sense, and Schamp’s (2005) suggestion to pay more attention to meso-scales is well taken in resource sectors. This scale facilitates analysis of core-periphery relations and takes into account regional governance that often, powerfully in federal states, extends well beyond metropolitan boundaries, Resource activities and communities are not just isolated links in global value chains. Rather, resources are typically distributed across geographically extensive areas that are organized according to rules and regulations implemented by regional and national governments in association with social interpretations of resource values that support distinct business systems and cultures. This idea of associated constellations or regulations, business practices and attitudes that define regional (or national) institutions of resource exploitation is captured by the political science concept of resource regime (Holling, Berkes and Folke 1998). Analysis at meso-scales can be further differentiated at more local levels.

To illustrate the population dynamics of a resource sector this study now turns to an analysis of BC’s forest economy 1980–2008.

Research Context and Design

The discussion of research design and context can be usefully presented in relation to study period, level of aggregation, and geographic scale.

Geographic scale. BC, a huge area, almost twice the size of Germany, is an appropriate meso-scale of analysis to analyse the population dynamics of the province’s forest industries. In Canada resources are provincially controlled, and in BC 93 percent of the forest base is provincially owned with around 3 percent each under federal and private ownership. The forest sector has been a central engine driving provincial economic growth, it has engulfed all major regions within BC and it remains important, even in decline, especially in hinterland communities.

The development of BC’s forest industry prior to 1980 is well documented (Hayter 2001; Marchak 1983; Prudham 2007). In outline, the sustained development of BC’s forest industry, especially sawmilling, awaited the province’s incorporation in the Canadian Confederation in 1871 and the subsequent building of the CPR that stimulated the growth of the Vancouver area, local demand for wood and gave access to national and U.S. markets. In 1913 the opening of the Panama Canal
gave BC mills access to UK and European markets. By this time the Vancouver area was the biggest wood processing centre in BC while a few pulp and paper mills had also been established in coastal locations. However, forest policy was experimental with an initial privatization strategy replaced by a battery of timber leases and licenses that led to rampant speculation and over-cutting. With production largely centred on the coast, the provincial Forest Act of 1913 stopped further alienation of timber until 1947 when this Act was amended. The 1947 policy specifically sought to promote forest product growth throughout the province by allocating extensive tracts of timber to large corporations in exchange for major investments in integrated facilities within the timber lease areas. Provincial forest policy reinforced integration trends by imposing increasingly stricter wood utilization standards that required formerly waste wood from sawmills to be used as a source of energy and fibre in pulp and paper. The provincial government’s building of economic and social infrastructure, including new towns, railways, highways, and power networks further helped diffuse investments around the province (Prudham 2007). During the so-called Fordist boom years, from the 1940s until the 1970s, BC’s forest industries became dominated by a few vertically integrated corporations, many foreign owned, that controlled large shares of timber harvest, primary wood industries (lumber, plywood, shingles and shakes) and paper and allied products (pulp, newsprint, and paperboard), plus some mass produced converted paper products (tissue paper, paper bogs, corrugated boxes) (Hayter 1981).

Basically provincial rules and administration govern BC’s forests that in turn have shaped business cultures and the evolution of a core-periphery structure within the province linking metropolitan Vancouver with an extractive hinterland. Indeed, Vancouver developed in part as a wood processing town, itself becoming a highly diversified forest production and business control center for the rest of the province. The core-periphery pattern of provincial and business control was further reinforced by a strongly unionized workforce (after 1950) with its head-office in Vancouver metro that was tied to locals throughout the province. Vancouver also became a center of trading and wholesaling, business services, equipment manufacturing, and research and development (R&D). Moreover, provincial forest policy from 1947 to the study period, privileged large-scale, export oriented commodity mills.

Geographic variations within BC’s provincial forest exist, and there is a basic distinction between coastal and interior regions in terms of species mix (hemlock, Douglas-fir and Western red cedar on the coast; pines, spruces and firs in the interior). The coastal region was also the first developed, and the problems of technological obsolescence exposed by the early 1980s recession were initially most serious there. Nevertheless, for reasons of functionality, policy and identity BC’s forest economy is a coherent scale of analysis.

**Study period (1980–2008).** The study period is a distinct evolutionary phase for BC’s forest industries marked by considerable volatility with alternating booms and busts and secular employment decline, especially among the main commodity producers. 1980 marked the onset of a severe and prolonged recession in BC’s forest industries that was not simply a temporary downturn but an historic turning point in the sector’s trajectory which also marks the entry into the stage of maturity (Edenhoffer and Hayter 2013a). For almost three decades following the Forest Act Amendment of 1947, that introduced new forms of timber tenure that basically exchanged cutting rights for large-scale industrialization, the forest industries experienced sustained rapid growth that spread throughout BC (Prudham 2007). During the 1970s, two energy-crisis inspired recessions indicated winds of change but production and employment bounced back and 1979 marked a record year for profits, jobs, and production. Between 1980 and 1985, however, recessionary conditions stimulated permanent job loss and plant closures, and threats to the survival of even the largest corporations (Grass and Hayter 1987). The industry had become technologically obsolescent, especially in the older coastal region, and one of the highest cost forest economies in the world.
Moreover, foreshadowed by Canada-wide forest inventories that recognized impending supply constraints in BC (Reed 1974), in 1980 British Columbia’s Ministry of Forestry first referred to looming fall-downs in harvest levels as industry’s reliance on nature’s bounty, high yielding “old growth” forests, was coming to an end. Increasingly production was based on lower yielding second growth forests. In practice, a fall down in provincial harvest levels has taken a long time to be realized, ironically in part because of a massive pine beetle epidemic, rooted in climate warming, that has devastated interior harvests. In response, the provincial government has allowed increased timber cutting while damaged wood still had economic value; but this policy is now resulting in sharp harvest declines. The 1980–2008 (and counting) period then marks a fundamental transition for BC’s forest industries, that may be labelled post-maturity, and there have been references to BC’s forest economy as a sunset industry. Meanwhile reforestation was not practiced on any scale until the late 1970s.

Since 1980, the public policy framework for the forest industry has changed profoundly. Thus free trade with the U.S., easily the biggest market for BC’s forest industries, had existed to a considerable degree in previous decades. The 1980s recession, however, stimulated protectionist lobbying by the U.S. lumber industry and since 1986 the U.S. has imposed punitive constraints involving tariffs, quotas, and export taxes on BC’s lumber exports. Until the 1980s forest policy was equated with industry policy, and the provincial government and business, with labour’s tacit acceptance, formed a “wood-exploitation alliance” (Wilson 1987/88: 7). Since then, driven by widespread, ongoing environmental and Aboriginal protests, and increasing entanglements in legal debate, provincial policies have sought to emphasize the environmental values of forests, reduced the environmental impacts of industry, increase local participation in forestry decision-making and address Aboriginal concerns in part by the re-allocation of forest resources from corporate tenures. The policy initiatives have been numerous, and details are provided elsewhere (Wilson 1998). Suffice to say that from industry’s point of view, embracing the non-industrial values of forests, along with the enduring, highly contentious trade dispute, has reduced timber supply availability and increased the costs and uncertainties facing the forest industries. The pine beetle epidemic and big changes in the value of the Canadian dollar (especially when it increases) have added to these woes.

With respect to provincial government policies towards industry, two changes from pre-1980 practices are worth noting in the context of this paper. First, while traditional policy specifically focused on large scale industrial development and the attraction of foreign investment, since the 1980s there has been more encouragement to small firms and “value adding” secondary wood and paper processing activities that have been seen as a source of jobs and environmental sustainability (M’Gonigle and Parfitt 1994). Thus, part of the timber tenures withdrawn from large corporations has been to supply auctions and community forests, making timber more available to small firms. Trade associations, training programs, small-scale R&D, and trade contacts have also been provided to help small firms. Second, in 2001 the requirement of appurtenancy in forest tenures, that meant fibre must be used locally, was removed. While criticized as a neoliberal initiative that threatens communities and an implicit social contract, this controversial initiative also can be seen in the reality of declining timber supplies and more efficient operations.

Finally, but by no means least, the 1980–2008 period has featured extensive technological change through the increasingly widespread application of micro-electronic technologies that have significantly increased the speed of operations, more effectively utilized wood inputs, enhanced quality, and allowed for flexible mass-production. Indeed, for large corporations “computerization” provided the key technological response to the problem of obsolescence and the basis for modernization and rationalization. These technologies were first introduced to the BC’s forest industries in the 1980s.
and among commodity mills have been a basic reason for job downsizing even if production levels were maintained.

**Levels of aggregation.** In the business and economics literature, studies of ILCMs typically use firm-level data, a choice compatible with concerns for market concentration and performance, doubtless facilitated by data availability (e.g., Klepper and Simmons 2005). From a local development perspective, however, the distinction between plants and firms is significant. A focus only on firms means plant openings and closures within multi-plant firms are not directly examined, or part of the contemplation of entry and exits. Yet, plant-level changes within multi-plant firms are varied and vitally important for understanding location dynamics (Kirkham and Watts 1997; Stafford and Watts 1991; Watts and Kirkham 1999; Watts and Stafford 1986). Further, firm exits may not imply plant closure while firms in financial distress may prefer to sell profitable plants in particular regions as a source of cash for rejuvenation elsewhere. Foreign firms, for example, may contemplate divesting foreign subsidiaries to help finance domestic restructuring. Further, significant location adjustments take place in-situ, at existing plants and variously feature expansion, contraction, specialization and diversification as well as changes in supplier systems and markets. Downsizing of plants often occurs over lengthy periods, a precursor for outright closure. The range of in-situ adjustments is also greater for multi-plant firms that can re-arrange production at alternative locations.

This analysis especially privileges plant-level changes, with important trends in firm-level characteristics also noted. The focus on plants allows for greater insights into the population composition of BC’s forest industry since entries and exits at plant levels are greater than at firm-levels, can be readily located, and have direct community impacts. The analysis reflects a comparative static approach and is based on the construction of unique data sets of individual plants conducted originally in 1980 and subsequently in 2008, covering a time range of almost three decades. Information on employment, production, capacity and product-mix is provided. While this comparative static analysis fails to identify plants that entered and exited between 1980 and 2008—a year by year compilation of entries and exits was beyond the authors’ resources to construct—its main implication is to underestimate change among small plants, in effect reinforcing the present study’s main conclusions. The dimensions of variability remain strongly evident, and distinct patterns of entry, exit, and survivorship rates can be identified including with respect to the volatility of small plants (and firms). This study also draws upon a longitudinal analysis of BC’s leading forest product corporation and of changing trends among the large multi-plant integrated corporations that have dominated BC’s forest economy, especially in terms of the locus of their ownership (Edenhoffer and Hayter 2013b). Finally, entry and exit rates have been calculated for individual forest industries that are conventionally classified in term of wood processing and paper and allied (or pulp and paper). The traditionally dominant large-scale commodity industries are sawmilling, plywood, pulp, and paper, while various composite boards became important after 1970. In terms of secondary processing wood-based activities are often classified six-fold (remanufacturing, mill work, cabinets, furniture, engineered wood, mobile, and log homes) while secondary paper converting refers to paper bags, boxes, fine papers and miscellaneous products.

As a summary footnote qua caveat to this research design we recognize the complexity of the forces shaping BC’s forest industry evolution since 1980 in terms of technological change, business (boom and bust) dynamics, wood supply fluctuations, forest policy changes, exchange rate changes, forest conflicts, and U.S. protectionism. Sometimes changes, for example decreases in the value of the Canadian dollar during the 1990s and until 2002, the release of low cost pine-beetle damaged wood over the past decade and market booms (late 1980s, late 1990s, and early 2000s), a degree of trade diversification towards Asia, have helped the industry’s viability. On the other hand, since
1980 and entry into post-mature phase of the resource cycle, the BC forest industries have faced significant costs and uncertainties in relation to fibre supply and market access while commodity production has continued to emphasize the search for economies of scale. With specific reference to US trade policy, three sets of restrictions passed in 1986, 1996 and 2006, have added costs and limitations on the export of BC’s commodity lumber exports that have been especially onerous for large firms during recessionary periods. Apart from a surge in growth in Japanese demands in the late 1980s (Hayter 1992)—that has since levelled off—and Chinese demands in recent years, some re-orientation towards domestic consumers, alternative markets have been hard to find. The rest of this paper addresses the collective implications of these forces for plant population dynamics in BC’s forest industries.

**Research expectations.** Following the 1980s recession and the threat of fall down in harvest levels, along with technological innovations in processing, stimulated by severe recession, a consolidation and exit of plants and firms, including large-scale operations is to be expected. The onset of American protectionism, along with contested shifts in forest policy to accommodate environmental and Aboriginal values, are factors that are likely to reinforce this expectation. The desire for new state of the art mills, and the implications of sunk and fixed costs might modify this expectation.

In contrast, entries of new plants and firms might be expected to be dominated by small-scale operations in secondary processing in a manner consistent with changing forest policy emphasis, and because of the greater flexibilities of small firms in coping with supply and market uncertainties. At the same time such a trend is uncertain, and dependent on a supply of entrepreneurs able to recognize market opportunities.

Geographically, exits of large firms might be expected to be widespread, with the lumber industry in the coastal region especially vulnerable, especially given the coast’s high cost structure and because forest conflicts over environmental values have been concentrated there. Geographically, entries are difficult to predict. Small scale operations are often associated with clustering to realize external economies of scale. Yet, public policy would prefer to see such firms help diversify hinterland communities where there is also a more ready available supply of wood fibre.

Specific hypotheses of entry, exit and survival rates among the forest industries are difficult to anticipate, and it will be interesting to see if there are any trends that might be classified as shakeouts or shakeins.

**Entries and Exists of Plants in BC’s Forest Industries 1980–2008**

Trends in BC’s forest industries since 1980 are captured by harvest levels and value of shipments (Figure 2). Overall, from these and related production perspectives, the trajectory of the forest industries plateaued, even declined, and experienced high levels of volatility. The bust that followed the financial crisis in 2007 was even bigger than the early 1980s recession. Meanwhile, jobs in the forest industries as a whole have experienced continuous declines during the study period.

In association with market and supply volatility, and trade and land use conflicts, the plant population comprising BC’s forest industries has experienced substantial change. The overall totals and numbers of exiting and entering plants are remarkably similar, consistent with Geroski’s (1995) insight (Table 1). The changes at sub-industry level, however, indicate both shakeouts and shakeins have occurred.

Thus there were 932 plants in the 1980 total, compared to 1,024 in 2008; overall 573 plants closed down and 665 plants opened, respectively corresponding to 61.5 percent and 71.4 percent of plants numbers in 1980. Among sub-industries, however, the rates of survival, exit and especially
entry rates differ notably. Thus large sawmills that have traditionally dominated lumber production exhibited high exit rates and very low entry rates involving just a handful of mills. Indeed, in 2008 there were 63 fewer large sawmills than in 1980, and the 61 mills operating in 2008 is just 58 percent of the 1980 total levels. According to Klepper and Miller’s (1995) rule of thumb of 70 percent survivors or less, this decline indicates a substantial shakeout during the study period. Similarly, medium-sized sawmills experienced a shakeout on this basis, with the 79 mills operating in 2008 representing 59 percent of 1980 totals. In contrast, although experiencing high exit rates (higher than for large and medium sized mills), small sawmills recorded almost as high entry rates, and 2008 plant totals were 90 percent of the 1980 level. Overall, the number of (large, medium and small) sawmills declined from more than half of all plants in BC’s forest industries in 1980 to about one-third in 2008. With respect to other large-scale operations, board mills and pulp and paper mills experienced net exit rates, but not to the point of constituting (plant) shakeouts. Even so, the high exit and entry rates for board mills are associated with replacement of plywood by particleboard operations. The exit of six pulp and paper mills is also noteworthy given the size of the operations involved (see below).

In contrast, there has been significant expansion of the wood and paper value-added industries. Indeed, during the study period secondary wood processing factories grew by 73.5 percent and paper converting activities by 34 percent. These trends reflect substantial shakeins, especially of the former. These plants now constitute more than half of the forest industry totals. In contrast to the big commodity mills, these activities are typically small-scale in output and employment terms, often owner-managed, and somewhat less dependent on exports. The emergence of the small, entrepreneurial plant (and firm) as a key trend in the population dynamics is also evidenced in logging activities and the relatively minor decline of small sawmill operations. At the same time, value-added operations have been subject to considerable turnover with high entry rates associated with high exit rates. Indeed, the survival rates of the large operations (sawmills, board mills and pulp and paper mills) are higher than for smaller operations. In general, these trends are consistent with economies of scale considerations; large plants have high fixed and sunk costs that lower exit and especially entry rates while small operations face lower barriers to entry and exit. Arguably, the changes across the sub-industries as a whole are consistent with the replacement hypothesis of entry-exit behaviour while changes in the value-added industries reflect the revolving door hypothesis.
**Table 1. Entries and Exits 1980–2008.**

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>2008</th>
<th>Exits</th>
<th>Survivors</th>
<th>Entries</th>
<th>Net change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of plants (% of total plants)</td>
<td></td>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>Logging</td>
<td>77 (8.3)</td>
<td>92 (9.0)</td>
<td>32</td>
<td>41.6</td>
<td>45</td>
<td>58.4</td>
</tr>
<tr>
<td>Large sawmills</td>
<td>131 (14.1)</td>
<td>68 (6.6)</td>
<td>68</td>
<td>51.9</td>
<td>63</td>
<td>48.1</td>
</tr>
<tr>
<td>Medium sawmills</td>
<td>134 (14.4)</td>
<td>79 (7.7)</td>
<td>86</td>
<td>64.2</td>
<td>48</td>
<td>35.8</td>
</tr>
<tr>
<td>Small sawmills</td>
<td>216 (23.2)</td>
<td>195 (19.0)</td>
<td>169</td>
<td>78.2</td>
<td>47</td>
<td>21.8</td>
</tr>
<tr>
<td>Large board mills</td>
<td>22 (2.4)</td>
<td>20 (2.0)</td>
<td>11</td>
<td>50.0</td>
<td>11</td>
<td>50.0</td>
</tr>
<tr>
<td>Value added wood</td>
<td>275 (29.5)</td>
<td>477 (46.6)</td>
<td>172</td>
<td>62.5</td>
<td>103</td>
<td>37.5</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>24 (2.6)</td>
<td>22 (2.1)</td>
<td>6</td>
<td>25.0</td>
<td>18</td>
<td>75.0</td>
</tr>
<tr>
<td>Value added paper</td>
<td>53 (5.7)</td>
<td>71 (6.9)</td>
<td>29</td>
<td>54.7</td>
<td>24</td>
<td>45.3</td>
</tr>
<tr>
<td>Total</td>
<td>932 (100.0)</td>
<td>1,024 (100.0)</td>
<td>573</td>
<td>61.5</td>
<td>359</td>
<td>38.5</td>
</tr>
</tbody>
</table>

\[a\] Percentage of 1980 plants that closed down until 2008.

\[b\] Percentage of 1980 plants still operating in 2008.

\[c\] Based on the number of plants in 1980.
Changes in plant size between 1980 and 2008, measured by the average number of employees per plant, help clarify the implications of population dynamics for local development (Table 2). In general, among large sawmills, board mills and pulp and paper mills, the average number of employees was significantly less in 2008 than in 1980. This trend needs to be underlined in the case of large sawmills as the five new entries were all extremely large with capacity levels 2–3 times greater than what had been considered the industry norm for the largest-scale operations. Among large-scale plants there has been considerable automation in both wood processing and pulp and paper, along with varying shifts towards more flexible labour practices. Similarly, employment down-scaling of logging operations is substantial, and consistent with the dismantling of large corporate logging crews, especially on the coast where they had been especially prevalent, in favour of small contractors. In contrast, the plants that populated value added wood and paper activities have remained small and the average employment increases during the study period are not statistically significant.

For large plants whose output is relatively standardized as dimension lumber or kraft pulp etc., but not for value-added industries, additional information on size in terms of production capacity is available and can be aggregated (Table 3). Large board mills more than doubled their 1980 capacity, mainly due to a shift of product lines from plywood and veneer to particleboard, including oriented strand

### Table 2. Changes in Plant Size 1980–2008 (Average Employees).

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>1980</th>
<th>2008</th>
<th>2-tailed p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging</td>
<td>60.0</td>
<td>26.7</td>
<td>0.0497</td>
<td>5%</td>
</tr>
<tr>
<td>Large sawmills</td>
<td>268.5</td>
<td>213.9</td>
<td>0.0453</td>
<td>5%</td>
</tr>
<tr>
<td>Medium sawmills</td>
<td>79.2</td>
<td>75.9</td>
<td>0.7532</td>
<td>not significant</td>
</tr>
<tr>
<td>Small sawmills</td>
<td>10.1</td>
<td>12.4</td>
<td>0.0702</td>
<td>10%</td>
</tr>
<tr>
<td>Large board mills</td>
<td>423.5</td>
<td>219.1</td>
<td>0.0244</td>
<td>5%</td>
</tr>
<tr>
<td>Value added wood</td>
<td>19.0</td>
<td>24.0</td>
<td>0.1658</td>
<td>not significant</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>819.2</td>
<td>427.1</td>
<td>0.0020</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Value added paper</td>
<td>33.4</td>
<td>31.0</td>
<td>0.7617</td>
<td>not significant</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Sample size</th>
<th>Both years</th>
<th>Mean 1980</th>
<th>Mean 2008</th>
<th>2-tailed p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large sawmills</td>
<td>126</td>
<td>64</td>
<td>58</td>
<td>186.7</td>
<td>196.1</td>
<td>0.502</td>
</tr>
<tr>
<td>Large board mills</td>
<td>22</td>
<td>19</td>
<td>11</td>
<td>126.4</td>
<td>285.6</td>
<td>0.000</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>22</td>
<td>22</td>
<td>18</td>
<td>299.0</td>
<td>317.0</td>
<td>0.744</td>
</tr>
</tbody>
</table>

---

*aCapacity is measured in millions of board feet (MMBF).

*bCapacity is measured in millions of square feet, 3/8 base (MMSQF).

*cOnly pulp capacity is considered. Capacity is measured in millions of tons.
boards (OSB). However, the average capacities of sawmills and pulp and paper mills did not change significantly, automation has meant job loss with fewer machines and processing lines. Moreover, especially among sawmills, and pulp and paper mills to some degree, capacities were mainly decreased by mill closures than by in-situ capacity reduction in order to achieve increased productivity among the survivors, in association with corporate-wide rationalization and consolidation (Table 4).

Corporate organization and the shift to domestic ownership. To a significant degree large sawmills, board mills, and pulp and paper mills were part of integrated multi-plant corporations that had become dominant in BC’s forest sector during the 1950s. Indeed large plant closures during the study period have typically occurred as part of corporate consolidation and rationalization strategies involving mainly cessation closures in sawmilling as defined by Stafford (1991) with selective closures being more important in board mills and as part of in-situ changes in pulp and paper mills. Large multi-plant firms remain important and their control over timber harvests remained intact until the 2000s. Thus in 1975, the ten largest companies controlled about 43 percent of the AAC and this share even increased, peaking at 57 percent in 1999/2000 (British Columbia Ministry of Forests, Mines and Land 2011: 126). Since then, however, as a result of government re-allocations of the AAC towards smaller firms, the share of the largest ten companies dropped back to 42 percent as of 2006/07, close to 1975 levels.

Yet the population of large corporations has changed dramatically. Among the ten largest companies in 1975, only Canfor is still operating. The other big companies of 1975 have failed, withdrawn from the province, or been acquired. Canfor’s survival strategy was based on acquiring several large lumber companies in BC, closing down numerous unprofitable mills while building a couple of so-called “super” sawmills, shifting out of plywood in favour of OSB operations, modifying its pulp and paper outputs towards higher value papers, and in 2007 geographically diversifying to the U.S., and beyond. Even so its survival ultimately depended on its acquisition by a huge, BC-based conglomerate in 2007 (Edenhoffer and Hayter 2013b).

More generally, the most significant corporate trend is the decline of foreign ownership. While FDI was significant in the rapid growth of BC’s forest economy after 1950, controlling large shares of the AAC and production, virtually all the foreign owned corporations that existed in 1980 have disappeared or virtually so. Major U.S.-owned subsidiaries such as Crown Zellerbach Canada, Rayonier Canada, British Columbia Forest Products, and Weldwood Canada were sold in the 1980s

<table>
<thead>
<tr>
<th></th>
<th>Total capacity</th>
<th>Net capacity change</th>
<th>Capacity loss in plant closures</th>
<th>In-situ capacity loss</th>
<th>In-situ capacity creation</th>
<th>Capacity created in new plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large sawmills</td>
<td>23,702</td>
<td>12,369</td>
<td>-11,333</td>
<td>-13,284</td>
<td>-2,186</td>
<td>3,413</td>
</tr>
<tr>
<td>Large board mills</td>
<td>2,870</td>
<td>5,427</td>
<td>2,557</td>
<td>-1,799</td>
<td>0</td>
<td>1,708</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>6,468</td>
<td>6,974</td>
<td>506</td>
<td>-675</td>
<td>-1,368</td>
<td>1,638</td>
</tr>
</tbody>
</table>

*Unit: MMBF.

*Unit: MMSQF (3/8 base).

*Unit: Millions of tons.
and their facilities extensively rationalized. The US-based giant Weyerhaeuser had entered BC in 1965 and built substantial lumber and pulp operations in the interior that in 1999 were massively expanded by the acquisition of MacMillan Bloedel, then BC’s largest, locally owned corporation based in the coastal region. But this acquisition proved short-lived and Weyerhaeuser has divested its operations in BC, apart from one sawmill. The New Zealand forestry giant, Fletcher Challenge entered BC in 1988 but has also since departed, as did the Norwegian-based Norske Skog. In general, foreign controlled operations have been closed or acquired by Canadian interests. Thus the biggest firms in 2008 were the Canadian-owned Canfor, Tolko, Interfor and Western Forest Products, along with West Fraser a family-owned firm with US and Canadian ties. Although not a focus for this paper, the reasons for the exit of foreign firms—Louisiana Pacific is an exception—are various, related to resource cycle dynamics, forest conflicts and low rates of return within British Columbia, technological change, U.S. protectionism, and problems of parent company restructuring that could be partially addressed by injections of cash from subsidiary sales. A related interesting trend is that as U.S. forestry firms have withdrawn from BC, the remaining dominant Canadian companies, such as Canfor, Interfor, and Western Forest Products, have increasingly invested and acquired forestry operations in the U.S., circumventing the latter’s protectionism and diversifying away from BC (Edenhoffer and Hayter 2013b).

**Components of employment change.** Between 1980 and 2008, total employment in the sample declined by 43 percent (Table 5). This decline was dominated by permanent job losses in large plants virtually all of which were high paying salaried or union employees. Large sawmills lost over 15,000 jobs and pulp and paper mills over 10,000 jobs during the study period. From a jobs perspective these losses indicate massive shakeouts in both industries. They nevertheless retain important shares of overall employment, and the former is still the largest sub-industry in employment terms. In contrast, the value added wood and paper industries experienced absolute employment growth, the former adding almost five thousand employees and increased its employment share four-fold from about 6 percent to 24 percent, a shift consistent with a shakein. Value-added wood is now the second most important sub-industry and value added paper industry doubled its share to about 5 percent of total employment.

### Table 5. Employment 1980 and 2008.

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>% of total</th>
<th>2008</th>
<th>% of total</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Employment</td>
<td></td>
<td>N</td>
<td>Employment</td>
</tr>
<tr>
<td>Logging</td>
<td>34</td>
<td>2,040</td>
<td>3.2</td>
<td>45</td>
<td>1,201</td>
</tr>
<tr>
<td>Large sawmills</td>
<td>96</td>
<td>25,775</td>
<td>39.9</td>
<td>47</td>
<td>10,052</td>
</tr>
<tr>
<td>Medium sawmills</td>
<td>90</td>
<td>7,131</td>
<td>11.0</td>
<td>50</td>
<td>3,796</td>
</tr>
<tr>
<td>Small sawmills</td>
<td>124</td>
<td>1,251</td>
<td>1.9</td>
<td>92</td>
<td>1,141</td>
</tr>
<tr>
<td>Large board mills</td>
<td>13</td>
<td>5,506</td>
<td>8.5</td>
<td>10</td>
<td>2,191</td>
</tr>
<tr>
<td>Value added wood</td>
<td>194</td>
<td>3,681</td>
<td>5.7</td>
<td>362</td>
<td>8,680</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>22</td>
<td>18,022</td>
<td>27.9</td>
<td>19</td>
<td>8,115</td>
</tr>
<tr>
<td>Value added paper</td>
<td>36</td>
<td>1,203</td>
<td>1.9</td>
<td>54</td>
<td>1,673</td>
</tr>
<tr>
<td>Total</td>
<td>609</td>
<td>64,609</td>
<td>100.0</td>
<td>679</td>
<td>36,849</td>
</tr>
</tbody>
</table>

16 GROWTH AND CHANGE, MONTH 2016
In general, large plants lost share to small, value added plants. In 1980, more than three out of four employees (75.7 percent) worked in large plants (large sawmills, large board mills, and pulp and paper mills); that ratio dropped to 55.2 percent in 2008. Meanwhile, the employment share of small firms (small sawmills and value added wood and paper industries) increased from 9.5 percent to 31.2 percent, virtually all non-unionized.

In order to highlight the effects of plant population dynamics on employment, employment change was decomposed into various components, plant openings, closures and in-situ change. As classified, net employment change is the sum of job loss due to plant closures, the jobs created in newly opened plants and the in-situ employment change in “surviving” plants (Table 6). Overall, plant closures dominated job loss, accounting for more than 98 percent of 1980 employment declines in logging and more than 80 percent in small sawmills and value added wood. Closures were still responsible for more than half the job loss in large sawmills and board mills. To varying degrees, jobs were created in newly established plants, especially small plants in the value added industries, sawmilling and logging. In the value added wood and paper industries, the number of newly created jobs exceeded the job loss due to closures. However, in general, small firms experienced greater volatility as more jobs were both created and destroyed compared to large plants, itself an indication of selection pressures on new entrants.

In all sub-industries, with the notable exception of pulp and paper mills, mill closures accounted for considerably more lost jobs than in-situ downsizing. With respect to job creation, except for large sawmills, in-situ additions were much fewer than in newly opened plants. New plants played an

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net employment change</strong></td>
</tr>
<tr>
<td>Logging # of employees</td>
</tr>
<tr>
<td>Large sawmills employees</td>
</tr>
<tr>
<td>Medium sawmills</td>
</tr>
<tr>
<td>Small sawmills</td>
</tr>
<tr>
<td>Large board mills</td>
</tr>
<tr>
<td>Value added wood</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
</tr>
<tr>
<td>Value added paper</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Logging % of 1980 employment | -41.1 | -98.2 | 0.0 | 0.1 | 56.9 |
| Large sawmills employment | -60.9 | -54.6 | -15.5 | 7.3 | 1.0 |
| Medium sawmills | -46.8 | -71.2 | -8.7 | 12.7 | 21.7 |
| Small sawmills | -8.8 | -83.5 | -4.6 | 9.0 | 69.4 |
| Large board mills | -62.1 | -58.2 | -16.0 | 1.6 | 10.5 |
| Value added wood | 135.9 | -81.4 | -4.6 | 7.2 | 214.7 |
| Pulp and paper mills | -55.0 | -19.4 | -37.6 | 0.3 | 1.8 |
| Value added paper | 39.0 | -74.2 | -4.3 | 8.2 | 109.4 |
| Total | -43.2 | -50.8 | -19.4 | 5.2 | 21.5 |
especially important role in creating jobs in added-value wood and paper activities. This characteristic reinforces the relative volatility of these activities, especially in comparison to large sawmills in which relentless job decline through in-situ cutbacks and plant closure are only modestly offset by in situ additions, and scarcely at all by plant openings.

**Core periphery trends.** The broad classification of BC’s forest economy into coastal and interior regions incorporates a core-periphery dimension as the former is dominated by the control and production centre of metropolitan Vancouver (although the Coast also contains some dispersed forest communities, and the interior some rapidly growing urban centres). While traditionally concentrated on the Coast, the provincial forest harvest in the interior became as large by 1970 and its relative importance as increased since. Even so in 1980 the Coastal region, led by metropolitan Vancouver, still had a larger share of forest product employment and plants (Table 7). Thus in 1980 the Coast had a larger share of medium sawmills, pulp and paper mills and the value-added industries, it still retained about 45 percent of large sawmill jobs, and almost 60 percent of total employment.

The key trend after 1980 has been the especially rapid relative as well as absolute decline in large scale operations, most evident among large sawmills but also apparent in pulp and paper and board mills, on the Coast. In tandem, even in decline, employment in large operations became increasingly (relatively) concentrated in the interior. With respect to small-scale dominated sub-industries that increased jobs during the study period, for example wood value added, the Coast more or less retained its dominant employment shares while increasing absolute levels of employment. In the

### Table 7. Plant Numbers and Employment 1980 and 2008, BC Coast and Interior.

<table>
<thead>
<tr>
<th></th>
<th>% of plants</th>
<th>% of employment</th>
<th>% of capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coast</td>
<td>Interior</td>
<td>Coast</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logging</td>
<td>42.9</td>
<td>57.1</td>
<td>55.3</td>
</tr>
<tr>
<td>Large sawmills</td>
<td>35.1</td>
<td>64.9</td>
<td>45.3</td>
</tr>
<tr>
<td>Medium sawmills</td>
<td>58.2</td>
<td>41.8</td>
<td>63.0</td>
</tr>
<tr>
<td>Small sawmills</td>
<td>42.6</td>
<td>57.4</td>
<td>54.4</td>
</tr>
<tr>
<td>Large board mills</td>
<td>45.5</td>
<td>54.5</td>
<td>57.0</td>
</tr>
<tr>
<td>Value added wood</td>
<td>67.6</td>
<td>32.4</td>
<td>77.6</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>58.3</td>
<td>41.7</td>
<td>68.1</td>
</tr>
<tr>
<td>Value added paper</td>
<td>94.3</td>
<td>5.7</td>
<td>93.0</td>
</tr>
<tr>
<td>Total</td>
<td>54.6</td>
<td>45.4</td>
<td>57.9</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logging</td>
<td>44.6</td>
<td>55.4</td>
<td>58.0</td>
</tr>
<tr>
<td>Large sawmills</td>
<td>23.5</td>
<td>76.5</td>
<td>14.9</td>
</tr>
<tr>
<td>Medium sawmills</td>
<td>65.8</td>
<td>34.2</td>
<td>66.1</td>
</tr>
<tr>
<td>Small sawmills</td>
<td>55.9</td>
<td>44.1</td>
<td>52.1</td>
</tr>
<tr>
<td>Large board mills</td>
<td>15.0</td>
<td>85.0</td>
<td>26.2</td>
</tr>
<tr>
<td>Value added wood</td>
<td>66.0</td>
<td>34.0</td>
<td>74.0</td>
</tr>
<tr>
<td>Pulp and paper mills</td>
<td>40.9</td>
<td>59.1</td>
<td>56.4</td>
</tr>
<tr>
<td>Value added paper</td>
<td>90.1</td>
<td>9.9</td>
<td>84.9</td>
</tr>
<tr>
<td>Total</td>
<td>59.5</td>
<td>40.5</td>
<td>49.7</td>
</tr>
</tbody>
</table>
interior, increases in jobs in small-scale operations were overwhelmingly confined to the Okanagan, itself a rapidly urbanizing region that is increasingly well connected to Vancouver metro.

By 2008 plant entry and exit rates among BC’s forest industries exerted different impacts on the coast, especially with respect to metropolitan Vancouver, and the interior. Thus while large sawmills (and large board mills and pulp and paper mills) declined throughout the province in metropolitan Vancouver large sawmills had almost disappeared by 2008 (while within metro Vancouver the one pulp and paper mill still survives). Although data are not provided the corporate head-offices that were once concentrated in downtown Vancouver have been largely closed or down-sized. In contrast, a significant share (circa 60 percent) of the small value-added plants are located in metropolitan Vancouver while most of the remainder are located in other coastal communities or in one southern region of interior BC, the Okanagan Valley. Thus, in 2008, 66 percent of the plants and 74 percent of employment in added-value wood activities were located on the coast, and the shares are even greater for added-value paper. In the central and northern parts of BC, however, the number of value-added mills declined between 1980 and 2008. In general, although the coastal region, including metropolitan Vancouver, has declined in terms of production volumes it has increased its share of locally-owned small-scale plants. Meanwhile, by 2008, more than 2/3 of the 20,000 plus employees that worked in large plants (large sawmills, board mills and pulp and paper mills) are located in the Interior, including 75 percent of large sawmills (and 85 percent of large sawmill jobs).

During a prolonged period of post-maturity and overall decline the evidence presented in this paper supports the view of the emergence of a new dual structure of BC’s forest economy in organizational and spatial terms. This dual structure contrasts diverse entrepreneurial value added activities in small scale plants in metropolitan Vancouver and to some extent the Okanagan region with corporately organized large-scale production in the interior. In the former high exit rates and even higher entry rates have created a dynamic population of small plants that have expanded employment among entrepreneurial firms that other studies reveal have relatively small, diverse fibre needs, use non-union labour, are owner-managed, serve diverse markets and bear a resemblance to flexibly specialized clusters (Woodbridge Associates 2009). While these activities tend to be dispersed within Vancouver metro and the Okanagan, these regions essentially provide a wide range of agglomeration and localization economies, not least accessibility to diverse timber supplies and local and export markets that are hard to match in remote communities. In contrast, even if rendered more flexible through computerization, the interior forest industry remains characterized by large scale production, organized by multi-plant firms in plants with high exit rates, low entry rates and declining employment. From a local development perspective, it is particularly disappointing that large plant closures and job losses in the specialized communities of the interior have not been offset by the growth of the value-added industries, and these trends are likely to continue. In the interior, outside of the Okanagan, the challenge to forest communities to emphasize ‘place-based development’ (Markey, Halseth and Manson 2012) and become value and local oriented, remains daunting.

The Vancouver metro area remains an export trading point, corporate, labour, R&D control, business service and even processing centre for the provincial forest industries. However, if a defining feature of Vancouver’s metropolitan status in the 1960s and 1970s these activities are less important in the contemporary urban economy. Control functions have also changed qualitatively, most obviously in the shift from corporate bureaucracies and unionized large-scale production to diverse, small scale entrepreneurial operations. In tandem corporate decision making is small-scale and not especially international in its sphere of influence, the forest unions that once dominated the voice of labour in BC have become muted, and R&D operations have shifted towards the support of small firms. An interesting caveat to the above is that the remaining dominant corporations are Canadian owned, some of
which have recently expanded internationally and increased hiring of head-office staffs in Vancouver. In the Interior, log are harvests projected to decline following the rapid cutting of pine beetle damaged wood. Thus, even with the revival of American housing markets and the continuing growth in Asian demands, highly automated large scale forest production is unlikely to supply many new jobs. Indeed, an interesting challenge is to maintain both large sawmills and pulp and paper mills, given that the profitability of both depend upon supplies of waste wood and sawdust from the former to supply fibre and energy inputs to the latter. That BC’s forests are vast and renewable nevertheless sustains realistic hopes of industrial rejuvenation, in the interior possibly to develop value-added activities. Such hopes, however, may have to contemplate alternative uses of the forest ranging from large-scale re-commodification for the bio-fuel industry to a greater emphasis on non-productive uses.

In summary, the characterization of BC’s forest industries as in decline has legitimacy, if oversimplified. Agglomerations of entrepreneurially organized small plants partially offset this trend and while overall employment has declined significantly there were as many plants in 2008 as in 1980. Between 1980 and 2008 BC’s forest industry has featured both shakeouts and shakeins, each with a distinct geography that is part of a re-definition of core-periphery relations.

Conclusion

The analysis of population dynamics underlying industrial trajectories is important for understanding changing spatial patterns, assessing future trends, and to provide context for case studies, whether corporate or community focused. Further, resource industries need to be a higher priority in evolutionary geographies of industry. Resource industries play vital roles in globalization and regional economic development. Their trajectories are distinctive, varied, geographically extensive, and a particularly graphic reminder that industrial trajectories are socially embedded and require understanding in particular places and periods. Their interface between economic and environmental tensions reinforces this plea, and intimates directions for future research. With respect to evolutionary approaches in economic geography, we would argue that the implications of the industrial cycle model is not to impose stylistic morphologies but to stimulate analyses of population dynamics in carefully chosen time periods and geographical scales of analysis that feature the calculation of entry, exit and survivorship rates, as presented in this paper, and further enriched by identification of in- and out-migration rates of plants and firms, and, if possible, by longitudinal data. As this paper has shown, even in post-maturity, shakeouts may be accompanied by shakeins within regions that in turn supports pleas (e.g., Schamp 2005; Hatch 2013) for examinations of alternative business strategies and local development policies to help rejuvenate established, apparently declining sectors of the economy.

NOTES


2. Most small plants choose not to report capacity. In addition, the products are very heterogeneous, especially in the value added industries.

REFERENCES


