Business Strategies of North American Sawmills:

Flexibility, Exports and Performance

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Abstract

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Lumber production in North America has declined sharply after the housing crisis in the U.S. The weak demand for lumber in the U.S. has been offset by strong international demand, however, some sawmills hesitate to export their products internationally, while others actively pursue opportunities overseas. This dissertation explores two research questions by analyzing the survey responses from 89 sawmills: 1) What are the factors that drive North American softwood lumber firms to enter international markets and commit to international customers? 2) What characteristics determine the flexibility of sawmill firms, and how do these characteristics influence firms' performance after the housing crisis?

The first question implemented a sequential hurdle ordered probit model to explain the degree of internationalization based on firm characteristics. Results showed that medium-sized firms are more likely to target international markets than smaller firms. Firms that have a strong differentiation orientation are more likely to participate in international markets. Most Canadian lumber firms have been exporters to the U.S., but after controlling for this fact, the data suggests that Canadian and U.S. firms have similar degrees of international commitment. Within the U.S., firms in the North are more likely to commit to exporting than firms in Southeast, but if a Southeast firm has adopted a product differentiation strategy, then they are more likely to commit to exporting.

For the second question, results showed that medium-sized firms are more flexible than smaller firms based on the number of operational changes a firm made after the housing crisis. Flexible firms are more export oriented and pursue a higher degree of differentiation than inflexible firms. The flexibility characteristics of firms are time invariant. Firms that are flexible perceive their performance is relatively better than firms that are not flexible; however, current performance could not give insight into past performance. These results suggest that flexibility was the key factor in the prosperity of softwood sawmills after the housing crisis, but the factors contributing to success in the sawmill industry are inconsistent over time.

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Chapter 1. Introduction to the Study

1. Forest resources in North America

North America[1] has rich forest resources. According to the Food and Agriculture Organization (FAO) of the United Nations Global Forest Resources Assessment 2010 (2011), the U.S. has about 304 million hectares (ha) and Canada has 310 million ha of forest land, which accounts for about 33 and 34 percent of total land area, respectively. In Canada, this forest land is almost equally divided between east and west. In the U.S., about 70 percent of the productive and available forest land is concentrated in the eastern part of the country. Two-thirds of U.S. forest lands, or almost 200 million ha (490 million acres), are classified as timberlands[2]. On average, 214 million and 481 million m3 of industrial roundwood, defined as the extracted wood consumed by wood processing and pulp industries, were removed annually during 2003 to 2007 from Canada and from the U.S., respectively, which accounts for roughly 12.1 and 25.5 percent of global industrial roundwood removals.

Wood of gymnosperm species (coniferous trees) is known as softwood, and that of angiosperm species (deciduous trees) is known as hardwood. Softwood lumber is produced from softwood species and is used mainly for construction. Softwood species usually grow in boreal and temperate forests. Traditionally, North America, Northern Europe, and Russia have a strong softwood lumber industry supported by their rich softwood resources. The main softwood species in North America include Douglas-fir, hemlock, spruce, pine, fir, larch, cedar, and cypress.

[1] The term North America maintains various definitions in accordance with location and context. In this dissertation, North America refers to the United States and Canada together. Mexico and the Caribbean Islands are not included in North America, unless noted otherwise.

[2] Forest land capable of producing at least 1.4 m^3/ha (20 ft^3/acre) per year of industrial wood and not withdrawn from timber utilization.

Forest types in North America are very diverse, from the northern boreal to the subtropical regions. There are four major ecosystems where softwood species are found. Boreal forests are found at the highest latitudes, from Alaska to Central Canada to Eastern Canada. The majority of the boreal forests are comprised of softwood species, such as spruce, pine, and fir, and softwood lumber produced from these species is known as spruce-pine-fir (SPF) lumber. The Pacific Coast of North America, from Southeastern Alaska to British Columbia to California, has rich softwood forests. Major softwood species in this region include Douglas-fir, western hemlock, western red-cedar, redwood, and Sitka spruce. The Rocky Mountain Complex forests stretch from northern New Mexico into Alberta and inland British Columbia. The major species in this region include lodgepole pine, ponderosa pine, spruce, and fir. The Southeastern U.S. region also has rich pine forests. The Southeastern pine forests extend over 200 million acres from Virginia to east Texas. Major pine species in this region include loblolly, slash, shortleaf, longleaf, and Virginia. Finally, the Northeastern Coniferous Forest is found in the Northeastern U.S. and Great Lakes region. Balsam fir, black spruce, jack pine, red pine, and white pine are the major coniferous species in this region, along with other hardwood species (Young and Giese 2003).

2. Importance of sawmills and survival of SMEs

Some extracted logs are input into sawmills to produce lumber. The U.S. produced 45.4 million m3 and Canada produced 38.0 million m3 of softwood lumber in 2011. The U.S. is the world's largest and Canada is the second-largest softwood lumber producer, which accounts for about 15.7 and 13.1 percent of global softwood lumber in 2011 (FOA 2013). The U.S. produced 16.3 million m3 of hardwood lumber (14.8 percent of the world's total), and Canada produced 0.9 million m3 (0.8 percent of the world's total) in 2011. The U.S. is the world's second-largest hardwood lumber producer, behind China. Dimension lumber is usually made from softwood species and most of it is consumed within the construction industry. On the other hand, hardwood lumber, appreciated for its attractive coloring and

grain, is used for a variety of value-added products including furniture, flooring, doors, trim, and cabinets.

Wood processing facilities are generally locate proximate to their raw material supplies (Bowe et al. 2004). Lumber processing sectors are a natural resource–dependent industry. By the 1950s, the ability of firms to produce wood products in North America was limited by how fast they could supply wood to sawmills (Cohen and Kozak 2002). Consequently, sawmill operations located near natural resources had a strong competitive advantage. At least four different softwood sawmill industry clusters are located in North America, each associated with the four types of ecological zones discussed above: 1) Western coastal U.S. and Canada, 2) Western inland U.S. and Canada, 3) Southeast U.S., 4) Northeast U.S. and Eastern Canada.

As time progressed, engineering technology advanced, and the management of sawmills started to focus on the efficiency of the operation rather than on securing natural resources. By the 1960s and 1970s, sawmill operations were limited only by their technological ability and how efficiently they could process readily available logs (Cohen and Kozak 2002). Softwood lumber is primarily used as a commodity, and it is not easy to differentiate between products; the price of lumber is competitively determined by the market. Reducing the cost of operations is the key driver to increasing profits. Some lumber producers located in developed nations attempt to achieve competitiveness through economy of scale (Sasatani 2009). In the 1990s, the availability of large-dimension logs dropped dramatically due to resource scarcity and environmental regulations. Many inefficient sawmills reliant on large-dimension logs went out of business. Due to industrial consolidation, the number of sawmills has been declining.

The forest products industry is very important for North American society. The forest products industry has traditionally been viewed as one of the major providers of jobs in rural areas. The U.S. lumber

industry experienced a continuous decrease in employment from 103 to 84 thousand full-time equivalents (FTEs) from 1990 to 2005. On the other hand, Canada's employment level rose from 73 to 87 thousand FTEs, or by 18 percent, between 1990 and 2000, but it dropped to 84 thousand FTEs by 2005 (FAO 2011).

Needless to say, a healthy forest provides many multifunctional, ecological benefits to society. Resilience in the forest products industry can contribute to maintaining the health of forests through good forest management as well as preventing the conversion of forest lands to non-forest uses. Hence, the health of the forest products industry is critically important to both rural economies and biodiversity. One solution can be encouraging sawmills to export forest products to diversify markets for North American forest products. That would increase the overall demand for North America's forest products by reaching out to international customers, helping to support the economic health of forest products industry. Meantime that demand for softwood lumber is tied to the economy which goes through ups and downs.

It is estimated that about 80 percent of softwood lumber in the U.S. is used within the construction sectors (Spelter et al. 2009). Hence, the demand for softwood lumber depends on the resilience of the housing sector in North America. Domestic demand of softwood lumber is volatile due to the fluctuation of housing starts. The North American sawmill industry enjoyed a period of relative prosperity between 1990 and 2006, an era now recognized as a real estate bubble. Lumber production in North America declined sharply after the bubble burst due to the subprime mortgage crisis and credit crunch. The number of sawmills declined substantially between 2006 and 2010. The current weak demand for lumber in the U.S. has been offset by strong international demand, especially in Japan and China. Since firms cannot always determine in advance which markets will succeed, they will always be operating in an environment of uncertainty. In order to mitigate financial risk, firms should diversify their lumber

sales markets. Vibrant sawmill industry is critical to maintaining forest health and providing income to support forest thinning operations.

3. Globalized world

Globalization is the process of international integration arising from the international flows of goods, services, money, people, information, and culture (Held et al. 1996). Globalization itself is not a new phenomenon, but the dissolution of the Soviet Union and advancement of communication technologies have resulted in rapid globalization since the 1990s. In the 1990s, some scholars were still skeptical about globalization (e.g. Kennedy 1993; Rodrik 1997) while some believed that the results of globalization would bring boundless prosperity and consumer joy (e.g. Ohmae 1990). Since the early twenty-first century, the world has been highly globalized, and innovative firms have adapted their globalized business strategy to retain competitiveness (Friedman 2005). Currently, most economists agree that globalization contributes to overall economic growth due to increased efficiency through specialization and from decreased transaction costs through liberalization (Bhagwati 2004).

With improvements in transportation and communication, international business grew rapidly. There is no doubt that technological advancements in transportation and telecommunication lower the risk of international business. Additionally, bilateral and multilateral intergovernmental agreements have been introduced to reduce or eliminate regional barriers to trade among participating states. The Free Trade Agreement (FTA)'s purpose is to liberalize international trade within a free-trade bilateral or multilateral block. Beyond the FTA, an economic partnership agreement (EPA) is an economic arrangement that eliminates barriers to the free movement of goods, services, and investment between countries. An EPA can be considered an intermediate step between a free-trade area and a single market in the process of economic integration. Sometimes nations create trade blocs, such as the European Union (EU), the North American Free Trade Agreement (NAFTA), and the Association of Southeast Asian Nations

(ASEAN). However, these economic blocs may encourage regional as opposed to global free trade (O'Loughlin and Anselin 1996). In order to establish a framework for global liberalized trade policies and to supervise international trade, the World Trade Organization (WTO) replaced the General Agreement on Tariffs and Trade (GATT) in 1995. The WTO decisions are absolute, and every member must abide by its rulings. As of 2012, the Doha Development Round is the current trade-negotiation round of the WTO since 2001. However, the future of the Doha Round remains uncertain because of significant differences of opinion on major issues, such as agriculture, mainly between developed and developing countries. Nevertheless, the trend of liberalization of international trade is irreversible. Many governments have concluded individual FTAs/EPAs as an alternative to the faltering WTO.

Exporting is important not only for individual firms but also for the home nation. For the individual firms, exporting can increase revenue sources beyond the domestic market. Simultaneously, they can reduce their economic risk due to market fluctuations by diversifying business activities across multiple markets. Furthermore, firms can learn through international business operations, which may result in new, innovative ideas. For the host nation, increasing exports can support a nation's balance of trade. If all other conditions are constant, increasing exports directly increases a nation's gross domestic product (GDP) and the average per capita income. Also, increasing exports can increase the total jobs in the nation, so supporting exports tends to become an easy political decision for the government in any country. For example, the U.S. Department of Commerce provides U.S. companies the opportunity to promote their products and services free of charge. According to the U.S. Department of Commerce's International Trade Administration (2012), small- and medium-sized enterprises (SMEs) account for almost 97 percent of U.S. exporters, but still represent only about 30 percent of the total export value of U.S. goods. Less than 1 percent of the 30 million businesses in the U.S. export, but if this percentage increases, the U.S. economy would receive a boost generate more jobs. Promoting the exports of SMEs is recognized as a critical priority of the U.S. government.

4. Competitiveness and business strategy of the sawmill business

The U.S. exported as much as two times more softwood lumber in 1990 than in 2010. From 1990 to 2006, the domestic housing boom and a strong U.S. dollar discouraged firms from exporting. Globalization encourages international competition, which is redefining the forest products industry all over the world. Offshore, emerging markets have become a promising outlet for North American softwood lumber. With a changing competitive environment, forest products firms should adopt a global perspective (Hansen and Juslin 2011) in order to grow or even to survive.

A resilient forest products industry benefits the nation. The U.S. softwood lumber industry has always competed against the Canadian softwood lumber industry in North American markets. In global markets, they compete against other nations as well. Consequently, U.S. policy makers are interested in how to increase the competitiveness of the U.S. softwood lumber industry, and the same is true in Canada.

Porter (1990) warns that "firms, not individual nations, compete in international markets." A sawmill firm's competitive advantage in a specific country stems from many factors, such as the abundance of natural forests, government regulations, domestic demand, the exchange rate, abundance of labor, technologies and infrastructure, related and supporting industries, and rivalry among competitors. Firms holistically judge these factors and formulate their business strategies depending on their internal resources and capabilities. Successful firms have a solid business strategy. However, a successful business strategy in a mature industry like the sawmill business differ from other industries.

Internationalization of a firm should be based on the scope of its business strategy. Some lumber processing firms, especially small- and medium-sized sawmills in North America, hesitate to export their products to international customers, even as other sawmills have actively cultivated opportunities in

offshore markets. Also, it is well known that Canadian firms are more internationally oriented than U.S. firms. Internationalization of the sawmill business should be based on their own business strategy. Firms that have achieved international leadership will produce business strategies different from those who haven't.

Chapter 2. Softwood Lumber Industry in North America

1. North American sawmill industry - macro view

Production trend

The North American sawmill industry enjoyed a period of relative prosperity between 1990 and 2006, an era now recognized as a real estate bubble. According to the FAO (2013), total lumber production (both softwood and hardwood) in the U.S. hovered between 80 and 100 million m^3 from 1990 to 2006 (figure 2-1). On the other hand, total lumber production in Canada increased from about 40 million m^3 to 60 million m^3 in 2006. Total lumber production sharply declined from 2005 to 2009 in the U.S. due to the housing collapse. Total production of lumber declined sharply between 2006 and 2009 in Canada as well. The U.S. produced 56 million m^3 and Canada produced 33 million m^3 of lumber in 2009, which is about 60 percent and 54 percent of the comparative level in 2005. About 97 to 98 percent of total lumber production in Canada is softwood lumber, whereas these figures are between 65 and 75 percent in the U.S. This is due to climate differences between the U.S. and Canada.

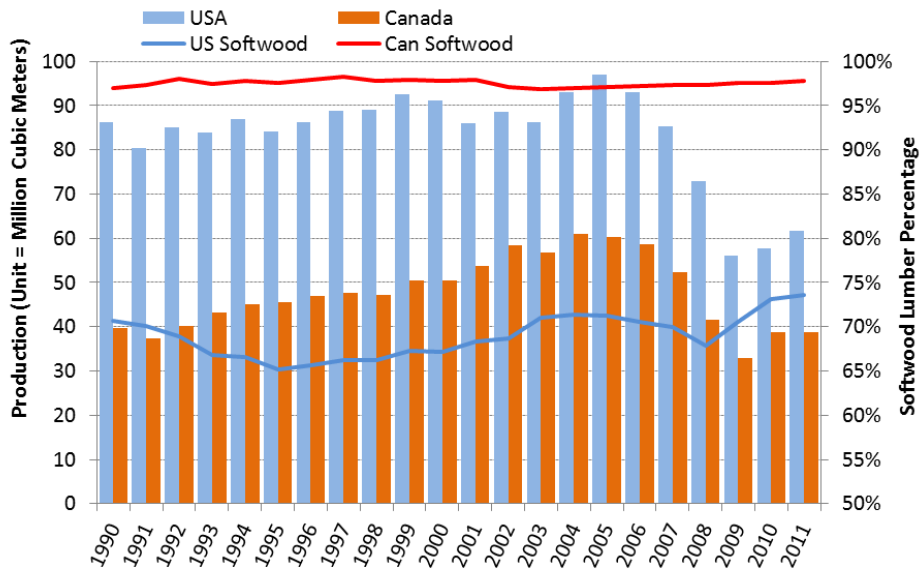

Figure 2-1. Lumber production from 1990 to 2011 in North America
(Source: FAO 2013)

Figure 2-2 focuses only on softwood lumber production from 1961 to 2011 in the U.S. and Canada. U.S. softwood lumber production fluctuated between 45 and 55 million m^3 in the 1960s and 1970s. Then, from 1985 to 2005, softwood lumber production rose from approximately 55 million m^3 to 65 million m^3 with production falling to 40 million m^3 by 2009. Similarly, softwood lumber production in Canada increased consistently from 1961 to 2005. In 1961, Canada produced approximately 13 million m^3 of softwood lumber, with production increasing to almost 60 million m^3 by 2005. Similar to the U.S., Canadian softwood lumber production declined sharply in response to the U.S. housing crash.

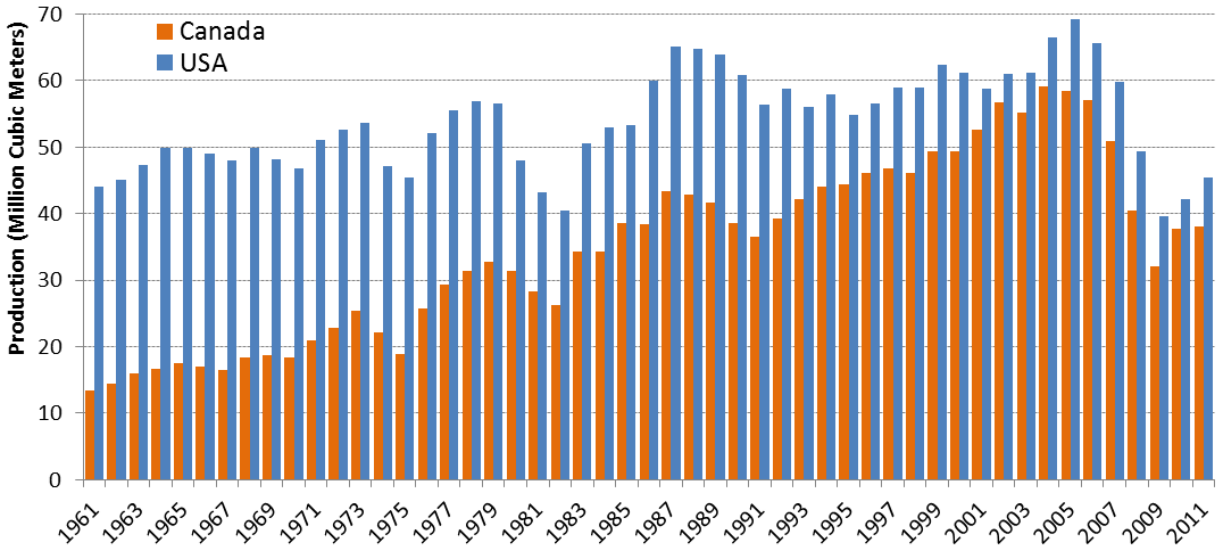

Figure 2-2. Softwood lumber production from 1961 to 2011 in the U.S. and Canada
(Source: FAO 2013)

Figure 2-3 shows the total softwood lumber production in North America. From 1961 to 2005, production doubled to about 125 million m^3. However, the U.S. share of softwood lumber production dropped from 76.7 percent in 1961 to 51.8 percent in 2002. This trend suggests that the Canadian softwood lumber industry may have been more competitive than the U.S. softwood industry, although it appears that non-market factors were also at play.

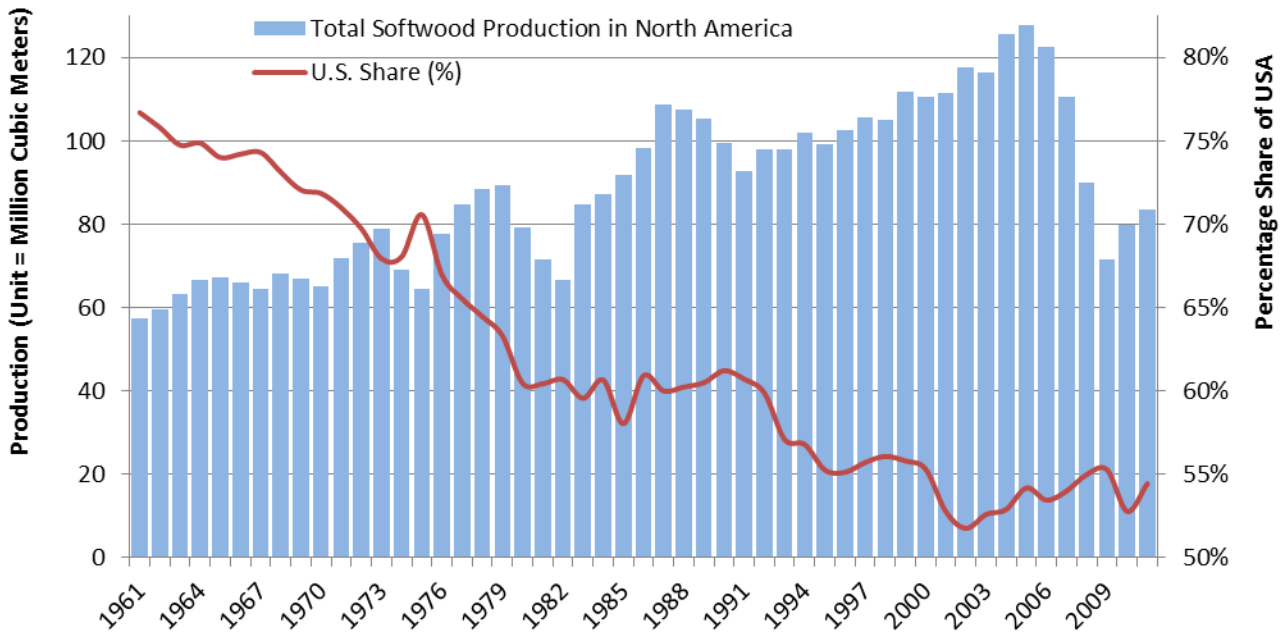

Figure 2-3. Softwood lumber production from 1961 to 2011 in North America and U.S. share
(Source: FAO 2013)

Figure 2-4 shows the total softwood lumber production in the U.S. and softwood lumber imports to the U.S. Total lumber production sharply declined from 2005 to 2009 in the U.S. due to the housing crisis. From 1970 to 2005, the market share of West has declined from 56.3 percent to about 30-35 percent. In contrast, the market share of South has increased from 21.3 to 37.6 percent during the same period. Foreign market share has also increased from 18.1 percent in 1970 to 37.9 percent in 2005 and majority of them are from Canada. Canadian softwood lumber industry may have been more competitive than the U.S. softwood industry.

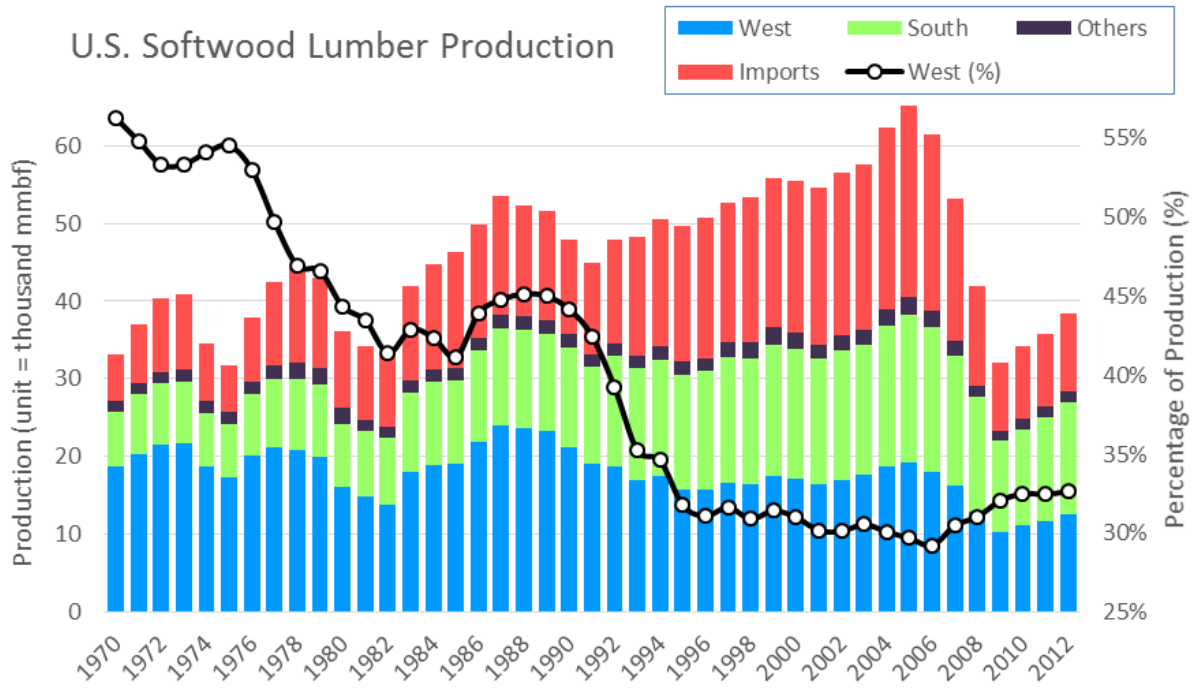

Figure 2-4. Softwood lumber production and imports from 1970 to 2012 in the U.S. by regions
(Source: WWPA 2013)

U.S. housing starts

It is estimated that about 80 percent of lumber from softwood sawmills in the U.S. ends up in total construction projects (Spelter et al. 2009). Hence, demand for softwood lumber depends on the resilience of the housing sector in North America.

The collapse of the dot-com bubble and the September 11 attacks caused an economic recession in 2001. In response, U.S. Federal Reserve chairman Alan Greenspan lowered the key interest rate gradually in order to boost the economy. The key interest rate dropped to as low as three percent, which encouraged many potential home buyers to purchase a home. Strong demand for homes led to a sharp increase in home prices. Since most Americans believe that home price will not decline and that homes are a good investment option. More people rushed to buy homes before prices could increase further.

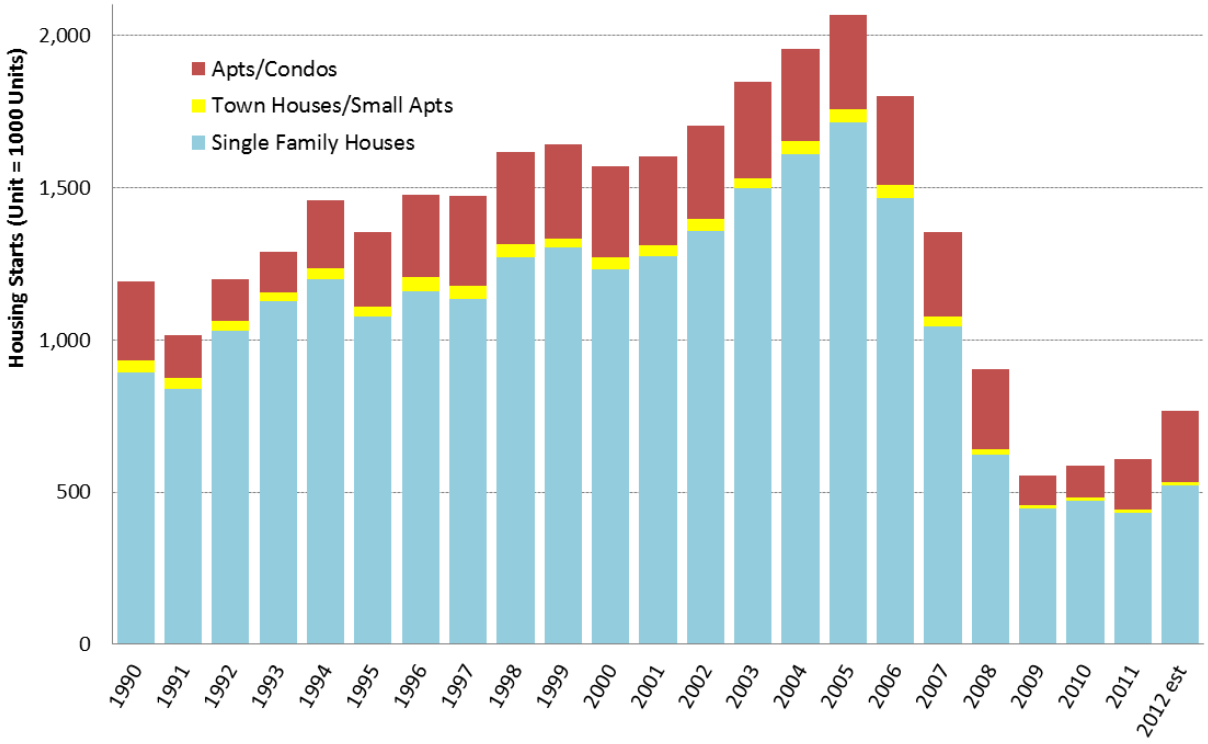

Figure 2-5. New privately owned housing units started in the U.S. (1990-2012)
(Source: U.S. Census Bureau 2013)

The Federal Reserve moved to tighten the economy in 2004 and by 2006 interest rates had risen to 5.25 percent, which reduced the demand for homes and increased monthly mortgage payments, especially for adjustable-rate mortgages. As the economy worsened, the resulting increase in foreclosures, house prices to fall rapidly. As mortgage delinquencies soared, securities backed with mortgages, including subprime mortgages, lost most of their value. In response, investors started selling these mortgage-backed securities and other related financial products simultaneously, which resulted in the meltdown of the U.S. financial market. Concerns about the soundness of the U.S. credit and financial markets led to a credit crunch, which deteriorated global financial markets. The financial meltdown eroded market fundamentals as well. The fallout from the credit crunch made it difficult for would-be-homebuyers to obtain mortgages and as the inventory of unsold homes increased, housing prices declined further. As shown in figure 2-5, housing starts plummeted from 2.07 million units in 2005 to just 550,000 units in

2009. Since 2009, housing starts have slowly recovered, although apartments and condominiums were the main contributors since many people cannot obtain loans to buy a house. It seems like single-family housing starts finally bottomed out in 2011 and they are projected to recover steadily over the next few years.

Many housing professionals state that "real estate is local." Figure 2-6 shows how annual housing starts[3] have changed differently within the different regions of the U.S. It is clear that housing starts went up sharply, especially in the West and South between 2000 and 2005, increasing by almost 50 percent by 2005. On the other hand, housing starts increased only about 20 percent in the Midwest and Northeast. This trend reflects the economic and immigration trends of the U.S.

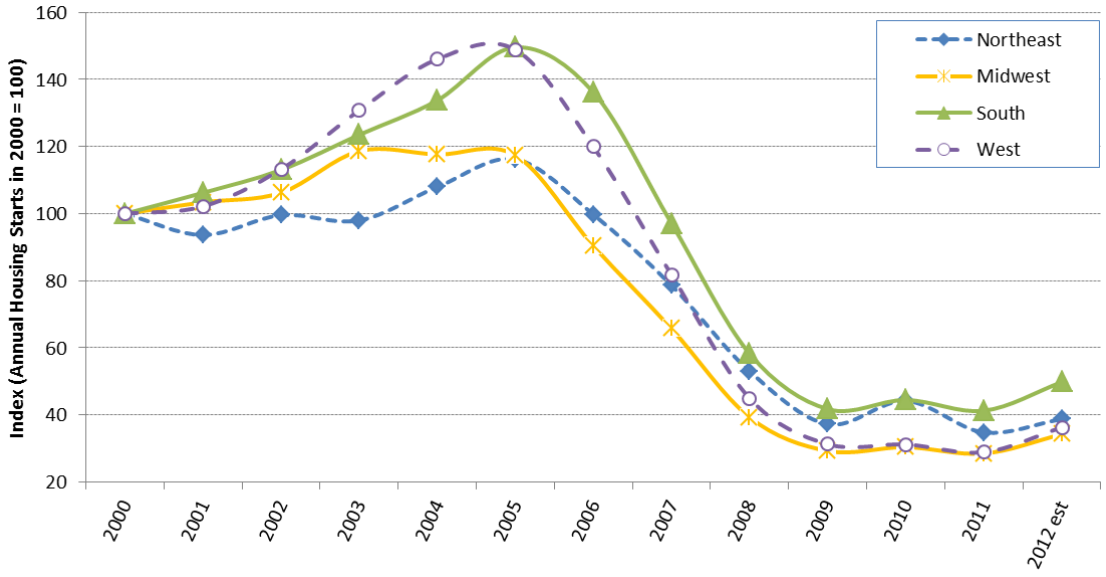

Figure 2-6. Annual housing units started index by U.S. regions
(Source: U.S. Census Bureau 2013)

Figure 2-7 shows the total softwood lumber consumption in the U.S. Total lumber consumption in the U.S. also sharply declined from 64,300 mmbf in 2005 to 31,300 mmbf in 2009. Between 76 and 85 percent of softwood lumber have been absorbed into construction sectors, such as residential

[3] The housing start index in 2000 is set at 100.

construction, non-residential construction and home repair and remodeling. The majority of remainders go to material handling and packaging sectors. The softwood lumber consumption in home repair and remodeling sector increased from about 20 percent in 1970 to 41.1 percent in 2012. Because about 80 percent of softwood lumber are consumed in construction sector, softwood lumber demand depends on the health of the U.S. construction sector.

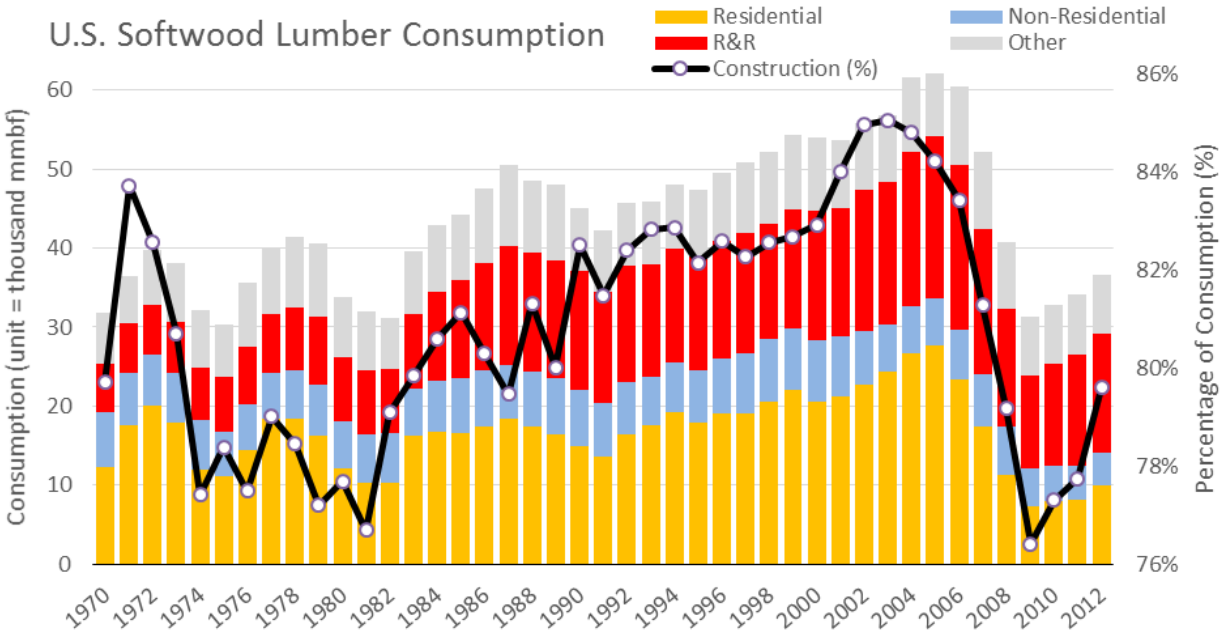

Figure 2-7. Softwood lumber consumption from 1970 to 2012 in the U.S.
(Source: WWPA 2013)

Lumber exports

In an era of globalization, businesses across the world increasingly seek out new export markets. Until the late 1990s, Japan was the primary export market for the U.S. softwood lumber industry. However, the Japanese economy has been struggling for more than two decades following the end of the bubble economy in 1990 and population started decreasing since 2005. Those issues has led to weak Japanese housing starts. As shown in figure 2-8, U.S. exports to Japan have decreased substantially, and the total volume of exports also declined until 2003. During the U.S. housing boom from 2001 to 2006, it seems

that the U.S. softwood lumber industry withdrew from export markets to focus on the strong demand in the domestic market. Export volumes during that time hovered between 1.9 and 2.2 million m^3. The volume of U.S. exports increased substantially in 2010 and 2011, mainly because of strong Chinese demand. By 2011, Japan, once the largest export destination for the U.S., ranked as the fourth largest export destination after China, Canada, and Mexico.

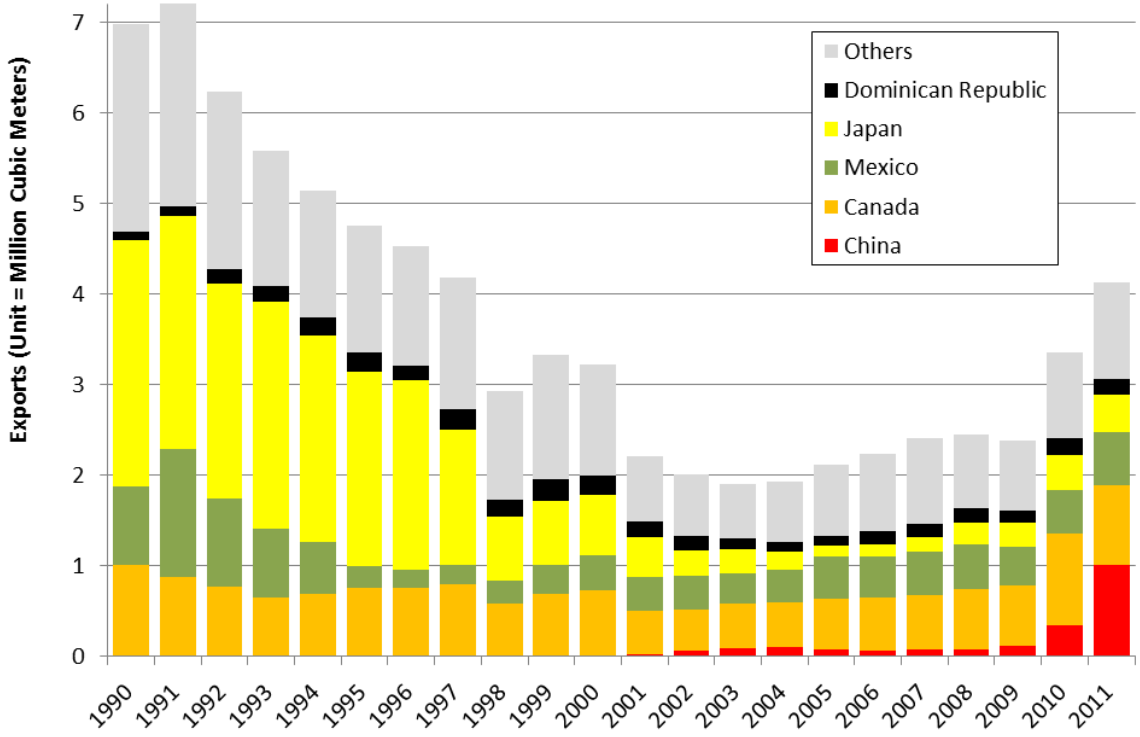

Figure 2-8. U.S. softwood lumber exports by destination (1990–2011)
(Source: U.S. Census Bureau 2013b)

The Canadian softwood lumber industry is much more export-oriented than its American counterpart (figure 2-9). Export volumes from Canada between 1995 and 2006 were around 50 million m^3, although the bulk of these exports went to the U.S. The big picture for Canadian exports, excluding those to the U.S., is very similar to the U.S. exports. Japan was initially the primary destination for Canadian lumber manufacturers, but this volume has since decreased. On the other hand, the volume of Canadian lumber

going to China has surged, and China has been the second largest importer of Canadian softwood lumber since 2009.

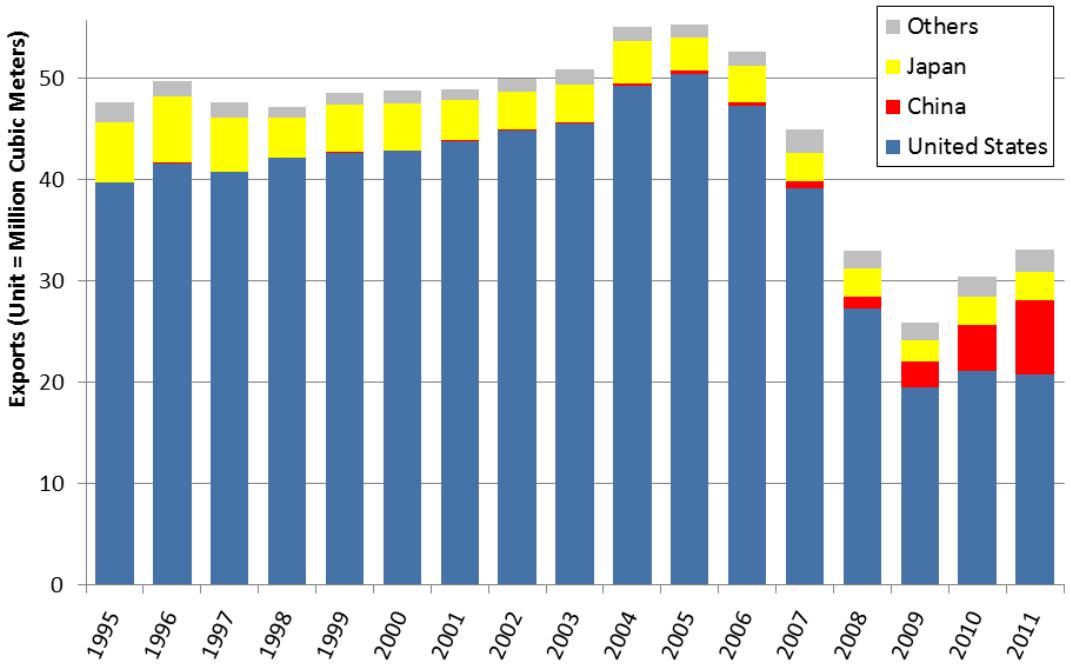

Figure 2-9. Canada softwood lumber exports by destination (1995–2011)
(Source: Statistics Canada 2013)

Since international trade between Canada and the U.S. is quite different from offshore export activities, these two activities are divided in figure 2-10. The positive area shows exports from North America to offshore markets. The negative area shows international trade between the U.S. and Canada. After the housing market crashed in the U.S., offshore export volumes have been surging.

Demand has remained strong in the offshore markets, even as the North American domestic market contracted due to the weak U.S. housing market. Since the U.S. housing market and demand for lumber in offshore markets often do not coincide, diversifying sales into both the domestic market and offshore markets can reduce financial risk for individual firms. In this way, weak demand for lumber in the U.S. can be offset by strong international demand.

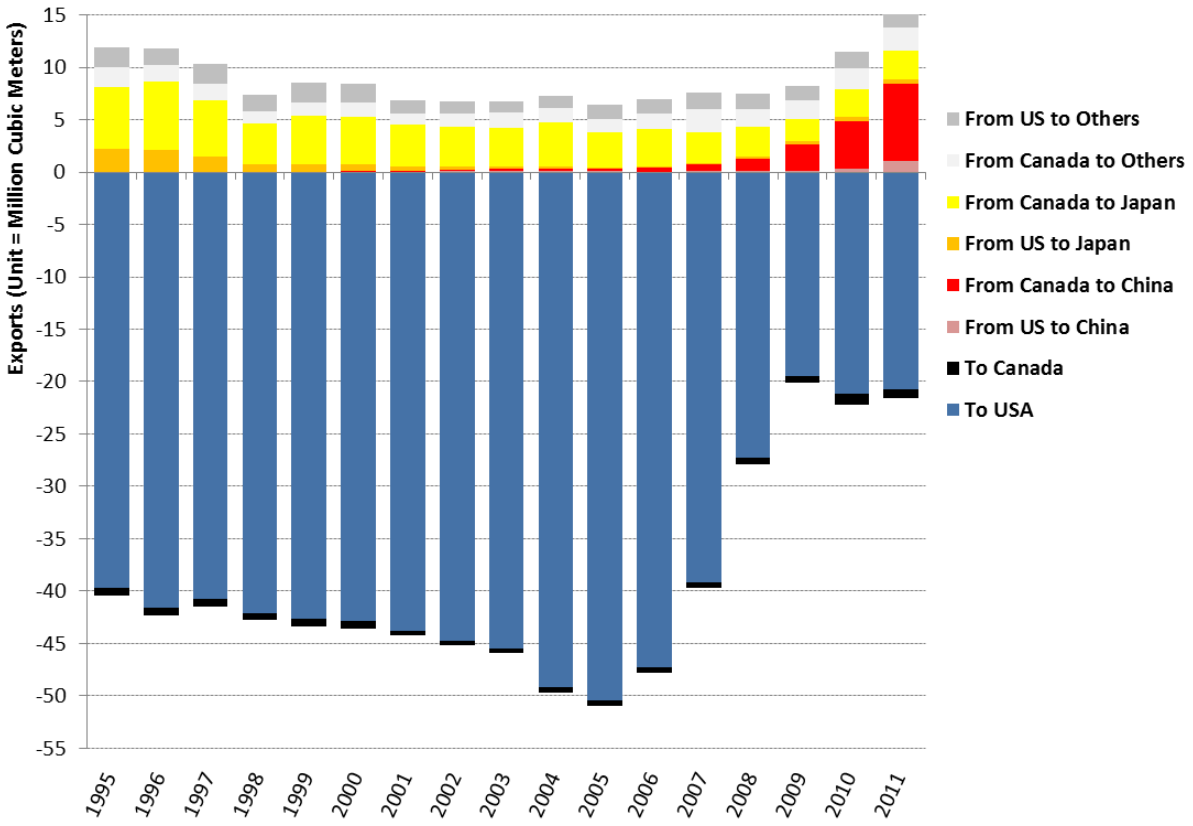

Figure 2-10. Combined North America softwood lumber exports by destination (1995–2011)
(Source: U.S. Census Bureau 2013b, Statistics Canada 2013)

2. North American sawmill firms – micro view

The unit of analysis in this study is the softwood lumber firm, not a single sawmill. Based on Spelter et al. (2009), Big Book 2010 (Random Lengths 2011), and opinions from industry experts, 1,070 sawmills were identified in North America. Among these, 772 individual sawmills, owned by 459 firms, were confirmed to be operating in 2010. The 459 firms that own the 772 sawmills were the population for this study. Among the 772 sawmills, some sawmills produce softwood lumber and hardwood lumber. Although I made a concerted effort to develop a census of sawmills, unfortunately it was not possible to completely identify all of the sawmills in North America. Some information from the identified mills was not acquirable because of the nature of business competition. Also, because of recent mergers, acquisitions, and sawmill closures, some sawmills may no longer have been in operation. Given these

limitations of the study, it appears that the vast majority of softwood sawmill in North America were included in the sample frames.

Individual sawmills

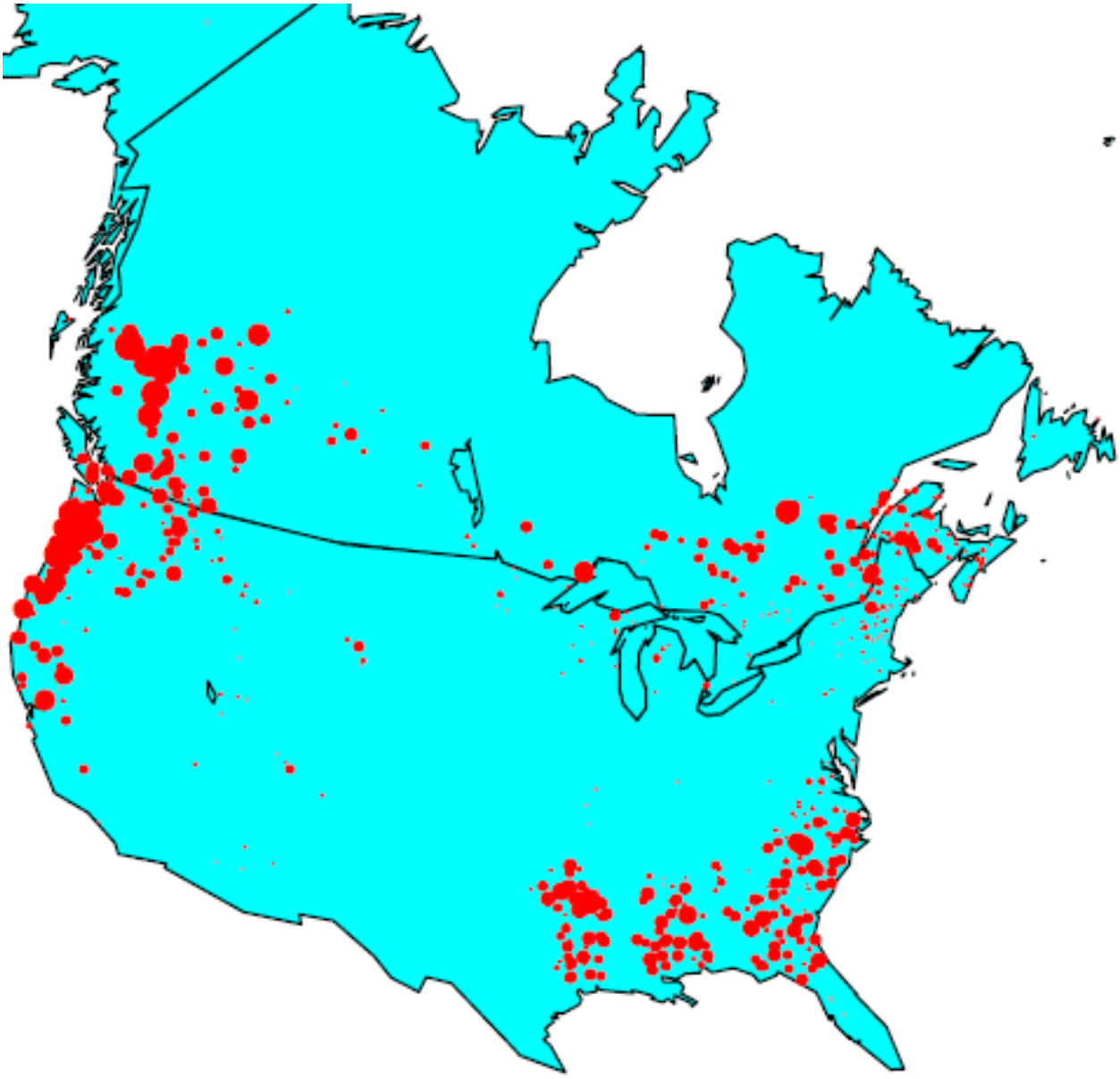

Figure 2-11. A map of sawmill locations and their annual production capacity in 2010

Figure 2-11 displays a map showing the location of the 772 North American sawmills analyzed in this study. Softwood sawmills are dispersed all over North America, and they are concentrated in four major

softwood lumber industry clusters, each associated with a different type of geographical regions: 1) coastal Western U.S. and Canada, 2) inland Western U.S. and Canada, 3) Southeast U.S., and 4) Northeast U.S. and Eastern Canada. Spelter et al. (2009) identified 891 sawmills in North America in 2009,though quite a few of them had gone out of business in 2010, perhaps victims of the prolonged housing crisis. The number of sawmills declined from 1,322 in 1995 (Spelter et al. 2009) to 772 in 2010, a decline of 41.6 percent over 15 years. Additionally, consolidation is an ongoing phenomenon in this industry, although the trend was accelerated by the housing crisis. It is very important to note that some sawmills, which are not on the map, were temporally idled as of 2010 and they would resume their operation if the marketplace improves. Forest Economic Advisors (2012) examined the status of 146 sawmills closed between 2008 and 2012, and 17.8 percent of them already resumed operations and 24.0 percent of them were put into idled status but are potentially revivable as of the fourth quarter of 2012. On the other hand, 39.7 percent of them were dismantled and permanently closed.

Annual production capacity and information about the wood species processed was collected from publications such as Spelter et al. (2009), Big Book 2010 (Random Lengths 2011), and individual firm websites. Units of production capacity were varied and included m^3/year, mbf/8hours, and mmbf/year. Information about annual production capacities in these publications sometimes conflicted. In such cases, we primarily relied on the information on firms' websites when available. Regardless, after a considerable effort, it was impossible to obtain or estimate production capacity information on about 49 of the 772 sawmills (6.3 percent). Most of the missing values were for micro firms that did not have websites. It is important to note that annual capacity does not necessarily represent annual production. In general, acquiring production information was much more difficult than acquiring production capacity.

Among the 772 sawmills, 490 were in the U.S. and 282 were in Canada. Table 2-1 shows the detailed breakdown by region[4]. Most of the sawmills were concentrated in the Southern U.S., from Texas to Virginia. The Southern U.S. had 214 sawmills and the mean annual production capacity was 184,000 m^3 in 2010. The Western coastal U.S. and Western Canada followed had 144 and 135 sawmills, respectively, and the mean annual capacity of a single sawmill in Western Canada was 243,000 m^3 and that of the Western coastal U.S. was 236,000 m^3. Eastern Canada had 147 sawmills, and the U.S. Rocky Mountains had 56 sawmills and the average size of a single sawmill was substantially smaller at 114,000 m^3 and 112,000 m^3, respectively. The North/Central U.S. had the fewest sawmills with 56. The mean annual capacity of North/Central U.S. was 63,000 m^3 in 2010, which is about one fourth of Western Canada.

Sawmills utilize a single species or multiple species. Inferring to the Herfindahl index in economics and the Simpson diversity index in ecology, the lumber species input diversification index is calculated as following:

Diversity Index = 1 - $\sum_{i=1}^{n} ratio\ species_i{}^2$ where $\sum_{i=1}^{n} ratio\ species_i = 1$

When a firm utilizes only one lumber species as a raw material input, the species diversity index is 1. On the other hand, a low index indicates a diversified mix of raw materials with no dominant lumber species. The Southern U.S. has the highest species index (0.920). Indeed, most Sothern sawmills specialize in southern yellow pine[5]. Eastern Canada has the second largest species diversification index

[4] Here is the categorization of regions. 1) Western Canada: BC, AB, SK and MB. 2) Eastern Canada: ON, QC, NB, NS and NF.3) Western coastal U.S.: AK, WA, OR and CA.4) U.S. Rocky Mountains: MT, WY, SD, ID, UT, CO, NM and AZ.5) North/Central U.S.: ME, NH, VT, MA, CT, NY, PA, WV, IN, MI, WI, MN, and MO.6) Southern U.S (or Southeastern U.S.).: OK, TX, AR, MS, LA, AL, FL, GA, SC, NC, VA, and MD. Since sawmill clusters disperse along the softwood ecological regions, the ideal categorization should be the ecological regions. This categorization attempts to divide sawmills by ecological zones as much as possible.

[5] The Sothern yellow pine varieties include loblolly, longleaf, shortleaf, and slash pines, but it is treated as a single lumber "species" in this study.

(0.802) with most sawmills utilizing SPF[6] logs. The North/Central U.S. has the smallest diversification index (0.612) because some sawmills produce both softwood and hardwood lumber. The Western coastal region has the lowest species diversification index at 0.530. Several different lumber species grow on the west coast, including Douglas-fir, pine, hemlock, larch, and fir, and Western sawmills often process a mix of different species, although, some sawmills process specialty species, such as cedar, redwood, and Sitka spruce.

Table 2-1. Number of sawmills and production capacity by location

Location	Number of Sawmills	Total Annual Production Capacity (1,000,000 m^3)	Mean Annual Production Capacity (1,000 m^3)	Species Diversification Index
Western Canada	135	31.8	243 (186)	0.704 (0.318)
Eastern Canada	147	21.6	160 (114)	0.802 (0.278)
Western coastal U.S.	144	32.4	236 (177)	0.530 (0.341)
Mountain U.S.	56	5.8	114 (112)	0.549 (0.301)
N.E./Central U.S.	76	4.4	66 (63)	0.612 (0.343)
Southern U.S.	214	39.4	195 (128)	0.920 (0.223)

Note: Values inside parentheses represent sample standard deviation of the data.

[6] SPF lumber can be used from different species, such as spruce, pine, and fir, but manufacturers treat them similarly and do not differentiate between them to produce lumber, so SPF is regard as a single lumber "species" in this study.

Figure 2-12 shows the species breakdown of softwood lumber production capacity in the U.S. and Canada. In the U.S., 53.2 percent of the annual capacity is assigned to the pine species (e.g. Southern yellow pine, lodgepole pine, and Ponderosa pine). Douglas-fir represents 21.3 percent of lumber production capacity and Hem-Fir[7] represents an additional 14.8 percent of softwood lumber production capacity. In contrast, 79.0 percent of Canadian softwood lumber production capacity based on the SPF species mix.

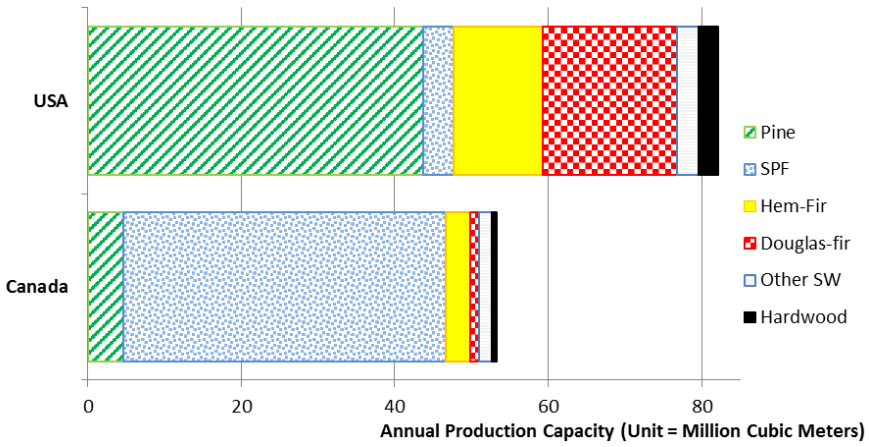

Figure 2-12. Annual production capacity by species in the U.S. and Canada

Figure 2-13 breaks down the species of softwood lumber production capacity by regions. As discussed before, the Southern U.S. had the largest production capacity in 2010, and 94.5 percent of the production capacity volume was Southern yellow pine. About 51.2 percent of production capacity volume in the Western U.S. coastal region was based on Douglas-fir with Hem-Fir accounting for 27.9 percent volume and pine (e.g. ponderosa pine and lodgepole pine) account for 9.5 percent. About 73.6

[7] Hem-fir is a species combination of Western hemlock and five of the firs: grand fir, noble fir, Pacific silver fir, California red fir, and white fir. While hemlock and firs are often marketed separately in products graded for appearance, these species share similar design values making products graded for structural applications interchangeable. Consequently, hem-fir is treated as a single lumber "species."

percent of lumber production capacity in Western Canada was SPF. Hem-Fir and Douglas-fir accounted for 9.4 percent and 3.9 percent of the annual production capacity volume and the majority of these species were processed in the coastal area of British Columbia. In Eastern Canada, SPF accounted for 86.5 percent of capacity volume and other pine species represented 10.3 percent. Since natural forests are distributed heterogeneously across North America, sawmills in different regions can be expected to utilize different mixes of wood species. This geographical resource limitation may influence the managerial flexibility of sawmill firms in terms of their ability to deliver certain types of products.

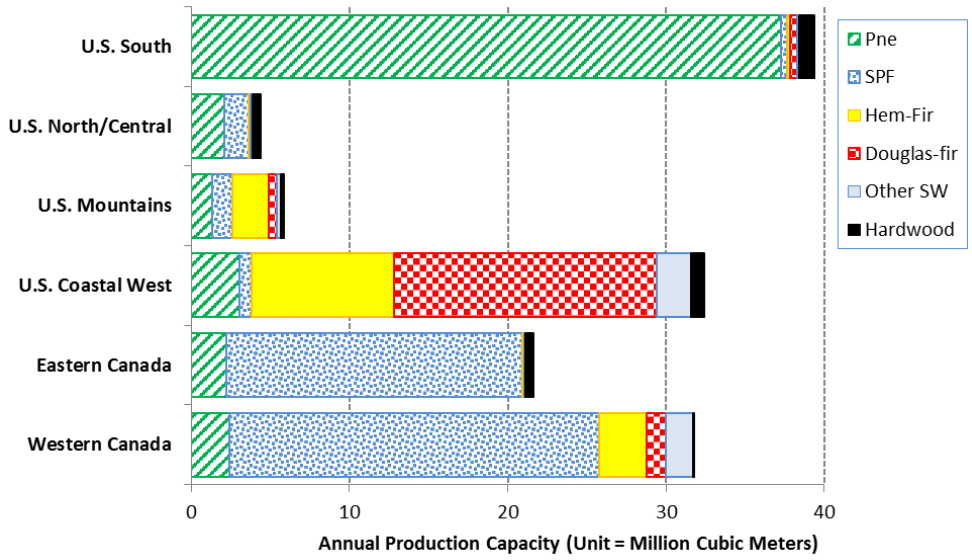

Figure 2-13. Annual production capacity of species by regions

Figure 2-14 shows the distribution of sawmills based on their estimated annual production capacity in 2010. As shown in this figure, North America has a small number of very large sawmills and many small sawmills, so the distribution of sawmills based on their annual lumber production capacity is highly skewed to the right. The overall mean annual production capacity was 187,300 m^3 in 2010, which is about 79.4 mmbf.

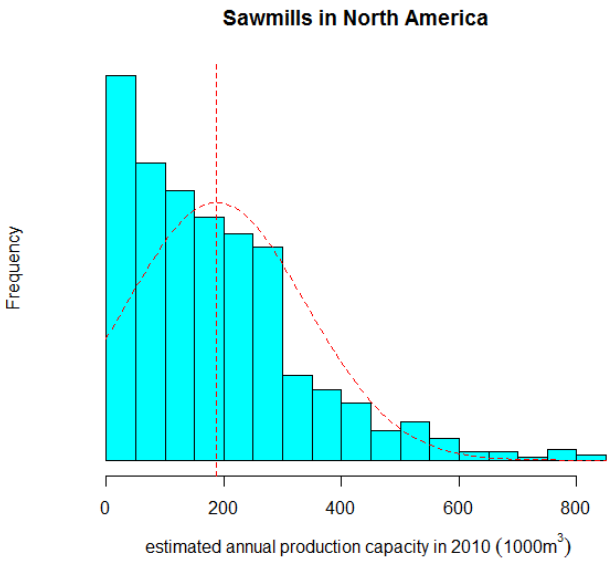

Figure 2-14. Histogram of estimated annual production per sawmill in North America

Note: The vertical break line shows the mean production capacity.

Regression analysis on production capacity

In order to empirically explore the trend of annual production capacity of individual sawmills, a regression analysis was applied. Since annual production capacity may increase proportionally, the log-transformed production volume is closer to a normal distribution, and it was chosen as the dependent variable. Several demographic characteristics of sawmills (e.g. geographical location of sawmills, the ratio of specialty species utilize, and species diversification index) were used as independent variables. Specialty sawmills target a smaller niche market, and they would be expected to produce less lumber than other softwood lumber sawmills.

After all variables are input to estimate the full model, stepwise model selection based on the Akaike Information Criterion (AIC) is applied to select the most parsimonious model. Because of the nature of heteroskedasticity, robust regression with an MM-estimator is used instead of the ordinary least squares method. Currently, the MM-estimation is a combination of high breakdown value estimation

and efficient estimation, which was introduced by Yohai (1987) and it is considered as the most commonly employed robust regression technique (Andersen 2007).

Table 2-2 summarizes the result of the robust regression analysis. If a sawmill firm has several locations, the production capacity of the sawmill is predicted to be significantly higher than an average firm. Western U.S. and the Western Canada had an almost similar estimated coefficient (1.02 and 1.00, respectively), followed by the Southern U.S. (0.74) and Eastern Canada (0.53). While species diversification did not affect the production capacity, specialization in cedar species was found to lower a sawmill's production capacity. Also, if a firm produced both hardwood and softwood lumber, it was predicted to have a smaller production capacity. On the other hand, specializing in redwood lumber in the Western coastal U.S. did not affect the production capacity of a firm.

Table 2-2. Results of robust regression with MM-estimator on annual production capacity of a firm

	Full Model				Parsimonious Model			
	P.E.	Std. Error	t-value		P.E.	Std. Error	t-value	
(Intercept)	10.71	0.13	79.8	***	10.91	0.08	144.6	***
Cedar%	-1.23	0.17	-7.17	***	-1.24	0.17	-7.26	***
HW%	-1.03	0.17	-5.88	***	-1.17	0.15	-8.00	***
RW% X West	0.11	0.47	0.24					
Species Div.	0.15	0.12	1.31					
Eastern Canada	0.53	0.12	4.43	***	0.46	0.10	4.64	***
Western Canada	1.00	0.12	8.06	***	0.90	0.10	8.71	***
US South	0.74	0.11	6.55	***	0.69	0.09	7.58	***
US West	1.02	0.12	8.21	***	0.90	0.10	9.03	***
US Mountains	0.25	0.15	1.66					
Subsidiary	0.77	0.06	12.8	***	0.79	0.06	13.2	***
AIC		1,887.4				1,887.1		

Note: (a) *** represents significant at the 1% level.

(b) P.E. represents point estimates and Std. Error represents standard error.

(c) "Species Div." is the species diversification index discussed previously. "Cedar%", "HW%", and "RW%" represent the percentages that a sawmill inputs cedar, hardwood species and redwood, respectively. Since all sawmills utilizing redwood are located in the Western coastal U.S., the interaction between the Western coastal U.S. and the ratio of redwood input was used. Location of a sawmill: assigned North/Central U.S. as a base, Western Canada, Eastern Canada, Western coastal U.S. (US West), Mountain U.S. (US Mountains), and Southern U.S. (US South) are used as dummy variables. Whether a sawmill was one of several sawmills owned by a firm or a single independent sawmill was used as a dummy variable, "subsidiary."

Firm analysis

Firms can own a single sawmill or multiple sawmills. Firms can acquire or sell sawmills based on their business strategy. The unit of analysis of this study is the firm, not the individual sawmill, because the interest of this study is the interaction between a firm's business strategy and their behavior. There were 459 firms operating softwood lumber sawmills in North America. In 2010, among them, 309 were U.S. firms, 149 were Canadian firms, and one was a Russian firm[8]. Four firms in the U.S. and six Canadian firms own sawmills in both Canada and the U.S.

Table 2-3. The top 20 sawmill firms in terms of production capacity in the U.S. and Canada

	North America Total			USA			Canada		
	Firm Name	Capacity (2010)	Mkt Share	Firm Name	Capacity (2010)	Mkt Share	Firm Name	Capacity	Mkt Share
1	Weyerhaeuser	10,383,000	7.67%	Weyerhaeuser	9,138,000	11.12%	Canfor	7,047,000	13.24%
2	Canfor	8,092,000	5.98%	Georgia Pacific	6,588,022	8.02%	West Fraser	5,026,000	9.44%
3	West Fraser	7,845,000	5.79%	Sierra Pacific	4,423,520	5.38%	Tolko	4,185,000	7.86%
4	Georgia-Pacific	6,588,022	4.86%	Hampton	3,390,000	4.13%	Resolute	3,250,000	6.10%
5	Sierra Pacific	4,423,520	3.27%	West Fraser (CAN)	2,819,000	3.43%	Tembec	2,491,584	4.68%
6	Tolko	4,185,000	3.09%	Simpson	2,343,000	2.85%	Western Forest Products	1,960,000	3.68%
7	Hampton Lumber	4,030,000	2.98%	RSG Forest Products	2,224,000	2.71%	EACOM	1,780,000	3.34%
8	Resolute	3,250,000	2.40%	Stimson Lumber	1,966,000	2.39%	J. D. Irving	1,567,000	2.94%
9	Tembec	2,491,584	1.84%	Temple-Inland	1,456,500	1.77%	Conifex	1,420,000	2.67%
10	Simpson Lumber	2,343,000	1.73%	Potlatch	1,310,000	1.59%	Weyerhaeuser (USA)	1,245,000	2.34%
11	RSG Forest Products	2,224,000	1.64%	Idaho Forest Group	1,298,000	1.58%	Kruger	1,215,000	2.28%
12	Stimson Lumber	1,966,000	1.45%	Gilman	1,281,480	1.56%	Carrier	1,120,000	2.10%
13	Western Forest Products	1,960,000	1.45%	D R. Johnson	1,225,900	1.49%	Sinclar	930,000	1.75%
14	EACOM Timber	1,780,000	1.31%	Canfor (CAN)	1,045,000	1.27%	Interfor	817,000	1.53%
15	J. D. Irving	1,687,000	1.25%	Anthony Timberlands	940,500	1.14%	Millar Western	790,000	1.48%
16	Conifex	1,475,000	1.09%	Hood Industries	918,500	1.12%	Le Groupe Cèdrico	681,000	1.28%
17	Temple-Inland	1,456,500	1.08%	Tolleson by ILIM (Russia)	900,000	1.10%	Barette-Chapais	660,000	1.24%
18	Interfor	1,320,000	0.97%	Rayonier	794,200	0.97%	Hampton (USA)	640,000	1.20%
19	Potlatch Corporation	1,310,000	0.97%	Yakama	770,000	0.94%	Great West Timber	550,000	1.03%
20	Idaho Forest Group	1,298,000	0.96%	Scotch Gulf Lumber	740,000	0.90%	Groupe Lebe	550,000	1.03%
	Total of Top 10	53,631,126	39.6%	Total of Top 10	35,658,042	43.4%	Total of Top 10	29,971,584	56.3%
	Total of Top 20	70,107,626	51.8%	Total of Top 20	45,571,622	55.5%	Total of Top 20	37,924,584	71.2%
	Total of Top 50	92,014,766	67.9%	Total of Top 50	59,532,682	72.4%	Total of Top 50	46,500,484	87.3%
	Total 459 firms	135,417,124	100%	Total 317 firms	82,175,550	100%	Total 154 firms	53,241,574	100%
	Herfindahl index	0.0223		Herfindahl index	0.0303		Herfindahl index	0.0467	

(Source: Big Book 2010, each firm's website)

Table 2-3 lists the top 20 softwood lumber manufacturers in terms of annual production capacity in North America in 2010. The largest firm was Weyerhaeuser with an estimated annual production

[8] The categorization is based on the location of the firm's headquarters.

capacity of about 10.4 million m^3. Two Canadian firms, Canfor Corporation and West Fraser Timber, followed with an estimated annual production capacity of 8.1 and 7.8 million m^3, respectively. Georgia-Pacific, Sierra Pacific Industries, Tolko Industries, Hampton Affiliates, Tembec, and Simpson Lumber followed. The top 10 firms represented 39.6 percent of the total production capacity, and the top 20 firms commanded a 51.8 percent share of production capacity for the total 459 firms.

In the U.S., the production capacity of top 10 firms and of top 20 firms were 43.4 and 55.5 percent for the total 317 U.S. firms, respectively. In Canada, the production capacity of top 10 firms and of top 20 firms were 56.3 and 71.2 percent for the total 154 Canadian firms. The Herfindahl-Hirschman Index in the U.S. was 0.030, whereas in Canada was 0.047. A higher Herfindahl index generally indicates a decrease in competition and an increase in market power, and vice versa. Consequently, the Canadian softwood sawmill industry appears to have more market power and less competition than in the U.S. and the softwood sawmill industry in Canada was more concentrated than in the U.S.

In North America, 392 out of 459 firms (85.4 percent) own a single sawmill, while the remaining 67 firms (14.6 percent) owned multiple sawmills (table 2-4). In contrast, four firms owned more than 20 sawmills, six firms owned between 10 and 19 sawmills, and ten firms owned between 6 and 9 sawmills. These firms are considered to be very large firms or “giants” in this industry.

Table 2-4. Frequency of the number of sawmills owned by a single firm in North America

Number of Sawmills Owned	Firms	Ratio
1	392	85.4%
2	25	5.4%
3	14	3.1%
4-5	8	1.7%
6-9	10	2.2%
10-19	6	1.3%
20+	4	0.9%

The relationship between the numbers of sawmills owned by a firm and the firm's total annual production capacity is shown in figure 2-15. Both the numbers of sawmills and production capacity are related to the size of the firm, and they usually grow proportionally, so the scale of axis on the figure is log-transformed. With some exceptions, especially when a firm owns fewer sawmills, the annual production capacity of a firm increases proportionally as the firm owns more sawmills.

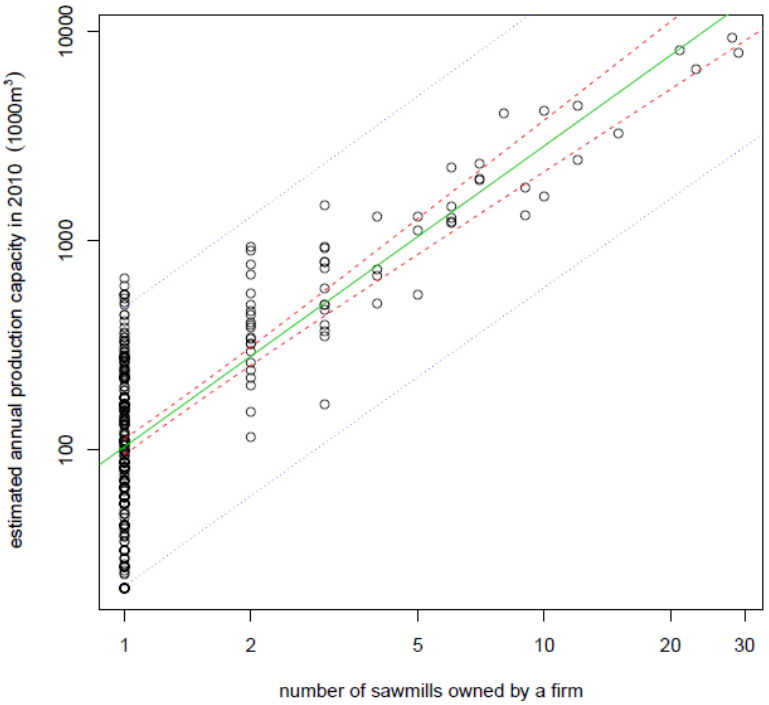

Figure 2-15. Firm's total annual production capacity compared the number of sawmills owned

Note: The green solid line shows the estimated regression line. The red break lines and the blue break lines show 95% confidence interval and 95% prediction interval, respectively.

3. Summary

Sawmills are distributed within distinct ecological zones of softwood species in North America. There are several softwood sawmill clusters in North America and each cluster utilizes a very different mix of species.

The demand for softwood lumber in the domestic market is largely determined by the number of housing starts in the U.S. When housing starts are booming, domestic demand for softwood lumber increases. On the other hand, when the housing sector in the U.S. is weak, the domestic demand for softwood lumber decreases. The current weak demand for lumber in the U.S. market has been offset by strong international demand, especially in Japan and China. There are numerous emerging markets that North American sawmills can target to potentially increase softwood lumber production in North America.

The number of sawmills in North America has been declining steadily. The softwood industry is saturated, and it is a mature industry. There were 772 sawmills owned by 459 firms in North America in 2010. The location of the sawmills, their species specialization, and whether or not the parent firm owns multiple sawmills influences the average production capacity of a sawmill in North America.

Chapter 3. Research Questions

1. Statement of the problem and purpose of the study

The current weak demand for lumber in the U.S. market can be offset by strong international demand. However, some sawmills in North America hesitate to export their products to international customers, even as other sawmills actively cultivate opportunities in offshore markets. Whether a firm exports or not depends on its business strategy. The types of business strategies that a firm can pursue are limited by their internal resources and capability. Any business strategy has both advantages and disadvantages. Softwood lumber firms' financial performance after the housing bubble burst is the result of their business strategy. It is not possible to understand the international business commitment of sawmill firms without addressing the heterogeneity of business strategies that sawmill firms pursue.

The first part of this dissertation empirically explores why some lumber firms export while others do not. The second part empirically explores the kinds of business strategies that have allowed firms to prosper during the housing crisis. According to the result of these empirical studies, a generalized business strategy of sawmill firms in North America will be proposed in the concluding chapter of this dissertation. The main interest of this study is the softwood lumber firm's strategic business position.

2. Research questions

There are two main parts to this dissertation: 1) the international business commitments of softwood sawmill firms and 2) the economic performance of sawmill firms after the housing crisis.

In the first part, I investigate the following two questions. 1) What factors drive softwood lumber firms in North America to enter international markets? and 2) What factors drive them to commit to a higher degree of international commitments? These are two sequential questions we use to address a firms' international business decisions.

In the second part, I investigate the following two questions. 1) What factors made softwood processing firms in North America prosper after the housing bubble burst? and 2) What characteristics determine the flexibility of sawmill firms? Flexibility is the key characteristic in determining a firm's economic performance when they face a contingency, such as a demand shock.

In order to answer these four questions, a questionnaire was designed and surveys were mailed to 396 softwood lumber SMEs located in the U.S. and Canada in 2011. A detailed hypothesis related to the survey is presented in chapter five.

3. Contributions of the study

As discussed later, empirical findings abound concerning export decisions in the forest products sector. Unfortunately, most studies don't have a strong theoretical foundation. Export decisions are a well-studied area in the international business field. However, even though export decisions are one strategic option for a firm, they are often studied separately from other business strategy problems. This dissertation investigates the role of export decisions as one of the strategic options of sawmill firms in North America with respect to the strategic management literature.

Furthermore, there are several different approaches that can explain the decision of SMEs to internationalize. By utilizing the case of softwood sawmills in North America, I bridge the classic internationalization process model with international entrepreneurial theory, which represents a significant theoretical and empirical contribution to the international business field. In addition, a hurdle model is applied to the data analysis, and counterfactual probabilities are calculated and shown graphically. By doing so, the complex findings can be more easily interpreted by both general audiences and policy makers.

Sawmill management is very complex, and firms are idiosyncratic in terms of their internal resources. It is necessary for forest products academicians to bring rigid and appropriate knowledge from other fields to help analyzing the mechanisms of such complex issues. The business strategy that each firm adopts is heterogeneous and each strategy has advantages and disadvantages, and the factors that may allow each firm to succeed vary depending on the situation. However, as is natural for human beings, it is tempting to introduce a simple explanation for solving complex issues. Similarly, sometimes scholars overemphasize a small component of a complex system to justify their beliefs. This study attempts to bring a standard view to sawmill management in North America and to their international business operations.

Chapter 4. Literature Review

To lay the theoretical foundation for this dissertation, this chapter will discuss two main issues; 1) internationalization theory and its application to sawmills and 2) business strategy and financial performance within softwood lumber industry.

1. Internationalization theory and its application to sawmills

Exporting by SMEs

In general, exporting is important for governments because it contributes to the economic development of nations and the creation of new jobs (Singer and Czinkota 1994). Since small and medium-sized enterprises (SMEs) play a major role in the economic development of most countries, the promotion of exports by SMEs has been an area of critical interest for policymakers (Diamantopoulos et al. 1993). The studies on exporting firms have been subjected to widespread empirical research (Dichtl et al. 1984).

The foreign entry process of SMEs and large firms should be very different because large firms tend to determine foreign entry strategies structurally (Reid 1981). Generally, large firms research foreign markets intensively, find opportunities to suit their operation portfolio, and choose the best foreign market entry mode based on their business strategy. On the other hand, it is clear that managers of SMEs have specific attitudes and expectations about engaging in foreign activity (Reid 1981). Miesenbock (1988) concludes that the single most important determinant of an SME's export strategy is the decision maker of the firm. Abdel-Malek (1974) defined managerial export-orientation as the extent to which management is willing, and feels able, to mobilize the necessary resources to initiate, maintain, or expand the firm's active involvement in export marketing. It concludes that export-orientation should be thought of as a priority to guide the process of export decision making of SMEs in Canada.

Leonidou and Kastikias (1996) comprehensively review of the literature on export strategy. They separate export barriers into two groups: external and internal barriers. Internal barriers are barriers associated with organizational resources/capabilities and the company is approach to an export business, such as information about foreign markets and the firm's marketing ability. External barriers are barriers stemming from the home and host environment within which the firm operates, such as cultural barriers, economic situations, and governmental regulations. Leonidou (2004) concludes that the informational barriers are consistently rated high by both exporters and non-exporters, stressing their critical impact on influencing export-managing decisions.

Empirical findings in the forest products field

Despite resource abundance, some firms are willing to export while others hesitate. The export orientation of wood product SMEs in North America has been a core area within the management literature in the forest products field, and there are many empirical studies.

In the U.S., many scholars conclude that international market knowledge, or at least the perception, of whether a firm has sufficient knowledge about international markets or not is one of the most important obstacles to whether a firm enters international markets. Ifju and Bush (1993) found that lack of knowledge of foreign markets is an impediment to hardwood products companies interested in exporting. Dickerson and Stevens (1998) found that experienced exporters among Michigan hardwood lumber producers rated themselves as having higher levels of knowledge concerning international business elements, although there were no significant differences in the respondents' levels of experience and training in international business activities. Among forest products exporters in Oregon, Gottko and McMahon (1989) found that neither exporters nor non-exporters were customer oriented to their export markets. Hammet and DeForest (1993) conclude that a lack of knowledge about international customers' desires is a greater obstacle to exporting than the inability to produce lumber

to their specifications. Hammett, Naka, and Parsons (2009) compared Appalachian hardwood exporters in 1989 and 2002. Even though some firms exported through intermediators in 1989, most of them had internalized those export functions in 2002 as they accumulated experiential knowledge.

Some scholars have compared export orientation of lumber producers between several countries. Rich (1981) wrote that U.S. mills have traditionally taken an opportunistic view of the export market as a place to get rid of excess production that the domestic market could not absorb during declines in housing demand. On the other hand, Canadian and Scandinavian firms think the export market has far greater importance than do American firms. Consequently, overseas customers have tended to view U.S. exporters as less dependable than other lumber-supply regions. For example, foreign customers in Japan perceive European lumber producers as being much more customer oriented than their American lumber counterparts (Sasatani et al. 2005).

Some researchers have applied a resource-based view (Wernerfelt 1984) to explain the export behavior and performance of forest products companies. This view focuses on how a sustained competitive advantage is generated by the idiosyncratic bundle of resources at the core of the firm, which are valuable, rare, imperfectly mobile or sticky, and non-substitutable (Barney 1991). Since these idiosyncratic resources are not directly observable, the majority of them are intangible (Itami and Roehl 1987). Ilinitch et al. (1994) conclude that not-directly-observable intangible resources play a key role in the export performance of forest products firms.

Although there are many empirical findings about exporting in a wide variety of sectors, it is very difficult to find a conventional theory about exporting. One reason for this challenge might be that export is just an extension of the business operations of a firm. Firms decide whether to export or how they would like to assign resources for international business based on their business strategies. In other

words, they cannot see the wood for the trees. There are many theoretical frameworks in international business to explain why and how firms expand their business operations internationally. Focusing on SMEs in the North American softwood lumber industry, this study attempts to empirically explore why and how such firms conduct international business. Understanding how a business strategy comes from the decision-making process of managers and affects the internationalization of a firm is one of the main objectives of this research.

Internationalization Theory

The international business activities of SMEs have been attracting researchers interested in internationalization, entrepreneurship, and small business growth (Andersson et al. 2004). Internationalization theory has been developed in the international business field in order to explain the international growth of individual firms. Many scholars have attempted to conduct interdisciplinary research in order to generalize the internationalization process of SMEs for over four decades, and consequently, the internationalization of firms is a relatively well-studied field (Nummela and Saarenketo 2010).

Many popular international trade theories are found in the field of economics, including theories on absolute advantage (Smith 1776), comparative advantage (Ricardo 1817), factor endowment (Heckscher 1919; Ohlin 1933), demand similarity (Linder 1961), product lifecycle (Vernon 1966; Wells 1968), and the role of increasing return to scale and network effects (Krugman 1979; Helpman 1981; Ethier 1982). These theories are especially useful in understanding the macro-economic conditions of international trade between several countries; however, they are only partially effective in explaining the individual export activities of firms (Bilkey 1978).

Some scholars have attempted to use the optimization theory to explain the foreign investment of individual firms. In this theory, an eclectic paradigm was developed to explain how firms choose the best entry mode of foreign investment based on transaction costs and factor costs as the main explanatory variables under perfect information in foreign markets (Buckley and Casson 1998; Dunning 1980; Dunning 1988; Dunning 2000). Transaction costs are affected by uncertainty, bounded rationality, and opportunities (Williamson 1981). An eclectic paradigm predicts that production will be established where advantages can be realized. Hence, an eclectic paradigm can predict the best normative method for entering an international market, but it fails to explain the decision-making process of individual firms since it assumes that managers of firms process perfect information.

Internationalization is an incremental decision-making process. Scholars from Scandinavia (e.g. Johanson and Wiedersheim-Paul 1975; Johanson and Vahlne 1977) and North America (Bilkey and Tesaer 1977; Cavusgil 1984; Reid 1981; Czinkota 1982) have attempted to generalize the internationalization of firms based on their learning processes.

The Uppsala internationalization model

In the 1970s, the economic theory of international business suggested that firms should choose their optimal mode for entering an international market by rationally analyzing the costs and risks of the market with respect to their own resources (Hood and Young 1979). Researchers at Uppsala University found that the internationalization of firms in Scandinavia did not necessarily follow the normative theory (Johanson and Vahlne 2009). Firms usually started internationalizing with *ad hoc* exporting. They first began exporting through external intermediaries and then replaced these agents with their own sales teams as their export sales grew (Vahlne and Wiedersheim-Paul 1973). Johanson and Wiedersheim-Paul (1975) developed an internalization stage model through the case observation of Swedish firms. Their international stage model proposed that there are four hypothetical sequential

stages that describe the process of international business involvement: 1) no regular export activity, 2) export via independent agencies, 3) establishing a foreign sales subsidiary, and 4) foreign production. They assumed that a firm would initially develop in the domestic market with internationalization being the consequence of a series of incremental decisions related to the psychic distance, a factor that makes managers' understanding of foreign markets difficult (Johanson and Vahlne 1990).

Psychic distance is a core concept of their internationalization model and it was later widely incorporated into many other export behavior models (e.g. Bilkey and Tesar 1977; Cavusgil 1984; Dichtl et al. 1985; Andersen 1993). Johanson and Vahlne (1977) defined psychic distance as the sum of factors preventing the flow of information to and from a market, such as differences in language, education, business practices, culture, and industrial developments. The concept of psychic distance has been qualitatively verified, but attempts to quantitatively measure psychic distance and test its relevance have been very limited with inconsistent results (Stöttinger and Schlegelmilch 1998). Despite this, many scholars have attempted to measure the psychic distance of a firm. Luostarinen (1980) measured psychic distance using three dimensions: economic development, language, and level of education. Kogut and Shingh (1988) measured psychic distance based on uncertainty avoidance and cultural distance. O'Grady and Lance (1996) used a job involvement scale and Hefstede's cultural score. Nordström (1991) empirically found the influence of psychic distance to the managerial decision of firms, but argues that as the world has become more homogeneous, the importance of psychic distance has decreased.

Using the knowledge-based theory of the growth of the firm (Penrose 1959), the behavioral theory of the firm (Cyert and March 1963), and the foreign investment decision process (Aharoni 1966), Johanson and Vahlne (1977) advanced the stage model and proposed the Uppsala internationalization model. In this model, once a firm enters a foreign country, it can learn market knowledge through its business

operation. As this knowledge accumulates, the firm can adjust their degree of foreign business commitment in order to strengthen their position in the foreign market. Since firms often experientially learn before they engage in a higher level of international business commitments, step-by-step patterns of foreign expansions are often observed. Also, firms usually expand their operations from nations closer to their home nation to nations that are more distant from their home nation.

Doing business in foreign countries results in higher costs arising from the unfamiliarity of the environment, cultural, political, and economic differences, among other factors (Hymer 1976), a concept is known as the liability of foreignness (Zaheer 1995). Some markets are much closer to the firm's domestic market than other markets. Empirically, in the 1970s, the internationalization process of a firm frequently began from markets that were similar to their own domestic market (Johanson and Wiedersheim-Paul 1975). Though the allocation of resources to foreign activities holds some risk, firms can acquire market-specific knowledge through ongoing operations. The accumulation of market-specific knowledge therefore reduces the risk of doing business in a foreign market and stimulate the allocation of additional resources to other foreign markets (Eriksson et al. 1997).

The innovation-related internationalization model

The innovation-related internationalization model proposed by scholars mainly from the University of Wisconsin has been widely accepted. The innovation-related internationalization model has developed through empirical observation of the export behavior of SMEs in North America. Similar to the Uppsala internationalization model, the innovation-related model also emphasizes the learning process of internationalization. However, the model considers internationalization as an innovation to a firm (Bilkey and Teaser 1977; Cavusgil 1980; Reid 1981).

Based on the research of Wisconsin manufacturing firms, Bilkey and Tesar (1977) concluded that a firm's export development process follows six consecutive stages: 1) management is not interested in exporting, 2) management is willing to fill unsolicited orders but makes no effort to explore the feasibility of exporting, 3) management actively explores the feasibility of active exporting, 4) the firm exports on an experimental basis to some psychologically close countries, 5) the firm is an experienced exporter to the initial country and adjusts exports optimally to changing exchange rates and tariffs, and 6) management explores the feasibility of exporting to additional countries that are psychologically further away. Cavusgil (1980) proposed a slightly different model with five consecutive stages where a firm is more interested and active during the early stage: 1) domestic marketing, 2) pre-export stage, 3) experimental involvement, 4) active involvement, and 5) committed involvement.

Transaction cost economics and international business

According to the internationalization model, indirect exports are followed by direct exports. Intermediators provide a critical function for firms that have not yet established their own direct export channels into international markets (Hulbert and Brandt 1980). The internationalization model does not theoretically explain the role of intermediators, but the strategic choice of whether or not a firm internalizes or externalizes export functions can be explained through transaction cost economics (Peng and Ilinitch 1998).

A transaction cost is the cost of participating in a marketplace as an institution, and organizations are regarded as a nexus of transactions or contracts (Coase 1937). Williamson (1985) advanced this theory and developed transaction cost economics (TCE) to explain the behavior of an organization. TCE relaxes the assumption of neo-classical economics that firms are assumed to be rational within their cognitive boundary, in the sense that their behavior is limitedly rational (Simon 1947) and opportunistic in the sense of "self-interest seeking with guile" (Williamson 1985). TCE characterizes transactions along three

dimensions: uncertainty, frequency, and asset specificity (Williamson 1979). Milgrom and Roberts (1992) further developed Williamson's theory and proposed five dimensions that influence transaction costs: specificity, frequency, complexity/uncertainty, difficulty in measuring performance, and connectedness. In the international business field, TCE is applied as an eclectic paradigm, which was developed to primarily explain how firms choose the best entry mode for foreign investment based on transaction and factor costs as its main explanatory variables (Buckley and Casson 1976; Dunning 1980; Dunning 1988; Hill, Hwang and Kim 1990).

Peng and Ilinitch (1998) focused on search, negotiation, monitoring, and enforcement as transaction costs that can alter the behavior of exporters. Market distance and product complexity are two important proxies to predict if firms will export directly or indirectly through intermediators. Peng et al. (2006) proposed two propositions: 1) "the more distant and unfamiliar the markets are, the more likely that export intermediaries will be selected by manufacturers," and 2) "the higher the commodity content of the products, the more likely that export intermediaries will be selected by manufacturers." However, Peng et al. (2006) do not explicitly explain if distance means the physical distance or psychological distance, although it is more natural to consider that they implied psychological distance rather than physical distance. When the firm targets unfamiliar markets where the psychological distance is greater, search costs and negotiation costs rise. Hence, firms are better off using intermediators who specialize in these markets rather than to export on their own since the transaction costs of the former are cheaper than the latter. When the firm sells complex and diversified products rather than a simple commodity, monitoring and enforcement costs rise. Complex products generate higher transaction costs, such as specialized sales force training and post-sales services. Hence, if a firm sells a complex product, it can be better off internalizing the sales functions rather than utilizing intermediators (Williamson 1985).

International entrepreneurship

The theory of internationalization has been criticized heavily in the international business literature (e.g. Andersen 1993; Dunning 1980; Oviatt and McDougall 1997). In spite of the accumulation of many theoretical and empirical studies, scholars have not yet been able to agree upon a common view of the internationalization process (Nummela and Saarenketo 2010). Although there are many empirical studies on individual internationalization and export behavior, little integration of these empirical works in relation to export development have been attempted, so the field of export behavior is still immature and in need of a stronger structural, conceptual, and methodological framework (Leonidou and Katsikeas 1996).

The following are some criticisms of internationalization studies. Reid (1984) questioned the assumptions of incremental step-by-step internationalization and criticized the internationalization model for being too deterministic. Also, the internationalization process model stresses only the early stages of internationalization (Melin 1992). The internationalization model is too general and it does not consider both internal and external specific factors (Andersen 1993). Vahlne and Nördstrom (1992) stated that psychic distance has become less important as the world has become more homogeneous, and Johanson and Vahlne (1990) have accepted this criticism. The business environment of a highly integrated globalized world in the twenty-first century is very different from that in the 1970s when researchers first developed the internationalization model.

McDougall et al. (1994) empirically observed firms who not only skipped stages of the internationalization process but go into international markets from their inception. The firms that not only skipped stages of internationalization but have targeted international markets from their inception are variously referred to as Born Global firms (Knight and Cavusgil 1996), International New Ventures (McDougall et al. 1994), Global-Start-ups (Oviatt and McDougall 1994), and Instant Exporters (McAuley

1999). Some firms contend that there is an option for strategic choice when it comes to selecting national markets and modes of entry. This has been discussed within the emerging body of international entrepreneurship literature, where firms can go to global markets shortly after their inception. The firms in these studies did not slowly and incrementally accumulate knowledge before going to international markets, which appears to contradict the classical internationalization models. Global new trends, such as the increasing role of niche markets all around the world and advances in process technology and communication technology, allow some small firms to gain an inherent advantage (Knight and Cavusgil 1996). These studies are still based on an internationalization process model and focus on SMEs but are they applied to the globalized world.

The most significant contribution of these studies is that they combine entrepreneurship studies and international business studies. Since the single largest deterministic factor of SME management is decisions by managers, incorporating entrepreneurship studies would allow one to better understand the internationalization of SMEs. The international entrepreneurship (IE) literature has been shown to enhance the understanding of the early stages of a firm's internationalization (Andersson 2004). When Oviatt and McDougall (1997) first discussed Born Global firms, IE was initially meant to explain the international business expansion of new ventures in their early life cycles; however, many researchers have expanded the IE domain in order to include the international activities of firms apart from Born Global firms (Zahra 2005).

Entrepreneur in Austrian economics

An entrepreneur, in the Austrian Economics view, is an individual who perceives and pursues economic opportunities in the face of uncertainty (e.g. Kirzner 1973; Schumpeter 1942). Kirzner (1973) describes alertness as the fundamental quality of the entrepreneur. Alertness is the entrepreneur's ability to perceive new opportunities that no prior economic actor has yet recognized. These entrepreneurs, who

are seeking their own profits, are essential to identifying mistakes in the structure of prices and remedying the sheer ignorance and error exhibited by some economic actors. Their profits derive from their services in detecting and eliminating arbitrage opportunities, thereby allowing supply and demand for a given good to meet. If you accept this Austrian Economics view of entrepreneurship, IE would include entrepreneurs who are alert and seek arbitrage opportunities offshore, which include a mixture of innovative, proactive, and risk-seeking behaviors across borders. Zahra and Schulte (1994) defined IE as a process by which the firm would discover and exploit opportunities in the international marketplace.

Diversification and international business

Without mentioning Chandler's (1962) classic work, the most fundamental question in the strategy research of firms relates to determining the scope of the firm. Yet, academics need more inputs to achieve a better understanding of the scope of a firm (Peng and Delios 2006). There are two different kinds of questions to help determining the scope of a firm: 1) product scope and 2) geographic scope of the firm. Even though both diversification strategies have many similarities, they are usually studied in different fields. Product diversification is usually studied under the strategic management field, while geographic diversification is usually studied under the international business field. There are two basic questions concerning the scope of the firm: 1) why firms diversify, and 2) what the sequence of the diversification process. It is natural to assume that firms implement diversification strategies because the diversification strategy benefits the firm. Therefore, it is very important to view the scope of the firm from an economic framework.

Although many firms have pursued a diversification strategy, diversification is not a guaranteed route to success for a firm because many empirical studies have found that firm performance and the degree of diversification are not positively correlated (Montgomery 1994). How firms pursue a diversification

strategy in a highly globalized market have been extensively discussed in the business literature. Before the dissolution of the Soviet Union, some radical scholars believed that multi-national corporations (MNCs) with a standardization strategy rather than a localization strategy could survive better in a globalized world. Globalization forces converged consumer needs and preferences, and therefore to be competitive, marketing should be standardized to lower costs and gain a competitive position in the global market (Levitt 1983). Standardization that targets one big global market allows a corporation to achieve economy of scale, which allows them to offer a competitive low price. However, Kotler (1986), and Douglas and Wind (1987) have criticized this extremely simplified view and emphasized the importance of differentiation through the marketing mix as a more effective strategy to successfully earn profits while reducing business risk. The ongoing process of globalization does not form a single homogenized market as some scholars had expected, rather, successful MNCs have to adapt their products for local markets.

Table 4-1. Four Generic International Strategies

	Global Strategy	Country-centered Strategy
Many Segments	Global Cost Leadership or Differentiation	Protected Markets
Few Segment	Global Segmentation	National Responsiveness

(Source: Porter 1986)

Porter (1980) argued that there are two generic strategies that a firm can use to target a broad market: cost-leadership and differentiation. However, most companies find themselves stuck in the middle between low-cost and differentiation and thereby lose their competitiveness. Porter (1986) advanced his framework for global competition, which assumes that international strategy is primarily an issue of geographic scope. Porter (1986) defined a global industry as one in which a firm's competitive position in one country is significantly affected by its competitive position in other countries. Table 4-1 shows Porter's (1986) the four dimensions of Porter's international generic strategy in global competition:

global cost leadership or differentiation, global segmentation, protected markets, and national responsiveness.

Value-added products are the opposite of commodity products and include remanufactured lumber, furniture, flooring, and millwork (Wilson et al. 2001; Kozak 2002; Kozak et al. 2004; DeLong et al. 2007). Commodity wood products, such as dimension lumber, offer little or no perceived differences between competitive offerings besides price. On the other hand, value-added products are usually differentiated by consumers in the marketplace in terms of their attributes besides price. Juslin and Hansen (2003) categorized forest products firms into three production categories: commodity, specialty, and custom-made. Firms manufacturing different categories of products will apply different corporate strategies. Generally, producers of commodities are driven to compete on low price and high volume.

The price of undifferentiated commodity products, such as 2X4 SPF lumber, is determined by the marketplace. If a firm can reduce the cost of production more than its competitors, it can enjoy increased profits. Some firms in North America attempted to pursue economies of scale and thereby have successfully reduced their unit production costs. There are certainly many offshore markets for a standardized commodity. Many customers in offshore markets are happy to purchase low priced lumber and firms that pursue a cost-leadership strategy can target these offshore markets. On the other hand, some offshore markets require that products conform to a localized standard that is not the same as the North American standard. For example, the Japanese post and beam housing sector requires metric sized lumber, so North American lumber manufacturers need to mill lumber to metric dimensions in order to target this lucrative offshore market (Eastin et al. 2003; Sasatani et al. 2005). If firms are to successfully target these international niche markets, they need to apply a well-designed differentiation strategy.

2. Business strategy and financial performance within softwood lumber industry

In forest products literature, the "innovativeness" of a firm is believed to be key to financial performance, and many scholars have reported a positive relationship between performance and innovativeness. This innovativeness hypothesis has become very popular in terms of the number of published papers in the forest products field (e.g. Hovgaard and Hansen 2004; Crespell et al. 2006; Crespell and Hansen 2008a; Knowles et al. 2008; Nybakk and Hansen 2008; Nybakk et al. 2009, Quesada-Pineda 2010). Innovativeness is defined as a firm's ability to innovate (Hansen et al. 2007). Knowles et al. (2008) defines innovativeness as a firm's propensity to adopt and/or create new products, new processes, or a new business system. Many researchers in the forest products field cite these definitions and conclude that innovativeness is a key driver of a firm's performance.

Resource-based view

Since innovativeness is a capability, the resource-based view (RBV) posits that branches of a firm (e.g. Penrose 1959; Wernerfelt 1984; Barney 1991; Conner 1991) are the backbone of the innovativeness hypothesis either explicitly or implicitly. The RBV has become one of the most influential and highly cited perspectives in the strategic management field (Acedo et al. 2006), and it has been utilized as a tool to analyze managerial issues of the forest products field as well (Lahtinen 2007). The RBV assumes that a firm's sustainable competitive advantage comes from their bundle of idiosyncratic resources being rare, valuable, inimitable, non-tradable, and non-substitutable (Barney 2001a). This proposition is also at the core of other RBV-related branches of research such as core competencies theory (Prahalad and Hamel 1993), the knowledge-based view (Grant 1996), and the dynamic capabilities view (Teece and Pisano 1994; Teece et al. 1997; Helfat and Peteraf 2003). The RBV of a firm explains its ability to develop a sustainable competitive advantage when resources are managed such that their outcomes

cannot be imitated by competitors, which ultimately creates a competitive barrier (Mahoney and Pandian 1992). Resources are defined as those tangible or intangible assets (Itami and Roehl 1987) that are tied to the firm (Maijoor and Witteloostuijn 1998). Examples of such resources include: brand names, in-house knowledge of technology, skilled personnel, trade contracts, efficient procedures, and so forth (Wernerfelt 1984). According to the RBV, rent is generated by the idiosyncratic characteristics of a firm, and competitors cannot imitate that superior bundle of resources; hence the firm can sustain a competitive edge near over the long-term. Innovativeness would be an example of an idiosyncratic resource or capability of a firm that would enable them to sustain their competitive edge in the forest products industry.

RBV vs. SCP: Can RBV really explain a firm's competitiveness?

There are two rival explanations of firm performance in the business strategy field, the Structural-Conduct-Performance (SCP) paradigm of the industrial-organization economics and the resource-based view (RBV) (Spanos and Lioukas 2001). According to the SCP, the structure of an industry influences the conduct of its constituent firms, which in turn influences the firms' performance (Bain 1951). Porter (1980) argues that conditions within an industry, to a large extent, determine firm strategy and performance. A strategic (or conduct) consists of firms within an industry that have similar characteristics and was classified as a "strategic group" by Hunt (1972). A strategic group consists of firms with similar competitive approaches and positions in the market and firms in the same strategic group can resemble one another. For example, firms may share similar marketing methods, production technologies, economies of scale, product differentiation, high capital requirements, cost advantages, and proprietary knowledge within the same strategic group (Porter 1979). Mobility barriers are structural factors within an industry that protect successful firms within a strategic group from invasion by adjacent competitors (Caves and Porter 1977). A firm will have higher profits if it is located in a group with the best combination of high mobility barriers, insulation from intergroup rivalry and substitute

products, strong bargaining power with adjacent industries, a limited number of members, and suitability to the firm's execution ability (Porter 1979).

In contrast, as discussed above, the resource-based view (RBV) defines the firm in terms of its property-based and knowledge-based resources (Penrose 1959; Wernerfelt 1984; Barney 1991). Firms are idiosyncratic bundles of resources (Conner 1991) and capabilities (Amit and Schoemaker 1993), and heterogeneity in the resources and capabilities explains the variations in firm performance (Hamel and Prahalad 1994; Makadok 2001). Some firms may have a dynamic capability that the firm can integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al. 1997), though it is not possible to empirically prove since it is an ex-post argument.

In RBV, a firm can be profitable in a highly competitive market as long as it can exploit advantageous valuable, rare, inimitable, and non-substitutable resources (Barney 1991) that should be virtually unknown to other players (and also to researchers). However, in SCP, a firm's performance is relative intra-industry, so the performance of the firm is not an absolute term but a relative term. This implies that a firm's performance may change as market structure changes. While Porter's (1980) generic strategy mentioned often in this dissertation, this idea is based on the assumption of SCP, and it does not recognize the idiosyncrasy of firms in terms of the source of profit generation. Competitive advantage of SCP paradigm is defined as a "position" of superior performance that a firm achieves through offering products at lower prices than other competitors, or by offering differentiated products for which customers are willing to pay higher price.

Innovation: exploitation or exploration

Because of the lack of a standard definition it is difficult to measure innovation and innovativeness directly (Välimäki et al. 2004). The definition of innovativeness is comprised of two completely different

capabilities (or propensities). The capability of Schumpeterian innovation in the economics field and the capability to adopt Roger's innovation of diffusion field are different. Both Schumpeterian innovation and Roger's adoption of innovations could theoretically generate supranormal rents, but these rents come from completely different sources, and it does not make sense to combine these two capabilities together.

"Innovation" is a widely and over-used buzz word in business today. In reviewing the innovativeness studies in the forest products field, it appears that researchers often skip the definition of innovation and ignore the explanations behind the economic theory of innovation. Innovativeness is the first derivative of innovation (i.e. the ability to create innovations), so it is critically important to define innovation and understand how it delivers profitability for the firm within an economic context. There are many types of innovations, and Ganguly (2008) reviewed the classification of innovation along the diffusion study framework. From a macroeconomic perspective, technological advancements increase long-term economic growth (Solow 1956; Howitt and Aghion 1998). That is why innovation is an important concept in the field of economics.

From the micro perspective, innovation can bring benefit not only to entrepreneurs but also to imitators. Korhonen (2006) defines two types of economic growth drivers, exploitation and exploration, based on the rent generation mechanism. Exploration is the search for new knowledge, use of unfamiliar technologies, and creation of products with an unknown demand (March 1991). Because these activities do not reliably and quickly generate revenue, exploration has uncertain and distant benefits. Schumpeterian innovation is one of the best examples of exploration. On the other hand, exploitation is the use and refinement of existing knowledge, technologies, and products, and has more certain and proximate benefits (March 1991). Hence, imitation is the exploitation of industrial rent. This section is based on this view and will apply an Austrian perspective of economics to define innovation as

a profit generation mechanism and will divide “innovation” into two different concepts: Schumpeterian innovation and imitation.

Let’s consider a Schumpeterian innovation first. In the Austrian economics view, entrepreneurship is very important for economic growth. An entrepreneur is a person who is willing and able to convert a new idea or invention into a successful innovation. Entrepreneurship encourages “creative destruction” across markets and industries, simultaneously creating new products and a new business system (Schumpeter 1942). In other words, the entrepreneur disrupts the market and moves it away from its previous equilibrium. When new innovations are completed and new products enter the market, or when a new business process is developed, the Schumpeterian innovator, or entrepreneur, outcompetes other firms to earn supranormal economic profits. In this context, Schumpeterian innovation is defined as the successful commercialization of a new invention (product, business process, or organizational techniques) that imposes disequilibrium of the market. Incremental innovations and radical innovations are often differentiated in the literature, but when these innovations are new in the industry, it is the Schumpeterian innovation to explore the new market. Schumpeterian innovation is exploration. Schumpeterian innovation cannot be observed until it is adopted by the market and is commercially successful. Therefore, studies of Schumpeterian innovation often become *post hoc* arguments. Firms usually need to invest to innovate, but they are not sure if they can successfully commercialize and gain profits or if they will fail and lose their investment. Investment in Schumpeterian innovation is a real option; and they either succeed or fail. This suggests that profitability and introducing Schumpeterian innovation cannot be linearly correlated.

Once a firm successfully innovates, however, the supranormal profit is short lived because of imitators. Once competitors identify the source of profit, they start adopting the innovation. As innovations are imitated, economic profits dissipate and finally disappear. These imitators are exploiting the high profits.

It is important to note that a diffusion of innovation study generally uses the word "innovation" as a completely different terminology compared to Austrian Economics. According to Rogers (1983), innovation is an idea, practice, or object that is perceived to be new by an individual or other unit of adoption. From this perspective, "imitation" of Austrian Economics is treated as an innovation of Rogers'. Thus, the source of rent from Austrian innovation and Rogers's innovation are very different. Rogers's innovation does not necessarily limit the innovations to commercially successful events. Innovativeness in Rogers's context refers to individuals or organizations that adopt new ideas or practices. Hence, there is no theoretical causation that innovativeness in Rogers's context increases the firm's performance. However, it is possible that profitable firms may adopt new ideas, fixed investments, or business practices more often than unprofitable firms because they have more money to spend. If so, empirical research may pick up the correlation between these *post hoc* imitations and performance as a spurious relationship.

Possibility that radical changes destroy a firm

Adopting new technologies or business practices are critical normative tasks for managers. Unfortunately, it is not necessarily a panacea for all firms in terms of increasing profitability. Adopting a new technology or idea always generate direct or opportunity costs. Needless to say, only firms that gain more than they invest can succeed financially. Furthermore, perhaps the most underrated issue in the forest management literature is the importance of organizational routine and inertia. Organizational inertia is both positive and negative for the survival and performance of firms. According to the ecological theory of organizational change (Hannan and Freeman 1977; Hannan and Freeman 1984), structural inertia is internalized to firms as sunk costs in plant, equipment, human resources, power structure, and decision-making processes. Attempting radical structural change often threatens legitimacy, and could result in managerial failure. Furthermore, resource-dependence theories emphasize that structural changes may mitigate environmental uncertainty (Pfeffer and Salancik 1978).

Firms can either adapt to the environment or remain inert, good or bad. The environment would be predictable but not directly controllable for firms, and it strains firms through a sieve. If selection favors reliable and productive, organizations with high levels of inertia can succeed. On the other hand, if selection favors changes, flexible firms may succeed. These environmental changes will select firms, and firms will routinize their business operations according to their learning experiences.

Flexibility and inertia

Since Max Weber (1946), organization theory has argued that efficiency requires bureaucracy. The bureaucratic inertia of an organization maintains high levels of standardization to maximize efficiency. With respect to organizational tasks, bureaucratic inertia is beneficial for routine tasks that are characterized by repetition, but is assumed to be harmful for non-routinized tasks such as innovation (Adler et al. 1999). Hence, in a dualistic way, bureaucratic inertia impedes flexibility, so organizations need to balance the trade-off between efficiency and flexibility (Ford and Gioia 2000). When the organizational structure of a firm is inert, change will be difficult to implement, which could be good or bad. Conversely, when a firm is flexible, change will be accomplished relatively easily.

However, institutions that firms cannot control always change, so firms sometimes need to adjust to these environmental changes to survive or to perform well. However, in reality, some organizations cannot adjust to changing external environments because organizational inertia act as an impediment to change (Hannan and Freeman 1977; Hannan and Freeman 1984; Utterback 1994; Tushman and O'Reilly 1996; Tripsas and Gavetti 2000). The failure of firms to change may result in difficulties with operations.

Historically, the most common competitive strategy in the forest products industry has been a low-cost strategy through process efficiency (Rich 1981; Bush and Sinclare 1991). Cohen and Sinclair (1992) found that companies who pursue the adoption of process technologies were able to generate supranormal

financial performance. Their operations were highly routinized to achieve efficiency. To maximize efficiency and to minimize the conflict of organizational activities, firms use rigid routines to achieve their work processes (March and Simon 1958; Cyert and March 1963; Nelson and Winter 1982).

Frazelle (1986) claims flexibility is critically important in order to gain competitiveness. Flexibility has been discussed in response to the external environment. For example, Gupta and Goyal (1989) defined manufacturing flexibility as "the ability of a manufacturing system to cope with changing circumstances or instability caused by the environment." In a drastically changing environment, flexible manufacturers can respond quickly to adjust to a changing environment (Upton 1995; Skinner 1996). The main sources of change in the environment are the market, competitors, technology, and regulatory agencies (Duncan 1972). In reality, flexible firms are heterogeneous. Many researchers have proposed classifications of manufacturing flexibility using multi-dimensional factors (e.g. Sethi and Sethi 1990; Koste and Malhotra 1999; D'Souza and Williams 2000). Recently, manufacturing flexibility has been defined to reflect the ability of firms to respond not only to changes in their customers' needs but also to contingencies arising from competitive pressures (Vokurka and O'Leary-Kelly 2000). This paper will attempt to measure the flexibility of response to changes in customers' needs as differentiation orientation. Hence, flexibility in this study focuses solely on the flexibility to respond to changes in external factors. Flexibility refers to the firm's ability to change and adjust when external factors change.

Inflexible firms attempt to minimize unnecessary distractions so they can focus on their rigidly structured routines. Outsiders may describe these inertial firms as very conservative since they cannot quickly adjust their business practices in response to changes in the external environment. On the other hand, flexible firms apply flexible routines. These firms allow their employees to have a wider scope in decision-making, and they are able to find serendipities and to be aware of environmental uncertainties more than the inflexible firm. However, flexible firms need to bear additional costs in order to search for

external opportunities relative to the efficient but inflexible firm. Maintaining flexibility is not a free lunch for firms (Jack and Raturi 2003).

Chapter 5. Development of Hypotheses

There are two main parts to this dissertation: 1) the international business commitments of softwood sawmill firms and 2) the economic performance of sawmill firms after the housing crisis.

1. Hypothesis to explain export behaviors of sawmill firms

The research question in the first part is what factors drive softwood lumber firms in North America to enter international markets and to commit to a higher degree of international commitments. In order to explore the question further, the following hypotheses are developed based on the literature reviewed in chapter four. The hypotheses were tested in chapter eight.

Firm age

According to the traditional internationalization process model (Johanson and Vahlne 1977), firms learn experientially as they penetrate foreign markets, accumulating knowledge that allows them to reduce business risk as they move into higher levels of international commitment. In other words, firms gradually increase international commitments and they may have to develop their competitiveness in new markets for some years to overcome the liability of newness (Stinchombe 1965).

As globalization progresses, Oviatt and McDougall (1994) challenge the traditional internationalization model. They investigated factors that lead to the early internationalization of younger firms, how these new international ventures created and protected their competitive advantages, and how they configured their value chain to attain flexibility while building strong and profitable competitive positions. Oviatt and McDougall (1994) imply that there is a learning advantage for new firms, so that these ventures can perform better than established competitors.

Focusing on age has been a weakness in the evolving literature on international new ventures (Zahra 2005). The internationalization process model does not explicitly mention that the number of years in business relates to the international business commitments since learning capability and speed of learning would vary by firms. Also, "international new ventures" can explain those firms that committed to international business in the early lifecycles of their firms, but it does not explain why some firms go international. Thus, a firm's international commitment might be expected to be independent of the number of years that it has begun in.

H1: The international business commitment of a firm is dependent on the age of the firm.

Firm size

Firm size could reflect a firm's resources and influence the export decision of the firm. In empirical studies, with a few exceptions, most researchers have agreed that larger firms are more frequently engaged in exporting than smaller firms. The method for measuring a firm size varies, but popular measurements include the number of employees, total company sales, and value of company assets. From international business to economics literature, researchers have reported that firm size positively influences the likelihood of exporting (Cavusgil et al. 1979; Cavusgil and Nevin 1981; Dichtl et al. 1990; Bernard and Jensen 1999). However, some empirical studies have found that smaller firms are more likely to export (Bilkey and Tesar 1977) or that firm size and export behavior are independent (Cavusgil 1984; Moen 1999).

In the forest product marketing literature, scholars also report that firm size increases the likelihood of export participation. Ifju and Bush (1993) found that non-exporting companies who expressed no interest in becoming exporters perceived themselves as being too small to export and were focused on selling into the domestic market. It is likely that many small sawmills view international business as a

risky investment for allocating their limited resources. Naka, Parsons, and Hammett (2009) investigated hardwood lumber manufacturers and concluded that firm size was the most important factor in determining their likelihood to export.

On the other hand, firm size and export intensity have a mixed relationship. Miesenbock (1988) reviewed 200 studies and concluded that overall there was a positive relationship between firm size and export intensity. On the other hand, Gemünden (1991) conducted a meta-analysis of the export literature and concluded there was only a weak association between firm size and export intensity. This trend is the same in forest products studies. Ringe et al. (1987) found that firm size was not a significant factor in successful foreign trade among Kentucky hardwood lumber producers. Eastin et al. (2004) found that medium-sized U.S. exporters that targeted Japanese markets were more likely to perform well than were larger or smaller competitors during the economic recession in Japan.

H2a: Larger firms are more likely to export than smaller firms.

H2b: Firm size does not relate to levels of international business commitment.

Product differentiation strategy

From the social control view, a firm that creates fewer products is more dependent on its customers than a firm that has multiple products that are being sold into a variety of markets (Pfeffer and Salancik 1978). Hence, product diversification and market diversification should have a positive correlation, and it is expected that the same relationship will be observed between product diversification and international market diversification.

As the marketplace has become globalized, each country has different legal and cultural frameworks, and consumers prefer different products. If firms would like to successfully exploit lucrative

international markets, they need to understand the different needs between their home customers and international customers in specific target markets. Eastin et al. (2004) found that the product mix of the more successful U.S. exporters targeting Japan had a higher portion of value-added products which allowed them to compete in niche markets where the price competition was less intense. Japanese importers expect not only competitive prices but also higher product quality, a different product mix, and better customer service (Eastin et al. 2003).

These empirical findings can be supported by transaction cost economics (TCE) (Williamson 1979). Based on TCE, Peng and Ilinitch (1998) proposed that the higher the commodity content of products, the more likely that export intermediaries would be selected by manufacturers. This proposition was empirically supported by Trabold (2002) and Peng et al. (2006). When the firm sells complex and diversified products rather than a simple commodity, monitoring and enforcement costs rise. Complex products require higher transaction costs, such as specialized sales force training and post-sales services, than do commodity products. Hence, if firms sell complex products, they are often better off internalizing the sales function rather than utilizing intermediators (Williamson 1985). Therefore, firms selling commodities are more likely to use intermediators, while firms selling value-added, diversified products are more likely to directly export by themselves.

H3a: A firm that applies a differentiation strategy is more likely to enter international markets than a firm that has not applied a differentiation strategy.

H3b: A firm that applies a differentiation strategy is more likely to commit to a higher degree of international business than a firm that has not applied a differentiation strategy.

2. Hypothesis to explain business strategy and financial performance of firms within softwood lumber industry

There are two research questions in the second part: 1) What factors made softwood processing firms in North America prosper after the housing bubble burst? and 2) What characteristics determine the flexibility of sawmill firms? In order to explore those two questions, following hypotheses are developed based on the literature discussed in chapter four. The hypotheses were tested in chapter nine.

Autocorrelation

Many previous studies in the forest products field have attempted to predict a firm's profitability by analyzing cross-sectional data. Cross-sectional studies suffer from an inability to determine the true causal relationship between factors and performance/profitability. Most previous studies that utilized a cross-sectional approach have claimed to find factors that influenced the firm's profitability. These studies imply that if the factor is a time-invariant consistent variable such as organizational culture, firms can sustain performance no matter when you conduct a study. If so, past profitability/performance is the best single predictor of today's profitability/performance. However, many studies include a caveat stating that a cross-sectional study cannot prove a causal relationship and that a longitudinal study is needed.

Many argue that firms' idiosyncratic resources cannot sustain a competitive advantage as the RBV predicts, but it may at least create a competitive edge that disappears over time. It is believed in economics that in a competitive environment, profitability is mean reverting (Fama and French 2000). Even though the effect of idiosyncratic time-invariant factors, such as corporate culture, scarce resources, and managerial capability positively influence a firm's performance (Itami and Roehl 1987), competitors will imitate these success patterns, so the competitive advantage will therefore dissipate

over time. Hence, these result in a weak competitive position rather than a sustainable competitive position.

In any case, a serial correlation is observed in the time-series data on profitability. In order to predict the profitability, the serial correlation is one of the most widely used specifications to control for unobservable effects (Jacobson 1992). For any econometrics time series analysis, a serial correlation is included in the model. Hence, today's profitability can be explained by past profitability. Otherwise, the market is controlled by contingency events, and "luck" would determine the firms' performance.

H4: A firm's current performance can be explained by its past performance.

Flexibility

The housing market in the U.S. crashed around 2007, and the North American lumber demand shrank dramatically. That was a contingency event for most sawmills. If the firm was flexible, it modified its routines and adopted operational changes based on the new demand condition. In contrasts, inflexible firms were under or unwilling to change their business operations because rigid operational inertia impeded them from changing. Hence, a firm's flexibility can be estimated by how many operational changes the firms made after the housing crash in the U.S.

If a firm is highly routinized and inflexible, managerial inertia impedes change. When economic conditions are good, inflexible firms can concentrate on their operations without any destruction, so they may perform better. However, when inflexible firms face a contingency like the demand shock caused by the housing crisis, they may not be able to adjust operations quickly enough, so they might not perform well. However, flexible manufacturers can respond quickly to adjust to a changing environment (Upton 1995; Skinner 1996; Beach et al. 2000), so they should perform better than inflexible firms after a contingency.

H5: Firms that are flexible performed better than firms that were inflexible after the housing crisis.

Time invariant flexibility characteristics as a firm's routine

Most decisions of firms are made in a habitual manner, or as part of a routine, because their rationality is bounded (Simon 1957). Routines are used to explain the inertial quality of organizational structure in evolutionary theories (Nelson and Winter 1982). Change and adaptation are paradoxical for firms since routines emphasize the stability of the system (Feldman and Rafaeli 2002). Organizational routines can adapt or mutate (Nelson and Winter 1982; Cohen et al. 1996). In the evolutionary theory of economics, routine is metaphorically comparable to a gene in a firm. Reflection of general routines and modified strategic orientations comes as a result of deliberate problem-solving efforts and random events (Nelson and Winter 1982).

Many theories consider that organizational routines to be a critical part of organizational flexibility and change (Adler et al. 1999). Organizational routines play a large role both in intrinsic stability and in intrinsic adaptability to change (Feldman and Pentland 2000; Narduzzo et al. 2000). If changes made in response to an external threat succeed, the firm learns and repeats the same kind of change repeatedly in the future (Amburgey et al. 1993; Larsen and Lomi 2002). Thus, the change process may become routinized for the firm. Consequently, a firm's flexibility is a time invariant capability, so the number of changes firms made in past and the number of changes firms would like to make in the future should be correlated.

Meta-routines have been theorized to generate dynamic capabilities; a firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al. 1997). Some studies in forest products area claim to have successfully measured dynamic capabilities

(e.g. Cao 2011), but it must be extremely difficult to capture dynamic capabilities within an empirical context.

H6: The number of changes a firm made in the past is positively correlated with the number of changes a firm would like to make in the future.

Innovativeness

Innovativeness is treated uniquely in the forest products literature, and this has caused some controversies. Knowles et al. (2008) defines innovativeness as a firm's propensity to adopt and/or create new products, new processes, or new business systems. Many empirical studies follow this definition and conclude that innovativeness is a key to increasing a firm's performance (e.g. Hovgaard and Hansen 2004; Crespell et al. 2006; Crespell and Hansen 2008b; Nybakk et al. 2008). These authors have the diffusion of innovations in mind which discussing innovativeness. "Innovators" are the first individuals to adopt a new idea or technology, followed by early adopters, early majority, late majority, and laggards (Rogers 1995). In this context, innovativeness is the capability or organizational trait to be an "innovator." Knowles et al. (2008) measured innovativeness based on whether a firm had a certain manufacturing technology or not. Adopting new technology or business systems usually increases efficiency, so innovators can exploit industrial profits and increase their revenue. However, only when the additional revenue exceeds the initial cost of installing the new technologies can the firm enjoy profits. Therefore, investing in new systems or machines involves a managerial decision to consider the trade-off between the initial investment and the stream of additional revenues that can be expected in the future. Hence, innovativeness itself does not automatically increase profitability. Also, the causality between innovativeness and profitability is uncertain. True causality may be that profitable firms invest more in new technology or systems since they can afford it. Of course, the above argument presumes that they successfully quantify the innovativeness of the firm. Ultimately, there is little theoretical

justification in the management literature to support the assertion that adopting a new technology or business practice unconditionally increases profitability.

H7: Innovativeness is independent from performance.

Age and size with changes

Structural inertia of firms may vary with a firms' age and size. Older and larger firms have more formalized bureaucratic structures, standardized routines, determined dependencies, and commitments, so inertia might be expected to increase with age and size (Nelson and Winter 1982). Moreover, as firms grow and learn through experience, they may come to rely on their past experience in making decisions, so larger and older firms may become inflexible.

H8: Smaller firms are more flexible than larger firms.

H9: Younger firms are more flexible than older firms.

Chapter 6. Survey Design and Descriptive Statistics

This chapter described how to collect data for the study. A survey method was used to collect primary data. Descriptive statistics of general results among respondents are also shown.

1. Research method

A mail survey was used to collect primary data. The population examined in this study consisted of North American (U.S. and Canada) small- and medium-sized sawmill firms (SME). The unit of analysis is a firm as an organization and a firm may own multiple sawmills. How to made the list of the sawmill firms in North America was already discussed in chapter 2-2.

Preliminary interviews were conducted with several sawmill managers, forest products traders, market consultants, and industry experts to gain a broader understanding of the issues confronting sawmill managers and the lumber export decision. A preliminary questionnaire was developed based on these interviews. The survey instrument was pre-tested by eleven industry experts. Finally, four forest products marketing experts in the Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington provided comments and suggestions on contents, grammar, terminology, readability, clarity, and ease-of-use. The final questionnaire incorporated all of the comments and suggestions. The final survey totaled four pages with a cover letter and was designed to solicit basic information on the sawmill firm's demography and the attributes of their management. The objective of the research project was explicitly described on the cover page with the signature of the director of CINTRAFOR. For sawmill managers in Quebec, the survey and cover letter were translated in French by a market researcher at FP Innovations in Quebec, Canada. The French version of the survey was then translated back to English to check the consistency of the questions.

The cover letter and questionnaire (included in the appendices) were mailed from the University of Washington in two waves. The first surveys were mailed in June 2011 while the second wave of surveys were mailed in October 2011. The sawmill managers in the Quebec and New Brunswick provinces in Canada were sent both English and French versions of the surveys with a cover letter together. We asked respondents to return the completed questionnaires in the business reply envelope that was included with the survey. Due to budget constraints, we could not offer any incentives to respondents besides a summary of the study results.

2. Response rate

Figure 6-1. A map of respondents' headquarter
Note: The size of red dots represent the annual production volume in 2010.

Ninety-six responses were received (24.2 percent), but seven responses were not valid because of the insufficient quality of answers; therefore, 89 valid responses were used for the analysis. Figure 6-1

shows the distribution of 89 respondents. The total population was 406 and the overall response rate was 22.4 percent. Among the respondents, 65 were from the U.S. and 24 were from Canada. The response rate from the U.S. was 23.3 percent and from Canada it was 20.3 percent.

To facilitate the analysis, firms were categorized in nine different geographic regions. As shown in figure 6-2, Central U.S., Western Coastal U.S., Eastern Canada, and Northeastern U.S. had higher response rates than the overall average; 39.1, 34.5, 26.0, and 23.1 percent, respectively. In contrast, the response rates from Central Canada (13.0 percent), Southeastern U.S. (16.4 percent), Western Coastal Canada (16.7 percent), Western Inland U.S. (18.9 percent), and Western Inland Canada (18.2 percent) regions were lower than the overall average.

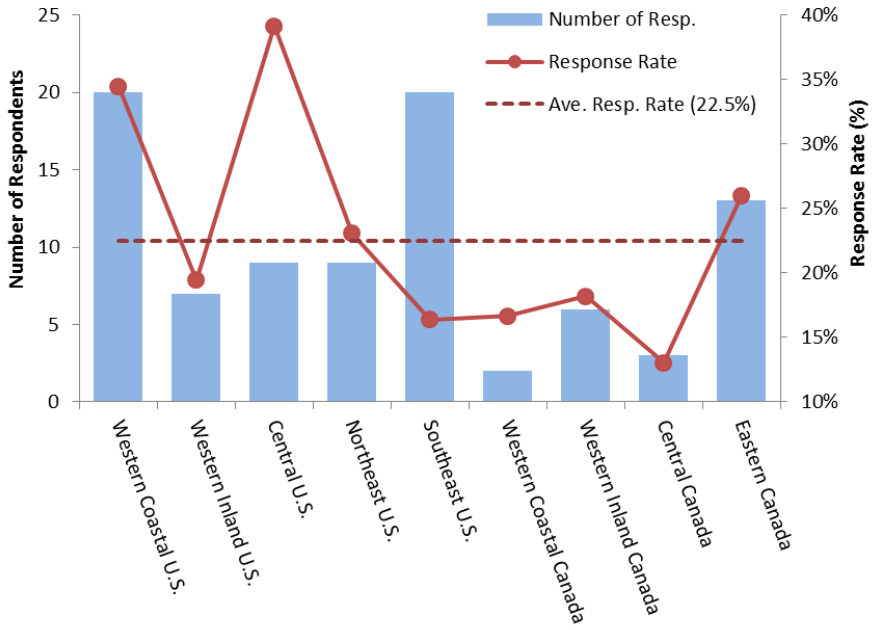

Figure 6-2. Response rate by region

To assure that non-response bias did not significantly affect the results, independent sample t-tests comparing the mean responses of early respondents (those who responded for the first wave of survey)

and late respondents (those who responded for the second wave of survey) were performed for each variable. The Armstrong-Overton test for non-response bias (Armstrong and Overton 1977) determined that non-response bias in this survey was not significant.

3. Firm demography

Individual firm size

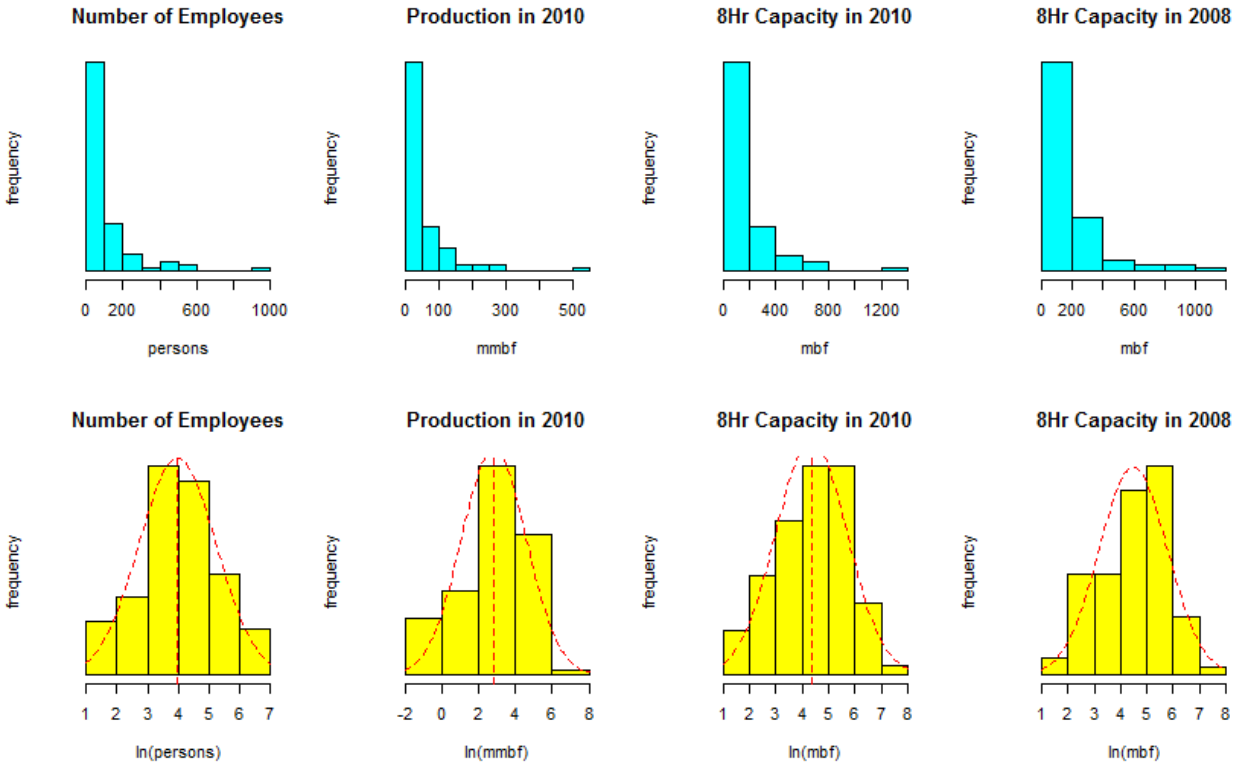

Figure 6-3. Histograms of the four firm size indicator variables

Firm size was measured using three indicators: 1) number of employees, 2) actual lumber production volume in 2010 [mmbf], and 3) the 2010 lumber production capacity for an eight hour shift [mbf]. In addition, the 2008 lumber production capacity for an eight hour shift [mbf] was used as a secondary data source (Big Book 2011) added to the primary survey data. Although the population of this study was SMEs, the distribution of all of the firm size indicators is extremely right-skewed since the size of the

firm usually increase proportionally. Therefore, a natural logarithm was used to transform and normalize the data. Figure 6-3 shows the original histograms (upper figures) and the log-transformed histograms (lower figures) for each of four indicators. Obviously, the log-transformed charts more closely approximate a normal distribution than did the untransformed original data.

Linear correlations among the four firm size indicators were investigated and the Pearson's correlation and the associated t-test results (table 6-1) showed that all of the variables were a positively and strongly correlated.

Table 6-1. Correlation matrix of the size of firm indicator variables

	8hr Cap in 2008	Employees	8hr Prod Cap in 2010
Actual Production in 2010	.909***	.928***	.855***
8hr Prod Cap in 2010	.921***	.895***	
Number of Employees	.842***		

Note: *** represents 1% significance by Pearson's correlation test.

Figure 6-4 shows scatter plots between the actual 2010 production volume and the eight-hour production capacity in 2010 and 2008. It was deemed important to investigate the consistency and validity of the data quality from 2008 to ensure it could be used in the analysis. The first chart shows the trend line using log-transformed annual actual production volume in 2010 vs. log-transformed eight-hour production capacity in 2010. This graph shows those variables are highly correlated. However, since each firm in the survey sample operates different numbers of shifts and not all firms utilize 100 percent capacity, total annual production and eight-hour production will not be perfectly correlated.

In order to evaluate the consistency of each firm's daily (eight hour) capacity for both years, the second chart shows the linear trend line using log-transformed eight-hour production capacity in 2010 (primary data) vs. log-transformed eight-hour production capacity (secondary data) in 2008. This graph shows that the eight-hour capacity in 2008 and 2010 are highly correlated.

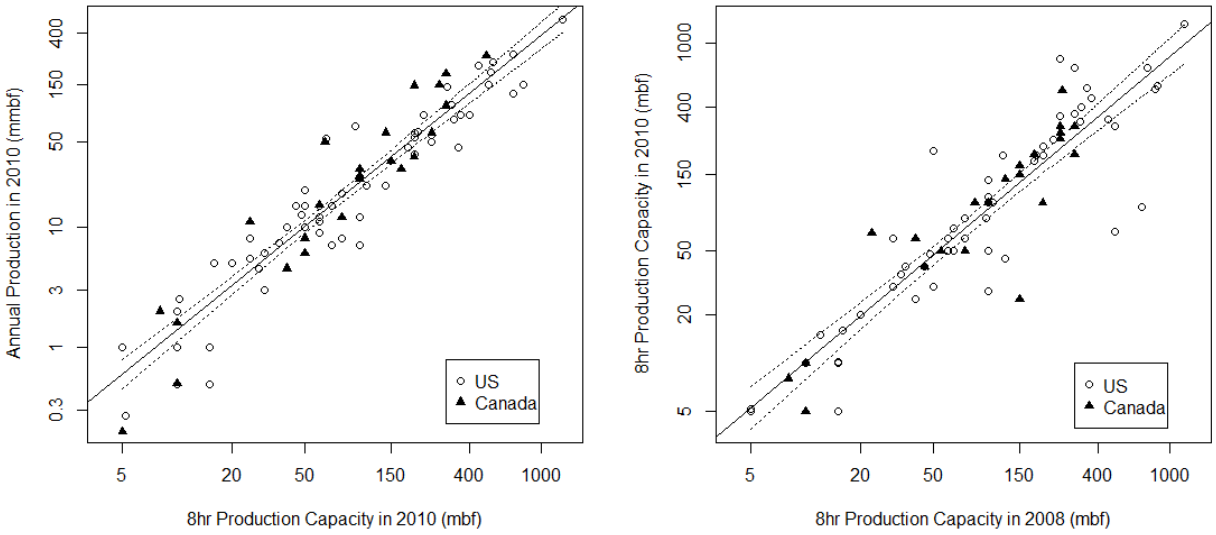

Figure 6-4. Annual production vs eight-hour production capacity in 2010 and eight-hour production capacity in 2010 vs eight hour production capacity in 2008

Note: The solid lines are the estimated regression line and the break lines are 95% confidence intervals.

$\ln(\widehat{Production\ in\ 2010}) = -2.48 + 1.22 \times \ln(8hr\ capacity\ in\ 2010)$ for the left chart. (r^2=0.899)

$\ln(\widehat{8hr\ capacity\ in\ 2010}) = 0.126 + 0.954 \times \ln(8hr\ capacity\ in\ 2008)$ for the right chart. (r^2=0.830)

Next, the relationship between the number of employees and actual lumber production in 2010 was investigated. Figure 6-5 shows the scatter plot between and natural-log transformed actual production volume in 2010 and the natural-log transformed number of employees in 2010.

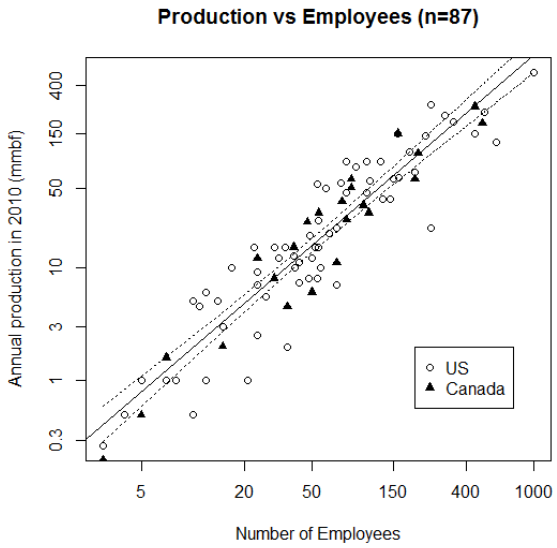

Figure 6-5. Relationship between production volume and the number of employees

Note: The solid lines are the estimated regression line and the break lines are 95% confidence intervals.

A single linear trend line is shown in the chart, and the equation follows:

$$\ln\left(\widehat{Production\ in\ 2010}\right) = -2.29 + 1.29 \times \ln(Numbers\ of\ Employees)$$

The results of the regression model estimation are shown in table 6-2. Both the estimated intercept and slope coefficients are significant at the 1 percent level and the model explains 86.1 percent of the total variability of the data. Sometimes, because of the economy or diseconomy of scale, the relationship between lumber production and the number of employees will not be linear. To check this, a quadratic model was run, and the coefficient of the quadratic term didn't show significance. Hence, the initial simple regression model is able to explain the relationship between lumber production and the number of employees at softwood sawmills in North America. Four firm size indicators are highly correlated.

Table 6-2. Regression analysis of number of employee vis-à-vis production volume

	Point Estimates	Standard Errors	t-test	
(Intercept)	-2.315	0.234	-9.91	***
Employee	1.288	0.056	22.99	***
R^2	0.861			
F-test	528.7			***

Note: *** means significant at 1 percent.

Total lumber production by region

The total annual lumber production volume in 2010 among respondents (n=88) was 4,428 mmbf. As shown in figure 6-6, 36.9 percent was produced in the Western U.S. (inland + coastal), 36.5 percent was produced in the Southern U.S., 17.4 percent was produced in Eastern Canada, 4.1 percent was produced in the Northeast/Central U.S., and 5.1 percent was produced in Western Canada. It is important to note that this survey was only small- and medium-sized softwood sawmills. The total lumber production volume reported by respondents in Western Canada was amazingly small but not surprising, since large

corporations dominate there. Assuming the respondents were randomly distributed, this ratio should be represented of the total lumber production by SMEs in North America.

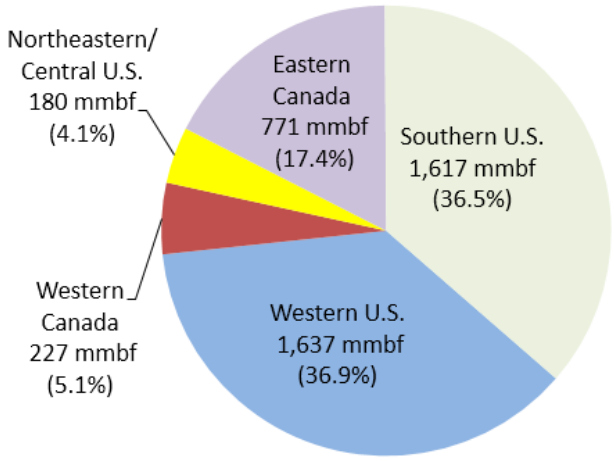

Figure 6-6. Respondents' total lumber production volume in 2010 by region

The total employees hired by respondents (n=88) was 9,564; 7,150 (74.8 percent) in the U.S. and 2,414 (25.2 percent) in Canada (figure 6-7). The Southern U.S. had 35.2 percent of the workers and the Western U.S. had another 34.8 percent. Note that this ratio does not include the employees of large corporations but it may reflect employment trends for SMEs.

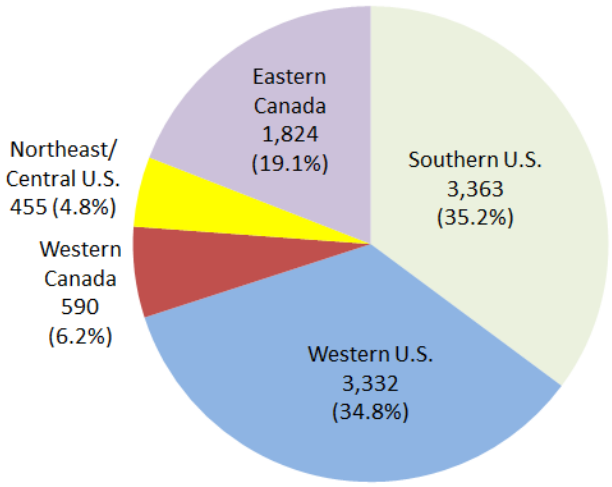

Figure 6-7. Respondents' total employments in 2010 by region

Total lumber production by species

Considering the 4,430 mmbf of softwood lumber produced by respondents, 40.8 percent was pine (including Southern yellow pine, lodgepole pine, Ponderosa pine, and Eastern white pine). Followed by Douglas-fir (24.5 percent), SPF (21.6 percent), and hem-fir (6.7 percent) (figure 6-8). Other softwood species, such as cedar, Sitka spruce, larch, and redwood accounted for 5.5 percent of the total lumber produced by respondents.

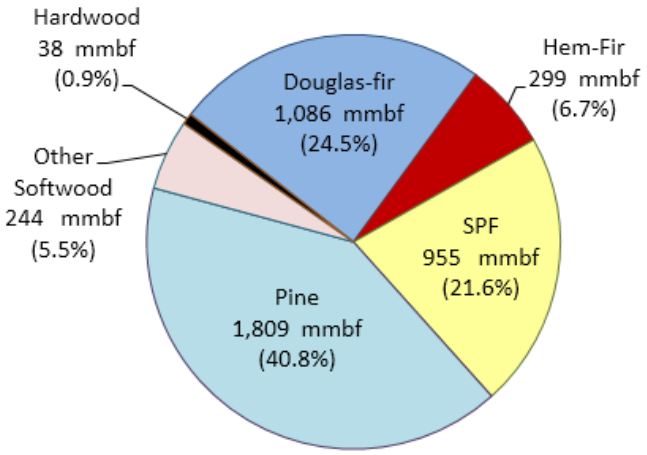

Figure 6-8. Respondents' total lumber production volume in 2010 by species

Timber species distribution is primarily influenced by the climate of region, so the mix of available timber species is often unique to the region where the sawmill is located. As anticipated, Southern yellow pine dominates in the Southeast U.S., and Douglas-fir dominates in the Western U.S. (figure 6-9). SPF is the major species mix in Eastern Canada. Although the ratio of SPF is high in Western Canada and the Central/Northeast U.S., sawmills in these regions also utilize pine and other timber species. Hardwood species are mainly utilized in the northeastern regions of both the U.S. and Canada.

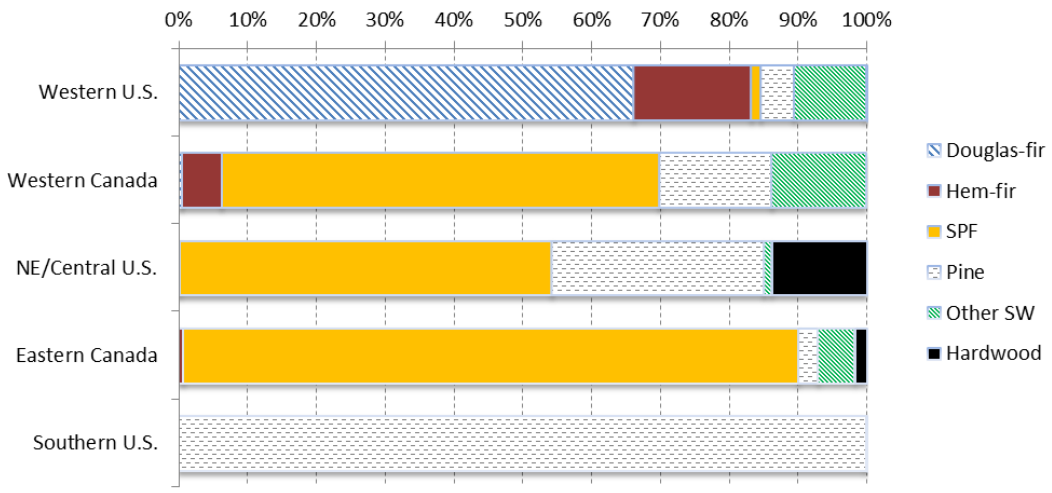

Figure 6-9. Respondents' species mix of lumber production by region

Note: Pine used in different region is a mix of different species, but treated as a same timber species.

Understanding the versatility and flexibility of sawmills is one of the objectives of this study and the number of species processed by each sawmill can be measured by the diversity index, which is discussed in chapter 2-2. When a firm utilizes only a single species as raw material input, the species diversity index is, by definition, equal to zero. As a firm diversifies their raw material input (i.e. uses more species), the index gets larger (but cannot exceed one). The sample mean of the species diversity index for all respondents was 0.243, and the sample standard deviation was 0.265. Then analysis of variance (ANOVA) is used to see if there was a difference between the mean species diversity index between regions. The ANOVA analysis estimated the F-value as 7.40 (p=0.000) and the null hypothesis that all the means of the species diversity index were equal was rejected, indicates that there were some differences in the species diversity index between regions. Figure 6-10 shows the box-and-whisker plot of diversity index by region. Almost all (except one) respondents from the Southern U.S. utilize Southern Yellow Pine exclusively as their raw material, so their diversity index is zero. On the other hand, the diversity index of the Central/Northeast U.S. is 0.410, which is higher than the other regions since some

sawmill in this region process many kinds of hardwood species. The sawmills in Southeastern U.S. would be less flexible than sawmills in other regions in terms of the manufacturing versatility.

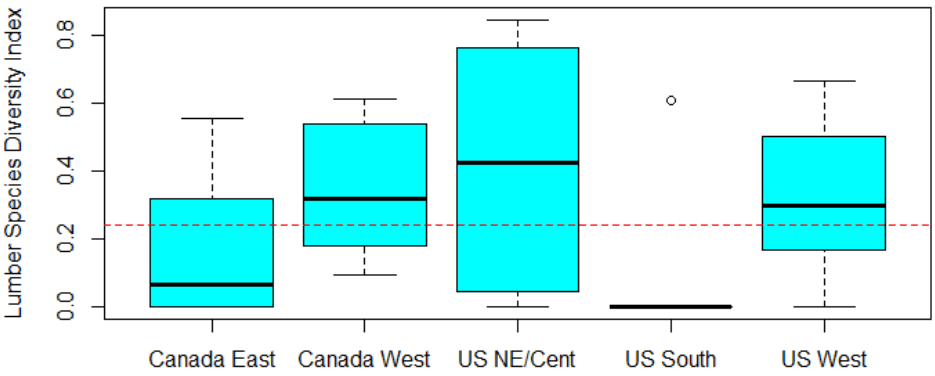

Figure 6-10. Species diversity index by region

Year in business

The survey also asked the year that each firm began business operations to determine how long each sawmill had been in business. The sample mean number of years was business was 51.2 years, and the sample standard deviation was 27.3 years. The histogram is shown in figure 6-11, and the shape of the distribution was skewed to the right.

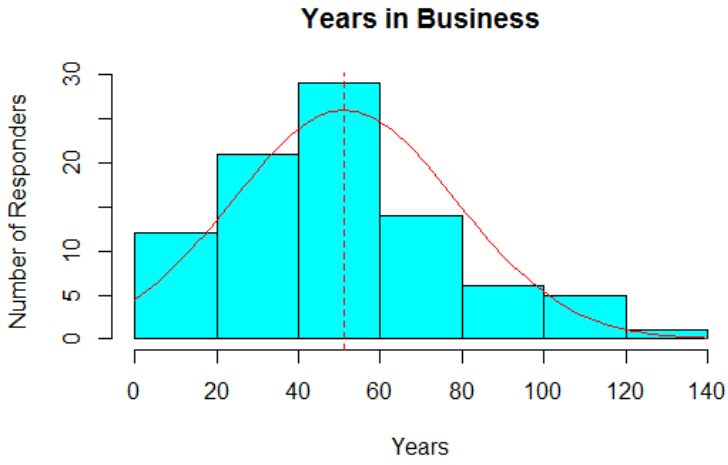

Figure 6-11. Histogram of years in business for SME softwood sawmill firms

To examine possible regional differences, ANOVA was used to examine whether mean years in business are different between the regions. The ANOVA analysis estimated the F-value as 1.17 (p=0.331) and the null hypothesis that all the means of the numbers of years in business were equal was failed to reject, indicates that there was no difference in the numbers of years in business between regions.

4. Performance

A company's bottom line is profit[9], and maximizing profit is a rational firm's *raison d'être*. Profitability is a firm's ability to generate earnings over and above its cost of doing business for owners and/or shareholders, so profitability is one of the best measurements of a firm's economic performance. In business research, profitability is usually measured by Return on Assets (ROA) or Return on Investment (ROI), since these accounting ratios best describe the economic returns of firms (Jacobson 1987). However, obtaining small and medium firms' financial information to calculate the ROI or ROA is extremely difficult, especially through a survey methodology.

In order to estimate the performance of the firms surveyed in this study, I asked each firm how they performed relative to their competitors both before and after the housing market crash in 2007. Respondents replied using a five-point Likert-like scale: much worse, worse, the same, better, and much better. Results shown in figure 6-12 illustrate that 17.2 percent of the respondents reported that they performed much worse or worse than their competitors before the housing market crash. About 28.7 percent of respondents said they performed about the same, 43.7 percent answered they performed better, and 10.3 percent said they performed much better than their competitors before the housing

[9] It is very important to note that profitability is the difference between revenue and cost. Needless to say, increasing sales revenue does not necessarily guarantee an increase in profit. Amazingly, many previous business studies in the forest products field mix up revenue and profit, which might lead to an incorrect conclusion. Many theories in the business field are originally from the economics field, and most theories derived from economics are meant to explain profits, not revenues, of a firm.

market crash (mean score was 3.46[10]). In comparison, 14.9 percent of respondents reported that they performed worse or much worse, 17.2 percent answered the same, 52.9 percent answered better and 14.9 percent thought much better than their competitors after the housing market crash (mean score was 3.67[11]).

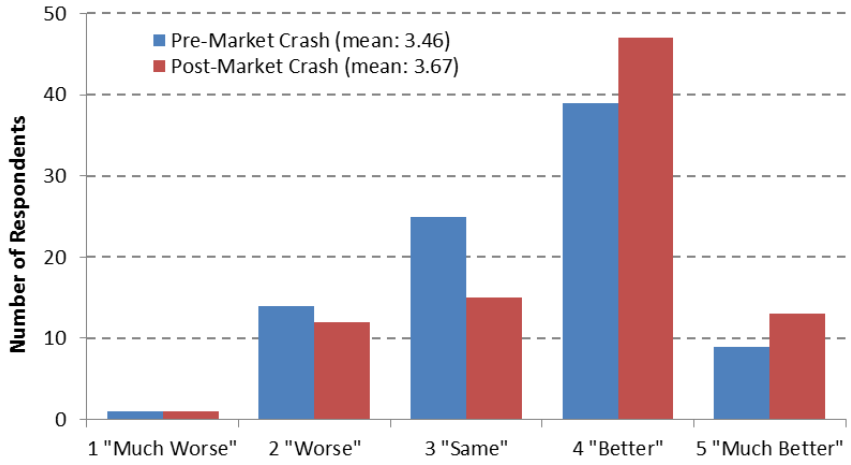

Figure 6-12. Profitability before and after housing market crash

Note: 1=much worse, 2=worse, 3=same, 4=better, 5=much better than their competitors. Means were calculated, as measurement was regarded as a pseudo interval scale.

Interestingly, more respondents perceived they were doing better than their competitors after the housing market crashed despite the fact that the demand for softwood lumber remains weak. In order to test if the median response was higher than 3 ("same") or not, the non-parametric sign-test was applied. The null hypothesis was that the median value was equal to or less than 3 ("same"). During the pre-housing-crash era, 47 firms responded that they performed either "better" or "much better" than their competitors, and the p-value from the exact binomial distribution is 0.26. Thus, the null hypothesis is not rejected. On the other hand, for the post-housing-crash era, 59 firms answered that they performed either better or much better than their competitors. The associated p-value is 0.0006, so the

[10] Mean score was calculated by assuming the data is pseudo-interval value: 1=much worse, 2=worse, 3=same, 4=better, 5=much better than their competitors.

null hypothesis is rejected at a 1 percent level of significance. Hence, the median value of relative financial performance was significantly higher than 3 ("same") following the housing market crash. However, this result might be caused by a well-known cross-sectional research bias. Since some firms that did not perform well during the housing market crash went out of business, the result of the relative financial performance question could be biased upward.

The differences in financial performance pre- and post-housing crisis performance of each respondent are calculated (figure 6-13). Positive numbers mean they relatively performed better than their competitors after the housing crisis than before the crisis, and vice versa. Zero means their perceived relative performance was the same before and after the crisis. If a performance higher after the housing crash than before the housing crash was tested by applying the paired sample sign test. With a p-value of 0.038, the null hypothesis, that performance is the same or lower after the housing crash than before the housing crash, is rejected at a 5 percent level of significance and I conclude that more firms performed better after the housing crisis than before the housing crisis.

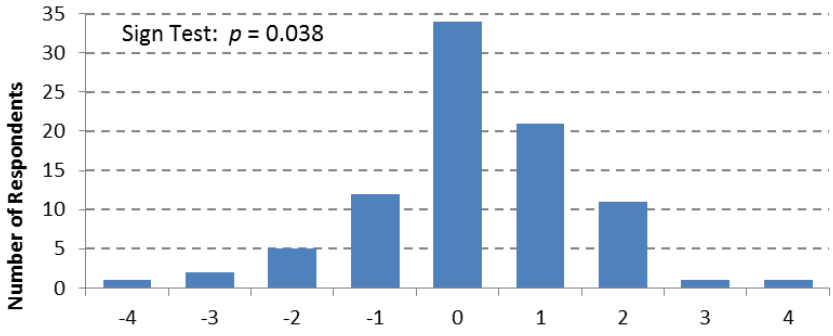

Figure 6-13. Difference of a firm's perceived performance after and before the housing crisis

In order to understand how financial performance change over time, the data was tested to determine whether pre- and post-housing crash financial performance were independent or not (table 6-3). "Much worse" and "worse" were aggregated to "worse," and "much better" and "better" were aggregated to

"better." Log-linear analysis was applied to the table to analyze the independence between pre- and post-housing crash performance. The residual deviation of the Poisson regression of independent model is χ^2=1.67 with 4 degrees of freedom (p=0.205), which indicates the model does not show significant overdispersion[11]. Consequently, performances before and after the housing crash are independent.

Table 6-3. Cross tabulation of perceived performance before and after the housing market crash

Pre-House Market Crash		Post House Market Crash		
		Worse	Same	Better
	Worse	2	3	10
	Same	4	6	15
	Better	7	6	34

Note: Worse includes "worse" and "much worse." Better includes "better" and "much better."

In addition, the non-parametric Mann-Whitney U-test was applied to compare the differences of performance between the different regions (e.g. U.S. vs. Canada, West vs. South), but no significance differences were found. Consequently, a firm's relative financial performance was independent of both time and location. This result raises questions about the results of previous forest products studies wherein a firm's financial performance and demographic attributes or attitudes are examined using a cross-sectional survey. This result also suggests that it is not a good idea to unconditionally assume that good or bad financial performance will be sustained over a period of time[12].

5. Management

Number of managers

The survey revealed that the mean number of managers of SME softwood sawmill firms was 6.76, with a sample standard deviation of 7.93. As shown in the upper left chart of figure 6-14, the distribution of

[11] The log-linear model fits well when the residuals (i.e., observed-expected) are close to 0. If the likelihood ratio chi-square statistic is non-significant, then the Poisson model fits well. If the likelihood ratio chi-square statistic is significant, then the Poisson model has overdispersion and does not fit well.

[12] Hence, applying a resource-based view would not be appropriate to analyze a sawmill firm's performance. This topic shall be discussed further in chapter 7.

respondents was skewed to right. The mean number of sales managers was 1.96, with a sample standard deviation of 1.31. The range was from one to eight managers as shown on the upper right chart of figure 6-14. The mean number of the ratio of managers-to-employees was 0.129, and the sample standard deviation was 0.140. This distribution was also right skewed (bottom left chart of figure 6-14). On average, each manager supervises 7.75 employees. The mean number of the ratio of sales managers-to-total managers was 0.470, indicating that, on average, every one person per 2.13 managers was a sales manager (bottom right chart of figure 6-14).

Figure 6-14. Histograms of the number of managers

Demography of sales team

Among the sales team, the survey asked what percentage of people in sales team hold a bachelor's degree. The overall mean of bachelor's degree was 47.8 percent. Figure 6-15 shows the ratio of

bachelor's degree holders of sales teams by region. The mean ratio of bachelor's degree holders of sales teams was 36.7 percent in Canada and 52.3 percent in the U.S. Two-sample t-test estimated the t-value as 1.811 (p=0.074) and the null hypothesis that the means of Canada and the U.S. were equal was rejected at a 10 percent level of significance, indicates that there was difference in mean ratio of bachelor's degree holders of sales teams in the U.S. and Canada.

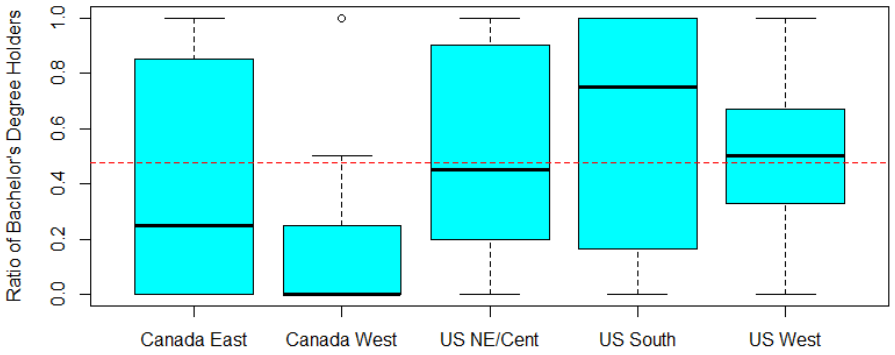

Figure 6-15. Ratio of bachelor's degree-holders among sales teams by region

The average age of the sales team among respondents was 49.1 years, with a standard deviation of 7.8 years. The box-and-whisker plot of a sales team's mean age by region is shown in figure 6-16 and an ANOVA analysis found no significant difference between regions (F=1.55; p=0.195).

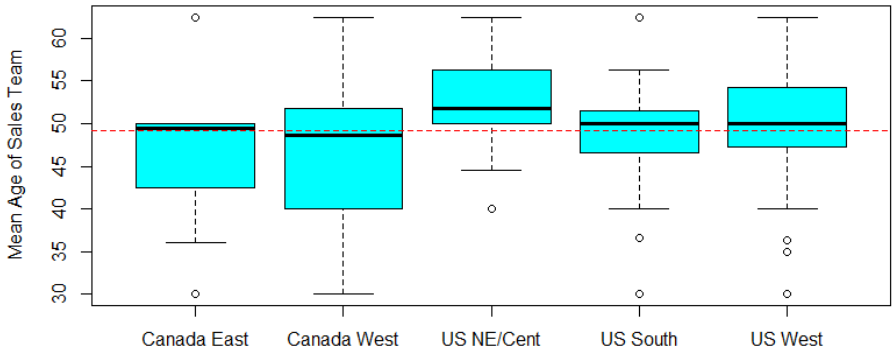

Figure 6-16. Mean age of sales team by region

Attitude of sales team

Besides the demography of the sales team, six attitudinal questions related to a firm's sales team were asked, including: 1) Does the sales team have the authority to make sales decisions, 2) Does the sales team respect the international experience of their team members, 3) Is the sales team very aggressive, 4) Are the members of the sales team highly entrepreneurial, 5) Have the members of the sales team formed a strong bond, and 6) Are the members of a sales team very innovative. Respondents were asked to respond to these statements using a five-point Likert-like scale: 1) strongly disagree, 2) somewhat disagree, 3) neutral, 4) somewhat agree, or 5) strongly agree.

The overall results for these questions are shown in table 6-4. The mean score of strong international experience is important for a sales team was the lowest with 2.84, but the means of other categories were ranged between 3.57 are 4.34.

Table 6-4. Attitudes of sales team

	1	2	3	4	5	Median	Mean	Std. Dev.
Authority	1	0	1	50	33	4	4.341	0.628
Int'l Experience	16	19	19	20	9	3	2.843	1.292
Aggressive	0	6	31	40	7	4	3.571	0.749
Entrepreneurial	0	3	28	44	9	4	3.702	0.708
Strong Bond	0	2	14	49	17	4	3.988	0.694
Innovative	0	2	24	48	10	4	3.786	0.678

Note: The means and standard deviations for the six attitudinal questions were calculated by assuming that the scales were pseudo-interval.

As shown in figure 6-17, North America was divided into two groups in four different ways: 1) Canada vs. the U.S., 2) West vs. East/Central, 3) North vs. South and 4) Coast vs. Inland.

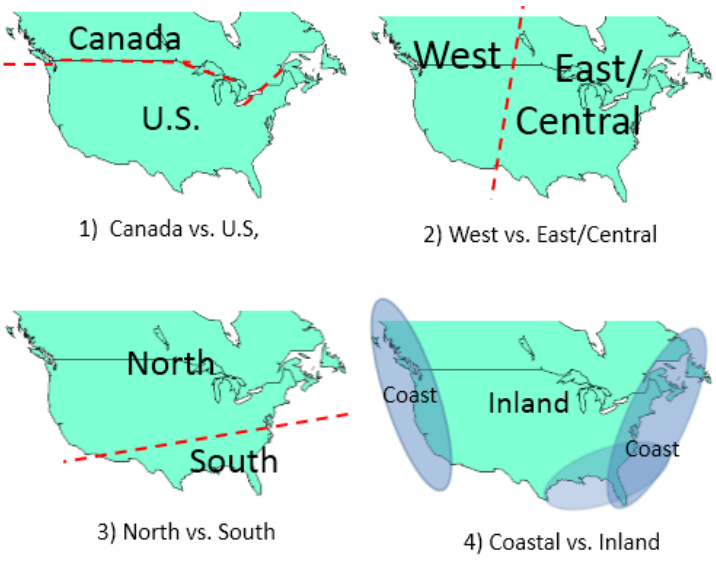

Figure 6-17. Four ways to divide North America into two geographical regions

The influence of geographical location on respondents' answers to the statements was tested by applying the non-parametric Mann-Whitney's U test because the responses were measured on an ordinal scale. The null hypothesis was that two samples are from the same population (Hollander and Wolfe 1999). More precisely, the null hypothesis of the Mann-Whitney test is H_0: $P(x_{1st}>x_{2nd})=0.5$.

Table 6-5. Mann-Whitney U-test on attitudes of sales team by region

	U.S. vs. Canada		West vs. East/Cent	South vs. North	Coast vs. Inland
Authority	-1.506		-0.536	-0.586	-0.708
Int'l Experience	-2.888	***	-1.007	-1.719	-0.299
	$\bar{x}_{US} = 2.95; \bar{x}_{Can} = 3.52$				
Aggressive	-1.095		-0.090	-0.284	-0.367
Entrepreneurial	-1.525		-0.546	-0.560	-0.110
Strong Bond	-0.153		-0.884	-0.050	-1.196
Innovative	-1.147		-0.565	-0.718	-0.591

Note: a) *** represents significant difference at 1 percent level.
b) The null hypothesis of the Mann-Whitney test is that both samples are from the same distribution.

Table 6-5 shows the asymptotical Z-scores and their associated p-values derived from this test. Only one category shows a statistical difference—Canadian firms were more likely to agree that their sale team

have international experience than were U.S. firms. However, the difference found between all other categories were not statistically significant.

The non-parametric Spearman's correlations are displayed in table 6-6. Most of the correlation coefficients among sales team attitudes were weakly correlated but statistically significant (so correlation exists except with two pairs).

Table 6-6. Correlation matrix of sales team attitudes

	Authority	Int'l Exp.	Aggressive	Entre.	Str. Bond
Int'l Experience	0.195*				
Aggressive	0.066	0.241**			
Entrepreneurial	0.388***	0.180	0.507***		
Strong Bond	0.253**	0.187*	0.207*	0.287***	
Innovative	0.237**	0.204*	0.353***	0.427***	0.432***

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level, respectively

Attitude on business strategy

It is extremely difficult to accurately assess a firm's business strategies unless one has access to inside information. In order to categorize respondent forms business strategies, six attitudinal questions about their business strategy were asked: 1) Did the firm offer customize products rather than standardized products, 2) Did they sell to new customers, 3) Were they outsource their sales functions to agents, 4) Did they always strive to improve product quality even if it costs more, 5) Did they target niche markets, and 6) Did they compete on price rather than on product quality.

Respondents were asked to respond to these statements using a five-point Likert-like scale: 1) strongly disagree, 2) somewhat disagree, 3) neutral, 4) somewhat agree, and 5) strongly agree. The overall results are shown in table 6-7. Many respondents disagreed that they used a sales agent and that they

competed on price rather than on product quality. In contrast, most agreed that they targeted niche markets with their marketing strategy.

Table 6-7. Attitudes of business strategy

	1	2	3	4	5	Median	Mean	Std. Dev.
Customized	3	7	22	34	21	4	3.721	1.036
New Customers	0	4	34	38	11	4	3.640	0.766
Sales Agent	33	23	18	11	2	2	2.140	1.139
Product Quality	0	2	15	50	20	4	4.023	0.703
Niche Market	0	3	17	31	36	4	4.174	0.829
Price Competition	17	31	27	10	1	2	2.388	0.977

Note: The means and sample standard deviations are calculated by assuming these scales are pseudo-interval.

The influence of geographical location on respondents' answers to the statements was tested by applying the non-parametric Mann-Whitney's U test because the responses were measured on an ordinal scale. The null hypothesis was that the distributions of both groups are equal. Table 6-8 shows the asymptotical Z-scores and their associated p-values derived from this test. Whether firms are located in the U.S. or Canada did not influence their business strategies. Western firms tended to agree more on customizing their products, targeting new customers, striving to improve their quality, and targeting niche markets than Eastern and Central firms did. Firms in the South tended to not customize products and target niche markets compared to their Northern competitors. On the other hand, Southern firms competed more on price than Northern firms. Firms located in coastal or inland areas did not show any statistical differences in terms of business strategies.

Table 6-8. Mann-Whitney U-test on attitudes of business strategies by region

	U.S. vs. Canada	West vs. East/Central		South vs. North		Coast vs. Inland
Customized	-0.435	-1.958	*	-2.914	***	-0.953
		$\bar{x}_W = 3.95; \bar{x}_E = 3.56$		$\bar{x}_S = 3.20; \bar{x}_N = 3.88$		
New Customers	-1.748	-1.708	*	-1.255		-0.556
		$\bar{x}_W = 3.81; \bar{x}_E = 3.52$				
Sales Agent	-0.342	-1.202		-1.291		-1.38
Product Quality	-1.349	-1.784	*	-0.595		-0.739
		$\bar{x}_W = 4.14; \bar{x}_E = 3.92$				
Niche Market	-0.355	-2.76	***	-2.505	**	-1.446
		$\bar{x}_W = 4.41; \bar{x}_E = 3.96$		$\bar{x}_S = 3.75; \bar{x}_N = 4.27$		
Price Competition	-1.642	-0.091		-2.794	***	-0.94
				$\bar{x}_S = 2.95; \bar{x}_N = 2.22$		

Noe: a) Geographical locations are described in figure 6-17.
b) ***, **, * represent significant difference at 1%, 5%, and 10% level respectively
c) Means and standard deviations are calculated assuming they are pseudo-interval measurements.
c) The null hypothesis of the Mann-Whitney test is that the distributions of both groups are equal.

The non-parametric Spearman's correlation coefficients are summarized in table 6-9. Most of the attitudinal factors are weakly correlated. New customers shows only a significant weak correlation with customized products. The sales agent category also does not show significance compared to other categories. In chapter six, a confirmatory factor analysis will be applied to this data in order to quantify the firm's business strategy.

Table 6-9. Correlation matrix on business strategies

	Customized	New Cust.	S.Agent	Prod.Qual.	Niche
New Customers	0.260**				
Sales Agent	0.267**	0.071			
Product Quality	0.240**	0.140	0.050		
Niche Market	0.404***	0.112	0.206*	0.473***	
Price Competition	-0.185*	-0.090	-0.069	-0.347***	-0.202*

Note: ***, **, * mean significant difference at 1%, 5%, and 10% level respectively

Changes firms made

Using preliminary interviews with sawmill managers and industry experts, the following nine categories were identified as major managerial decisions considered by sawmills in recent years: 1) investing in new technology, 2) adding new products, 3) entering a new international market, 4) developing a new marketing campaign, 5) undergoing ownership change, 6) adding new material suppliers, 7) reducing fixed costs in the manufacturing process, 8) adding new managers from outside the firm, and 9) introducing any product certification programs.

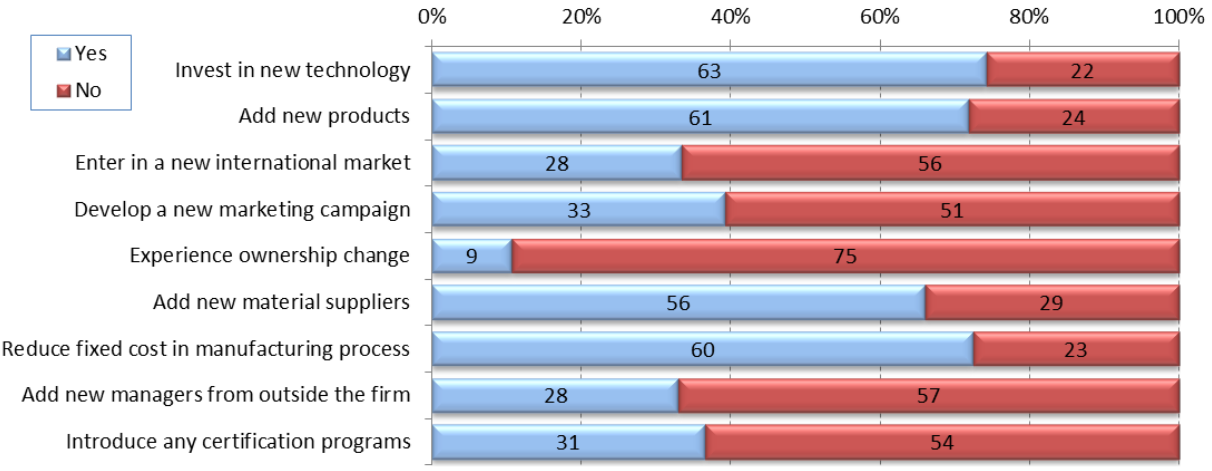

Figure 6-18. Changes reported in past five years by survey respondents

We first asked whether a firm experienced any of these nine change categories in the past five years. Respondents answered either yes or no. As shown in figure 6-18, 74.1 percent of the respondents invested in new technology, 72.3 percent of the firms reduced fixed costs in the manufacturing process, 71.8 percent of the firms added new products, and 65.9 percent of the firms added new material suppliers within the last five years. Firms' experience with the other change categories were relatively minor. About 39.3 percent of the firms developed a new marketing campaign, 36.5 percent introduced

new certification programs, 33.3 percent entered a new international market, 32.9 percent added new managers, and only 10.7 percent experienced ownership change.

The impact of geographic location on managers' adoption of the nine change categories was also considered. Since some of the expected values are very small, and Pearson's Chi-Square Goodness of Fit test may inflate the significance value, Fisher's Exact Test with a one-sided tail was used. Fisher's Exact Test calculates the exact p-value under a null hypothesis of independence to a hypergeometric distribution of the numbers in the cells of the contingency table and is applicable when sample sizes are relatively small.

Table 6-10. Fisher's exact test on changes firms made in the past five years

	U.S. vs. Canada	West vs. East/Cent	South vs. North	Coast vs. Inland
Invest in new technology	0.465	**0.061**	0.527	**0.070**
Add new products	0.570	**0.075**	0.394	0.269
Enter a new international market	0.267	0.241	0.201	0.529
Develop a new marketing campaign	0.525	***0.025***	**0.078**	0.367
Experience ownership change	0.177	0.376	0.417	0.570
Add new material suppliers	0.504	0.479	0.221	0.569
Reduce fixed costs in manufacturing process	0.437	0.396	0.395	0.375
Add new managers from outside the firm	0.441	**0.062**	0.412	0.300
Introduce any certification programs	***0.011***	**0.086**	***0.042***	0.318

Note: a) Values represent p-values by applying Fisher's Exact Test
b) Bold figures and bold italic figures represent significance level at 10% and 5%, respectively.
c) Geographical locations are described in figure 6-17.

As shown in table 6-10, there are several categories where the relationship between location and managerial decision were significant. Around 83.8 percent of the firms in the West invested in new technology, while 66.7 percent of the firms in the eastern/central did so (p=0.061). Also, 79.7 percent of the coastal firms invested in new technology, while 61.5 percent of the inland firms did so (p=0.070). Almost 82 percent of the western firms added new products, compared to 64.6 percent of the eastern/central firms did so (p=0.075). Fifty three percent of the western firms developed a new

marketing campaign, whereas 29.2 percent of the eastern/central firms did so (p=0.025). Also, 43.9 percent of the firms in the North developed a new marketing campaign, but only 22.2 percent of the firms in the South did so (p=0.078). Forty four percent of the firms in the West hired new managers from the outside, but only 25.0 percent of the eastern/central firms did this (p=0.062). Certification wise, 59.1 percent of the Canadian firms introduced new certification programs (e.g. ISO, FSC, SFI) in the past five years, but only 28.6 percent of the U.S. firms did so (p=0.011). Forty six percent of the western firms introduced new certification programs, while 29.2 percent of the eastern/central firms did so (p=0.086). Finally, 16.7 percent of the southern firms introduced new certification programs in the past five years, while 41.8 percent of the northern firms did so (p=0.042).

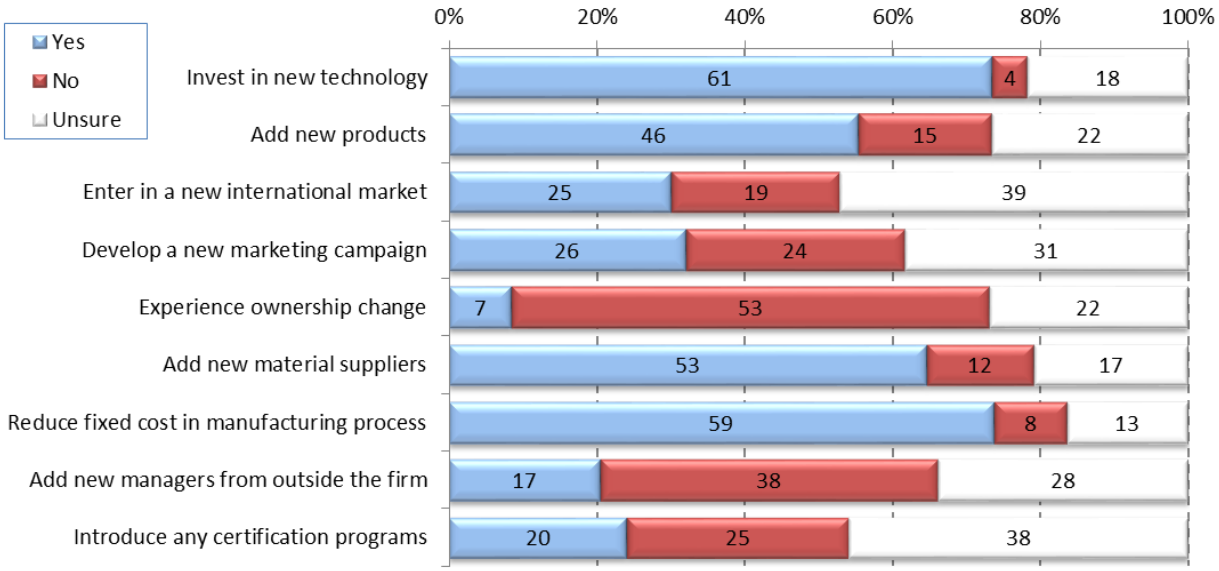

Figure 6-19. Changes firms plan to make within the next five years

Firms were also asked whether they were planning to make any of these managerial decisions over the next five years. Unlike the previous question, respondents could choose “unsure” in addition to yes and no. There were several areas where respondents were unsure about the future. Ignoring the responses of “unsure,” as shown in figure 6-19, 93.8 percent of the respondents want to invest in new technology,

88.1 percent would like to reduce fixed costs, 81.5 percent plan to add new material suppliers, and 75.4 percent are planning to add new products. Also, 56.8 percent of the respondents want to enter a new international market, 52.0 percent want to develop a new marketing campaign, 44.4 percent want to introduce new certification programs, 30.9 percent want to add new managers from outside the firm and 11.7 percent thought that the ownership of the firm may change in the next five years.

Table 6-11. Fisher's exact test on changes firms plan to make within the next five years

	USA vs. Canada	West vs. East/Cent	South vs. North	Coast vs. Inland
Invest in new technology	0.611	0.445	0.660	0.361
Add new products	0.279	0.205	0.261	0.465
Enter a new international market	**0.078**	0.333	0.320	0.618
Develop a new marketing campaign	0.433	**0.074**	0.310	0.298
Experience ownership change	0.271	0.538	0.572	0.522
Add new material suppliers	0.331	0.572	0.280	0.564
Reduce fixed costs in manufacturing process	0.594	0.593	0.249	0.674
Add new managers from outside the firm	0.472	0.052	0.263	0.606
Introduce any certification programs	***0.007***	0.408	**0.089**	0.571

Note: a) Values represent p-values by applying Fisher's Exact Test
b) Bold figures and bold italic figures represent significance level at 10% and 5%, respectively.
c) Geographical locations are described in figure 6-17.

The impact of geographic location on future managerial changes was also investigated. Many respondents chose "unsure," but these were ignored, and only "yes" and "no" responses were compared. Table 6-11 shows the p-values of the one-sided Fisher's Exact Test. About 76.9 percent of the Canadian firms would like to enter a new international market in the next five years, whereas only 48.4 percent of the U.S. firms would like to do so (p=0.078). Also, 62.5 percent of the Western firms are planning to develop a new marketing campaign, while 40.7 percent of the Eastern and Central firms were planning to do so (p=0.074). On the other hand, 70.5 percent of the Canadian firms wanted to introduce new certification programs in the next five years, whereas only 28.6 percent of the U.S. firms would like to do so (p=0.007). Finally, half of the Northern firms would like to introduce new certification programs, while only 14.3 percent of the firms in the South would like to do so (p=0.089).

Figure 6-20 compares the managerial changes that firms have made during the past five years with the managerial changes that firms would like to make over the next five years. The non-parametric Spearman's rank correlation coefficient test assessed the strength of the relationship between these two variables. Spearman's rank correlation between changes made during the past five years and projected over the next five years is 0.715, which is significantly different from zero (independent) at the 1 percent level. They are strongly and positively monotonically related. The firms that implemented changes in the past also likely implement changes in the future. It seems that the characteristics of change within the firms persist over time.

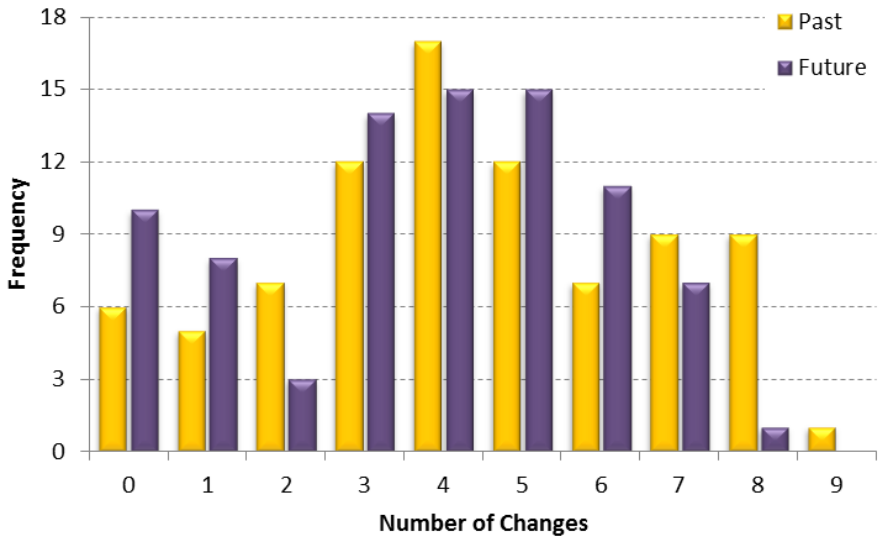

Figure 6-20. The number of changes made in past five years and planning to make within five years

6. Upstream and downstream

In order to achieve economy of scale, some firms integrate horizontally. Alternately, other firms choose not to expand their businesses horizontally because they fear a diseconomy of scale. In order to internalize a larger portion of the value chain, some firms integrate vertically. Alternately, some firms choose to focus and allocate their resources on what they are good at and externalize what they are not good at.

Horizontal integration

Figure 6-21 shows the number of sawmills that the survey respondents own. Among the respondents, 70 firms (78.7 percent) own only one sawmill. Twelve firms (13.5 percent) own two sawmills, four firms (4.5 percent) firms own three sawmills, and three firms own more than three sawmills.

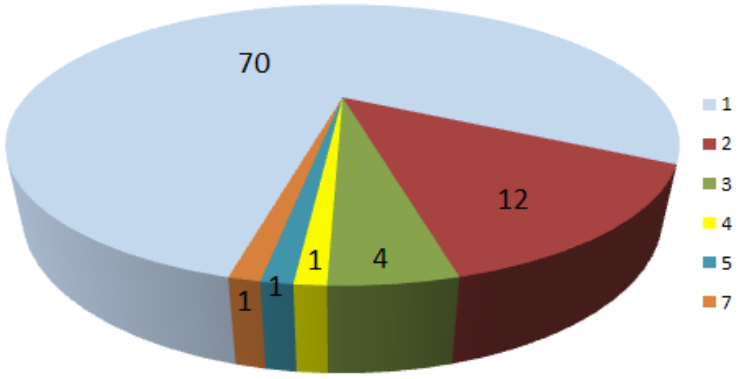

Figure 6-21. Number of sawmills owned by a firm

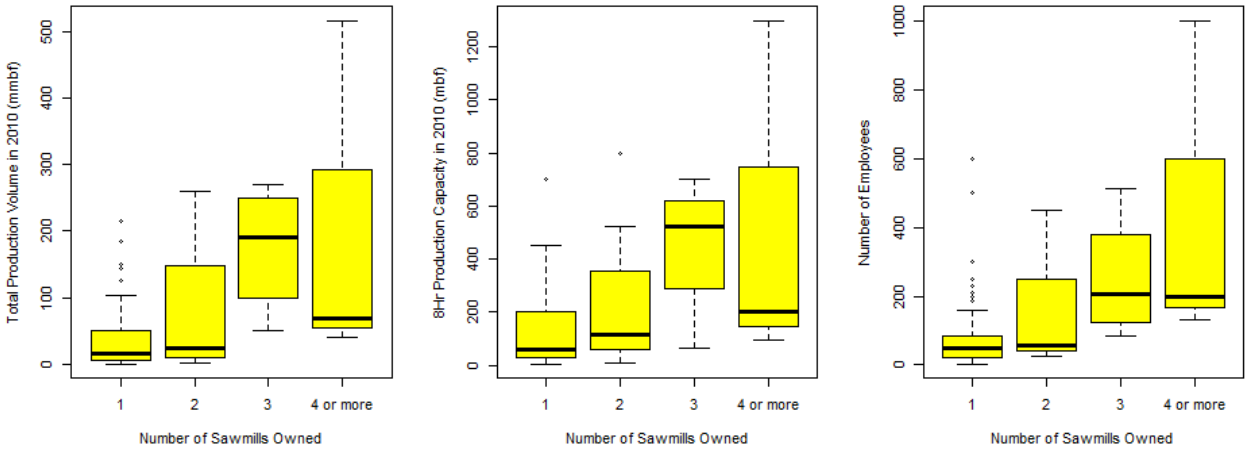

Figure 6-22. The number of sawmills owned, vis-à-vis firm size

Box-and-whisker plots using three surrogates of firm size versus the number of sawmills a firm owns, are shown in figure 6-22. Surprisingly, the number of sawmills owned and the three surrogates measures of

firm size had a weak correlation. Using Spearman's rank correlation, the number of sawmills has r=0.331 (p=0.01) with total production volume in 2010, r=0.283 (p=0.04) with eight-hour production capacity in 2010, and r=0.334 (p=0.01) with the number of employees. Although they were statistically significant, horizontal integration and the size of firms were not strongly correlated. Some firms may pursue horizontal integration in order to achieve economies of scope rather than economies of scale.

Backward vertical integration

Considering backward vertical integration (from the viewpoint of the sawmill), some sawmills own forest lands. About one third (32.2 percent) of the surveyed sawmills own forest land. Comparing firms in the South with those in the North, 52.3 percent of Southern firms owned forest lands, but only 26.9 percent of the firms in the North did (Fisher's Exact Test: p=0.035). Comparing between firms located in coastal areas and inland areas, 38.3 percent of the coastal firms owned forests, while 19.2 percent of the inland firms owned forests (Fisher's Exact Test: p=0.066). Other geographical differences, such as comparing between U.S. firms and Canadian firms, did not show any statistical differences.

Forward vertical integration

In general, forward integration of sawmills indicates that sawmills also produce secondary or tertiary products by further processing their lumber. These value-added secondary or tertiary products include treated lumber, finger jointed lumber, glulam lumber, moldings, wooden furniture, decking, and wood frame houses. However, in this study, forward vertical integrations undertaken within a much narrower scope than generally understood. The definition of vertical integration is when a firm expands into areas that are located at different points along the same production path. Sawmill operation is the business activity that produce commodity softwood lumber. Any other value-added activities in the value chain of lumber are regarded as "extra" business operations in addition to the core business (sawing lumber). Figure 6-23 shows the kinds of value-added products softwood sawmill firms reported manufacturing.

The most popular value-added activity is planning, and 87.1 percent of the firms manufacture planing lumber, followed by kiln-dried lumber (77.6 percent), certified lumber (47.6 percent), painting (36.1 percent), precut (29.9 percent), decking and shop lumber (28.7 percent), railroad ties (25.3 percent), laminated lumber (23.0 percent), and pallets (21.8 percent).

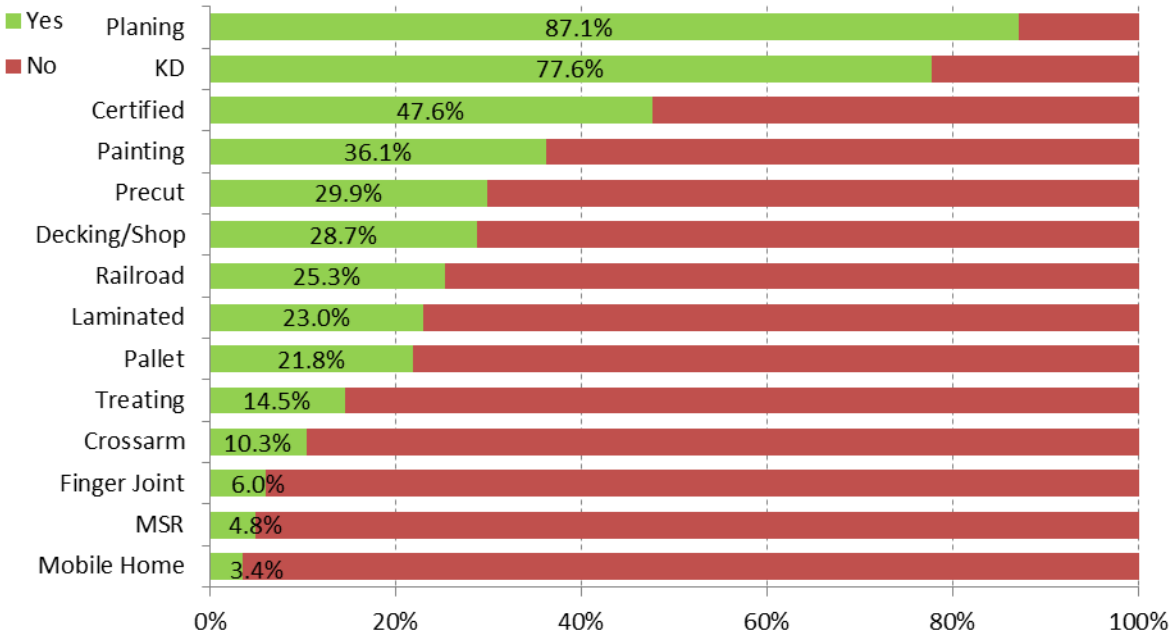

Figure 6-23. Value-added products manufactured by respondent firms

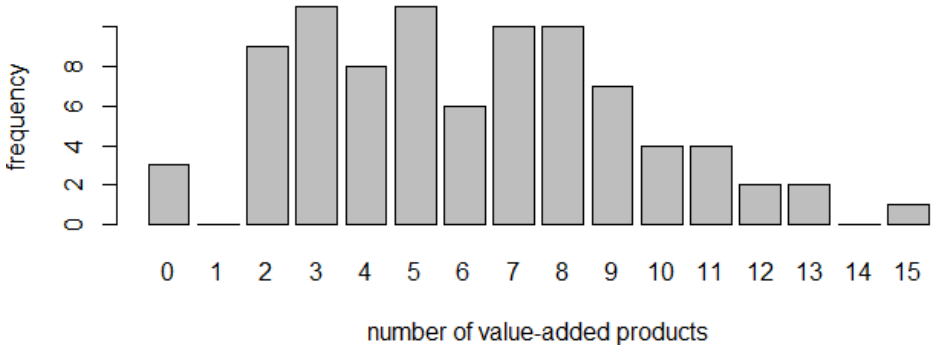

Figure 6-24. The number of value-added products firms manufactured

Twelve firms manufactured three or less value-added products, while 13 firms (14.8 percent) manufactured 10 or more value-added products (figure 6-24). Majority of the respondents manufactured between three to eight value-added products.

Assuming the core operation of softwood sawmill is manufacturing commodity lumber, then the selling or marketing activity is a value-added business operation. Transaction cost economics (Williamson 1979 and 1981) indicate why some firms choose a vertically integrated structure, while others specialize in one stage of production and outsource the remaining stages to other firms. This problem is also known as a buy-or-make decision. If a firm is good at manufacturing but is not good at sales, then they may want to outsource sales activities since transaction costs to internalize sales activities are higher than the transaction costs to use wholesalers. By doing so, the firm can be better off by outsourcing and can allocate their limited resources on what they are good at.

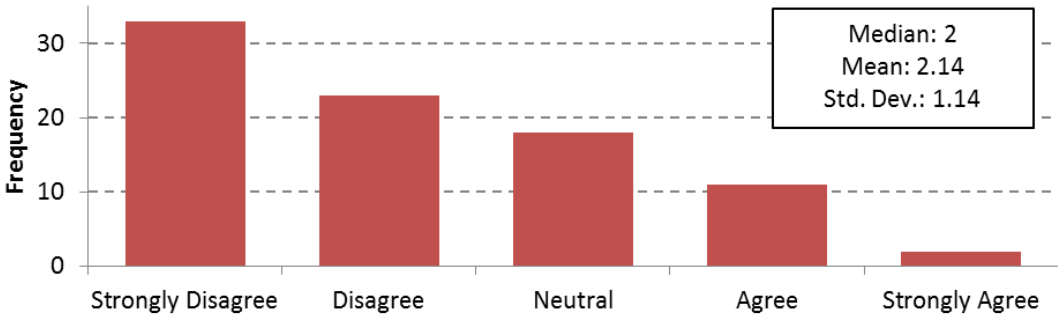

Figure 6-25. Agree or disagree on outsourcing sales/marketing function
Note: The mean and standard deviation are calculated assuming they are pseudo-interval measurements.

In the survey, firms were asked if they outsourced sales. Respondents could choose from a five-point Likert-like scale from strongly disagree to strongly agree, figure 6-25. Just 14.9 percent of the respondents either agree or strongly agree that their firms outsource the sales and marketing functions. On the other hand, 64.4 percent of the respondents either disagree or strongly disagree that their firms

outsource sales and marketing functions. Consequently, most firms would like to retain the sales and marketing function within the firm.

The sawmill survey also asked how much managerial effort a firm allocates to sales or production (figure 6-26). Fifty one respondents (58.6 percent) allocated 25 percent of their managerial efforts to sales activity so the reminder 75 percent of their efforts to production activity. On average, firms allocate 33.6 percent of their managerial efforts to sales activity and 66.4 percent of their efforts to production activity.

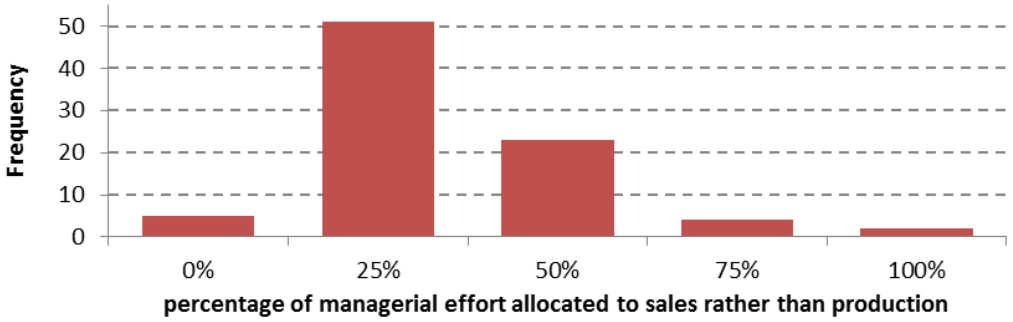

Figure 6-26. Managerial efforts allocated to sales activities rather than production activity

Respondents were also asked to indicate where they sold their products (figure 6-27). The survey results indicated that 48.2 percent of all products were sold to pro-dealers and wholesalers. Further, 26.7 percent were sold directly to end users and 13.9 percent to Do It by Yourself (D.I.Y.) retailers (or home centers). In the transaction cost framework, the decision to organize transactions within the firm as opposed to on the open market—the "make or buy decision"—depends on the relative costs of internal versus external exchange. With about 62 percent of all products being sold to wholesalers or D.I.Y. retailers, it actually means that quite a few firms externalize the sales function and failed to cultivate the full length of value chain because they used external sales representatives or firms to deliver their products to the end customers rather than through internal sales force directly to end customers. To

maintain the full length of sales function entails certain costs such as collecting information, negotiating and enforcing contracts.

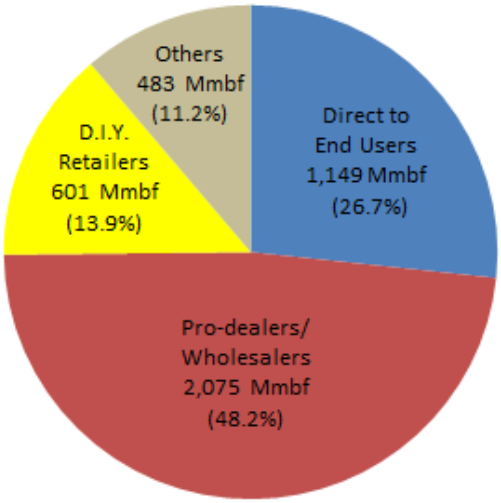

Figure 6-27. Total products sold to customers

The sales figures were broken down into five regions as shown in figure 6-28. In the Central and Northeast U.S., 50.7 percent of products were sold directly to end-users. In the Southern U.S., 39.1 percent were sold directly to end users, while only 7.8 percent and 6.3 percent of products are sold directly to end users in Western and Eastern Canada, respectively. Also, 82.0 percent, 63.1 percent, and 55.2 percent of products were sold to pro-dealers in Western Canada, Eastern Canada, and the Western U.S., respectively. Firms in Canada were more likely to externalize their sales force than firms in the U.S. Canada has smaller domestic markets than the U.S., so searching cost for customers may be higher for Canadian firms, which may be the reason for Canadian firms to rely on external sales force.

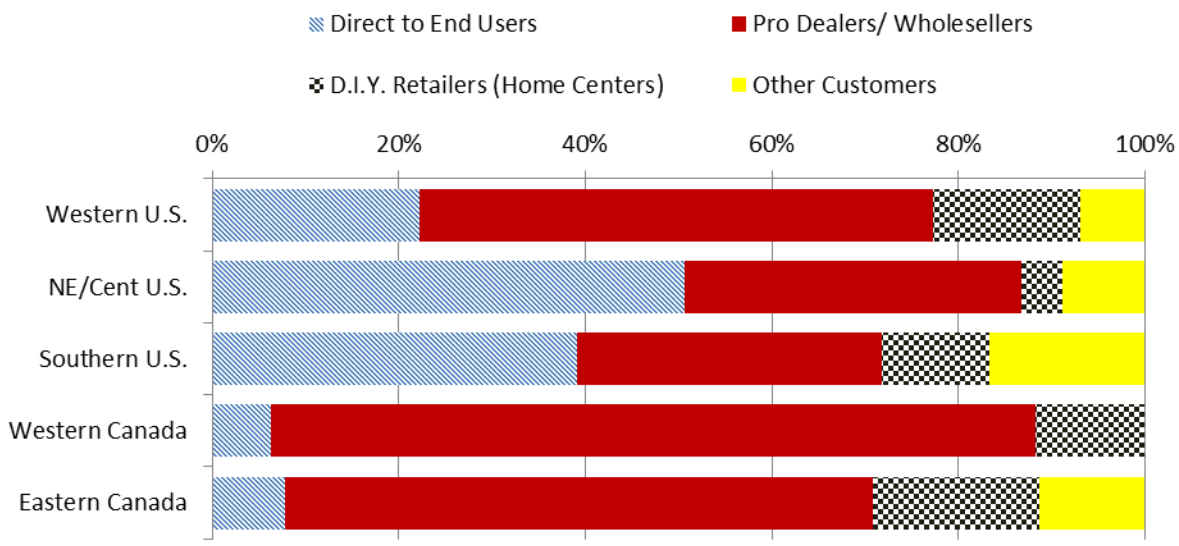

Figure 6-28. Products sold to customers by region

The sales diversity index is also calculated by using the same logic discussed in chapter two.

Sales Diversity Index = 1 - $\sum_{i=1}^{n} ratio_i{}^2$

When the sales diversity index is zero, a firm sells to only one customer. Histogram of sales diversity index is shown in figure 6-29, and the frequency is evenly distributed with 9.9 percent of respondents relied on single type of customer. The mean value of the sales diversity index was 0.363 and ANOVA analysis found no significant difference between five regions[13] F-test is 0.898; p=0.469), so no systematic difference was found in terms of sales diversity index. It implies that diversifying customers is uniquely decided by individual firms based on their business strategy.

[13] Five regions include Eastern Canada, Western Canada, Western U.S., Southern U.S. and Northeastern/Central U.S.

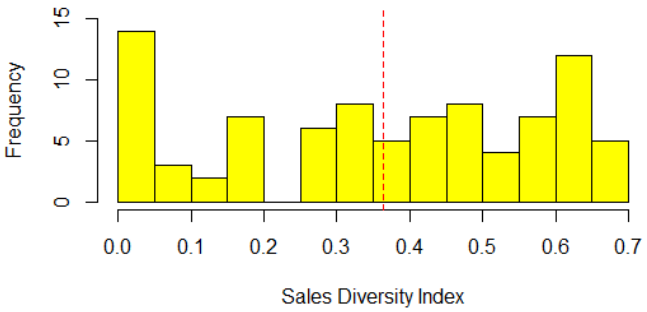

Figure 6-29. Histogram of sales diversity index

7. International business commitment

Respondents were asked about their involvement in the international markets. Among respondents, 29.9 percent reported that they directly exported their products to offshore markets (besides Canada and the U.S.), 23.0 percent directly exported only to the U.S. or Canada, and 6.9 percent were previous direct exporters but sold only into the domestic market at that time (figure 6-30). Another 12.6 percent of respondents reported that they were indirect exporters, only exporting their products through intermediate traders, while 27.6 percent have never exported to international markets.

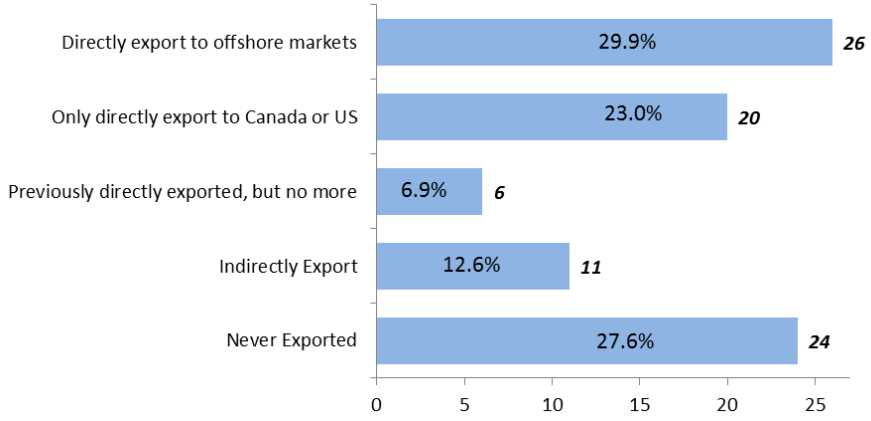

Figure 6-30. Current international business status

Respondents indicated that they started exporting at various times. As shown in figure 6-31, 30.4 percent of respondents started exporting operations before 1980; 23.9 percent of respondents started

exporting in the 1980s; 32.6 percent started in the 1990s; and 13.0 percent started between 2000 and 2010. The mean starting time was 1984, with a sample standard deviation of 15.6 years.

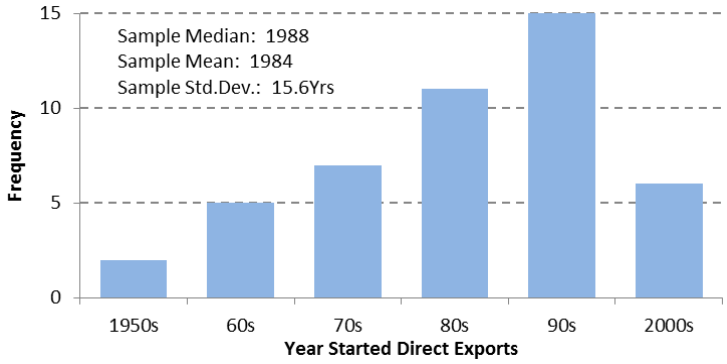

Figure 6-31. Year when firms started exporting

Figure 6-32 shows how many times firms shipped their products overseas in 2010. Firms that have never directly exported are not included in this graph.T he distribution of frequencies of direct export is highly right skewed, so the intervals of the chart are subjectively adjusted for visualization purposes. Among direct exporters, 28.9 percent of the respondents did not ship overseas in 2010 because the orders they receive are infrequent; 24.4 percent of them shipped from one to ten times; 24.4 percent of them shipped from 11 to 50 times; and 22.2 percent of them shipped more than 50 times in 2010. Two firms answered that they shipped around 1,000 times in 2010.

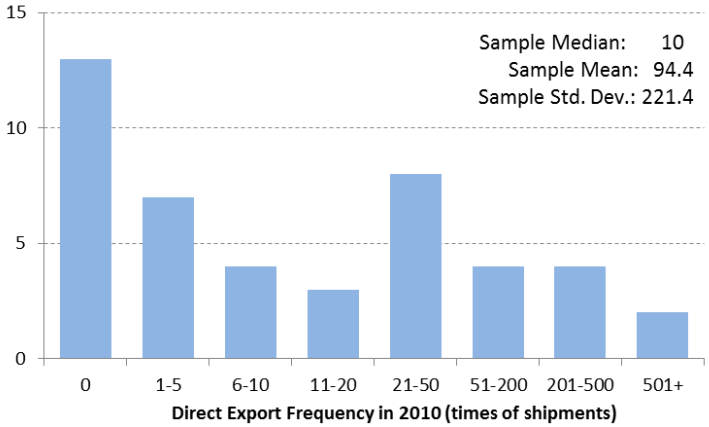

Figure 6-32. Frequency of direct exports in 2010

Figure 6-33 shows the volume of softwood lumber the respondents directly shipped to various countries or regions, including home country. Of the 4,602 mmbf produced by respondents in 2010, 76.5 percent was shipped to the U.S., 17.7 percent was shipped to Canada, and 5.7 percent was shipped to offshore markets, with Japan importing 3.5 percent, Europe 0.5 percent, China 0.4 percent, Mexico 0.1 percent, and the remainder went to other nations. It is important to note that this chart includes only "direct" shipments and does not include indirect exports where the final destination is unknown. Some firms sold their products to domestic wholesalers, but it is possible that they may have eventually sold some lumber to offshore markets, which this survey did not catch.

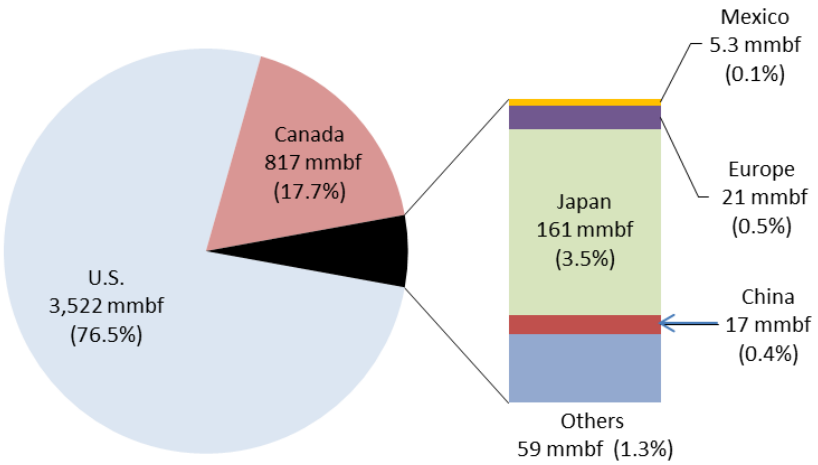

Figure 6-33. Sales volume by countries where respondents sold their products directly in 2010

Figure 6-34 contains two pie charts of the volume of lumber directly shipped to various countries or regions of the U.S. respondents (the left chart) and of the Canadian respondents (the right chart). U.S. firms predominantly shipped their products domestically in 2010—93.1 percent of the total 3,346 mmbf of softwood lumber production. The second best customer for the U.S. was Japan, which received 135 mmbf (4.0 percent). Followed by Canada with 44 mmbf (1.3 percent) to Canada. Smaller offshore markets included China (0.5 percent), Europe (0.2 percent), and others including Mexico, South Korea,

Taiwan, Vietnam, Australia and the Philippines. Canadian respondents shipped 61.5 percent of their 1,257 mmbf softwood lumber domestically, with 32.3 percent being shipped to the U.S.—their largest customer in 2010. The second largest customer for Canada was Japan, which imported 2.1 percent of their production. Canadian respondents also directly shipped 1.0 percent of their production to Europe, 0.3 percent to Mexico, 0.1 percent to China, and 2.7 percent to other nations, such as Middle East and Asia.

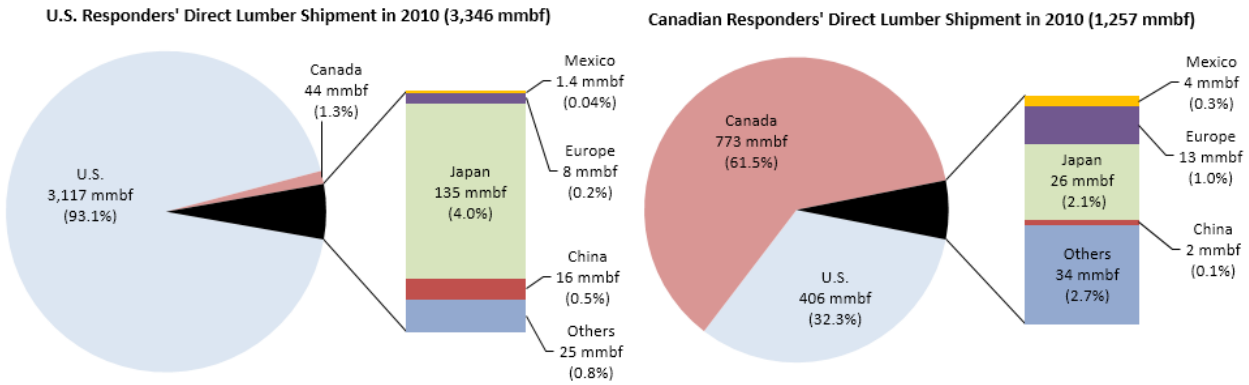

Figure 6-34. Sales volume by countries between Canada and the U.S.

The regional heterogeneity of export markets is shown in figure 6-35. Eastern Canada sold 34.8 percent and Western Canada 27.4 percent to the U.S. Only the Western regions sold to Japan; 8.4 percent of Western U.S. lumber production and 12.5 percent of Western Canada lumber production was shipped to Japan in 2010. Around 98 percent of Southern U.S. lumber production was shipped domestically.

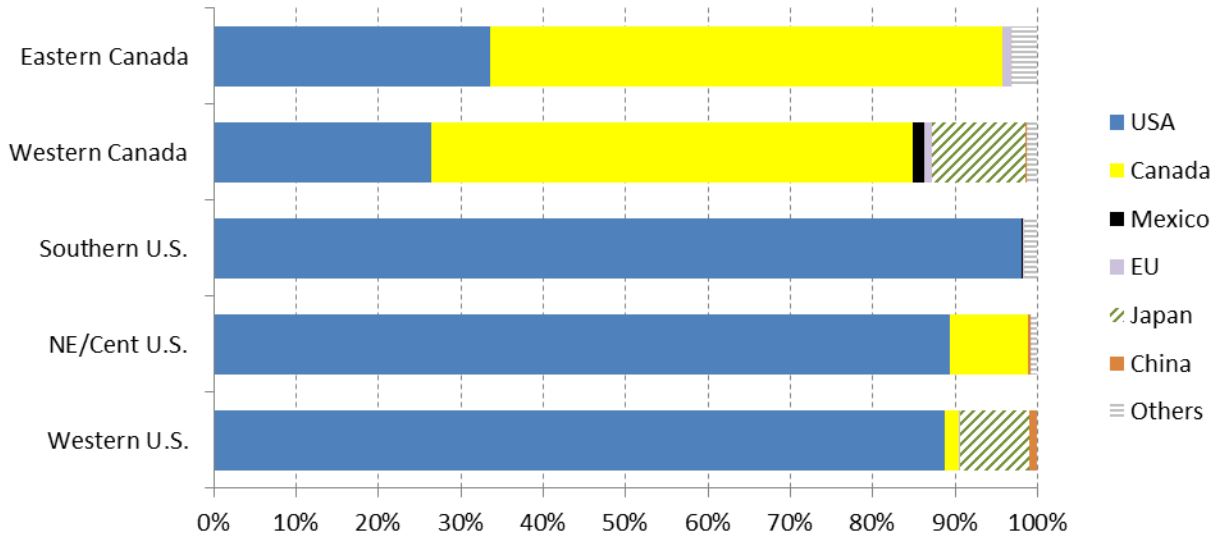

Figure 6-35. Shipping destinations by regions

The international diversity index is also calculated by using the same logic discussed in chapter 2-2. When this index is equal to zero, a firm only sells its products to a single country. As a firm sells to more countries, the index will increase, so a firm with a higher international diversity index would export their products to a larger number of markets. Analyzing the trade data found that, the overall international diversity index of the North American (U.S. and Canada) softwood lumber industry was 0.330, considering the well-diversified ideal figure of the international diversification index. The distribution of individual firm international diversity indexes is shown in figure 6-36, where 51.7 percent of the respondents have an international diversity Index of zero since they only sold products within the domestic market. The mean international diversification index of respondents was 0.137, measurably lower than the ideal number. The box-and-whisker plots for the international diversity index by production regions (the right chart) demonstrates the international diversity index of the Southern U.S. concentrated around zero, but the indexes of Western or Eastern Canada had wider variations. Since the international diversity index does not seem homoscedastic between regions, a non-parametric Kruskal-Wallis test was applied, and it suggests there were some significant differences in the distributions of

the five regions at a 1 percent level (Chi-square=14.26:p-value=0.007). These results show that international business commitments vary significantly by regions.

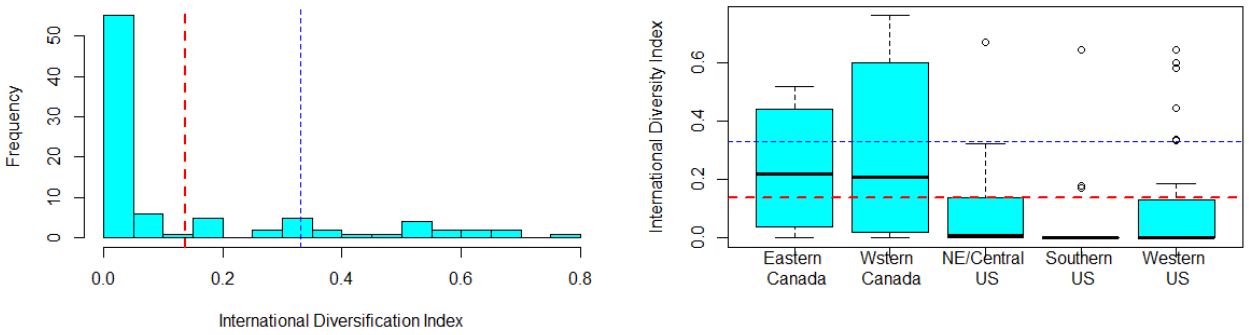

Figure 6-36. Distributions of international diversification index

Note: The red dotted line represents the mean of the respondents, while the blue dotted line represents the North American international market diversification mix based on the total export volume.

International orientation

Abdel-Malek (1974) defined managerial export orientation as the extent to which management is willing and able to mobilize the necessary resources to initiate, maintain, or expand the firm's active involvement in export marketing. Export orientation should be thought of as a priority that guides the process of export decision making. In order to measure this concept, each firm was asked to indicate the likelihood that export their products to a specific region or country within the next five years. The frequency table of the survey results is shown in table 4-13. The vast majority of respondents (97.7 percent) answered that they would continue to sell into their home market over the next five years. Almost 13 and 11 percent of respondents would like to sell to China and Japan over the next five years, respectively. On the other hand, 73.8, 69.4, 63.5 and 55.2 percent of respondents would unlikely to sell to Mexico, Europe, Japan and China, respectively. Among Mexico, Europe, Japan and China, it seems like respondents are the most interested in Chinese market.

Table 6-12. Frequency table of international orientation

	<= Unlikely	Likely	Very Likely	Definitely	Median	Mean	Std. Dev.
Home	0 (0%)	0 (0%)	2 (2.3%)	85 (97.7%)	6	5.977	0.151
Neighbor	32 (37.6%)	15 (17.6%)	11 (12.9%)	27 (31.8%)	4	4.188	1.55
(USA)	3 (3.4%)	5 (5.7%)	4 (4.6%)	75 (86.2%)	6	5.713	0.820
(Canada)	29 (34.5%)	10 (11.9%)	9 (10.7%)	36 (42.9%)	5	4.459	1.61
Mexico	62 (73.8%)	14 (16.7%)	2 (2.4%)	6 (7.1%)	3	2.845	1.32
Europe	59 (69.4%)	14 (16.5%)	7 (8.2%)	5 (5.9%)	3	3.000	1.34
Japan	54 (63.5%)	19 (22.4%)	3 (3.5%)	9 (10.6%)	3	3.188	1.38
China	48 (55.2%)	20 (23.0%)	8 (9.2%)	11 (12.6%)	3	3.379	1.49
Overall	43 (51.2%)	18 (21.4%)	8 (9.5%)	15 (17.9%)	3	3.571	1.56

Note: Means and sample standard deviations were calculated by assuming they are measured on a pseudo-interval scale: 1=Definitely Not, 2=Very Unlikely, 3=Unlikely, 4=Likely, 5=Very Likely, and 6=Definitely.

Respondents' likelihood of exporting to each of the counties was tested using the non-parametric Friedman test because the responses are measured in ordinal scale, where the null hypothesis was that the likelihood of exporting to each country was the same. A Chi-Square test of the Friedman test statistics gave a value of 14.5 with 3 degrees of freedom (p=0.002), means that the null hypothesis is rejected at a 1 percent level of significance. Therefore, respondents' likelihood of exporting to each country was not the same. A *post hoc* analysis was applied to detect which combinations are different[14]. The results show that respondents perceive a significantly higher international orientation toward China than Mexico at the 10 percent level (table 6-13). Mean ranks for the other combinations were not statistically significant at a 10 percent level.

[14] A Wilcoxon sign-rank test was initially applied to compare each combination and a Boneferroni adjustment is applied to adjust, dividing the significant level by the number of tests run—6 in this case. The Wilcoxson sign-rank test itself may detect a significant result of multiple comparison when it should not (i.e. the probability of a Type I error is inflated because of the pair-wise comparison). So, after applying a Boneferroni adjustment, the new significance level would be 0.10/6 = 0.17, 0.05/6=0.0083, and 0.01/6=0.0017, respectively.

Table 6-13. Post-hoc Wilcoxon signed rank test on Friedman test with applied Boneferroni adjustment

	Z	Asymp. P-value	Mean Rank	Sig. by Boneferroni
EU vs. Mexico	-0.856	0.3923	EU > Mexico	
Japan vs. Mexico	-2.123	0.0337 **	JP > Mexico	
China vs. Mexico	-3.102	0.0019 ***	CN > Mexico	*
Japan vs. EU	-1.252	0.2107	JP > EU	
China vs. EU	-2.239	0.0252 **	CN > EU	
China vs. Japan	-1.803	0.0714 *	CN > JP	

Note: Z-statistics is based on Wilcoxon signed rank test
***, **, * Significant difference at 1%, 5%, and 10% level respectively

To assess whether a firm's international orientation toward a specific region/country was the same between the geographic regions in figure 6-14, the non-parametric Mann-Whitney U test was used. Since the survey was ordinal scale, the assumption of equal intervals is not supported; hence, the two-sample t-test is not appropriate. The Mann-Whitney test, a non-parametric alternative to the two-sample t-test, was used to compare every observation in the first group with every observation in the second group.

Table 6-14. Mann-Whitney U test: international orientation by regional differences

	U.S. (65) vs. Canada (22)		West (49) vs. East/Central (38)		South (20) vs. North (67)		Coast (61) vs. Inland (26)	
	higher	Approx. Z	higher	Approx. Z	higher	Approx. Z	higher	Approx. Z
Home	Same	-0.81	Same	-1.22	Same	-0.78	Same	-0.93
Neighbor	Canada	-2.54 **	Same	-0.11	North	-3.97 ***	Same	-1.04
(USA)	US	-5.71 ***	Same	-0.55	North	-2.02 **	Same	-0.38
(Canada)	Canada	-5.32 ***	Same	-0.07	North	-4.54 ***	Same	-1.52
Mexico	Same	-0.15	Same	-1.15	Same	-0.24	Same	-0.25
EU	Canada	-2.08 **	Same	-0.37	Same	-0.14	Same	-1.57
Japan	Same	-0.43	West	-3.17 ***	Same	-0.84	Same	-1.40
China	Same	-0.44	West	-2.32 **	Same	-0.10	Same	-1.08
Int'l Buz	Same	-1.16	Same	-1.00	Same	-0.28	Coast	-2.29 **

Note: Approximated Z-statistics are based on Mann-Whitney U-test.
***, **, * represent significant difference at 1%, 5%, and 10% level respectively

First, U.S. and Canadian firms were compared to see if their samples were from the same distribution or not (table 6-14). As might be expected, U.S. firms would like to target the U.S. market more aggressively

than Canadian firms. On the other hand, Canadian firms like to target the Canadian markets and European markets more seriously than U.S. firms. Western firms were more interested in the Japanese and Chinese markets than firms in the Eastern and Central regions. Finally, firms near the coast have a significantly higher overall international business orientation than firms located inland.

Opportunity and risk perception

Firms were asked to assess the level of opportunity and business risk for 16 specific export markets[15], including the US and Canada. Respondents were asked to assess the potential attractiveness of the 16 countries using a five-point Likert-like scale: 1) not at all attractive, 2) somewhat attractive, 3) attractive, 4) very attractive, and 5) extremely attractive. Since these are ordinal measurements, there is no clear reference point for respondents' perceptions. While they may hold similar perceptions of the attractiveness for each market, some respondents tended to select overall high scores, and vice versa. In order to remove these individual biases, the ratings were standardized for each respondent, and the differences between ratings were assessed. A standardized score for the attractiveness will be referred to as the "opportunity perception" for each country.

Figure 6-37 shows the violin plots of the opportunity perception for each country. Countries are listed from the highest perceived opportunity to the lowest. Overall, respondents perceived the U.S. to have

[15] Sixteen nations were identified for this part of the study. Since our target population is either U.S. firms or Canadian firms, U.S. (USA) and Canada (CAN) are on the list. Also, Mexico (MEX) is on the list since Mexico is a member of the North American Free Trade Agreement (NAFTA). U.S. and Canadian firms ship some lumber to Caribbean nations, so the Dominican Republic (DOM) was selected to be on the questionnaire in order to represent these Caribbean nations. Since many respondents' mother tongue is either English or French, the UK (GBR) and France (FRA) are on the questionnaire. Italy (ITA) was chosen as the developed nation from Europe that uses a different language. Turkey (TUR) is included because it is in the middle of Europe and the Middle East and they have a large population. From the Middle East and Africa, Egypt was initially listed; however, Egypt was the center of the Arab spring uprising when this study was designed, so it was removed from the list since the result may be biased because of the news. Instead of Egypt, Saudi Arabia (SAU) was added, even though they are one of the wealthiest GCC nations in the region. Japan (JPN), South Korea (KOR), and China (CHN) are on the list because they are in a slightly different economic development stage in East Asia. Australia (AUT) was chosen since they are an English-speaking developed nation in the Asia-Pacific region. Some forest products business owners practice a so-called "China-Plus-One strategy" which refers to the practice of international business activity in China plus investments with a second market, generally in another Asian economy, such as Indonesia (IDN) and Vietnam (VNM). Last, India (IND) was chosen since they have a huge population and many people foresee a bright future in terms of economic growth.

the highest opportunity, followed by Canada, China, Japan, Mexico, India, and Korea. Respondents perceived the least opportunity in the Dominican Republic. They perceived the highest opportunity in North American nations and ranked the developing nations as having the least opportunity.

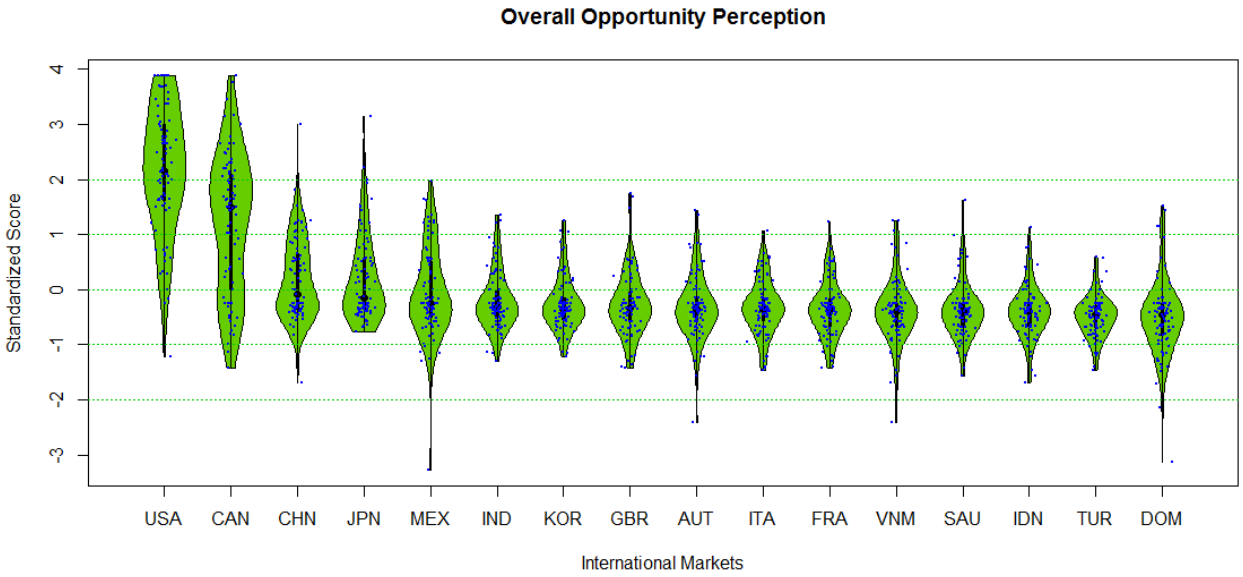

Figure 6-37. Overall opportunity perception of 16 countries

Risk perception is considered as a key variable in relation to internationalization speed (Acedo and Jones 2007). Respondents were also asked to assess the overall level of business risk for each of the 16 different countries using another five point Likert-like scale; 1) not risky at all, 2) somewhat risky, 3) risky, 4) very risky, and 5) extremely risky. In order to remove respondent bias, the responses were also standardized for each individual and the standardized risk assessment score will be referred to as the "risk perception" for each country. Figure 6-38 shows the violin plots of the risk perception for each country. The countries are sorted from the lowest to the highest risk perception. Overall, respondents perceived that the U.S. and Canada had the lowest risk, followed by Japan, the UK, Australia, France,

Italy, and Korea. Even though China and India were ranked higher in opportunity perception, they were perceived to be moderately high-risk countries. Respondents perceived high risk in developing nations. It is also interesting to note that the survey risk perception ranking roughly corresponds to the corruption perceptions index scores reported by Transparency International (2013). Spearman's rank correlation revealed the correlation between business risk perception and corruption perceptions index was 0.895, suggesting strong correlation of perceptions between business risk and corruption in each country.

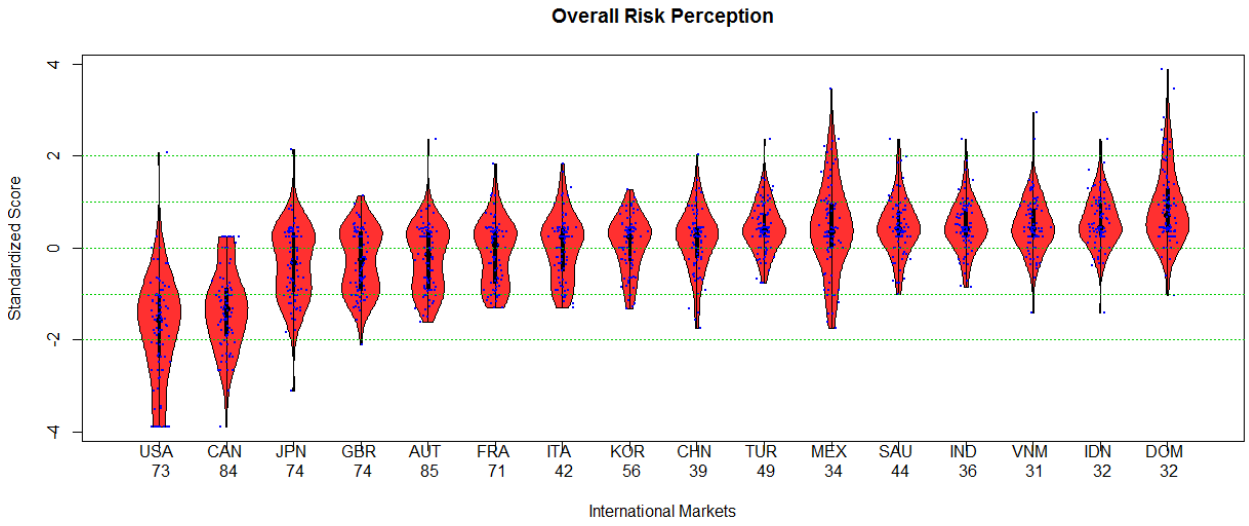

Figure 6-38. Overall risk perception of 16 countries

Note: Numbers below the country code represents the Corruption Perception Index scores reported by Transparency International (2013)

These perceptual rankings may be a useful tool to understand the trends of international commitments among firms in the softwood lumber industry. Perceived opportunity/risk information can complement information obtained from a technical analysis (e.g. econometric analysis on historical trends) and a marketing analysis to predict future international trade flows.

8. U.S. Pacific Northwest vs. Southeastern U.S.

In the U.S., Pacific Northwest (PNW)[16] and Southeastern U.S.[17] are the two major softwood production regions. Comparison between those two regions is one of the most interesting research topics with respect to the domestic competiveness within the U.S.

Table 6-15. International commitments between PNW and Southeastern U.S.

	Domestic Focus	Indirect Exporter	Previous Direct Exporter	Directly Export to Canada Only	Directly Export to Offshore
PNW	11	2	2	1	11
Southeast	9	4	1	0	3

The frequency of international business commitment of firms in PNW and Southeastern U.S. is shown in table 6-15. Firms are categorized into six groups based on the degree of international commitments: 0) only target domestic market ("Domestic"), 1) indirectly exports and never directly export ("Indirect"), 2) currently indirectly exports and previously directly exported ("Previous"), 3) directly exports only to Canada or the U.S. ("Export to Canada"), or 4) directly exports outside of North America ("Export Offshore"). Firms in PNW are more likely to conduct higher degrees of international business, such as directly exports to offshore markets, than firms in Southeast.

The proportion of observed variables between PNW and Southeastern U.S. are compared (figure 6-16). Since sample size is relatively small, Fisher's exact test was used in the analysis of contingency table to find whether any differences of proportions between PNW and Southeastern firms exist. As discussed above, the PNW firms are more likely to directly export to offshore markets than Southeastern firms at 10 percent level of significance. Also, Southeastern firms are significantly more likely to own forest

[16] PNW includes WA, OR, Northern CA, ID, MT and WY. Since the focus of this section is the competition within the U.S., BC Canada is excluded.
[17] Southeastern U.S. includes OK, TX, AR, MS, LA, AL, FL, GA, SC, NC, VA, and MD.

lands than PNW firms (p<0.1). Within last five years, firms in PNW were significantly more likely to have changed marketing strategies (p<0.05) and have added forest certification products (p<0.1) than firms in Southeast. Finally, firms in PNW are significantly more likely to make painted lumber and treated lumber than those in Southeast (p<0.1).

Table 6-16. Proportions and differences between PNW and Southeastern U.S.

	PNW	Southeast	
Directly Export Offshore	0.519	0.235	*
Owns Forest	0.250	0.500	*
Changed Marketing	0.593	0.235	**
Applied Certification	0.429	0.176	*
Painted Lumber	0.423	0.176	*
Treated Lumber	0.308	0.059	*

Note: ***, **, * represent significant difference by Fisher's exact test (one-tail) at 1%, 5%, and 10% level respectively.

Variables measured in continuous scale and ordinal scale between PNW and Southeastern U.S. are also compared. Since most data are not assumed to be normally distributed, a non-parametric Mann-Whitney U test rather than two-sample t-test was used to find differences of distributions between PNW and Southeastern firms. Table 6-17 only shows the items which showed significant differences at 10% level. On average, firms in PNW made significantly more changes than firms in Southeastern U.S. Firms in PNW are significantly more likely to provide customized products rather than standardized products than firms in the Southeast (p<0.05). More PNW firms focus on niche markets rather than mass markets than firms in Southeast (p<0.05). On the other hand, firms in Southeast are significantly more likely to compete on price than firms in PNW (p<0.1). Firms in PNW produce significantly more products than firms in Southeast (p<0.05). Also, firms in Southeast target geologically narrower markets (p<0.1) and utilize less species (p<0.01) than PNW competitors.

Table 6-17. Means and differences between PNW and Southeastern U.S.

	PNW	Southeast	
Changes made	4.86	3.59	*
Willing to Customize	3.93	3.17	**
Target Niche Market	4.29	3.72	**
Compete on Price	2.43	3.00	*
Number of Products	2.26	1.65	**
Geo-Market Diversification	0.87	0.94	*
Species Diversification	0.69	0.97	***

Note: ***, **, * represent significant difference by Mann-Whitney's U test at 1%, 5%, and 10% level respectively.
Means were calculated by assuming they are measured on a pseudo-interval scale.

The likelihood to sell to a market within five years was compared between PNW and Southeastern U.S. Since data is measured in ordinal scale, non-parametric Mann-Whitney U test was used to find whether any difference of distribution between PNW and Southeastern U.S. exist (table 6-18). Firms in PNW are significantly more likely to sell to Canada ($p<0.05$) and Japan ($p<0.1$) than firms in Southeast. Indeed those markets are much easier to access for firms in PNW than firms in Southeastern U.S. Firms would like to sell to Mexican, European and Chinese markets are not statistically different between PNW and Southeast.

Table 6-18. The likelihood of exporting to international markets within next five years between PNW and Southeastern U.S.

	PNW	Southeast	
Canada	4.14	3.00	**
Mexico	3.04	3.00	
Europe	2.93	3.24	
Japan	3.81	3.00	*
China	3.86	3.39	

Note: ***, **, * represent significant difference by Mann-Whitney's U test at 1%, 5%, and 10% level respectively.
Means were calculated by assuming they are measured on a pseudo-interval scale.

At last, opportunity perception of 16 different markets were compared between PNW and Southeastern U.S. Since data was measured in ordinal scale, non-parametric Mann-Whitney U test was used to find if differences of distribution between PNW and Southeastern U.S. were significant (table 6-19). The firms

in PNW overall perceived significantly more opportunities in Canada, Japan, China, and Australia than the firms in Southeastern U.S. On the other hand, the firms in Southeast perceived significantly more opportunities in Dominican Republic than the firms in PNW ($p<0.01$). Geographically, PNW firms can access Canadian, Japanese, Chinese and Australian markets much easier than Southeastern firms. On the other hand, Dominica Republic is much closer for Southeastern firms than for PNW firms. It is likely that those geographical factors influenced the differences of opportunity perceptions between PNW and Southeast.

Table 6-19. The opportunity perception of 16 countries between PNW and Southeastern U.S.

	PNW	Southeast	
U.S.	4.70	4.65	
Canada	3.30	2.12	***
Mexico	2.26	2.41	
Dominica	1.52	2.29	***
UK	1.85	1.88	
France	1.70	1.82	
Italy	1.96	1.88	
Turkey	1.67	1.88	
Saudi Arabia	1.67	1.76	
Japan	3.07	2.00	***
Korea	2.26	2.06	
China	2.96	2.24	**
Vietnam	2.11	1.71	
Indonesia	2.11	1.76	
India	2.22	2.12	
Australia	2.33	1.65	**
Int'l Business	2.67	2.29	

Note: ***, **, * represent significant difference by Mann-Whitney's U test at 1%, 5%, and 10% level respectively.
Means were calculated by assuming they are measured on a pseudo-interval scale.

Chapter 7. Measuring Strategic Orientation Constructs

Based on the hypotheses, this study used the degree of firms' strategic orientations as key independent variables, but they are not directly observable. Three important strategic orientation constructs were identified: 1) sales orientation, 3) differentiation orientation, and 3) innovativeness of sales functions. This chapter discusses how those strategic orientation constructs of each firm were estimated.

1. Strategic orientation constructs

Strategic orientations, a component of the organizational culture of a firm, are the guiding constructs influencing a firm's strategy-making decisions (Noble et al. 2002). Many scholars have investigated strategic orientations in the marketing and strategic management fields. For example, research on market orientation (e.g. Narver and Slater 1990; Jaworski and Kohli 1993) is perhaps one of the most popular strategic orientations. Firms' strategic orientations are not directly observable. Researchers often apply latent variable models, such as factor analysis and structural equation modeling, to estimate the unobservable strategic orientations of firms. Some researchers believe that the cognition of managers well represents the elements of organizational culture of firms (Hitt et al. 1997), which is also a core assumption of this study. Hence, survey responses provided by managers of firms can represent the strategic orientations of the firm.

International orientation or entrepreneurship of the firm is embedded in organizational culture (Dimitratos and Plakoyiannaki 2003). Three business strategic orientation constructs have been identified as important drivers of a firm's international business decisions according to the preliminary interviews of a dozen managers of forest products firms and industrial experts. The first business strategic construct is "sales orientation" as opposed to a production orientation. The second business

strategic construct is “differentiation orientation” as opposed to a cost-leadership orientation. The third business strategic construct is “innovativeness of sales functions.”

The ultimate goal of this chapter is to estimate the relative degrees of these three intangible business strategic constructs of each firm in order to later use them as independent variables for regression models to explain the degree of international commitment. On the other side, to understand how these three latent variables interact is out of the scope of this study. Consequently, confirmatory factor analysis is applied to determine which scale items can measure these latent constructs.

2. Instrument development

This section considers whether the underlying latent factors or constructs can account for the patterns of covariation among a number of measured variables. In order to collect the necessary data, a survey was developed to measure the business strategy constructs for each firm. While several existing scales for measuring similar constructs were available from previous studies, these scale items were not appropriate for use with the lumber industry. To develop a relevant survey instrument, three constructs from the business literature were identified, taking care to tap the domain of each construct. Next, five to seven scale items were selected from each construct with respect to the content or face validity of the constructs. Items were tested for clarity and appropriateness within the context of the forest products industry by industry experts and marketing academicians. Also, several scale items were set to a reverse-scored scale in order to avoid response set bias. Finally, five sawmill managers were asked to complete a draft questionnaire and identify any ambiguity or other difficulty they experienced in responding to the items. This initial evaluation was followed by the pre-test where five academicians evaluated the scale items from the view of domain representatives. Based on their feedback, two to five items were left for each construct in the survey.

Sales orientation

Many firms have followed a production orientation based on the belief that production efficiencies, cost minimization, and product improvement will bring profits. In this way, they can deliver quality goods and services to consumers at attractive prices. On the other hand, many other firms have adopted a sales orientation based on the belief that consumers will purchase more goods and services if aggressive sales and advertising efforts are employed (Noble et al. 2002). These two strategic orientations both may raise competitiveness. Although they may not be mutually exclusive, firms always decide to allocate their limited resources in production or sales activities. These decisions are made based on the firm's sales/production orientation.

Sales orientation was measured using five items. Each item was measured on a five-point Likert-like scale, ranging from "strongly disagree" to "strongly agree." Following are the questions:

1. Management resources go to production rather than sales activities. (MKTG)
2. We sell to new customers. (NEWC)
3. We outsource our sales functions to agents and/or distributors. (DEAL) [Reversed-Scale]
4. Sales teams have authority to make sales decisions. (AUTHO)
5. Sales teams are very aggressive. (AGGR)

Differentiation orientation

Two kinds of questions were used to determine the scope of the firm: 1) product scope and 2) geographic scope of the firm. Even though both diversification strategies are similar, they are usually studied in different fields. Product diversification is usually studied within the strategic management field while geographic diversification is usually studied within the international business field (Peng and Delios 2006). Geographic diversification is a dependent variable in this chapter. On the other hand, I will

treat product diversification as a major explanatory variable and will discuss in this section how to measure the degree of product diversification of each firm.

Differentiation orientation is the firm's constructs which urges firms to pursue a differentiation strategy rather than a cost-leadership strategy. Differentiation orientation was measured using a four-item scale. Each item was measured on a five-point Likert-like scale, ranging from "strongly disagree" to "strongly agree." Following are the questions:

1. We offer customized products rather than standardized products. (STAND)
2. We strive to improve product quality even if it costs more. (QUAL)
3. We target niche markets rather than the generalist market. (NICH)
4. We compete on price rather than on product quality in the market. (PRICE) [Reversed-Scale]

Innovativeness of sales functions

Innovation is one of the most widely abused words in daily life. Unless precisely defined, the constructs are unclear and opaque (Välimäki et al. 2004). Nevertheless, it is widely believed that innovation is a key to success in business. There is no established way to measure organizational innovation, although many previous studies in management, strategy, marketing, and even the forest products field have attempted to quantify the innovation or innovativeness of a firm. The definition of innovation varies depending on the goals and contexts of each study. Innovation may include very different constructs: new product development, R&D, new technology adoption, incremental quality improvement, cutting cost structure, exploring new markets, and imitating competitors[18]. A firm's innovativeness is a composition of variable activities, thus there is no single indicator for innovativeness (Rogers 1985).

[18] See Ganguly (2008) who integrates the classification of innovation along the diffusion study framework.

In the forest products literature, Knowles et al. (2008) defines innovativeness as a firm's propensity to adopt and/or create new products, new processes, or new business systems. Many researchers in the forest products field have cited this definition and conclude this is key to increasing a firm's performance (e.g. Hovgaard and Hansen 2004; Crespell et al. 2006; Hansen 2006; Crespell and Hansen 2008b; Nybakk et al. 2008, Hansen 2010; Hansen et al. 2011). However, unless one clearly defines innovation, it is not easy to convince the research community that these scales successfully measure a firms' ability to innovate, or its innovativeness. Now, I will follow the eland to the frequently cited previous studies in the forest products field and estimate the degree of innovativeness based on the established methodology.

Knowles et al. (2008) developed a self-evaluation scale to measure innovativeness. A total of 25 items using a five-point Likert-like scale were applied from previous studies. These items can measure a firm's propensity to create new products, new manufacturing processes, new business systems, or its propensity to adopt new manufacturing processes and new business systems. Crespell and Hansen (2008b) applied 15 self-scales to measure innovativeness. On the other hand, Nybakk and Hansen (2008) used only four items to measure process innovativeness.

However, the interest of this study is innovativeness of sales functions of the firm, not the innovativeness of the manufacturing process, since some "innovativeness" might already be captured by the differentiation orientation. Although including many similar questions usually raises the reliability and correlation, they simultaneously lower both the response rate and the quality of the survey. In this study, just two self-scale items were used to evaluate the innovativeness of the sales team and the respondents were allowed to interpret the definition of "entrepreneurial" and "innovative" themselves. Each item was measured on a five-point Likert-like scale, ranging from "strongly disagree" to "strongly agree." Following are the questions:

1. Sales teams are highly entrepreneurial. (ENTRE)
2. Sales teams are very innovative. (INNOV)

3. Data analysis

Three missing values out of 979 cells (0.3 percent) were detected, and a multiple imputation method was utilized to impute the missing values in order to reduce bias in both the coefficients and standard errors versus a simple list-wise deletion (King et al. 2001). Correlations between these thirteen questions are shown on table 7-1, and this was used to check the convergent and discriminant validity. Since original data was ordinal data, the non-parametric rank correlations are shown. The upper right triangle on table 7-1 shows Spearman's ρ rank correlation, and the lower left triangle shows Kendall's τ rank correlation.

Table 7-1. Correlation between observed variables

	mktg	newc	deal	autho	aggr	stand	qual	nich	price	entre	innov
mktg		0.29	-0.16	-0.07	0.13	0.32	0.18	0.29	0.03	0.11	0.01
newc	0.26		0.07	-0.13	0.29	0.23	0.13	0.12	-0.09	0.03	-0.01
deal	-0.14	0.06		-0.01	0.03	0.21	0.03	0.19	-0.10	0.00	-0.13
autho	-0.07	-0.12	-0.01		0.00	-0.04	-0.02	0.19	-0.04	0.40	0.27
aggr	0.12	0.26	0.02	-0.01		0.00	0.24	0.00	-0.09	0.44	0.21
stand	0.28	0.26	0.24	-0.05	0.00		0.25	0.41	-0.17	0.05	0.11
qual	0.16	0.11	0.03	-0.03	0.27	0.23		0.47	-0.30	0.21	0.13
nich	0.26	0.10	0.16	0.20	0.00	0.36	0.43		-0.15	0.06	0.10
price	0.02	-0.08	-0.09	-0.05	-0.10	-0.15	-0.26	-0.13		-0.19	-0.16
entre	0.10	0.02	0.00	0.38	0.41	0.04	0.19	0.06	-0.16		0.38
innov	0.01	-0.01	-0.11	0.25	0.20	0.10	0.12	0.09	-0.14	0.35	

Note: Upper right triangle shows Spearman's rho, and lower left triangle shows Kendall's tau.

In addition, the polychoric correlation is shown in table 7-2. Since ordinal data does not provide metrical information, the analyst needs to analyze the information using a contingency table. In the psychology

field, it is often hypothesized that an underlying metrical variable is associated with the observed ordinal data. Unlike Kendall's τ and Spearman's ρ, polychoric correlations assume an underlying bivariate normal distribution, which captures the linear dependency between two variables, so it can be used in many other statistical applications, especially for latent variable modeling.

Table 7-2. Polychoric correlation between observed variables

	mktg									
newc	0.37	newc								
deal	-0.25	0.03	deal							
autho	-0.09	-0.22	-0.01	autho						
aggr	0.17	0.39	0.00	-0.04	aggr					
stand	0.33	0.30	0.32	-0.11	0.00	stand				
qual	0.21	0.19	0.05	-0.06	0.35	0.33	qual			
nich	0.35	0.15	0.27	0.24	0.00	0.49	0.58	nich		
price	0.07	-0.16	-0.09	-0.03	-0.12	-0.22	-0.37	-0.19	price	
entre	0.15	0.07	0.02	0.54	0.48	0.07	0.31	0.14	-0.22	entre
innov	-0.01	-0.07	-0.13	0.41	0.24	0.12	0.16	0.11	-0.16	0.49

4. Result

Confirmatory factor analysis (CFA) was used to estimate the three latent business strategic constructs: "sales orientation," "differentiation orientation," and "innovativeness." The computer software M Plus 7 (Muthén and Muthén 2012) was used to analyze the data. The weighted least square method was used to estimate the model parameters from the sample polychoric correlation matrix. To determine the extent to which the various CFA models provided valid evidence based on the internal structure of the survey, a χ^2 test for lack-of-fit was primarily used to judge the fitness of the model. The root mean square error of approximation (RMSEA), CFI/TLI, and weighted root mean square residual (WRMR) were used as complementary indices. Following the recommendations of Marsh et al. (2004), fit indices were

used as evidence complementary to existing theory rather than making absolute judgments about validity. The model fit cutoff values are reliant on Hu and Bentler (1999).

The overall goodness-of-fit indices for each of the models are given in table 7-3. For the main CFA analyses, the Full Model was the null model, and all 11 proposed items are loaded onto the three constructs discussed above. The Full Model does not fit well with χ^2 statistics of 115.6 (d.f.=41), suggests the model does not fit well. Next, variables are deleted from the Full Model step-by-step to find the best-fit model based on the fit indices while face validity is maintained. According to the loading scores, sales-orientation looked unstable and several variables were dropped. When "auth," "aggr," and "mktg" were dropped, the χ^2 statistic of lack-of-fit with 21.16 (d.f.=17) became small enough to conclude the model fits well. The CFI was larger than 0.9, which also implies a good fit (Hu and Bentler 1999). The model with standardized coefficients is shown in figure 7-1. This structure of the model was applied for the further analysis in this study.

Table 7-3. Model fitness of confirmatory factor analysis

	χ^2	d.f.	p-value	RMSEA	CFI	TLI	WRMR
Full Model	115.61	41	0.000	.143	.657	.539	1.130
Drop deal	94.884	32	0.000	.149	.709	.590	1.098
Drop auth	86.049	32	0.000	.138	.736	.629	**.961**
Drop aggr	96.544	32	0.000	.151	.628	.476	1.087
Drop newc	**76.035**	32	0.000	**.124**	**.783**	**.695**	.981
Drop mktg	80.052	32	0.000	.130	.729	.619	1.039
Drop auth aggr	**52.342**	24	0.0007	.115	.821	.731	.810
Drop deal, newc, mktg	25.420	17	0.0857	.075	.957	.929	.625
Drop auth, aggr, mktg	**21.163**	17	**0.2191**	.052	.969	.949	.556
Drop Sales Orientation	**10.454**	8	**0.2346**	.059	.981	.964	.440

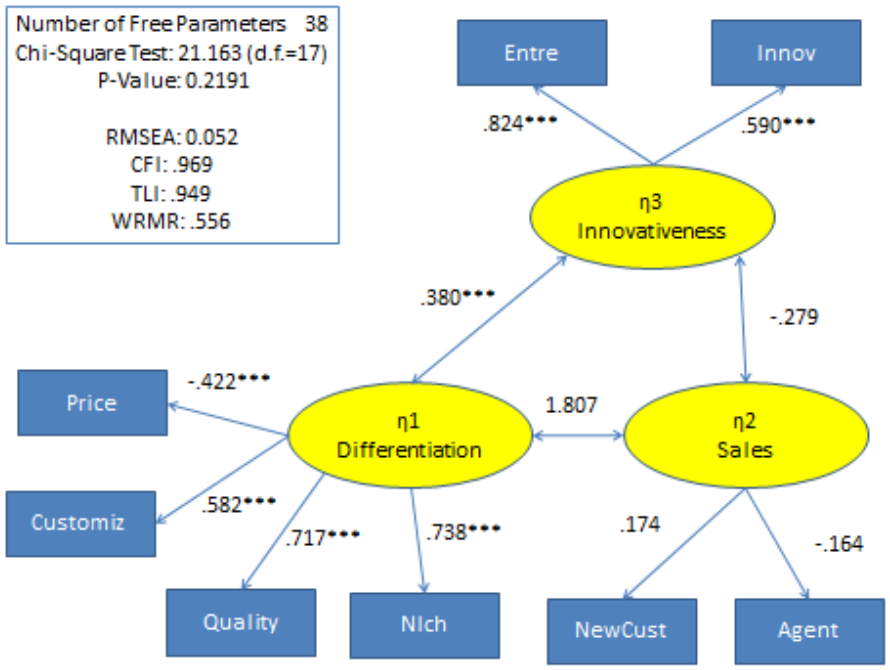

Figure 7-1. Diagram of three-factor model

Graded response model to calculate factor score

Based on the model structure, latent component scores were calculated for each construct for each firm. These scores are later used as explanatory variables for the international business commitments of the firm. In order to investigate the relationship between estimated latent scores and each observed item scale, box-and-whisker plots were created. Those plots will visually help to understand the latent constructs of three strategic orientations.

Figure 7-2 shows the box-and-whisker plots of the differentiation orientation index scores versus each observed response. Following the procedure to estimate the ordinal reliability for Likert-type items (Gadermann et al. 2012), Cronbach's alpha of four items was 0.71, which suggests internal consistency is acceptable. As respondents gave higher scores on offering customized products, striving to improve quality, and targeting of a niche market increase, the differentiation orientation index increased. On the

other hand, as the respondents selected higher scores on competing on price, differentiation orientation index decreased.

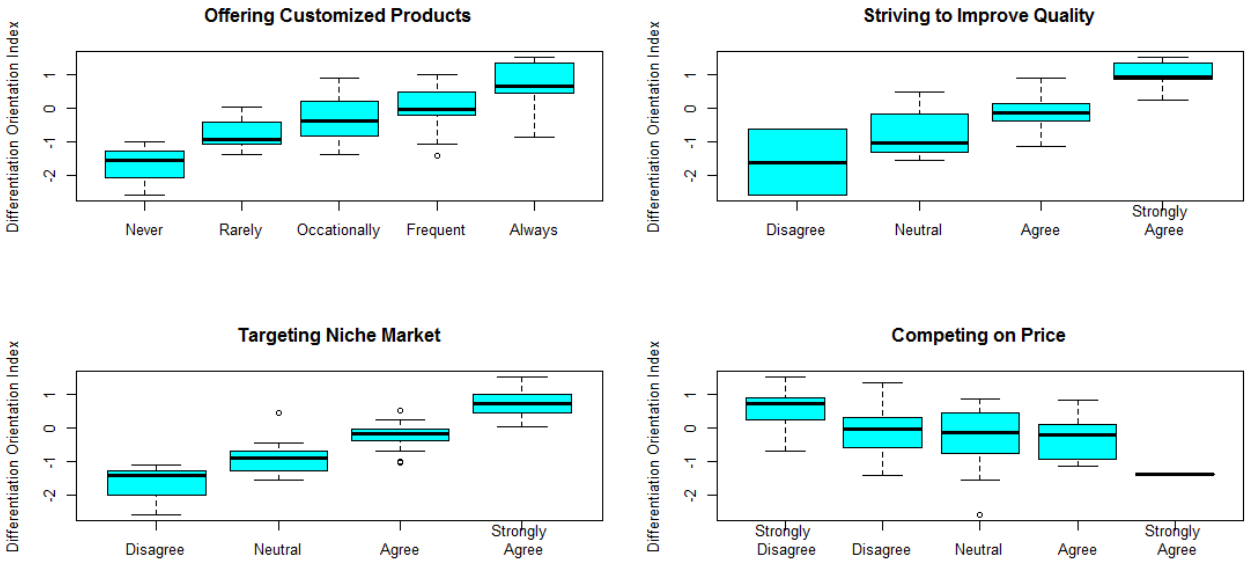

Figure 7-2. Boxplots between observed responses and estimated differentiation orientation index

Figure 7-3 shows the box-and-whisker plots for the sales orientation index scores versus each observed response. Cronbach's alpha of two items was 0.214. As the respondents selected higher scores on sales to new customers, the sales orientation score increased. In contrast, as the respondents selected higher scores on using agents for sale, the sales orientation score decreased.

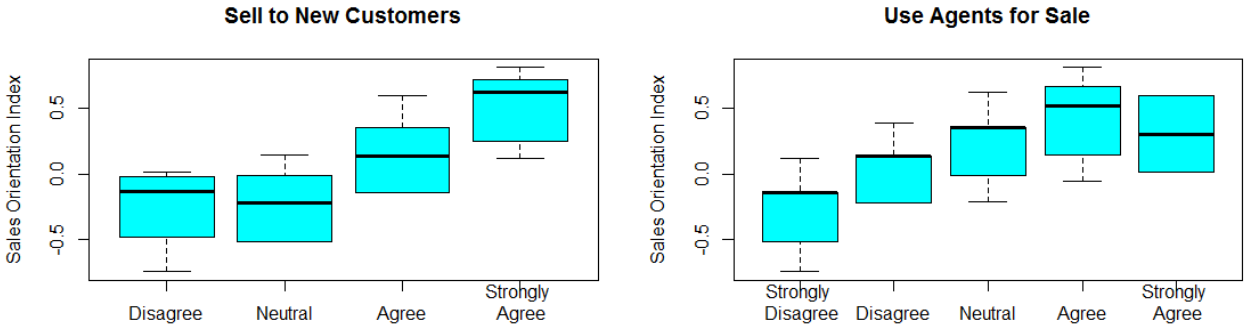

Figure 7-3. Boxplots between observed responses and estimated sales orientation index

Figure 7-4 shows the box-and-whisker plots for the innovativeness of sales functions index scores versus each observed response. Following the procedure to estimate the ordinal reliability for Likert-type items (Gadermann et al. 2012), Cronbach's alpha of two items was 0.650. As the respondents selected higher scores on entrepreneurship and innovative categories, the innovativeness score increased.

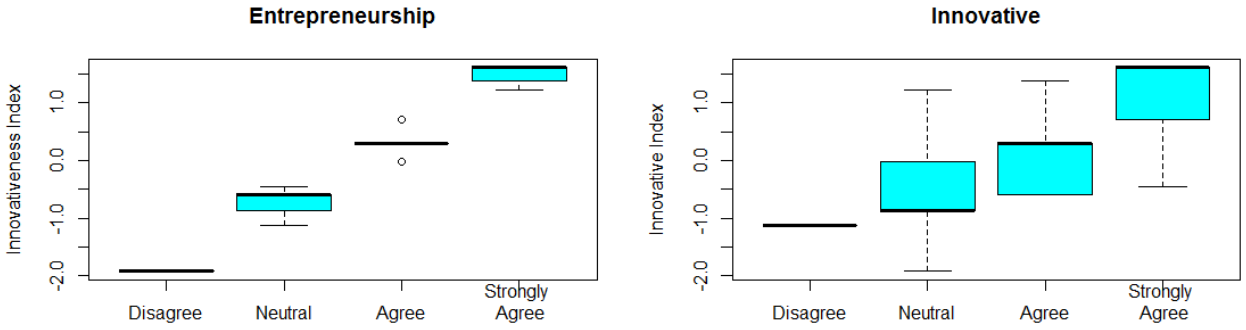

Figure 7-4. Boxplots between observed responses and estimated innovativeness of sales functions index

Chapter 8. Export Behavior between Canadian Firms and U.S. Firms

The total export value of U.S. wood products (excluding paper and furniture) was about 8.6 billion USD in 2011, which is about 0.6 percent of the total value of U.S. exports. The total export value of wood products from Canada (excluding paper and furniture) was about 9.2 billion USD in 2011, which is about 2.0 percent of the total value of Canada's exports. U.S. and Canada are forest resource-rich nations. Since policy makers are always interested in boosting exports to create jobs, expand the economic and increase national revenue, supporting the export activity of the forest products industry in North America can contribute to these goals.

The North American sawmill industry enjoyed a period of relative prosperity between 1990 and 2006, an era now recognized as being a real estate bubble. Lumber production in North America declined sharply after the bubble burst due to the subprime mortgage crisis and the number of sawmills declined substantially between 2006 and 2010. It is estimated that in 2010 there were 772 sawmills in North America owned by 459 firms with a total production capacity of approximately 135 million m^3. The current weak demand for lumber in the U.S. market has been offset by strong international demand. However, some sawmills still hesitate to export their products, even as other sawmills have actively cultivated opportunities in offshore markets. In addition, some exporters sell directly to foreign customers while others use intermediators to facilitate the export process.

This chapter explored empirically why some lumber firms export while others do not. Also, this study tried to explain these differences in terms of the international business commitments existing between exporters.

1. Methodology

Dependent variable

Based on the internationalization process model, firms gradually increase their international commitment step-by-step. The following is a description of the basic framework based on the Uppsala Model and the Innovation-Related Model, although the idea will be revised slightly later. Initially, firms sell only to their domestic customers. Then, some internationally oriented firms start selling their products to international customers through intermediators. Finally, after they accumulate international business knowledge, they export directly to foreign customers. So the firms' international commitment shifts as it amasses "experiential knowledge."

Five different types of ordinal-level international commitments were observed among the 89 respondents to our survey: 1) the firm has never exported and focused solely on the domestic market (n=26), 2) the firm indirectly exports via intermediators but has never directly exported (n=11), 3) the firm indirectly exports via intermediators but previously exported directly (n=6), 4) the firm directly exports but only to a neighboring country (either U.S. or Canada) (n=20), and 5) the firm exports directly outside North America (n=26).

Independent variables

Corresponding to the hypotheses, the following variables were used as independent variables:

1. Firm age was measured by years in business.
2. Two dummy variables were recorded to identify the location of firm—whether the headquarters of a firm was in Canada or not, and whether the headquarters of a firm was in the Southeast U.S. or not[19].

[19] Ideally more geographic dummy variables (e.g. East vs West, coast vs inland) are desired, but singular matrix problems arose when regression estimation was run because of the small sample size. Consequently, only two dummy variables, US vs Canada and South vs others are used to analyze the data.

3. Firm size was measured by the number of employees. Since the number of employees increase proportionally, a natural logarithm of the number of employees was used as an independent variable.
4. Differentiation strategy was measured by latent constructs and the real observation. Differentiation orientation was used as the latent constructs. While the number of value-added products was used as the real observed value.

Besides the major independent variables, some control variables were also included in the model in order to avoid an omitted variable bias. Sales orientation and innovativeness of sales functions were inserted as latent constructs. If the firm owns forest land, they were considered to be vertically integrated, so it is used as a control variable. Sales diversification and species diversification, profitability, the percentage of bachelor's degree holders, and the mean age of the sales team were also included as control variables.

2. Model specification

The international commitment may be a process that starts with the decision whether a firm targets solely domestic or sells internationally leading to another decision how much resources they would like to allocate. This assumption would define the problem as an ordinal analytical problem where the two sequential decision will be defined by a single process. However, the decision whether a firm targets solely domestic or not is nested in making the decision of the resource allocation to international markets. In this case, a hurdle definition better suits the problem. Hurdle models combine a left-truncated count component with a right-censored hurdle component (Mullahy 1986). The first stage, or hurdle, in the process is the decision whether a firm solely focuses domestic market or not. The second stage in the process is the incremental commitment of the international business.

A hurdle model is a modified count model in which there are two processes, one generating the zeros and one generating the positive values. The concept underlying the hurdle model is that a binomial probability model governs the binary outcome of whether a count variable is a zero or has a positive value. If the value is positive, the hurdle is crossed, so the conditional distribution of the positive values is governed by a second model. In this study, a binomial probit regression was utilized as a first hurdle and an ordered probit regression was utilized as a second model. From here on, the model is called a hurdle ordered probit regression.

Because of the small sample size, only three geographical locations were defined and utilized in the model: Canada, Northern U.S. and Southern U.S.[20] Table 8-1 shows the summary of level of international commitment and location of firms. There were five different types of ordinal-level international commitments observed among the 89 respondents as discussed earlier. The level of international commitment varied by regions. Forty percent of the U.S. firms did not sell to any international markets. While no Canadian firm focused solely on the domestic market, which required the hurdle model to have certain conditions.

Table 8-1. The level of international commitment and location of firms

	Canada	**U.S.**	Northern U.S.	Southern U.S.
0) Sell to Domestic Market Only	**0**	**26**	15	11
1) Indirectly Export (Has Never Directly Exported)	**1**	**10**	5	5
2) Indirectly Export (Has Directly Exported)	**0**	**6**	5	1
3) Directly Export to either U.S. or Canada only	**13**	**7**	7	0
4) Directly Export outside of North America	**10**	**16**	13	3

[20] Majority of Northern U.S. firms located in Pacific Northwest, but failed to separate from Northeastern U.S. firms. Ideally more location categories (e.g. Western Canada, Eastern Canada or Pacific North West) are desired, but it won't generate a statistically sound result due to the small sample.

Following is the modified hurdle model to use in this study:

$$z_i^* = x_{1i}\beta_1 + \delta_i, \delta_i \sim \mathcal{N}(0,1), \forall i = 1, \dots, N$$

$$y_i^* = x_{2i}\beta_2 + \varepsilon_i, \varepsilon_i \sim \mathcal{N}(0,1), \forall i = 1, \dots, N$$

If firm *i* locates in the U.S.,

$$\Pr(y_{0i} = 0 | x_{1i}) = \int_{-\infty}^{z_i^*} f_{\mathcal{N}}(0,1)$$

$$\Pr(y_{ji} = k | x_{1i}, x_{2i}) = \int_{z_i^*}^{\infty} f_{\mathcal{N}}(0,1) \int_{\tau_{j-1}}^{\tau_j} f_{\mathcal{N}}(y_i^*, k), \forall j = 1, \dots, 4$$

If firm *i* locates in Canada,

$$\Pr(y_{ji} = k | x_{2i}) = \int_{\tau_{j-1}}^{\tau_j} f_{\mathcal{N}}(y_i^*, k), \forall j = 1, \dots, 4$$

x_{1i} and $x_{2i}$are vectors of characteristics of firm *i*, and β_1 and β_2 are the vectors of the regression coefficients x_{1i} and x_{2i}respectively. Assuming that the latent value is explained by the linear combination of a firm's characteristics, $x_{1i}\beta_1$ leads to z_i^*, which is an unobserved latent value determines if the firm would be likely to commit to any type of international business. $x_{2i}\beta_2$ leads to y_i^*, which is an unobservable latent which indicates the level of a firm's international commitment.

There are five ordered levels from 0 to 4, and 0 means the firm does not commit to any international business. j is the level of international commitment from 1 to 4. The first hurdle is whether a firm commits to any type of international business or not. Only firms that cross the hurdle can advance to the ordered probit regression, which ranges from j=1 to j=4. No Canadian respondent focuses solely on the domestic (Canadian) market, so all Canadian firms are assumed to inherently cross the first hurdle. Given a firm crossing the hurdle, the probability that a firm i adopts the international business

commitment j is the area under the cumulative normal distribution curve with mean as the linear model for the mean and standard deviation as one from τ_{j-1} to τ_j, where τ_0 is -∞, τ_1 is set to 0,and $\tau_4$is +∞.

In order to estimate coefficient parameters β_1, β_2 and τ for the model, the log of the likelihood function has maximized, and the open source statistical software R was used for this model estimation. Because of the empirical nature of the study, the best parsimonious model was selected using the goodness of fit criteria. The Akaike Information Criteria (AIC) was utilized as a model selection criterion (Buckland et al. 1997).

3. Result

Table 8-2 shows the correlation between variables. Pearson's correlation is applied between two continuous variables, and Spearman's rank correlation is applied for nominal or ordinal variables.

Table 8-2. Correlation matrix

	expord	usa	south	forest	sindex	mindex	iindex	emp	speciesdiv	selldiv	divprod	postbubble	year	ba
expord	1	-0.42	-0.35	0.13	0.19	0.22	0.12	0.25	-0.11	-0.12	0.39	0.14	0.14	0.02
usa	-0.42	1	0.33	0.10	0.09	0.04	-0.13	-0.03	0.03	0.08	-0.14	-0.11	-0.03	0.18
south	-0.35	0.33	1	0.20	-0.17	-0.26	-0.09	0.11	0.52	0.03	-0.10	-0.08	0.17	0.17
forest	0.13	0.10	0.20	1	0.06	0.14	-0.08	0.28	0.05	-0.11	0.17	0.16	0.35	0.22
sindex	0.19	0.09	-0.17	0.06	1	0.26	0.02	-0.04	-0.14	-0.01	0.13	0.18	0.04	0.00
mindex	0.22	0.04	-0.26	0.14	0.26	1	0.21	-0.12	-0.26	0.04	-0.01	0.09	0.05	0.06
iindex	0.12	-0.13	-0.09	-0.08	0.02	0.21	1	0.07	-0.01	-0.05	0.02	0.19	-0.02	0.04
emp	0.25	-0.03	0.11	0.28	-0.04	-0.12	0.07	1	0.23	-0.20	0.56	0.33	0.26	0.17
speciesdiv	-0.11	0.03	0.52	0.05	-0.14	-0.26	-0.01	0.23	1	0.13	0.04	-0.10	0.21	0.00
selldiv	-0.12	0.08	0.03	-0.11	-0.01	0.04	-0.05	-0.20	0.13	1	-0.25	-0.07	-0.07	0.01
divprod	0.39	-0.14	-0.10	0.17	0.13	-0.01	0.02	0.56	0.04	-0.25	1	0.16	0.23	0.08
postbubble	0.14	-0.11	-0.08	0.16	0.18	0.09	0.19	0.33	-0.10	-0.07	0.16	1	0.07	-0.02
year	0.14	-0.03	0.17	0.35	0.04	0.05	-0.02	0.26	0.21	-0.07	0.23	0.07	1	0.03
ba	0.02	0.18	0.17	0.22	0.00	0.06	0.04	0.17	0.00	0.01	0.08	-0.02	0.03	1
meanage	-0.29	0.22	-0.03	-0.21	0.20	0.16	-0.15	-0.30	-0.05	0.02	-0.14	-0.26	-0.11	-0.38

A backward stepwise procedure was used with the hurdle-ordered probit regression to determine which firm characteristics and interaction variables to include in the final model. The full model including all possible variables were first estimated. Using the AIC criteria, the most parsimonious model M1 with interaction terms and the parsimonious model M2 without including interaction terms were chosen. Table 8-3 shows the results.

Table 8-3. Estimated parameters of hurdle-ordered probit regression on international commitment

	Full Model				Parsim. M2 w/o interaction				Parsim. M1 with interaction			
	PE	SE	t-test		PE	SE	t-test		PE	SE	t-test	
Hurdle												
(Intercept)	-0.030	2.51	-0.01		-1.525	0.63	-2.42	**	-1.548	0.63	-2.44	**
South	-0.370	0.58	-0.64									
Forest Own	0.405	0.47	0.86									
Sales Orient.	1.196	0.60	1.99	*	1.022	0.51	2.02	**	1.076	0.50	2.14	**
Differ. Orient.	0.241	0.29	0.82		0.438	0.22	1.96	*				
Innovativeness	-0.006	0.22	-0.03									
log(Employees)	0.631	0.23	2.76	***	0.467	0.16	2.91	***	0.507	0.17	3.06	***
Species Divers.	0.320	0.81	0.40									
Sales Divers.	1.045	0.95	1.10									
Prod Divers.	-0.219	0.23	-0.94									
Profitability	-0.242	0.26	-0.94									
Year	0.000	0.01	0.00									
BA %	0.007	0.01	1.10									
Mean Age	-0.005	0.03	-0.14									
South*Diff	0.819	0.71	1.16		NA				1.137	0.52	2.18	**
Ordered Regression												
(Intercept)	5.066	2.07	2.44	**	2.144	1.11	1.93	*	2.144	1.11	1.93	*
USA	-0.176	0.42	-0.42									
South	-0.366	0.56	-0.65		-0.882	0.43	-2.07	**	-0.882	0.43	-2.07	**
Forest Owned	-0.075	0.37	-0.20									
Sales Orient.	0.208	0.45	0.46									
Differ. Orinet.	0.363	0.44	0.82		0.392	0.21	1.84	*	0.392	0.21	1.84	*
Innovativeness	0.118	0.21	0.57									
log(Employees)	-0.132	0.18	-0.74									
Species Divers.	0.325	0.76	0.43									
Sales Divers.	-0.706	0.79	-0.90									
Prod Divers.	0.596	0.19	3.19	***	0.484	0.13	3.60	***	0.484	0.13	3.60	***
Profitability	-0.314	0.22	-1.45									
Year	0.005	0.01	0.69									
BA %	-0.006	0.00	-1.16									
Mean Age	-0.069	0.03	-2.39	**	-0.039	0.02	-1.85	*	-0.039	0.02	-1.85	*
South*Diff	-0.764	0.61	-1.26		NA							
USA*Diff	0.337	0.54	0.62		NA							
τ2	0.455	0.18	2.59	**	0.390	0.15	2.60	**	0.390	0.15	2.60	**
τ3	1.627	0.27	6.00	***	1.471	0.24	6.09	***	1.471	0.24	6.09	***
AIC	250.0				220.8				218.7			
BIC	329.7				243.2				241.1			

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level respectively.
PE and SE represent point estimates and standard errors, respectively.

For the first hurdle part on M2, sales orientation, firm size measured by number of employees, and differentiation orientation remained. On the other hand, the Southern U.S. dummy does not show significance at a 10 percent level. However, if the interaction term between the South and the differentiation orientation is included on M1, it shows statistical significance at a 5 percent level. The range of differentiation orientation is from -2.5 to +1.5, so when a firm in the South adopts a cost-leadership strategy, their likelihood to cross the first international business hurdle is very small. On the other hand, when a firm in the south adopts a differentiation strategy, it increases the likelihood that they will commit to international business activity.

Once a firm crosses the hurdle, they can accumulate experiential international business knowledge and extend their international commitments to a higher level according to the internationalization model. Both M1 and M2 perfectly agree upon the variables selection of the ordered regression part. Differentiation orientation and product diversification measured by the number of value-added products they produced show a positive relationship for the likelihood of adopting a higher level of international business commitment. On the other hand, when mean age of sales team of the firm increases, the firm is less likely to adopt a higher level of international commitment after they cross the first hurdle. If a firm is located in the Southern U.S., they are less likely to commit to a higher level of international business activity even after they cross the first hurdle. Meanwhile, years in business and whether a firm is located in the U.S. or Canada do not show any significant result.

Since AIC of M1, the most parsimonious model with interactions, is smaller than M2, the discussion will be based on M1. Years in business does not show significance. Hence, H1 is supported and the number of years in business does not influence the international business commitment of softwood sawmill firms.

Since Canadian firms skip the first hurdle part by the assumption of the model supported by the observation, a firm in Canada would be more likely to participate in international business. However, ordered regression wise, whether a firm locates in the U.S. or Canada does not matter because the U.S. dummy does not show significance. Therefore, among exporters, Canadian firms do not commit to a higher degree of international business than U.S. firms.

Firm size shows a significant coefficient in the hurdle part but does not in the ordinal regression part. Hence, H2a and H2b are both supported. Among SMEs, larger firms are more likely to export than smaller firms, but firm size does not influence the level of international business commitment.

Differentiation orientation, the latent variable, shows a significant coefficient in the ordinal regression part. In addition, production diversification, the actual observation, also increases the level of international commitment in the ordinal regression part. Hence, H3b is supported and firms that apply a differentiation strategy are more likely to commit to a higher degree of international business. On the other hand, only the interaction between the Southern U.S. dummy and differentiation orientation shows significance in the first hurdle part. So, H3a is partially supported only in the Southern U.S. and the differentiation strategy of a firm in the Southern U.S. increases the likelihood of it entering international markets.

Besides the hypothesis testing, interestingly, having a sales orientation significantly increases the likelihood of a firm entering international markets. Also, firms in the Southern U.S. have a lower level of international commitment. The species diversification index does not show significant impact, in agreement with the work by Hammett et al. (2007), which also did not find a significant relationship between the number of species sawn and the export participation of Southern hardwood manufacturers.

4. Discussion

To better understand the complex results by the hurdle model, the predicted probabilities of the international commitment of hypothetical firms under different scenarios were calculated. A simulation-based approach was applied (King et al. 2000). In which, 10,000 draws were taken from the multivariate-normal distribution with means as the point estimates from the best parsimonious model and with a variance matrix as the estimated variance-covariance matrix for the coefficients estimated in the model. The 10,000 simulated coefficients are placed into vectors and simulated to predict the counterfactual probability of a hypothetical lumber producer who has independent variables for each international commitment, and then they were graphically displayed for simplification. Reporting differences in predicted probabilities associated with empirically relevant changes in key independent variable values, when the other independent variables are also set to empirically relevant values, will deliver a meaningful interpretation of nonlinear models in the business strategy field (Zelner 2009).

First of all, three different scenarios are created based on where a firm is located: Southern U.S., Northern U.S., and Canada. The number of employees a hypothetical firm has varies from 3 to 1000. Other continuous independent variables of the hypothetical firm are set to sample mean values, and discrete independent variables are set to sample median values. Counterfactual probability is estimated for cases where the firm: 0) only target domestic market ("Domestic"), 1) indirectly exports and never directly export, 2) currently indirectly exports and previously directly exported, 3) directly exports only to Canada or the U.S. ("Export to Canada" or "Export to US"), or 4) directly exports outside of North America ("Exporter"). Figure 8-1 shows only 0), 3), and 4) in order to reduce the complexity of the figure. The central lines in the figures represent the point estimates, and the shading is the 68.3 percent confidence interval (one standard deviation) around the mean.

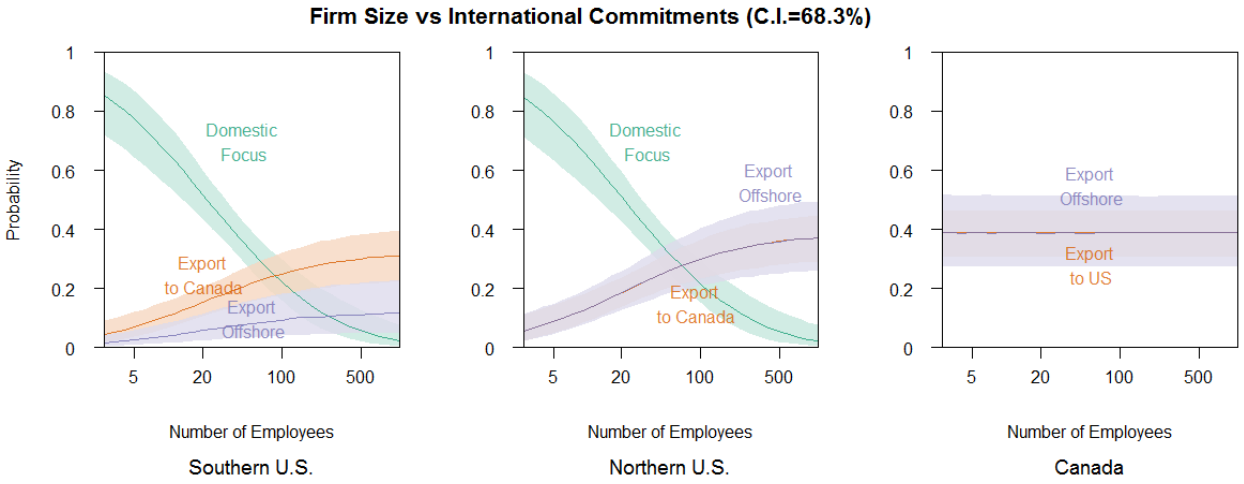

Figure 8-1. Counterfactual probabilities by hurdle model of three locations associated with changes in number of employees using a simulation-based technique

On the graph of a hypothetical firm in the South, as the number of employees increases, the likelihood that the firm will only sell into the domestic market sharply declines. If a firm is really small (less than 20 employees) the probability that they will sell their products only domestically is around 60-90 percent, and the probability that they target international markets is very small. The probability that a firm in the Northern U.S. targets only the domestic market is identical to that of a firm in the Southern U.S., since the number of employees does not directly affect the first hurdle part of the model. However, once they cross the hurdle, the number of employees influences the higher level of international commitment. A hypothetical firm in the Northern U.S. is more likely to commit to a higher level of international business activities, such as exporting to offshore markets, than a firm in the South as they increase the number of employees. Since the number of employees does not influence the ordered regression, the probability that a hypothetical Canadian firm directly exports or that it exports only to the U.S. does not vary by the number of employees.

Figure 8-2 only shows the counterfactual probability if a hypothetical firm in Northern U.S. and in Southern U.S. directly exports to offshore markets or not associated with changes in number of

employees. This figure is extracted from figure 8-3. A hypothetical firm in the Northern U.S. is more likely to directly export to offshore markets than one in the Southern U.S. Firm size influence relatively small effect in terms of the decision to be a direct exporter in Southeastern U.S.

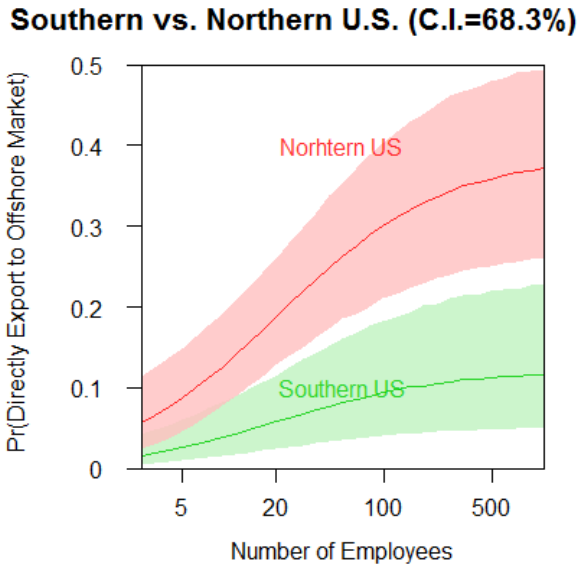

Figure 8-2. Counterfactual probabilities by hurdle model whether a firm directly export to offshore from Northern U.S. and Southern U.S. associated with changes in number of employees

The next scenario focuses on a firm's strategy, whether a hypothetical firm takes a differentiation strategy or a cost-leadership strategy. A differentiation orientation reflects the degree of differentiation orientation opposed to cost-leadership orientation. When the differentiation orientation of a firm is a large value, the firm is classified as adopting a differentiation strategy. On the other hand, when the differentiation orientation of a firm is small, the firm is classified as adopting a cost-leadership strategy. The actual range of differentiation orientation in this study ranged from -2.5 to +1.5. Similar to the previous scenario, three different scenarios are created based on where a firm is located: Southern U.S., Northern U.S., and Canada. Continuous independent variables of a hypothetical firm besides the differentiation orientation are set to sample mean values, and discrete independent variables are set to sample median values. Counterfactual probability is estimated for cases where the firm: 0) only target

domestic market ("Domestic"), 1) indirectly exports and never directly export, 2) currently indirectly exports and previously directly exported, 3) directly exports only to Canada or the U.S. ("Export to Canada" or "Export to US"), or 4) directly exports outside of North America ("Exporter"). Figure 8-3 shows only cases 0), 3), and 4).

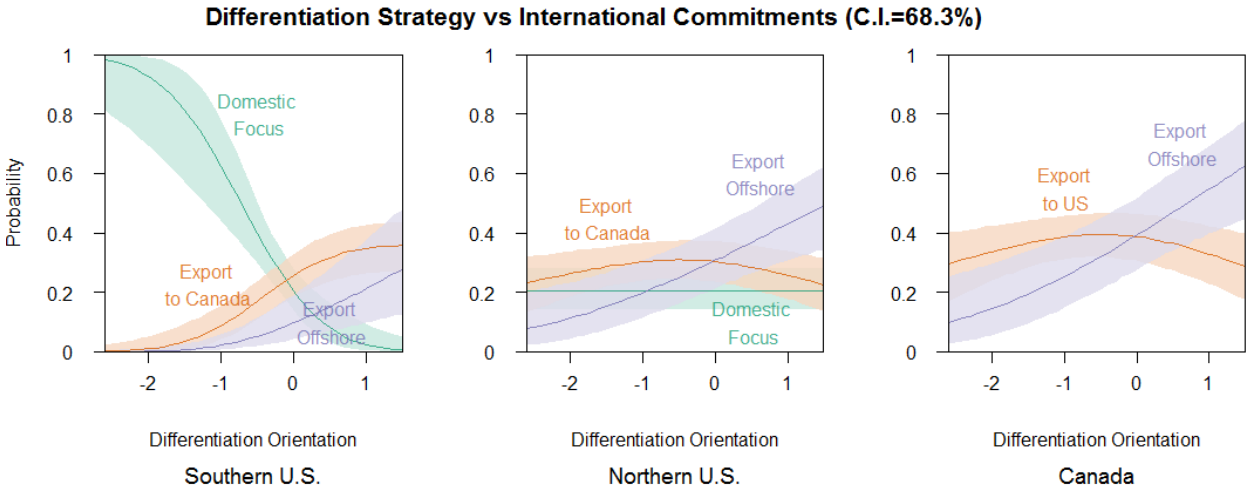

Figure 8-3. Counterfactual probabilities by hurdle model of three locations associated with changes in differentiation orientation using a simulation-based technique

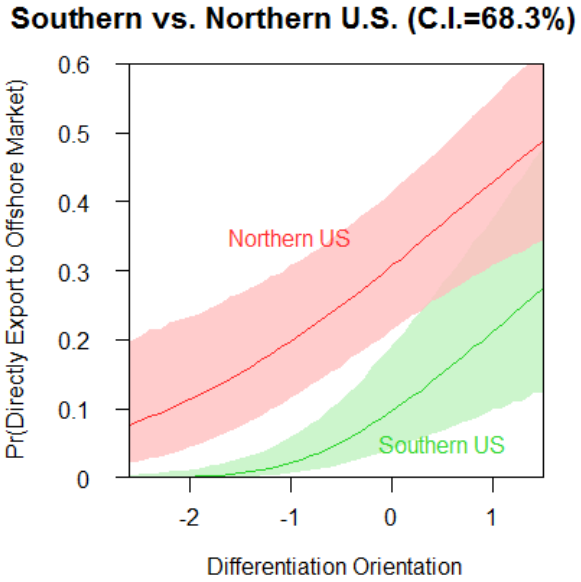

Figure 8-4. Counterfactual probabilities by hurdle model whether a firm direcly export to offshore market with changes in differentiation orientation

Figure 8-4 only shows the counterfactual probability if a hypothetical firm in Northern U.S. and in Southern U.S. directly exports to offshore markets or not. This figure is extracted from figure 8-3. A hypothetical firm in the Northern U.S. is more likely to directly export to offshore markets than one in the Southern U.S. Once a firm in Southern U.S. applied differentiation orientation, it will more likely to become a direct exporter.

Since differentiation orientation significantly influences both the first hurdle and the second ordered regression part of the model simultaneously, it intricately interrelates the likelihood of a firm's international business commitment. On the chart of a hypothetical firm in the Southern U.S., if the firm has a negative differentiation orientation (which means they have a cost-leadership strategy), it is very likely to focus solely on the domestic U.S. market. As its differentiation orientation increases, the firm in the South increases its likelihood to commit to a higher level of international business activity. On the chart of a hypothetical firm in the Northern U.S., the probability that it will focus solely on the U.S. domestic market is fixed at around 20 percent since the estimated model suggests that only the interaction of the differentiation orientation and the dummy variable of the Southern U.S. significantly influenced the predicted probability. As its differentiation orientation increases, the firm increases its likelihood to commit to a higher level of international business activity. For example, if a hypothetical firm in the Northern U.S. is very differentiation oriented, say 1.0 on the scale, the probability that the firm directly exports to offshore markets approaches 50 percent. As in the hypothetical Canadian firm scenario, there is no firm which focuses solely on the Canadian domestic market, hence, only two cases are shown on the chart. As their differentiation orientation increases, the firm increases its likelihood to commit to a higher level of international business activities. If a hypothetical Canadian firm is very differentiation oriented, say 1.0 on the scale, the probability that the firm directly exports to offshore markets exceeds 60 percent.

Instead of varying the latent differentiation orientation, the observed products diversification values were changed. Product diversification is measured by the number of value-added products that firms produce. Similar to the previous scenario, three different scenarios are created based on where a firm locates: Southern U.S., Northern U.S., and Canada. Continuous independent variables of a hypothetical firm besides the differentiation orientation are set to sample mean values. The number of value added products varies from zero to six. Counterfactual probability is estimated for cases where the firm: 0) only target domestic market ("Domestic"), 1) indirectly exports and never directly export, 2) currently indirectly exports and previously directly exported, 3) directly exports only to Canada or the U.S. ("Export to Canada" or "Export to US"), or 4) directly exports outside of North America ("Exporter"). Figure 8-5 shows only 0), 3), and 4).

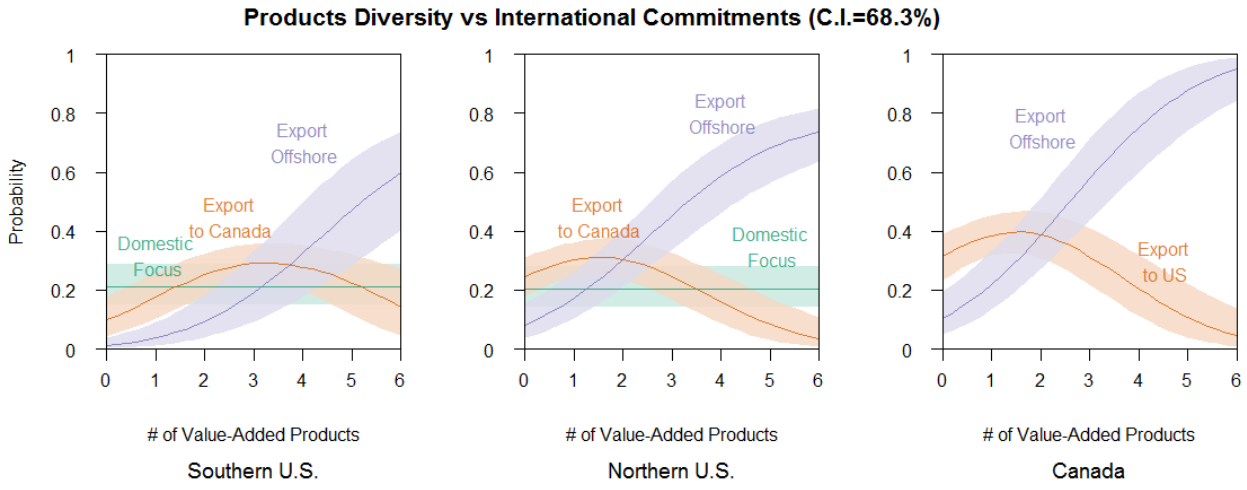

Figure 8-5. Counterfactual probabilities by hurdle model of three locations associated with changes in the number of value-added products using a simulation-based technique

Products diversification matters only for the ordered probit regression part of the model but not for the first hurdle. So, it does not affect the likelihood that a hypothetical firm sells their products solely to the U.S. domestic market for both the Southern U.S. and the Northern U.S. The probability that a U.S. firm focuses on the domestic market is fixed at around 20 percent no matter how many value-added

products they produce. However, as the hypothetical exporter increases its number of value-added products, the likelihood that it will commit to a higher level of international business activity increases. The acceleration for firms in the North is faster than in the South. A similar trend was observed in Canada, where as the hypothetical firm increases the number of value-added products, the likelihood that a firm will commit to a higher level of international business activity increases.

Sales orientation will be also investigated in the next two scenarios. Sales orientation reflects the degree to which a firm allocates resources to its sales operation rather than its production operation. When the sales orientation is high, the firm is more likely to internalize their sales operations. When sales orientation is low, the firm is more likely to externalize their sales operations. The actual range of sales orientation obtained for the sample went from -0.7 to +0.8. The first topic of interest is to evaluate the interaction effect between sales orientation and firm size for a hypothetical firm in the Northwest U.S. The second topic of interest is to evaluate the interaction effect between sales orientation and differentiation strategy of a hypothetical firm in the Northwest U.S. The continuous independent variables for a hypothetical firm, besides the differentiation orientation, were set to sample mean values, and the discrete independent variables are set to median values. Counterfactual probability is estimated for cases where the firm: 0) only target domestic market ("Domestic"), 1) indirectly exports and never directly export, 2) currently indirectly exports and previously directly exported, 3) directly exports only to Canada or the U.S. ("Export to Canada" or "Export to US"), or 4) directly exports outside of North America ("Exporter"). Figures 8-6 and 8-7 show only cases 0), 1), and 4).

Assume three hypothetical firms in the Northwest U.S. with 20, 50, and 150 employees, respectively, labeled as "micro firm," "small firm," and "med.-sized firm." As seen in figure 8-6, as a firm's sales orientation increases, its likelihood of moving to a higher level of international commitment increases. As observed previously, larger firm tends to commit to a higher level of international business activities,

and you can see that trend if you compare these three graphs. It is very important to emphasize that when the sales orientation is very high, say around 0.8, no matter how large the firm is, the expected probability that the firm will directly export to offshore markets is between 35 to 40 percent.

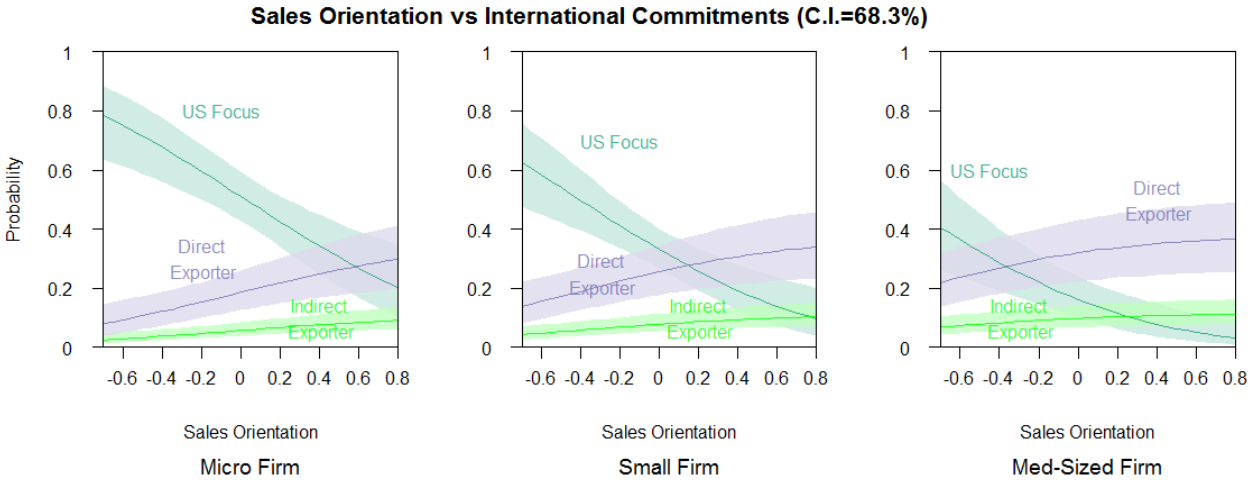

Figure 8-6. Counterfactual probabilities by hurdle model of three different firm sizes associated with changes in sales orientation using a simulation-based technique

The interaction between market orientation and business strategies is one of the most interested research question in forest products field (Hansen et al. 2006). Now, assume that these hypothetical firms in the Northwest U.S. have a differentiation orientation index of -2.0, 0, and +1.5. Hence the hypothetical firms have a "cost leadership" strategy, "stuck in the middle," and "differentiation" strategy, respectively. As seen in figure 8-7, as a firm's sales orientation increases, the likelihood that it will move to a higher level of international commitment will increase. As discussed previously, the more a firm differentiates its products, the more likely that it will commit to a higher level of international business activities, and you can see that trend if you compare these three graphs. If a firm applies a differentiation strategy, the probability that the firm will commit to a higher level of international business activities increases sharply as their sales orientation increases (right chart). On the other hand, if a firm adopts a cost-leadership strategy, the probability that the firm commits to a higher level of

international business activities increases very slowly as their sales orientation increases (left chart). The probability that a cost leader indirectly exports is measurably higher than others, which agrees with what Peng and Ilinitch (1998) observed about the higher the commodity content of the products, the more likely that export intermediaries will be selected by manufacturers. That is why firms that adopt cost leadership are rare, so the standard error on the left chart is more than on the other two charts (remember, this study only looked at SMEs). In a commodity manufacturing business, small firms cannot compete against very large firms in terms of production efficiency since they don't have similar economies of scale.

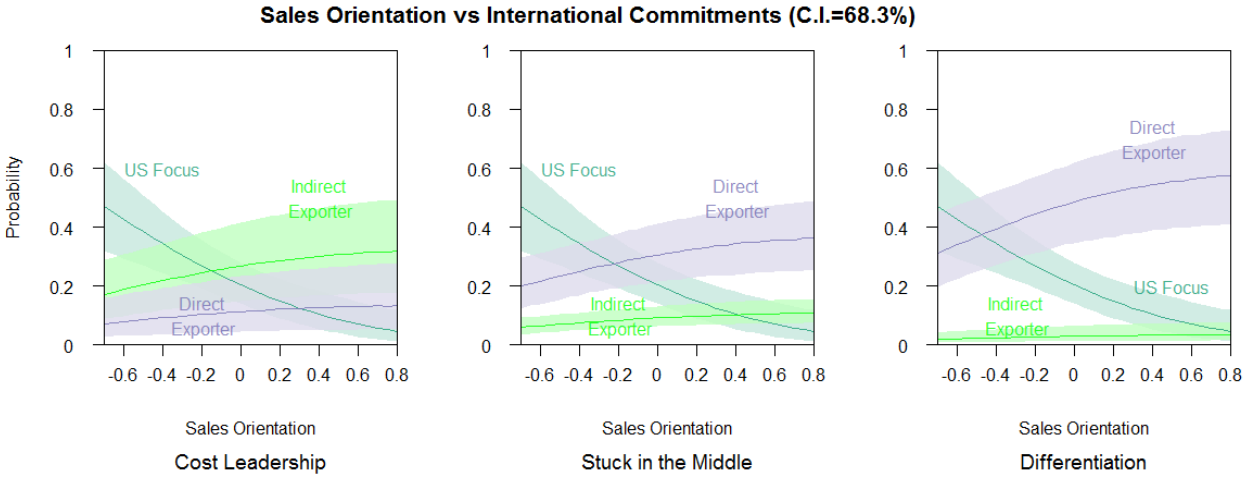

Figure 8-7. Counterfactual probabilities by hurdle model of three different generic strategies associated with changes in sales orientation using a simulation-based technique

Chapter 9. Performance after the Contingency Event: Flexibility vs. Inertia

Exporting to offshore markets is just one business option for a firm. Firms are heterogeneous, and they are always seeking the best business practice based on their business strategies, taking into consideration their internal resources and capabilities. A company's bottom line is profit and maximizing profit is a rational firm's raison d'être. It is not possible to discuss a firm's business strategy or operations without investigating a firm's performance. This chapter will explore the factors that contribute to a firm's performance following the housing crisis. Firm performance and internal resources are a well-studied area in the forest products field, and some hypotheses are proposed.

This chapter will focus on finding the success factors for lumber processing firms who faced the demand shock after the U.S. housing market collapsed around 2007. The primary objective of this study is to explore how flexibility of a firm determines the performance of a firm after the housing market crash in the U.S. Also, factors that determine the flexibility of softwood sawmill firms in North America were also investigated.

1. Methodology and Concept Measurement

Dependent variable

The relative performance of a firm in the sawmill industry is the dependent variable in this study. In business research, profitability is usually measured by Return on Assets (ROA) or Return on Investment (ROI) since these accounting figures best describe the economic returns of firms (Jacobson 1987). However, obtaining accounting information from small- and medium-sized firms is extremely difficult or almost impossible, especially when utilizing a survey method to collect data. To make the quantification of performance as easy as possible for survey respondents, respondents were asked how they think

their firm performed relative to their competitors before and after the housing market crash in 2007. Respondents used an ordinal scale from ”1: much worse” to “5: much better.”

Explanatory variables

The flexibility characteristic is the major explanatory variable to predict profitability, but it is not directly observable. If firms are more flexible, then they are likely to more quickly imitate another firm’s success so they can exploit entrepreneurial profits in the industry. To assess this, firms were asked how many changes made out of nine categories over the past five years. This is called changes made in past. Also, firms were asked how many changes they were willing to make within the next five years. This is called changes planning in future. Both of these are discrete variables. This method is very similar in Nybakk et al. (2008) who assessed the sum of yes/no questions about the changes that firms made. Knowles et al. (2008) also counted new machine adoption to estimate one aspect of innovativeness. Based on these enumerated changes, a flexibility capability index as a latent variable was estimated.

Innovativeness of sales functions (innov) is defined in chapter seven and was used as an independent variable. Another latent factor, the differentiation orientation, discussed in chapter seven, was also used as an independent variable. A differentiation orientation (diff) is the firm’s constructs that urge firms to pursue a differentiation strategy rather than a cost-leadership strategy. Firms that have a higher differentiation orientation should target more niche markets, accept customized orders from customers more often, improve quality of their products even it costs more, and attempt to avoid price competition. When firms have a lower differentiation orientation, they are competing on price, targeting mass markets, not accepting customized small orders, and hesitating to improve quality of products if it costs more.

Table 9-1. Correlation matrix

	postbubble	changep	changen	diff	innov	year	speciesdiv	prodea	divprod	ba	log(emp)	meanage	usa	south	forest	ib
prebubble	0.02	0.12	0.20	-0.03	0.22	0.16	0.05	0.32	0.13	0.05	-0.08	-0.17	0.01	0.05	-0.02	0.05
postbubble	1	0.40	0.30	0.09	0.19	0.33	0.07	-0.10	-0.07	0.16	-0.02	-0.26	-0.10	-0.05	0.16	0.06
changep	0.40	1	0.74	0.30	0.21	0.55	0.04	-0.14	0.01	0.41	0.06	-0.24	-0.15	-0.20	0.18	0.49
changen	0.30	0.74	1	0.13	0.26	0.43	0.08	-0.02	0.11	0.29	-0.12	-0.17	-0.22	-0.21	0.02	0.27
diff	0.09	0.30	0.13	1	0.21	-0.12	0.05	-0.26	-0.08	-0.01	0.06	0.16	0.04	-0.25	0.12	0.24
innov	0.19	0.21	0.26	0.21	1	0.07	-0.02	-0.01	0.04	0.02	0.04	-0.15	-0.13	-0.05	-0.06	0.08
log(emp)	0.33	0.55	0.43	-0.12	0.07	1	0.26	0.23	0.18	0.56	0.17	-0.30	-0.01	0.14	0.26	0.29
year	0.07	0.04	0.08	0.05	-0.02	0.26	1	0.21	-0.01	0.23	0.03	-0.11	-0.02	0.20	0.35	0.14
speciesdiv	-0.10	-0.14	-0.02	-0.26	-0.01	0.23	0.21	1	0.13	0.04	0.00	-0.05	-0.03	0.43	0.01	-0.04
prodea	-0.07	0.01	0.11	-0.08	0.04	0.18	-0.01	0.13	1	0.19	0.11	-0.16	0.00	-0.03	0.05	0.03
divprod	0.16	0.41	0.29	-0.01	0.02	0.56	0.23	0.04	0.19	1	0.08	-0.14	-0.17	-0.11	0.19	0.50
ba	-0.02	0.06	-0.12	0.06	0.04	0.17	0.03	0.00	0.11	0.08	1	-0.38	0.19	0.17	0.22	0.11
meanage	-0.26	-0.24	-0.17	0.16	-0.15	-0.30	-0.11	-0.05	-0.16	-0.14	-0.38	1	0.20	-0.02	-0.18	-0.18
usa	-0.10	-0.15	-0.22	0.04	-0.13	-0.01	-0.02	-0.03	0.00	-0.17	0.19	0.20	1	0.33	0.10	-0.17
south	-0.05	-0.20	-0.21	-0.25	-0.05	0.14	0.20	0.43	-0.03	-0.11	0.17	-0.02	0.33	1	0.20	-0.17
forest	0.16	0.18	0.02	0.12	-0.06	0.26	0.35	0.01	0.05	0.19	0.22	-0.18	0.10	0.20	1	0.13
ib	0.06	0.49	0.27	0.24	0.08	0.29	0.14	-0.04	0.03	0.50	0.11	-0.18	-0.17	-0.17	0.13	1

Other controlled independent variables include: U.S. firms vs. Canadian firms (USA), whether a firm locates in the Southeastern U.S.(South), whether a firm owns forest land (forest), whether a firm exports to international markets outside of North America (export), the percentage to sales to pro-dealers or wholesalers compared to sales directly to end-customers or retailers (prodealer), firm size measured in log-transformed number of employees (log(emp)), years in business, (year), diversification of species input (Species Div), diversification of products (Prod Div), percentage of bachelor's degree holders in the sales team (BA), and mean age of sales department (meanage). Table 9-1 shows the correlation matrix between variables.

2. Analysis

First of all, factors that influenced the performance after the housing market crash are estimated by an ordered probit model (OPM) with all possible variables (OP Full Model). Step-wise procedures with bidirectional elimination relied on AIC and BIC as selection criteria were then applied to select the most parsimonious model. As shown in table 9-2, OPM1 was selected based on the smallest AIC, and OPM2 was selected based on the smallest BIC. Overall, changes in the past was revealed to be the most

important variable. Firms that experienced changes in the most categories over the last five years had a greater likelihood of reporting that they had better performance after the housing crisis. Since the number of changes that firms made in the last five years should be determined by the firm's flexibility, this relationship may be spurious and further investigation is needed.

Table 9-2. Ordered probit regression on post-housing crash performance

	OP Full Model				OPM1 (AIC)				OPM2 (BIC)			
	PE	SE	t		PE	SE	t		PE	SE	t	
Pre-Crash Profit	-0.123	0.154	-0.80									
Change in Past	0.124	0.082	1.51		0.187	0.070	2.67	***	0.199	0.054	3.726	***
USA	0.018	0.324	0.05									
South	0.008	0.367	0.02									
Forest	0.195	0.301	0.65									
Exports	-0.564	0.345	-1.63		-0.559	0.308	-1.81	*				
Diff Orient.	0.155	0.189	0.82									
Innovativeness	0.194	0.162	1.19									
log(emp)	0.285	0.159	1.80	*	0.185	0.122	1.52					
Year	-0.001	0.005	-0.25									
Species Div	0.342	0.587	0.58									
Pro Dealers	-0.587	0.404	-1.45		-0.595	0.390	-1.53					
Product Div	-0.015	0.139	-0.11									
BA Ratio	-0.007	0.004	-1.73	*								
Mean Age	-0.051	0.021	-2.41	**	-0.035	0.017	-2.04	**				
worse|same	-3.558	1.419	-2.51	**	-1.878	1.057	-1.78	*	-0.332	0.255	-1.30	
same|better	-2.858	1.413	-2.02	**	-1.203	1.054	-1.14		0.313	0.255	1.23	
better|much b	-0.905	1.377	-0.66		0.640	1.047	0.61		2.019	0.314	6.42	***
Deviance	180.9				187.4				198.3			
Loglikelihood	-90.5				-93.7				-99.2			
AIC:	216.9				203.4				206.3			
BIC:	261.7				223.3				216.3			

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level respectively.
PE and SE represent point estimates and standard errors, respectively.

Meanwhile, the coefficient of pre-crash profit is not significantly different from zero. Hence, the performance of a firm before the housing crash cannot be used to predict the performance of the firm

after the housing crash. The performance before and after the housing crash are independent. Thus, H4 is not supported. A firm's performance is not stable overtime.

Changes made in the last five years were the most important factor to explain post-crash performance, and it was measured by the numbers of categories in which firms have made changes. According to the literature review, the flexibility capability of a firm likely influences these observations. A Poisson regression was applied to estimate the flexibility of a firm as its capability. Firms made many business changes over the last five years. Assuming that the changes identified by the survey were with an identical probability yet were independent from each other, the number of changes firms made over the last five years should follow a Poisson distribution.

Assumptions of the flexibility characteristics of a firm's capability can be explained by other variables of firms. Let the latent capability of flexibility be μ^*, the observed numbers of changes firms made over the last five years be Y, and firms' characteristics be x vector. Then,

$$\mu^* = e^{\beta x}$$

$$\Pr(Y = y|\mu^*) = \frac{e^{-\mu^*}\mu^{*y}}{y!}$$

β, a vector of coefficients, is estimated by applying the maximum likelihood estimation method.

Table 9-3. Poisson regression on the number of changes firms are expecting in the future

	Future Poisson Full Model				FPoisM1 (AIC)				FPoisFM2 (BIC)			
	PE	SE	t		PE	SE	t		PE	SE	t	
(Intercept)	-0.282	0.759	-0.37		0.307	0.190	1.61		0.406	0.141	2.87	***
Flexibility Past	0.217	0.039	5.56	***	0.207	0.028	7.52	***	0.190	0.025	7.72	***
Pre-Crash Profit	0.075	0.073	1.03									
Post-Crash Profit	0.014	0.073	0.19									
USA	-0.055	0.145	-0.38									
South	-0.141	0.183	-0.77									
Forest	-0.096	0.142	-0.67									
Exports	-0.138	0.154	-0.90									
Diff Orient.	-0.110	0.093	-1.18		-0.131	0.077	-1.71	*				
Innovativeness	0.108	0.079	1.37		0.136	0.074	1.83	*				
log(emp)	0.020	0.074	0.27									
Year	0.003	0.002	1.07									
Species Div	-0.014	0.272	-0.05									
Pro Dealers	0.272	0.185	1.47		0.276	0.178	1.55					
Products Div	0.019	0.066	0.28									
BA Ratio	-0.002	0.002	-0.88		-0.003	0.001	-1.82	*				
Mean Age	0.003	0.010	0.27									
Deviance:	75.1	d.f.=72			80.0	d.f.=83			90.6	d.f.=87		
Loglikelihood	-163.1				-165.5				-170.8			
AIC:	360.2				343.1				345.7			
BIC	402.5				358.0				350.6			

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level respectively.
PE and SE represent point estimates and standard errors, respectively.

First of all, factors influencing flexibility in the future are examined. After running the model with all possible variables (Future Poisson Full Model) and by applying step-wise procedures with bidirectional elimination relying on AIC and BIC as the selection criteria, the most parsimonious model was selected. As shown in table 9-3, FPoisM1 was selected based on the smallest AIC, and FPoisM2 was selected based on the smallest BIC. Applying the Chi-square test on the residual deviance and the degrees of freedom, neither models showed overdispersion, which suggests the Poisson model fitted well.

According to the model, although some other factors were picked up by FPoisM1, flexibility in the future was almost solely explained by flexibility in the past by FPoisM2. Thus H6 was supported. It suggests that a firm's flexibility characteristics persist over time, or flexibility is a time invariant characteristic.

Table 9-4. Poisson regression on the number of changes firms actually made

	Past Poisson Full Model				PPoisM1 (AIC)				PPoisM2 (BIC)			
	PE	SE	t		PE	SE	t		PE	SE	t	
(Intercept)	1.145	0.595	1.93	**	0.516	0.283	1.82	**	0.397	0.195	2.04	**
Pre-Crash Profit	0.059	0.067	0.89		0.093	0.062	1.50					
USA	-0.112	0.133	-0.85		-0.179	0.115	-1.56					
South	-0.052	0.173	-0.30									
Forest	0.005	0.124	0.04									
Exports	0.231	0.135	1.71	*	0.222	0.117	1.89	*	0.278	0.115	2.43	**
Diff Orientation	0.192	0.077	2.50	**	0.190	0.069	2.74	***	0.199	0.066	3.01	***
Innovativeness	0.071	0.071	1.00									
log(emp)	0.271	0.058	4.65	***	0.257	0.048	5.38	***	0.230	0.045	5.05	***
Year	-0.002	0.002	-0.94									
Species Div	0.399	0.254	1.57		0.548	0.221	2.47	**				
Pro Dealers	-0.142	0.175	-0.81									
Products Div	0.011	0.062	0.18									
BA Ratio	-0.001	0.002	-0.69									
Mean Age	-0.010	0.009	-1.09									
Deviance:	69.2	d.f.=74			73.4	d.f.=82			81.5	d.f.=85		
Loglikelihood	-170.8				-172.9				-177.0			
AIC:	371.7				359.8				361.9			
BIC	409.0				377.2				371.9			

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level respectively.
PE and SE represent point estimates and standard errors, respectively.

Second, the factors which influenced flexibility in the past was examined. After running the model with all possible variables (Past Poisson Full Model) and by applying step-wise procedures with bidirectional elimination relying on AIC and BIC as selection criteria, the most parsimonious model was selected. As shown in table 9-4, PPoisM1 was selected based on the smallest AIC, and PPoisM2 was selected based on the smallest BIC. Applying the Chi-square test on the residual deviance and the degrees of freedom,

neither models showed overdispersion, which suggests the Poisson model fitted well. According to PPoisM2, differentiation orientation, exports outside of North America, and the number of employees, significantly increases the flexibility of firms at a 5 percent level. Thus H8 was not supported. Actually, the larger firms are more flexible than the smaller firms. On the other hand, the coefficient of a firm's age in years in business does not show significance at a 10 percent level. Hence, H9, younger firms are more flexible than older firms, was not supported.

By utilizing the PPoisM2, the flexibility characteristic of the firm, μ^*, was estimated. The first ordered probit model used the number of changes that firms made over the last five years as an explanatory variable, but since this observable value may show a spurious relationship, the latent variable μ^* was used instead. After running the model with all possible variables (OP Adjusted Full Model) and by applying step-wise procedures with bidirectional elimination relying on AIC and BIC as the selection criteria, all coefficients were re-estimated.

As shown in table 9-5, OPAM1 was selected based on the smallest AIC, and OPAM2 was selected based on the smallest BIC. According to OPAM2, the coefficient of latent flexibility characteristics is positive and significant at a 1 percent level. Hence, H5 was supported. Firms that were more flexible, were more likely to succeed after the housing crisis. On the other hand, the coefficient of innovativeness of sales functions did not show a significant result. Thus H7 is supported. Innovativeness of sales functions does not increase the profitability of the firm after the housing crisis. Interestingly, based on OPAM2, having an international business commitment and the mean age of sales team negatively influence the performance of firms after the housing crash at a 5 percent level of significance.

Table 9-5. Ordered probit regression on post-housing crash performance utilized estimated flexibility, μ*

	OP Adjusted Full Model				OPAM1 (AIC)				OPAM2 (BIC)			
	PE	SE	t		PE	SE	t		PE	SE	t	
Pre-Crash	-0.080	0.153	-0.52									
μ*	0.485	0.368	1.32		0.410	0.107	3.85	***	0.352	0.103	3.44	***
USA	-0.049	0.324	-0.15									
South	-0.001	0.366	0.00									
Forest	0.157	0.306	0.51									
Int Buz	-1.081	0.612	-1.76	*	-0.969	0.372	-2.61	**	-0.859	0.365	-2.35	**
Diff Orient.	-0.159	0.354	-0.45									
Innov Orient.	0.252	0.164	1.53									
log(emp)	-0.032	0.362	-0.09		0.185	0.122	1.52					
Year	-0.002	0.005	-0.35									
SpeciesDiv	-0.609	0.583	-1.05									
Pro Dealers	-0.613	0.402	-1.53		-0.647	0.385	-1.68	*				
Product Div	-0.010	0.140	-0.07									
BA Ratio	-0.007	0.004	-1.92	*	-0.007	0.003	-1.98	*				
Mean Age	-0.057	0.021	-2.69	***	-0.060	0.018	-3.28	***	-0.041	0.016	-2.50	**
worse|same	-3.950	1.408	-2.81	***	-3.392	1.088	-3.12	***	-1.957	0.920	-2.13	**
same|better	-3.257	1.400	-2.33	**	-2.732	1.082	-2.53	***	-1.315	0.915	-1.44	
better|much b	-1.294	1.359	-0.95		-0.828	1.047	-0.79		0.475	0.911	0.52	
Deviance	181.5				186.3				193.2			
Loglikelihood	-90.7				-93.1				-96.6			
AIC:	217.5				202.3				205.2			
BIC:	262.3				222.2				220.1			

Note: ***, **, * represent significant difference at 1%, 5%, and 10% level respectively.
PE and SE represent point estimates and standard errors, respectively.

3. Discussion

Figure 9-1 summarizes the conceptual model and where the hypotheses were tested. The rectangles represent the observed variables including attitudes, and ellipses represent the latent variables that were estimated from the observed variables.

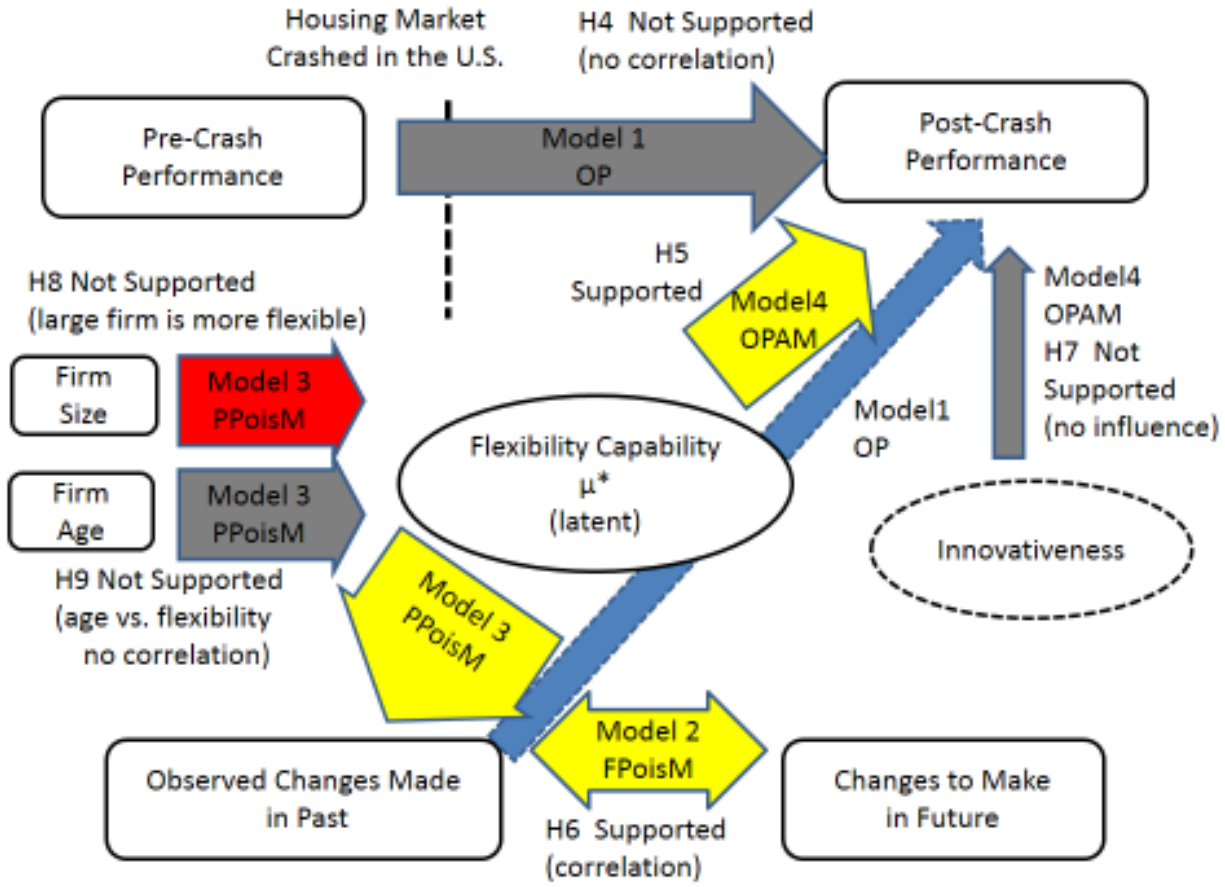

Figure 9-1. Model summarization

Since the models are complicated, and the estimated coefficients in the model translate into flexibility and individual probabilities of the firm's performance in a complex and non-linear manner, transformation of these coefficient estimates into counterfactual counts or counterfactual probabilities can aid in the interpretation of the relative magnitude of each type of effect on a hypothetical lumber processing firm's characteristic. The same simulation-based approach discussed in chapter eight was applied. Simulated results were graphically displayed for simplification by utilizing the "tile (Adolph 2012)" function of R.

An assessment of how flexibility is influenced by the independent variables was simulated by using PPoisM2. First, the interaction between the flexibility index and firm size was simulated. In this simulation, two different scenarios were created whereby a hypothetical firm: (i) exports outside of North America and ii) does not export outside North America. Firm size was captured by the number of employees, and the number of employees a hypothetical firm has was varied from 0 to 500. The other continuous of the independent variables of a hypothetical firm were set to their mean values. Figure 9-2 shows the simulated flexibility by number of employees. As you can see, as the number of employees increases, a counterfactual firm becomes more flexible. Flexibility sharply increases when a firm is very small, but flexibility increases more slowly with greater uncertainty, as the firm becomes larger. Comparing exporters and non-exporters shows that exporters are more flexible for firms of a similar size.

Figure 9-2. Simulated flexibility of a counterfactual firm by firm size and international commitment

In general, an incremental increase in firm size provides a firm will more access to resources including financial resource. Consequently, larger firms have more resources, so they can change more easily if they choose to than their smaller competitors. For very small firms, perhaps their bottleneck for new

investment would be financial resources, so they cannot change freely even though they would like to do so. This is why the incremental rate of flexibility is the most dramatic while a firm is very small, those with fewer than 100 employees.

Second, the interaction between the flexibility index and the differentiation orientation was simulated. In this simulation, three different scenarios were created whereby a hypothetical: (i) micro-firm with 20 employees, ii) small-sized firm with 100 employees, 3) medium-sized firm with 300 employees. The differentiation orientation of the hypothetical firm was varied from -3 to 1.5, which is the range of the sample. Other continuous independent variables for the hypothetical firm were set to the mean values, and discrete independent variables are set to the median values. Figure 9-3 shows the simulated flexibility by the differentiation orientation index and as the differentiation orientation increases, a hypothetical firm becomes more flexible. Given the same level of differentiation orientation, larger hypothetical firms have a higher flexibility than smaller firms.

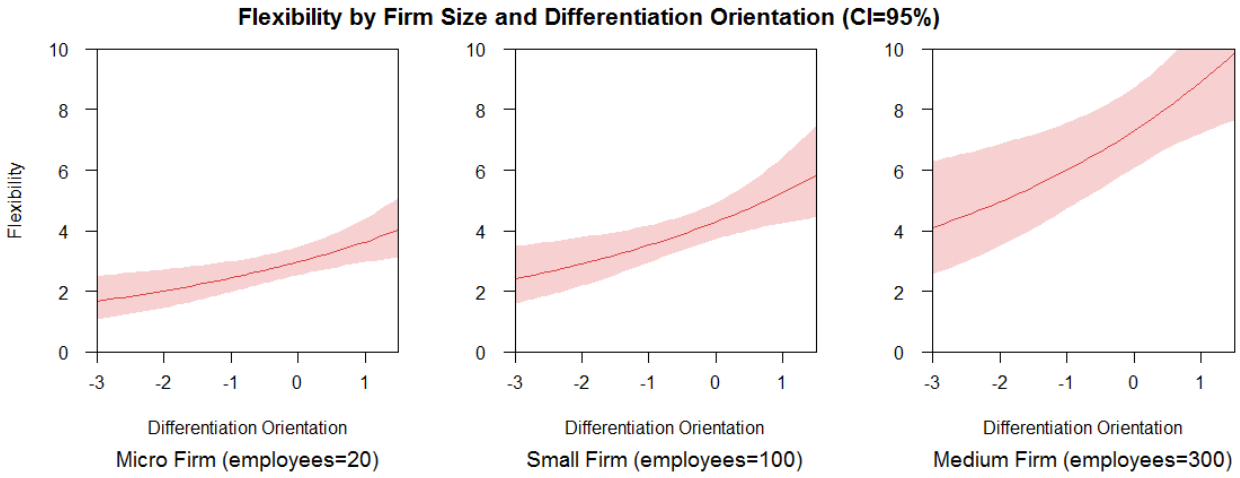

Figure 9-3. Simulated flexibility of a counterfactual firm by firm size and differentiation orientation

Finally, the counterfactual probability of respondent's perceived performance after the housing crisis was simulated by using OPMM2 where the hypothetical firm was varied its flexibility from 1 to 9, which

is the range of the sample. Other continuous independent variables of the hypothetical firm were set to the mean values, and discrete independent variables were set to their median values. Figure 9-4 shows the probability that a hypothetical firm answers that the firm's performance was 1) worse, 2) same, 3) better, or 4) much better than competitors as the firm's flexibility changes. The central lines in the figures represent the point estimates of the simulation, and the shading is the 68.3 percent confidence interval (one standard deviation) around the mean. As the flexibility index increases, the probability that a hypothetical firm performs better increases which suggests that after the housing crisis, flexibility was key to being successful.

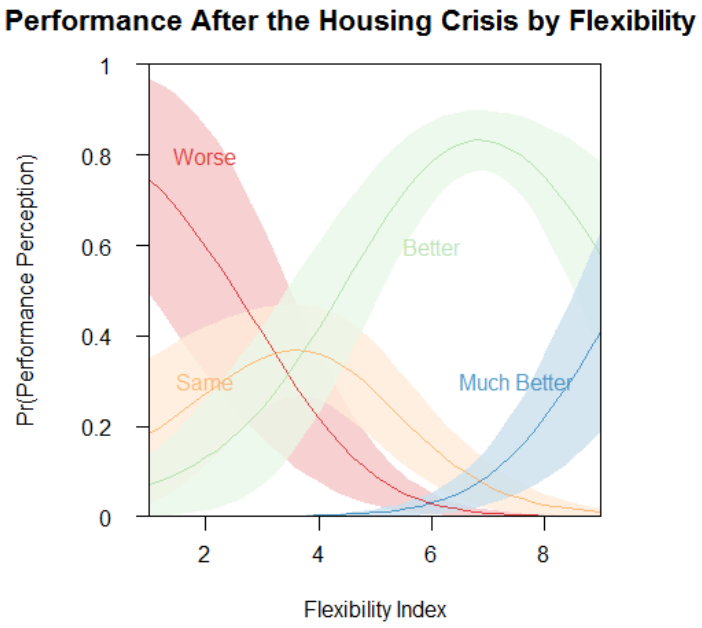

Figure 9-4. Counterfactual probabilities of a hypothetical firm's performance after the housing crisis by flexibility

Chapter 10. Conclusion

1. Performance after the Contingency Event

This study reveals that current profitability cannot be explained by past profitability, which implies that success factors in the sawmill industry are not stable over time. Hence, there is no set of variables that influence success in the long-term and applying a cross-sectional analysis to forest products firms in order to explain their performance over time may be misleading. This implies that the most efficient business strategy for sawmills differs depending on the environmental conditions. Indiscriminately applying a resource-based view to this industry is very dangerous. Table 10-1 shows the summary results of hypotheses.

Table 10-1. Summary results of performance after the housing crisis

Hypotheses	Results	Interpretations
Performance		
H4: Autocorrelation	Not Supported	-Current performance cannot be explained by past performance.
H5: Flexibility	Supported	-Flexible firms are more profitable after the housing crisis
H7: Sales Innovativeness	Supported	-Sales Innovativeness does not explain performance
Flexibility		
H6: Time Invariant	Supported	-Flexibility is time invariant
H8: Firm Size	Not Supported	-Medium-sized firm is more flexible than smaller firms.
H9: Firm Age	Not Supported	-Firm age cannot explain flexibility.

Flexibility

After the housing crisis, flexibility was the major driver for the firm to be economically successful in North America while firms were facing a contingency. Also, past flexibility is highly correlated to future flexibility, which suggests that a firm's flexibility is a time-invariant characteristic. Unlike the performance of a firm, a firm's flexibility remains relatively stable over time. There are flexible firms and

inflexible firms in the lumber industry, and flexible firms performed better than inflexible firms during and after the housing crisis.

Although it is somewhat controversial, marketing research suggests that smaller firms and younger firms seem to be more flexible (e.g. Nelson and Winter 1982). This view is not supported by these results from the softwood industry. According to the results of this research, firm size is positively correlated with flexibility while firm age does not show a correlation with flexibility. Since it is important to note that very large firms were not included in this study, it is more precise to say that medium-sized firms are more flexible than their smaller competitors. Among SMEs, perhaps very small firms don't have enough capacity to be flexible even though they would like to be. Simulation results show micro sawmills, for example, whose employees number about 20 lack the resources to be highly flexible. Flexible characteristics are not free for firms, so increasing flexibility is not a silver bullet for sawmill management particularly small sawmills. Business management for sawmills is highly restricted by firm size.

Meanwhile, there are generally no "young" firms, such as an entrepreneurial venture firms, in a mature industry like the sawmill industry. The softwood lumber industry is a mature industry where demand is highly influenced by housing markets. How to protect one's business from institutional changes, such as demand changes or regulatory changes, is one of the key managerial issues for softwood sawmill firms. Flexibility is one of the most important characteristics to protect from these changes.

How firms face institutional changes

Entrepreneurial discovery or external shocks can cause market disequilibrium and this section will discuss how these institutional changes influence firms in the lumber industry. The first two scenarios, demand changes and regulatory changes, are external shocks that firms cannot directly control. Firms

may be able to predict future demand or lobby for favorable policies, but disequilibrium will generally come from outside of their business activities. On the other hand, market disequilibrium of the next two scenarios is caused by competitors. Unless a firm is the first mover who disrupts the market equilibrium, the other firms must accept the new equilibrium and need to adjust in order to survive. Or, firms may able to take advantage of changes and be able to perform better than before. If any of the following institutional changes happen, firms that don't adjust quickly may fail.

First of all, a sudden boom or crash of housing markets causes a lumber shortage or surplus, respectively. Then, sawmills need to be able to rapidly adjust their production. If firms are flexible, they can quickly adjust to the new environment. Consequently, flexibility is the key to success for sawmill firms when demand conditions are volatile.

Second, forest policies are often changed by governments. These institutional changes result in a shift of the supply curve for sawmills, and disequilibrium is generated. In that case, firms are also forced to adjust toward the new equilibrium; hence, flexibility is still the key success in the industry when firms depend on natural resources whose regulatory framework is dictated by the government.

The third scenario is market innovation. Schumpeterian innovation can also generate disequilibrium. If one entrepreneurial firm brings an innovation to the market and successfully commercializes it, the demand curve will shift upward and a new equilibrium will emerge. Thus, total industrial rent will increase due to the *ex post* Schumpeterian innovation. The majority of rent will go to the entrepreneur. If other competitors quickly imitate the innovation of the entrepreneur, they can "scavenge" some of their surplus. Otherwise this opportunity will dissipate over time as other firms slowly imitate the innovation. If one succeeds, imitability, which may come from flexibility, is the key to exploit the profit.

The fourth scenario is market exploitation. Since technology constantly advances in our society, sawmills can apply new technology to increase their productivity. Technological advancement itself cannot move the demand curve upward, so total rent of the industry does not increase. Firms adopting a new technology increase productivity, so they can increase rent. Conversely, firms that do not adopt the technology will lose the same amount of rent. However, in order to adopt a new technology, firms need to invest.

Ironically, the worst case may be caused by firms that adopt a new technology that allows them to lower the price of lumber. In this case, the total rent of the industry decreases. Unfortunately, adoption of technology often makes the whole industry worse. Then the question is why some firms would like to initiate this kind of efficiency race that may not increase the industrial rent. A very large firm would like to adopt the newest technology in order to get rid of small, inefficient competitors so the industry will consolidate and competition may become less intense. Larger firms also can afford the initial investment easier than smaller firms. Furthermore, even though all players can become better off if no one initiates a price war, managers face a sort of prisoner's dilemma where they may think "we need to do it first; otherwise some others will do it and destroy us." This first-mover adoption strategy is generally not realistic for small- and medium-sized firms. Protection from a price war is difficult. The solution for this contingency is to either compete against other firms to continuously upgrade production efficiency or to avoid competing on price and focus on niche markets where the margins are higher.

Innovativeness, really?

Hansen et al. (2007) emphasize the importance of innovation and stated "separating the concepts is important. Whereas an innovation can be a new process, product, or business system, innovativeness is an organizational trait or characteristic. Thus, innovativeness is what enables an organization to create or adopt innovations." As Korhonen (2006) criticized, there is no solid definition of innovativeness, and

this definition does not separate rent exploration and exploitation. Although being an innovative firm sounds like a good option for sawmills, the concept is oversimplified and does not reflect the reality of sawmill management.

The innovativeness school believes firms should be innovative in order to be successful. Perhaps flexibility could be included in this study of innovativeness. Flexibility is a necessary attributes to help firms overcome external uncertainties, although it does not necessarily promise an increase in profitability for sawmills. Adopting innovation without understanding the concept can be misleading because external factors dominate the management of sawmill firms. Flexibility is not for all firms. Flexible firms need to bear the burden of additional costs in order to be flexible (Jack and Raturi 2003). Also, there is a hazardousness of organizational change (Amburgey et al. 1993).

From the managers' perspective, introducing new products is very risky. There are many new products that have failed in the forest products industry and needless to say creating new products, or invention, does not necessarily promise an above-average return. Once a firm fails when introducing a new product, it may face a financially tough time. Innovation is a creation of products, business systems, services, or ideas that are accepted by the market. There are some commercially accepted ex-post innovative products introduced in the forest products industry, such as OSB, I-joist, and glulam lumber, which have positively disrupted the market. Innovativeness is the capability to create an innovation, not just an invention. To find such innovativeness is a trillion dollar question, if that exists. Innovation will lift up the industry's value-added, so innovation is needed for the industry's overall growth. However, innovation is always an ex-post argument because we always recognize an innovation after the market has selected the products.

From the macro perspective, the most wanted innovation for the forest products industry sounds like Schumpeterian innovation since, according to Hansen et al. (2006), "Growth has been defined as a primary focus for many forest industry companies (Korhonen and Niemela 2004), but 'real' growth depends on innovation rather than acquisition and agglomeration, and the ability to outgrow the competition is inexorably tied to outinnovating (Hamel and Getz 2004)." Schumpeterian innovation is indeed important for the economic growth of society. However, the sawmill industry is not the same as the IT or biotech industry. The probability that a Schumpeterian innovation suddenly emerges in the forest products industry is not impossible but must be very low. Sawmills sell lumber as a commodity where demand is often constrained by housing starts.

2. Internationalization of sawmills

Export decisions are one strategic option for a firm which is willing to diversify its revenue source cross nations. Although empirical findings abound concerning export decisions in the forest products sector, most studies don't have a strong theoretical foundation. There are several different approaches that can explain the decision of SMEs to internationalize, and this study bridged the classic internationalization process model with international entrepreneurial theory.

The hurdle model was used to analyze the data in this study. The hurdle model is a very useful tool to analyze the process which is the combination of two fundamentally different consequential steps: entrance to the international market and incremental involvement of the international business commitments. A simulation-based approach was used to calculate the counterfactual probability of a hypothetical firm. By doing so, the complex findings was easily interpreted by both general audiences and policy makers. The results revealed that location of a firm, firms size and differentiation are important factors which drive softwood lumber firms in North America to involve international business

and to commit to a higher degree of international business activities. Table 10-2 summarizes the results of hypotheses.

Table 10-2. Summary results of internationalization of sawmill firms in North America

	Entrance to Int'l Business (Hurdle)	Incremental Involvement of Int'l Business (Ordered Regression)
H1: Firm Age	No	No
H2: Firm Size	↑	No
H3: Differentiation Strategy	↑ (Only in Southern U.S.)	↑

Location

As Rich (1981) reported, by the 1970s Canadian lumber firms in general already treated the export market much more seriously than U.S. lumber firms. Firms established in Canada naturally target not only a Canadian domestic market but also the lucrative U.S. market located just beyond their southern border. About 80 percent of the Canadian population lives within 150 kilometers of the Canada–U.S. border (Custred 2008), so it is not surprising that virtually all firms are aware of the U.S. market. Therefore, Canadian sawmills can cross the first hurdle very easily to become an exporter because of their inherent locational advantage. It may not be an overstatement that Canadian sawmills are "born global firms (Knight and Cavusgil 1996)" because of their locational advantage.

On the other hand, many U.S. firms are not interested in selling to neighboring markets, Canada and Mexico, since the U.S. domestic market is large enough to absorb their products. Also, consumers in the U.S. historically have had higher total purchasing power. So the international market would be outside of the cognitive boundary for many sawmill owners located in the U.S. I call it a liability that the home market is so large.

This study also found that firms located in the Southern U.S. have a disadvantage in terms of international markets. Regardless of firm size, there are many so-called “spaghetti mills” in the Southern U.S., and they almost exclusively utilize smaller-dimension Southern yellow pine log to manufacture dimension lumber. Selling commodity-grade dimension lumber to international markets is not easy for smaller mills since price competition is very high. Unless they differentiate their products, it would be difficult to obtain enough margin to sell products internationally. When firms in the Southern U.S. adopt a differentiation strategy, the likelihood that they will enter international markets increases. In contrast, when firms in the Southern U.S. do not adopt a differentiation strategy, they are less likely to enter international markets.

In addition, if a softwood lumber exporter locates in the Southern U.S., the probability that the firm commits to higher international business operations is lower than for exporters in other regions. According to the internationalization process model (Johanson and Vahlne 1977), after a firm starts exporting, they accumulate experiential knowledge. However, experiential knowledge does not always result in an expansion of international business activities. Firms may learn the hidden costs and realize the risks of international business through experience. If so, such experiential knowledge negatively influences the degree of international commitments.

Firm Size

As Ifju and Bush (1993) and Naka et al. (2009) reported, firm size is one of the most important factors to predict if a U.S. firm will export. When a firm is small in the U.S., they need to focus on a narrow market. With few exceptions, most U.S. firms focus on closer markets rather than on distant markets because of resource constraints. However, as the firm grows, they look offshore to find more profitable markets besides the more narrow domestic market. Lucrative international niche markets are definitely

candidates for the firm to target. This natural consequence can explain why larger SMEs are more likely to target international markets.

However, firm size does not increase the likelihood that a firm will commit to a higher degree of international business even though larger firms in general have more resources. When a firm grows, to some extent they may be less able to focus on niche markets, instead focusing on products with higher commodity contents to take advantage of their large production capacity. If that is the case, the firm can externalize sales operations, according to TCE. The higher the commodity content of a product, the more likely that a firm will use an export intermediary to export its products (Peng and Ilinitch 1998). Consequently, firm size and the degree of international commitment do not show a strong correlation. Hence, a basic deterministic step-by-step model is very questionable within the sawmill industry because firms change their mode of international commitments based on their resource and business strategies.

Differentiation

The purpose of the differentiation orientation index is to capture the business strategies that firms use. Basically, as firms become more differentiation orientated, they tend to have higher international business commitments. On average, firms tend to simultaneously expand both the product scope and geographic scope of markets as part of their diversification strategy.

A differentiation strategy by itself does not influence managers to target international markets. During the early stages of internationalization, firms often adopt standardized export marketing strategies (Leonidou and Katsikeas 1996) rather than differentiation strategies. However, as firms learn from the market and advance to the later stages of exporting, they often apply new marketing strategies (Cavusgi et al. 1993). Once they learn from the market, they finally understand experientially how different

customers request different products in different markets. Export marketing strategies, considered to be one of the major determinants of export performance (Brodrechtova 2008) are finally planned by managers after they gained experience in the international market. As a firm expands their geographical sales range, they need to adjust to new, heterogeneous customers, so a differentiation orientation becomes critically important. In their forest products study, Naka, Parsons, and Hammett (2009) empirically verified this view by comparing 1989 and 2002 Appalachian hardwood exporters. Even though some firms had exported through intermediators in 1989, most of them had internalized their export functions by 2002 as they accumulated experiential knowledge. More businesses have hired export managers, and more of them acquired foreign language skills by 2002.

While the generalized knowledge-based view can reflect the growing process of some firms but is not applicable to all of firms because the business strategies that each adopts will be different. Following Porter (1980), there are different generic strategies that reflect the degree of differentiation orientation index: the cost-leadership strategy and the differentiation strategy. The level of international commitment should differ from one business strategy to the other. The simulation study described in this section shows which firms are more likely to utilize intermediators—the probability that cost leaders indirectly export is measurably higher than that of differentiators. This result agrees with Peng and Ilinitch (1998)—the higher the commodity content of a product, the more likely that export intermediaries will be used by manufacturers. Thus, firms that pursue a cost-leadership strategy are more likely to their sales functions, and firms that pursue a differentiation strategy will likely internalize their sales functions in an effort to minimize transaction costs. Experiential learning from international markets is especially important for firms that pursue a differentiation strategy.

Connection between the internationalization process model and international entrepreneurship

This study bridges the internationalization literature (e.g. Johanson and Vahlne 1979; Bilkey and Teaser 1977; Cavusgil 1980; Reid 1981) and international entrepreneurship literature (e.g. Knight and Cavusgil 1996; McDougall et al. 1994; Oviatt and McDougall 1994; McAuley 1999). The international entrepreneurship literature rarely covers firms in a mature industry, like the softwood lumber industry. This study reveals that Canadian firms are "born international firms" because of their locational advantage, and many U.S. firms hesitate to export because of the liability posed by a home market that is too large. Firms that go into international markets can accumulate experiential knowledge, but that does not necessarily guarantee that they will increase their international commitments in the future. How to commit to international business varies by business strategy and firm size. For example, indirect exporting works better for cost leaders, while direct exporting works better for firms that adopt a diversification strategy.

3. Future direction of management field of forest products industry

Sawmill management is very complex, and firms are idiosyncratic in terms of their internal resources. It is necessary for forest products academicians to bring rigid and appropriate knowledge from other fields to help analyzing the mechanisms of such complex issues. The business strategy that each firm adopts is heterogeneous and each strategy has advantages and disadvantages, and the factors that may allow each firm to succeed vary depending on the situation.

It is extremely important for academicians to keep their feet on the ground and not pursue an elixir of immortality for complex issues. Because of organizational inertia, firms are path dependent. Since a path

once entered cannot be easily quit, economic consequences in terms of commitment and sunk costs are sticky (David 1985; Arthur 1989). Thus, the softwood lumber industry cannot incarnate into a bio-tech industry overnight. The essential mission of the softwood lumber industry is to deliver a product for the residential housing sector, and it is necessary to focus on the managerial plan for the sawmill business. Sawmills' management is influenced by external shocks, such as demand changes and regulatory changes by government. Lumber demand and price are very volatile because of fluctuations in the housing market. When firms experience a favorable environment, they are more profitable. On the other hand, when the industry faces uncertainties, firms need to protect themselves and adjust their business models to survive. Managerial policy needs to respect the characteristic of this volatile commodity demand.

Perhaps it is more useful for sawmill management to look to the institutional or contingency view with an SCP paradigm rather than on the easy-to-understand RBV. The appropriate management actions and approaches for a commodity business are, to a large degree, dependent on external shocks and firm size. Protecting their business from uncertainty is one of the most important issues for sawmill managers. If the market is stable, sawmills should focus on their core business operations. Theoretically, rigidly routinized firms are the most efficient and reliable, so they can maximize profit. However, the market is full of uncertainty. External shocks are brought by changing demand conditions, competitors, or new regulations, which firms cannot control. In order to protect their businesses from these external shocks, firms have to sacrifice some efficiency and in order to be flexible. Given a firm's size, efficiency and flexibility are trade-offs. Firms need to determine their flexibility based on their business strategy. Do they need to avoid risk or to pursue maximum profits? These are the main questions for sawmill firms.

4. Limitations of the study

Even with entering inputs to enhance the theoretical support of the model, it could still pick up correlations rather than causation. There could be confounding factors that influence both the dependent variables and independent variables simultaneously. If that is the case, the correlation which model picks up is spurious. Or, the causal relationship could appear to be opposite of what it really was. Furthermore, when simulated based on the model estimation, the multicollinearity between independent variables may influence the counterfactual probabilities. Future study is further explore these limitations.

Chapter 11. Business Practice Implications for Sawmills

There is no easy panacea for the sawmill business in North America. Without a doubt that the lumber industry is a mature industry and housing starts in North America strongly influence the lumber business. In reality, opportunities to develop and maintain a sustainable competitive advantage are very limited in a mature industry. Also, there are limited opportunities for product and process innovation in the sawmill industry. Local housing markets are strongly influenced by economic cycles, so the demand for lumber is quite volatile. Sawmill businesses need to confront the fact that the domestic market is very volatile. When housing markets are good, the business environment for the lumber market is also good, so sawmills in general can perform well. On the other hand, when housing markets are bad, the business environment for the lumber market is also bad, so sawmills in general earn less or go out of business. Moreover, exchange rates and international policies always change, and international competition makes a domestic price advantage very vulnerable. In order to survive in this turbulent marketplace, firms must recognize their competitive strength and discover how to survive in a volatile market.

Volatility can be mitigated by diversification. In portfolio theory, volatility is equal to financial risk, and one can mitigate financial risk through diversification (Markowitz 1991). The managerial question for sawmills is whether they would like to mitigate Markowitz financial risk or not. One business strategy is to accept the risk and to concentrate on the most profitable market. Another business strategy is to diversify revenue sources in order to mitigate the risk. It is also possible to find a business strategy in the middle. It all depends on how much financial risk firms can tolerate and what markets firms would like to pursue. The results of numerous marketing and economic studies implies that firm size is associated with making these decisions.

One may propose that the best business strategy for North American sawmills are as follows: It is a good idea for sawmills to concentrate on the U.S. market, the largest and most lucrative softwood lumber market, when it is strong but to diversify when it becomes weak. However, this business model is not realistic because firms cannot change that quickly because of routines and inertia. Also, contingencies such as market turbulence, regulatory changes, and actions by competitors are not always predictable. If a contingency arises, firms cannot respond quickly enough to avoid the crisis. Furthermore, all participants will rush to Noah's Ark simultaneously once doomsday comes to a certain market. Even if they successfully survive the contingency, unplanned changes in routines provoked by the crisis may deteriorate the merit of a firm's inertia. Being prepared based on one's business strategy is the only way to mitigate the worst-case scenario.

However, diversification is not the only way to be successful. Going into an unknown market and offering an unfamiliar product to a market brings many uncertainties for a firm that does not have experience. Diversification might necessitate significantly expanding human and financial resources, which may detract focus, commitment, and sustained investments in the core operation. Without a clear strategic direction with regard to manufacturing, diversification and changing can become an expensive solution for firms.

1. Proposed business strategies

Based on the debate between strategic management theory and organizational ecology theory about managerial inertia and managerial flexibility, this paper proposes six different strategies for a sawmill business depending on the firm's size and the financial risk they would like to take (figure 11-1). It is important to emphasize that financial risk here is defined as the unexpected variability or volatility of a firm's returns. Hence, it includes both potential worse-than-expected (downside risk) as well as better-

than-expected returns (upside risk). Firms can mitigate financial risk through diversification, but firms that allow some costs for diversification may need to sacrifice efficiency.

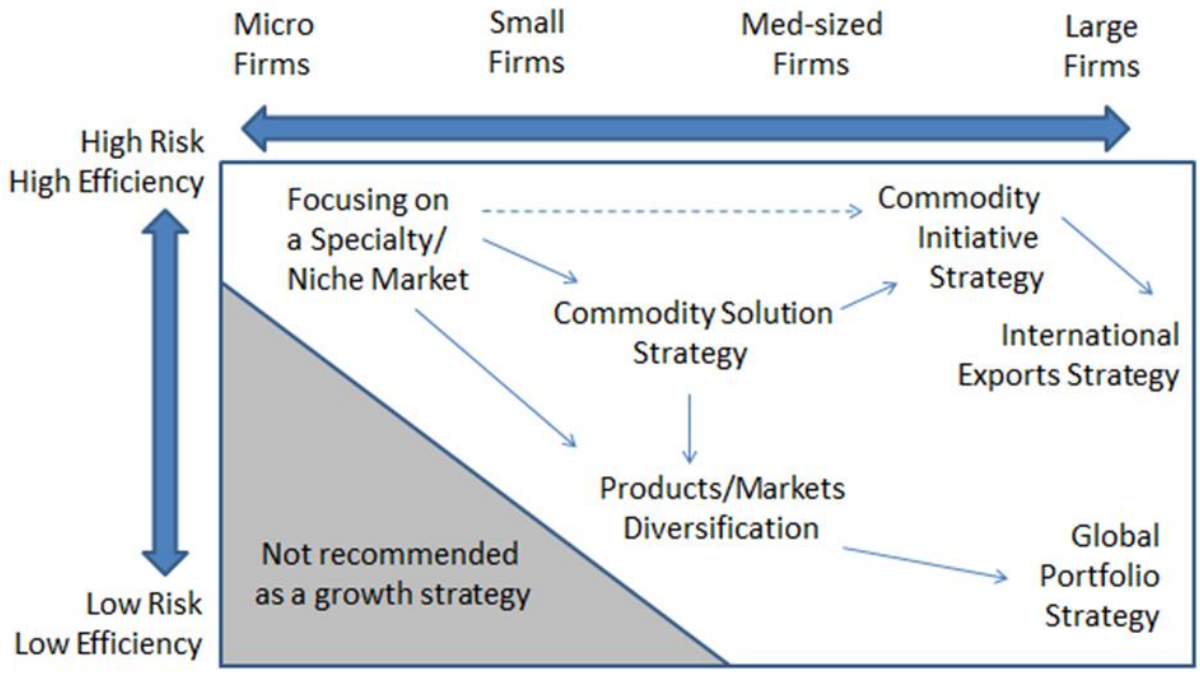

Figure 11-1. Strategies for a sawmill business depending on firm size and financial risk to take

As firms grow, they can move from one strategy to another strategy, but only certain moves are recommended in order to avoid disrupting the firms. These recommended moves are shown as arrows in figure 11-1.

Micro to small firms

Unfortunately, there are not many choices for very small firms outside of focusing on a single niche market. When a firm is very small, it cannot afford flexibility because of its limited of resources. Some may argue that a flexible micro firm can take a customization strategy, but it is not a recommended strategy with respect to the growth of sawmill firms. In general, since customization cannot take

advantage of economy of scale, it is very difficult for firms that have applied a customization strategy to grow quickly. The results of this study empirically suggest that flexibility is positively correlated with firm size.

A very small firm needs to focus on its core operation. Since they cannot compete with larger firms in terms of cost structure, they have to focus on niche markets rather than commodity markets. A niche market is a small group of customers who share a unique characteristic that makes them receptive to a particular product. Small firms can focus on selling specialty products that usually have a larger margin than commodity products. Small firms need to identify the best niche market for them by considering their production technology and capacity. The best niche market for a firm may exist in North America or in offshore markets. If the niche is right for the firm and brings profits, firms can accumulate resources and grow. Since they are not diversified, if a contingency strikes the niche market, small firms targeting the niche market will be significantly damaged.

Identifying the best market for a firm is the key success point for this strategy. They do not necessarily need to target the domestic market. For example, many small Canadian sawmills have targeted the U.S. market from the beginning since they perceive the U.S. market to be more profitable than the Canadian domestic market. They are literally “born-global” firms. On the other hand, most U.S. firms can easily target the lucrative domestic market, so they have a hurdle to overcome if they want to internationalize. A few exceptions are some U.S. softwood sawmills specializing in exporting high-grade lumber targeting a high-end international segment, such as Japanese traditional post and beam builders, Italian window frame manufacturers, and Indonesian or Chinese musical instrument manufacturers.

Small- to medium-sized firms

Once a firm accumulates financial resources internally, they are able to upgrade their production capacity. There would be three potential business strategies firms can take depending on how much financial risk they are willing to assume: commodity initiative strategy, commodity solution strategy, and diversification strategy.

If the sawmill would like to focus on production efficiency, they may want to take a commodity initiative strategy because it is extremely difficult to seek any competitive advantages with commodity products except by reducing price. However, in general, medium-sized firms are not competitive against very large firms in the industry in terms of their cost structure (the curse of medium-sized firms). This strategy is not recommended unless firms have the best available technology that permits them to lower production costs to compete against the large firms. Once a firm decides to pursue a commodity initiative strategy, they almost always are forced compete on price.

However, by relaxing efficiency they can take a commodity solution strategy. When a firm becomes large, they cannot avoid participating in commodity markets. Since it is extremely difficult to develop any competitive advantage for commodity products besides price, they should find a rent source from other activities rather than production efficiency. Perhaps they should approach buyers and listen to their wants and needs and deliver product packages directly. This is a vertical integration, and a firm can cultivate revenues from a larger portion of the value chain besides just production. In this regard, however, the commodity solution strategy requires skills, knowledge, and capability to provide solutions for buyers. Clearly, this strategy sacrifices efficiency and requires some flexibility. The ability to provide "solutions" brings extra value for firms and involves transitioning from selling to marketing.

If medium-sized firms want to diversify their financial risk, product/market diversification works for them. Transitioning to this strategy is easier for small firms focusing on a specialty/niche market. They basically extend their production lines and hold similar options. Unlike vertical integration, this is horizontal integration. If they would like to improve efficiency, they need to diversify into new markets rather than production lines, but it is perhaps similar to a commodity solution strategy. If they hold many irrelevant production lines, perhaps there is no meaning to do that as a single firm. Rather, they should focus on maximizing profits through improving their economy of scope while seeking out multiple markets that are not highly correlated. Economy of scope exists when a firm can produce a given level of output from each product line more cheaply than a combination of separate firms, each producing a single product at the given output level. To achieve economy of scope, firms need to be flexible. If a firm can manufacture multiple products with the same equipment and if the equipment allows the flexibility to change as market demands change, the firm can add a variety of new products to their current line. As the number of products increases, it offers a barrier to entry for new firms.

Some firms may want to diversify their markets internationally. The results of this study confirmed the liability of being located in a large domestic market. U.S. firms are less likely to go to international markets than Canadian firms. If firms would like to take a diversification strategy, diversifying to customers across the border can significantly reduce financial risk while keeping similar production lines. It is strongly recommended for U.S. firms that would like to diversify to target international markets.

However, the difficulty for the smaller firm to go international is investing in a sales force with little knowledge about a new international market. You may think relying on intermediators would be a good idea, but that might not be the case here. As discussed previously, when a firm is smaller, it's better to sell specialty or differentiated products rather than commodity products. However, compared to commodity products, complex and differentiated products have higher transaction costs, especially

post-monitoring and enforcement costs (Peng and Ilinitch 1998). Hence, selling differentiated products requires an asset-specific sales force, and it is usually better not to externalize the sales function. Small firms need to overcome this sales force paradox in order to grow through exporting.

Furthermore, as the results of this research empirically shows, when firms offer more products, they also increase the number of markets they target. Figure 11-2 describes the conceptual relation between the degree of product diversification and the degree of market diversification. If the number of production lines and markets simultaneously increase, the size of a firm becomes larger. How to balance economy of scope and organizational efficiency are the keys to success. Needless to say, if a firm increases fixed costs, such as employing a sales force, at the same rate as it grows, they could well lose their competitive edge. Once they become large enough, they may want to apply a global portfolio strategy, discussed in the next section.

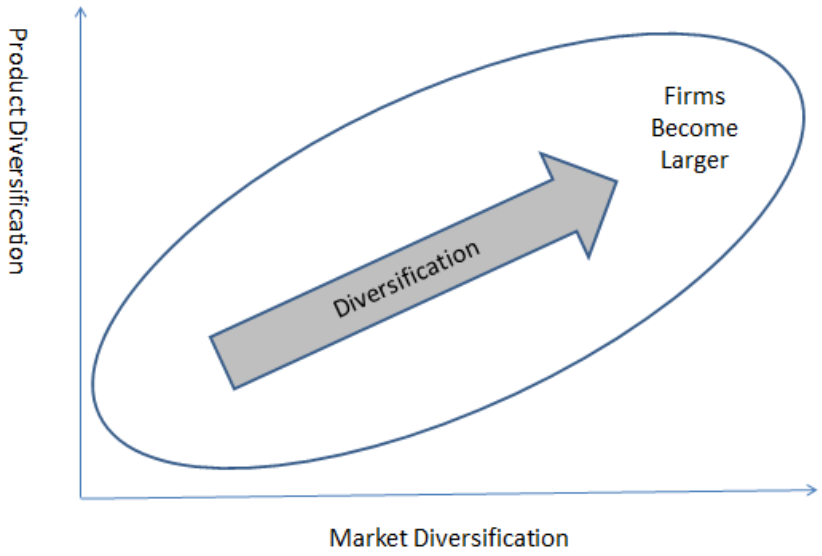

Figure 11-2. Conceptual chart of product diversification and market diversification

Large firms

Once a firm becomes large in terms of production capacity, they cannot avoid targeting the general commodity market. As Porter (1980) proposes, there are two generic strategies firms can choose, cost leadership or differentiation.

If the firm would like to thoroughly pursue the cost-effectiveness of products, they can take a commodity initiative strategy. However, they usually have to give up flexibility and apply inertial operational routines. Since they produce commodity products, they do not have to internalize the sales department, which requires additional costs. Relying on wholesalers or dealers could make economic sense for a commodity initiative strategy. This strategy exposes the firm to the full risk of the North American housing sector and the volatile nature of housing starts. Firms need to forecast the housing market regularly and conduct stress tests to see how their operation will change if the housing market changes.

A firm that attempts to achieve both cost-leadership and differentiation usually ends up stuck in the middle and forced to accept low profitability, so that is not a recommended business strategy (Porter 1980). However, as an extension of the commodity initiative strategy, a firm can take an international export strategy without deteriorating their strength of inertia. Even though there are many profitable niches in international markets, softwood lumber as a commodity market is almost homogeneous globally. If the North American market is saturated and competitive, firms can export excess production to international markets. The merit of this strategy is they don't have to hire additional international sales staff. Since commodity products tend to be very homogenous, externalizing a sales force to intermediators or traders may lower transaction costs while not necessarily lower sales revenue. According to TCE, the higher the commodity content of the products, the more likely that export intermediaries will be selected by manufacturers (Peng and Ilinitch 1998). Conducting this strategy

delivers a firm higher flexibility than does the commodity initiative strategy by itself, but it will not deteriorate the merit of inertia. However, if a firm diversifies beyond a certain point, they may be stuck in the middle and lower profitability since diversification can deteriorate the competitive advantage of an inertial firm.

If a firm would like to diversify, a global portfolio strategy might be the best choice. This is an extension of a diversification strategy. As discussed already, if the production lines of a firm and the markets they target increase, the size of the firm increases. However, the global portfolio strategy is beyond the large, diversified firm. A firm applying the global portfolio strategy always needs to seek optimal locations around the world for the various value chain activities. They have to identify the best markets to jump into with respect to their products. They have to identify the best locations from which to operate their production. They have to identify the best places to procure raw materials. They have to seek out integration opportunities not only horizontally but also vertically. They even need to seek out additional value chain activities besides classical sawmill business such as value-added products manufacturing, pulp and paper production, biofuel production, and securitizing timberland investment management. Of course they always need to discover the economy of scale since holding multiple irrelevant operations does not make the firm competitive. Firms need to identify the optimal portfolio with respect to profitability, risk hedging, and operational synergies. This strategy would be the most challenging of the six strategies. They need to be very flexible while they are large. If a firm conducted a commodity initiative strategy or an international export strategy as an extension of a commodity initiative strategy or attempted to turn toward this strategy, the changing process would harm the organizational core inertia, so that is not recommended.

2. Conclusion

When firms focus on narrow operations, they can achieve efficiency, but they are vulnerable against market downturns. On the other hand, if a firm diversifies operations, they can hedge the financial risk but absorb additional costs in order to be flexible and sacrifice operational efficiency. Whatever strategy they would like to pursue depends on their mission.

Business strategies generally depend on firm size. However, some strategies are not recommended for all firms. For example, it is not easy for small firms to pursue a diversification strategy because of their limited resources. Also, it is not easy for medium-sized firms to pursue a commodity initiative strategy because they lack of economy of scale. These limitations may sustain the structure of this industry, which would work as mobility barriers (Porter 1980). For the small firm looking to grow larger, these limitations are very important to consider.

Although many marketing experts overemphasize the importance of innovativeness, changing, and flexibility, these are not a universal remedies for all firms. Flexibility certainly can hedge the financial risk but requires additional costs for firms. On the other hand, operational inertia brings efficiency. I do not recommend that cost-leaders try to be flexible unless they fail a stress test. It is extremely dangerous to change from a differentiation position to a cost-leadership position because the transition will destroy the merits of organizational inertia. Confirming their organizational identity is one of the most important managerial issues for sawmill firms.

The softwood lumber industry is saturated in North America where domestic lumber demand depends on housing starts in the U.S. However, there are many promising markets offshore. Some advanced nations consume large volumes of lumber, while many emerging markets need commodity lumber to support their economic growth. Merits of entering these markets differ depending on what kinds of

business strategy a firm adopts. They can either sell directly or sell through intermediators. Flexibility is the key to conducting international business, but unfortunately it does not automatically increase profitability. Firms need to make sure that exporting fits their business model. Exporting can explore the economic rent of the industry. If many North American firms participate in selling to a certain international market, the bandwagon effect among buyers may arise. The bandwagon effect occurs when people's preference for a commodity increases as the number of people buying it increases. From the macro management perspective, strategically creating this kind of effect in many export markets can provide new opportunities for the entire softwood lumber industry in North America.

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Appendices

1. Cover Letter to U.S. Sawmills
2. Survey to U.S. Sawmills
3. Cover Letter to Canadian Sawmills (French)
4. Survey to Canadian Sawmills (French)

August 2011

Dear Sawmill President, General Manager or Sales Manager:

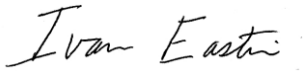
The Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington is conducting a survey to evaluate the international orientation and risk perception of sawmill managers. The primary purpose of this survey is to compare a company's sales perspective to its operational diversity. The survey will only take about 10 minutes of your time and we would greatly appreciate your help in making this survey a success.

To ensure the validity of the survey data, I ask that it be completed by the person in your firm who is most involved in decisions relating to the determining the scope of markets served (e.g., most likely the ***president, general manager or sales manager***). If you are interested in receiving a summary of the results of this project, please print your e-mail address on the last page of the survey and a complimentary summary of the research report will be sent to you.

Individual answers will be kept confidential by CINTRAFOR at the University of Washington. Group results will be presented and documented for academic purposes.

Your participation is very important to the success and reliability of this project. I would be more than happy to answer any questions you might have and thank you again for your time. Your kind assistance is greatly appreciated.

Sincerely,



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CINTRAFOR

1. Have you ever **directly exported** your products?
   O YES [Please go to next question]
   O Never [Please skip to **question 6** ↓]

2. How many times did you ship your products outside of North America in 2010?

   Total_____ times in 2010

3. Approximately which year did your firm start exporting?

   _____ (e.g. 2005, 1992, 1970s)

4. Please list the percentage of total revenue for the following markets in 2010.

Region	% of your sales
USA	%
Canada	%
Mexico	%
EU	%
Japan	%
China	%
Others	%
Total	**100%**

5. If you chose "Others", where did you sell in 2010?

   _____

6. In 2010, did you **export indirectly** by using a middleman such as an export consolidator?
   O YES **O** NO

   ↗ to Q.7

7. How many sawmills does your company own?

   _____

8. How many employees does your company have?

   Full-time Employees _____
   Part-time Employees _____

9. How many of your employees are **managers** (including president and owners if they perform the role of manager)?

   _____

10. How many of your managers are involved in sales and marketing activities?

    _____

11. How many years has your firm been in business?

    _____**Years**

12. How much lumber did your company produce in 2010?

    _____**mmbf**

13. What is the total 8 Hour capacity of all of your sawmills?

    _____**mmbf**

14. Does your company own forestland?
    O YES **O** NO

    ↙ to Q.15

15. Approximately what percentage of management resources goes to production and sales activities? (select one)
    O 0% Sales activity; 100% Production activity;
    O 25% Sales activity; 75% Production activity
    O 50% Sales activity; 50% Production activity
    O 75% Sales activity; 25% Production activity
    O 100% Sales activity; 0% Production activity

16. In past 5 years, did your company….
17. Within the next 5 years, is your company planning to …

	16. Past Five Years		17. Next Five Years		
	Yes	No	Yes	No	Unsure
Invest in new production technology?	O	O	O	O	O
Add new products?	O	O	O	O	O
Enter in a new international market?	O	O	O	O	O
Develop a new marketing campaign?	O	O	O	O	O
Experience ownership change?	O	O	O	O	O
Add new material suppliers?	O	O	O	O	O
Reduce fixed cost in manufacturing process?	O	O	O	O	O
Add new managers from outside the firm?	O	O	O	O	O
Introduce any certification programs (e.g. FSC, ISO…)?	O	O	O	O	O

18. Within the next 5 years, which markets do you think you will be selling to?

Region	Definitely Not	Very Unlikely	Unlikely	Likely	Very Likely	Definitely
USA	O	O	O	O	O	O
Canada	O	O	O	O	O	O
Mexico	O	O	O	O	O	O
Europe	O	O	O	O	O	O
Japan	O	O	O	O	O	O
China	O	O	O	O	O	O
Overall Int'l Market	O	O	O	O	O	O

19. Please indicate how well each of the following statements describes your company.

My company….	Never	Rarely	Occasionally	Very Frequently	Always
offers customized products rather than standardized products.	O	O	O	O	O
sells to new customers.	O	O	O	O	O
outsources our sales function to agents and/or distributors.	O	O	O	O	O

20. Please indicate how well each of the following statements describes your company.

My company	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
strives to improve product quality even if it costs more.	O	O	O	O	O
targets niche markets rather than the generalist market.	O	O	O	O	O
competes on price rather than product quality in the market.	O	O	O	O	O

21. How do you think your company performed relative to your competitors before and after the housing market crash of 2006? Please circle the best response for each period.

Period	Much Worse	Worse	Same	Better	Much Better
Pre-Housing Market Crash	O	O	O	O	O
Post-Housing Market Crash	O	O	O	O	O

22. Do you provide the following services within of your company?

Service	Yes	No
Kiln-Drying	O	O
Planing	O	O
End Painting	O	O
Preservative Treating	O	O
Finger Jointing	O	O
Machine Stress Rating	O	O
Certified Wood (e.g. FSC or SFI)	O	O

23. Approximately, what percentage of your sales goes to the following buyers?

Buyers	% of your Sales
Directly to end-users	%
Pro-Dealers/ Wholesalers	%
Home Centers (DIY retailers)	%
Others	%
Total	**100%**

This section is about your company's **Sales Team**.

24. Approximately, what percentage of your sales team has a bachelor's degree? _____%

25. What is the approximate age distribution of your sales team?

Age	% of Sales Team
Under 40	%
40 to 59	%
60 or above	%

26. Please indicate how each of the following statements describes your company's sales team.

About your Sales Team	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
They have authority to make sales decisions	O	O	O	O	O
They have international experience.	O	O	O	O	O
They are very aggressive.	O	O	O	O	O
They are highly entrepreneurial.	O	O	O	O	O
They have formed a strong bond with each other.	O	O	O	O	O
They are very innovative	O	O	O	O	O

27. Please rate the potential **Attractiveness** of the following markets to your company.

	Not at all Attractive	Somewhat Attractive	Attractive	Very Attractive	Extremely Attractive
USA	1	2	3	4	5
Canada	1	2	3	4	5
Mexico	1	2	3	4	5
Dominican Republic	1	2	3	4	5
United Kingdom	1	2	3	4	5
France	1	2	3	4	5
Italy	1	2	3	4	5
Turkey	1	2	3	4	5
Saudi Arabia	1	2	3	4	5
Japan	1	2	3	4	5
South Korea	1	2	3	4	5
China	1	2	3	4	5
Vietnam	1	2	3	4	5
Indonesia	1	2	3	4	5
India	1	2	3	4	5
Australia	1	2	3	4	5
Overall International Market	1	2	3	4	5

28. Please indicate your overall **Assessment of** the **Business Risk** in each of the following markets.

	Not Risky At All	Somewhat Risky	Risky	Very Risky	Extremely Risky
USA	1	2	3	4	5
Canada	1	2	3	4	5
Mexico	1	2	3	4	5
Dominican Republic	1	2	3	4	5
United Kingdom	1	2	3	4	5
France	1	2	3	4	5
Italy	1	2	3	4	5
Turkey	1	2	3	4	5
Saudi Arabia	1	2	3	4	5
Japan	1	2	3	4	5
South Korea	1	2	3	4	5
China	1	2	3	4	5
Vietnam	1	2	3	4	5
Indonesia	1	2	3	4	5
India	1	2	3	4	5
Australia	1	2	3	4	5
Overall International Market	1	2	3	4	5

Août 2011

Cher Président d'usine, Directeur général, ou Directeur des ventes,

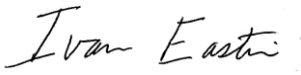
Le Centre pour le commerce international des produits du bois (CINTRAFOR), à l'Université de Washington, mène un sondage pour évaluer l'orientation internationale et la perception du risque des gestionnaires d'usines de sciage. L'objectif principal de cette étude est de comparer les perspectives de vente d'une entreprise à sa diversité opérationnelle. Le sondage ne prendra que 10 minutes de votre temps et nous vous en serions très reconnaissants.

Afin d'assurer la validité des données du sondage, nous demandons qu'il soit complété par la personne au sein de votre organisation qui soit la plus impliquée dans les décisions déterminant l'étendue des marchés desservis (p.ex. ***le président, le directeur général ou le directeur des ventes***). Si vous êtes intéressé à recevoir un sommaire des résultats du projet, veuillez svp inscrire votre adresse courriel à la dernière page du questionnaire et un résumé du rapport de recherche vous sera envoyé.

Les réponses individuelles d'usines seront gardées confidentielles par CINTRAFOR à l'Université de Washington et seulement les résultats agrégés seront présentés et documentés pour des besoins académiques.

Votre participation est très importante au succès et à la fiabilité de ce projet. Il me fera plaisir de répondre aux questions que vous pourriez avoir au sujet du sondage. En vous remerciant encore une fois pour votre temps. Sachez que votre assistance est très appréciée.

Sincèrement,



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CINTRAFOR

1. Avez-vous déjà **exporté <u>directement</u>** vos produits (incluant les É.-U.)?

   O OUI [Veuillez aller à la question suivante]
   O Jamais [Veuillez passer à la **question 6** ↓]

2. Combien de fois avez-vous acheminé vos produits <u>à l'extérieur de l'Amérique du Nord</u> en 2010?

   Total_____ fois en 2010

3. Approximativement en quelle année votre entreprise a- t-elle commencé à exporter?

   _____ (p.ex. 2005, 1992, '70)

4. Veuillez inscrire le pourcentage du revenu total pour les marchés suivants en 2010.

Région	% de vos ventes
Canada	%
États-Unis	%
Mexique	%
EU	%
Japon	%
Chine	%
Autres	%
Total	**100%**

5. Si vous avez choisi "Autres", où avez-vous vendu en 2010?

   _____

6. En 2010, avez-vous **exporté <u>indirectement</u>** avec l'aide d'un intermédiaire tel qu'un agent en export?
   O OUI **O** NON

   ↗ allez à Q.7

7. Combien d'usines de sciage votre entreprise détient-elle?

   _____

8. Combien d'employés votre entreprise a-t-elle?

   Employés temps-plein _____
   Employés temps-partiel _____

9. Combien de vos employés sont **gestionnaires** (incluant le président et les propriétaires s'ils accomplissent le rôle de gestionnaire)?

   _____

10. Combien de vos gestionnaires sont impliqués dans les activités de ventes et de marketing?

    _____

11. Depuis combine d'années votre entreprise est-elle en opération?

    _____**Années**

12. Combien de bois de construction votre entreprise a-t-elle produit en 2010?

    _____**Mpmp** (mmbf)

13. Quelle est la capacité totale de 8 heures, pour toutes vos usines de sciage?

    _____**Mpmp** (mmbf)

14. Est-ce que votre entreprise détient des terres forestières?
    O OUI **O** NON

    ↙ allez à Q.15

15. Approximativement quel pourcentage de vos ressources de gestion est dédié aux activités de production et de vente?

O 0% activités de vente; 100% activités de production; **O** 25% activités de vente; 75% activités de production

O 50% activités de vente; 50% activités de production **O** 75% activités de vente; 25% activités de production

O 100% activités de vente; 0% activités de production

16. Dans les 5 dernières années, est-ce que votre entreprise a….
17. Dans les 5 prochaines années, est-ce que votre entreprise prévoit….

	16. Derniers 5 ans		17. Prochains 5 ans		
	Oui	**Non**	**Oui**	**Non**	**Incertain**
Investir dans de la nouvelle technologie de production?	O	O	O	O	O
Ajouté/er de nouveaux produits?	O	O	O	O	O
Enté/er dans un nouveau marché international?	O	O	O	O	O
Développé/er une nouvelle champagne de marketing?	O	O	O	O	O
Changé/er de propriétaire?	O	O	O	O	O
Ajouté/er de nouveaux fournisseurs de matériaux?	O	O	O	O	O
Réduit/ire les coûts fixes du processus de fabrication?	O	O	O	O	O
Ajouté/er de nouveaux gestionnaires provenant de l'extérieur de l'organisation?	O	O	O	O	O
Introduit/re des programmes de certification (p.ex. FSC, ISO…)?	O	O	O	O	O

18. Dans les 5 prochaines années, sur quels marchés pensez-vous vendre?

Région	**Définitivement pas**	**Très peu probable**	**Peu probable**	**Probable**	**Très probable**	**Définitivement**
Canada	O	O	O	O	O	O
États-Unis	O	O	O	O	O	O
Mexique	O	O	O	O	O	O
Europe	O	O	O	O	O	O
Japon	O	O	O	O	O	O
Chine	O	O	O	O	O	O
Marché international dans l'ensemble	O	O	O	O	O	O

19. Indiquez dans quelle mesure chaque énoncé reflète votre entreprise.

Mon entreprise….	**Jamais**	**Rarement**	**Occasionne -llement**	**Très fréquemment**	**Toujours**
offre des produits personnalisés plutôt que des produits standardisés.	O	O	O	O	O
vend à des nouveaux clients.	O	O	O	O	O
assigne les ventes à des agents et/ou à des distributeurs.	O	O	O	O	O

20. Indiquez dans quelle mesure chaque énoncé reflète votre entreprise.

Mon entreprise….	**Fortement en désaccord**	**En désaccord**	**Neutre**	**En accord**	**Fortement en accord**
tente d'améliorer la qualité des produits même si c'est plus coûteux.	O	O	O	O	O
cible les marchés niches plutôt que le marché généraliste.	O	O	O	O	O
rivalise sur le prix plutôt que sur la qualité des produits.	O	O	O	O	O

21. Comment pensez-vous que votre entreprise a performé relativement à ses compétiteurs avant et après la crise immobilière américaine de 2007? Veuillez cochez la meilleure réponse pour chaque période.

Période	Bien pire	Pire	Pareille	Mieux	Beaucoup mieux
Pré-crise immobilière	O	O	O	O	O
Post-crise immobilière	O	O	O	O	O

22. Votre entreprise fournit-elle les services suivants?

Service	Oui	Non
Séchage au four (kiln-dry)	O	O
Rabotage	O	O
Peinture des bouts	O	O
Traitement de préservation	O	O
Bois jointé	O	O
Classification par contrainte mécanique (MSR)	O	O
Bois certifié (p.ex. FSC or SFI)	O	O

23. Approximativement quel pourcentage de vos ventes vont aux acheteurs suivants?

Acheteurs	% de vos ventes
Directement aux usagers finaux	%
Détaillants professionnels/ Grossistes	%
Centres de rénovation / bricolage (DIY)	%
Autres	%
Total	**100%**

Cette section concerne l'**équipe de vente** de votre entreprise.

24. Approximativement quel pourcentage de votre équipe de vente détient un baccalauréat?

_____%

25. Quel est la distribution d'âge approximative de votre équipe de vente ?

Âge	% de votre équipe de vente
Moins de 40	%
40 à 59	%
60 ou plus	%

26. Veuillez indiquer dans quelle mesure chacun des énoncés suivants dérivent l'équipe de vente de l'entreprise.

Au sujet de l'équipe de vente	Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
Ils ont l'autorité pour prendre des décisions de vente	O	O	O	O	O
Ils ont de l'expérience à l'internationale	O	O	O	O	O
Ils sont très agressifs	O	O	O	O	O
Ils sont hautement entreprenants	O	O	O	O	O
Ils ont formé un lien serré entre eux	O	O	O	O	O
Ils sont très innovants	O	O	O	O	O

27. Veuillez évaluer l'**attrait** potentiel des marchés suivants pour votre entreprise.

	Pas du tout attrayant	Quelque peu attrayant	Attrayant	Très attrayant	Extrêmement attrayant
Canada	1	2	3	4	5
États-Unis	1	2	3	4	5
Mexique	1	2	3	4	5
République Dominicaine	1	2	3	4	5
Royaume-Uni	1	2	3	4	5
France	1	2	3	4	5
Italie	1	2	3	4	5
Turquie	1	2	3	4	5
Arabie Saoudite	1	2	3	4	5
Japon	1	2	3	4	5
Corée du Sud	1	2	3	4	5
Chine	1	2	3	4	5
Viet Nam	1	2	3	4	5
Indonésie	1	2	3	4	5
Inde	1	2	3	4	5
Australie	1	2	3	4	5
Marché international dans l'ensemble	1	2	3	4	5

28. Veuillez indiquer votre évaluation du **risque commercial** pour chacun des marchés suivants.

	Pas du tout risqué	Quelque peu risqué	Risqué	Très risqué	Extrêmement risqué
Canada	1	2	3	4	5
États-Unis	1	2	3	4	5
Mexique	1	2	3	4	5
République Dominicaine	1	2	3	4	5
Royaume-Uni	1	2	3	4	5
France	1	2	3	4	5
Italie	1	2	3	4	5
Turquie	1	2	3	4	5
Arabie Saoudite	1	2	3	4	5
Japon	1	2	3	4	5
Corée du Sud	1	2	3	4	5
Chine	1	2	3	4	5
Viet Nam	1	2	3	4	5
Indonésie	1	2	3	4	5
Inde	1	2	3	4	5
Australie	1	2	3	4	5
Marché international dans l'ensemble	1	2	3	4	5