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The Wood Supply System of the Eastern United States: An Analysis of the Socioeconomic Impacts on Local and Regional Value Chains

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THE WOOD SUPPLY SYSTEM OF THE EASTERN UNITED STATES: AN ANALYSIS OF THE SOCIOECONOMIC IMPACTS ON LOCAL AND REGIONAL VALUE CHAINS

By

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The wood supply system is a dynamic and complex structure. Traditionally, key components of the system have been treated as stand-alone entities with very little regard to the performance of the overall system. The central component, the logging contractor, is usually viewed as a service provider and largely ignored. A value chain approach is an excellent tool to examine the primary stakeholders' contributions to the wood supply system. The value chain for forestry usually extends completely across the physical and political landscape, reaching into the most geographically and economically remote locations.

A conceptual model was developed depicting the wood supply system value chain and the socioeconomic impacts of a logging firm's cash flow contributions. Financial and production data were obtained from 93 independent logging firms from 18 Eastern US States. This analysis provided 690 business years of data, beginning with the 1988 financial year and concluding in 2005. In addition, three impact scenarios were modeled using Impact Analysis for Planning (IMPLAN) software to understand the effects of

Hurricane Katrina. The first model addressed the economic impacts of a timber deficit from the landowner's perspective, the second introduced a disruption in the wood supply system from a logger's position in the value chain, and the third attempted to analyze the impacts of a mill closure.

Data analysis showed that operating costs have increased drastically during the study period with payment for services failing to provide adequate compensation to contractors. Furthermore, no significant per unit cost incentive was found to justify expanding the scale of operation. Smaller-volume producers appeared to have more ability to generate a profit on operations than their larger-volume counterparts. Cash flow analyses revealed much of the economic activity generated by the wood supply system remained in the local community. Some deficiencies of IMPLAN appeared upon examining the models introduced in this research.

Many rural communities across the Southeastern US are heavily dependent on production forestry. When the logging industry suffers, so does the entire economy of these regions. It is important to ensure that the socioeconomic impacts of the wood supply value chain for such communities remains intact.

DEDICATION

This dissertation is dedicated to my wife, Courtney, for her infinite love, support, and encouragement.

And also to my daughter, Cora, who has made the last year the most enjoyable and rewarding of my life.

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I owe my parents, sister, extended family, and in-laws heartfelt thanks for their love, support, encouragement, and patience. It has been a long and challenging voyage, but well worth the investment. Finally, I owe the most to my wife, Courtney, and my daughter, Cora. There is no way words can express my appreciation for your love, patience, support, and encouragement. Thanks for tolerating the late nights, foul moods, and numerous road trips; not to mention the myriad of other sacrifices and compromises you were forced to make over the last several years. I could not have accomplished this without you and am forever indebted to you both. Thanks for experiencing the journey with me. I love you!

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CHAPTER I

INTRODUCTION

The wood supply system and the economic and social benefits that result from this activity are critically important to the overall viability of timber dependent communities. Likewise, production forestry is a vital component to the regional economies of rural communities, especially in the Southeastern US. While most people acknowledge this fact, few truly appreciate or embrace the degree of complexity of the complete wood supply system. A comprehensive analysis of this system's value chain provides a better understanding and appreciation of the wood supply process.

Chapter II defines both the wood supply system and the value chain approach. There are differences between a value chain and a supply chain model. This chapter explores this distinction and outlines stakeholders' involvement in the wood supply system. It introduces a conceptual model of a value chain centered on the consuming mill and expands outward capturing the role of the independent logging contractor. This model serves as the framework for a more detailed model constructed in Chapter IV. Furthermore, Chapter II provides an introduction and comprehensive overview of the direction and theme of the entire dissertation.

The independent logging contractor is essentially the heart and soul of the wood supply system. Other participants are involved in the process but a logger's investment and involvement are critical yet often discounted. Chapter III provides insight into the current health and status of the logging profession and examines the role of the independent logging contractor in the wood supply system. This chapter includes an analysis of the effects of inflation on the long-term operating expenses of independent logging contractors. One must develop an understanding of the deteriorating financial predicament of the logging sector, and the reasons for such performance, before further value chain modeling is useful. Chapter III addresses several common misconceptions about timber harvesting and explores the impacts of long-term cost control measures.

Chapter IV expands on the value chain model introduced in Chapter II. An increased emphasis is placed on examining the cash flow stream of logging contractors and the socioeconomic impacts of timber harvesting on regional economies on a particular cash flow expense category basis. Again, this expanded model is conceptual in nature but more involved than the original model as it delves further into the economic framework of a local community even exploring personal spending trends. This approach is important because it discusses the value of dollar turnover and the prevalence of leakage from the local economy.

Chapter V addresses the impacts of Hurricane Katrina on Mississippi's wood supply system. This chapter introduces the use of Impact Analysis for Planning (IMPLAN), an economic modeling system, which attempts to evaluate the socioeconomic contributions of the wood supply value chain. Three event scenarios are used to examine economic impacts of disruptions in the wood supply system from each

of the direct stakeholders' positions in the value chain. Event models are generated and the socioeconomic impacts of these events are both quantified and discussed. Criticism is quite common when reporting the impacts attributed to a particular industrial sector using IMPLAN models. Chapter V places an increased emphasis on determining if the existing models properly capture all of the contributions and impacts of the wood supply system and if the flow of socioeconomic impacts were properly allocated throughout the associated value chain. Finally, Chapter VI concludes the dissertation by discussing how the preceding chapters address the problems outlined in the study and suggests several topics for future research.

CHAPTER II

AN INTRODUCTION TO THE SOUTHERN US WOOD SUPPLY SYSTEM:

A VALUE CHAIN APPROACH

Introduction

Production forestry plays a vital role in the economic development of the Southern US. Munn and Tilley (2005) stated that over $1 billion worth of forest products are harvested from Mississippi's forest lands annually, with timber harvesting currently generating over 11,000 jobs[1]. This influx of revenue is assumed to be divided among the key players in the wood supply system (forest landowners, logging contractors, and consuming mills) with much of the economic benefits staying in local coffers recognizing that some of this revenue leaves local, state, and regional jurisdictions. A well-constructed value chain model is useful for depicting these interactions and demonstrating how important production forestry is for the livelihood of rural southern communities. In many instances, a mill closure and the subsequent job loss for such communities has devastating effects. The social and economic impacts of these unfortunate events are widespread and long-term in nature. A better understanding and appreciation of the entire process is paramount for all stakeholders involved in the wood supply system and those responsible for managing it.

[1]Attendees at Mississippi's Sustainable Forestry Initiative Logger Education Programs report nearly twice as many jobs are allocated to the logging sector.

Current Wood Supply System

The wood supply system in the Southern US is comprised of three primary stakeholders: the landowner, the logging contractor (logger), and the consuming mill. One of the social and economic dilemmas facing production forestry today is that the relationships between the key players in the wood supply system are poorly understood and not well documented. Research has traditionally focused on growth and increasing yield of individual trees or stands, or on the finished product once the raw material arrives at the manufacturing plant. The broad area consisting of harvesting timber and transporting this raw material to the consuming mills has generally been taken for granted and largely ignored. This process is critical to the field of forestry and forest products, and has a myriad of social and economic impacts for society as a whole. This is precisely the reason that the development of a wood supply value chain is imperative to the overall health of the industry.

Mississippi State University researchers have acknowledged the importance of maintaining the structural integrity of the system and have responded by placing an increased emphasis on examining the timber harvesting component of the overall system. This collaboration has produced a series of reports documenting some alarming trends afflicting the current health and status of the logging sector. Most notably, the long-term logging cost index developed through this research effort documented a 42 % increase in the overall total cost per delivered ton of wood fiber from 1995 to 2005 (Stuart et al. 2006).

When compared to the consumer price index (CPI) and the producer price index for logging services (PPIL), both indices produced by the US Department of Labor –

Bureau of Labor Statistics, an even more troubling trend is apparent. For 2005, the logging cost index was 12 % higher than the consumer price index; the largest disparity between the two figures for the entire 10-year study period (Stuart et al. 2006). The consumer price index is the price a consumer pays for a myriad of essential goods and services and is commonly used as an indicator of cost of living and/or inflation. Stuart et al. (2006) further contended that a 52 point divergence is apparent for 2005 between the logging cost index and the producer price index for logging services (the price paid for logging services). In fact, the price paid for logging services reported by the producer price index has decreased 10 % since the base year of 1995.

Supply Chains vs. Value Chains

The focus on supply chain relationships and management in the forest products industry and wood supply system has been economic in nature, and generally centered on the wood consumer. Meeting production demands and ensuring that certification guidelines are met are common supply chain concerns. Traditional emphasis has been on only two segments of the system: the timber growers and the converting firms. The intermediate enterprises and participants have been considered mere service providers, therefore largely "outside" the system. Very little emphasis has been placed on examining social and policy relationships; and responsibilities associated with managing the process of timber conversion from the stump, through the mill gates, to the finished product.

According to Beamon (1998), "a supply chain may be defined as an integrated process wherein a number of various business entities (i.e., suppliers, manufacturers,

distributors, and retailers) work together in an effort to: (1) acquire raw materials, (2) convert these raw materials into specified final products, and (3) deliver these final products to retailers". This chain is typically depicted as a forward flow of materials and a backward flow of finances and information. The backward flow is the framework for a value chain. Value chains are the "other side" of the supply chain, responsible for distributing elements of value back to the suppliers of those goods and services.

Supply chains have been used more frequently than value chains even though the terms are often used interchangeably. Neither is commonly used in describing the wood supply system. They are more common in the field of agricultural economics, specifically in relation to topics directly involved in the food chain. Salin (2000) examined the cattle-beef market and focused on the importance of responsiveness to consumer needs and efficient delivery of goods to consumers. Ward and Stevens (2000) stated that for many agricultural products, mainly beef and dairy products, the identity of the initial product remains virtually clear along the distribution chain. For other products, including those manufactured from wood fiber, the identity of the initial product can be "lost" as it is transformed into the finished product.

The development of an integrated supply chain requires the management of material and information flows at three levels: strategic, tactical, and operational (Mason-Jones and Towill 1999). These approaches are commonly found in business system engineering designs and information systems. Consumers are becoming more diverse in their demands which have created increased pressures on service industries to provide high quality diversified products at a low cost (Talluri et al. 1999). Modern society has added a forth dimension, that of protecting the environment.

Davis (1993) stressed three distinct sources of uncertainty confronting supply chains: suppliers, manufacturing, and customers. Late deliveries from suppliers, machine breakdowns in the manufacturing process, and changing consumer preferences are a few, among many, scenarios that can disrupt the smooth flow of an ideal supply chain. The forestry supply chain is complex beginning with the grower (landowner), the producer (logger), and the supplier (dealer or broker).

Chains differ from traditional marketing channels in the degree of cooperation among firms involved in the process (Salin 2000). With a supply chain, it is much easier to identify stakeholders and attach appropriate responsibilities and degrees of separation. A well-constructed value chain is much more complex, and the economic and social interactions are more difficult to trace. For the purposes of simplification, supply chains illustrate the relationships necessary in converting a raw material into a finished merchantable product through a specific mill. On the other hand, value chains depict the entire process in a more complex 3-dimensional model which encompasses all that either contributes or benefits from the process being analyzed.

The wood supply system differs from other raw material supply systems. Most generate only one product at the time of harvest or exploration and the movement of that product to a single, specific converter. The harvest of even a tract of intensely managed forest land usually results in the production of multiple products that, in turn, are moved to multiple markets or mills. The effectiveness of the production system therefore depends on accommodating multiple markets.

Conceptual Model

This research presents a conceptual model depicting the wood supply value chain. All stakeholders in the system were documented and their sphere of influence was traced throughout the wood supply process. This model should serve as a foundation for a more complex depiction of the wood supply value chain. It should be noted that in reality the stakeholders comprising the model function and interact in a 3-dimensional structure. However, to better describe the model and facilitate comprehension, it is unraveled and presented in a 2-dimensional format.

Landowners, logging and transportation firms, and the consuming mills have a direct or vested interest in the process. It is important that these entities, while sometimes of lower profile, are included in the stakeholder process. Failure to include all results in an incomplete value chain and leads to flawed decision making. The model constructed quickly evolves into a considerable network and defining it will require additional expansion. The structure is most easily illustrated by dividing the model into several different sections for discussion, and by following one sample branch of the network. Other branches of the network can be expanded and explored in the same manner. The reader should understand that the model accounts for both direct and indirect relationships at several levels and these relationships extend in both directions.

Primary relationships with any entity in the supply chain are those with a direct business relationship, such as between the mill and a chemical or energy supplier or between the logger and a wood dealer. A secondary relationship for the mill is that between a primary supplier or customer and his customer or supplier. A mill, relying on a dealer system for procurement, has a primary relationship with the wood procurement

division of the plant, a secondary relationship with the wood dealer, and a tertiary relationship with the logging contractor supplying wood through that dealer and with the landowner from whom the dealer acquires timber. A fourth level or quaternary relationship is one step further removed. The mill has a quaternary relationship with the labor force working for the logging contractor, the fuel supplier to that operation, and the equipment dealership supplying logging machinery. The grocery store where that worker's family buys food and the bank that holds their mortgage and savings has a fifth level or quinary relationship with the mill.

"Arms length relationship" is a term used to explain legal relationships between separate entities and is commonly used in the wood supply industry (Black 1990). Primary, secondary, tertiary, quaternary, and quinary simply describe how many "arm lengths" separate the entities. These arm lengths form the value chain and the action of any one of these entities has an effect on the others. That effect may be diminished or amplified by the distance between the two parties. Some actions are diffused as they move down the supply chain while others are amplified. All direct suppliers and customers are stakeholders in the supply chain for they have made an investment of money, skill, energy, and time in the functioning of the process. Process changes and variability will affect those investments.

The model can be best understood by selecting a starting point and tracing the multiple direct and indirect relationships through the entire system. The mill was chosen to be the center of the model for this discussion (Figure 2.1). The choice of the mill as the center is not intended to reflect a placement of importance, but is simply an arbitrary, but important, starting point. Solid connector lines between boxes indicate direct or

"primary" relationships. The direct suppliers are shown at the top of the chart; the direct customers are to the right. These are the stakeholders who have invested in the mill's supply chain in expectation of economic return. Indirect suppliers and customers are located below the mill in the diagram and are joined by dashed lines. They were not separated as suppliers and customers because in many instances such as the political structure of the community surrounding the mill, they serve both roles. These suppliers and customers seldom have a direct investment in the mill or supply chain, but may have a financial or emotional investment in things affected by the actions of the supply chain. Suppliers were grouped into broad categories by goods or services offered, and even this list was truncated for simplification. The order of listing does not imply importance or the amount of money spent.

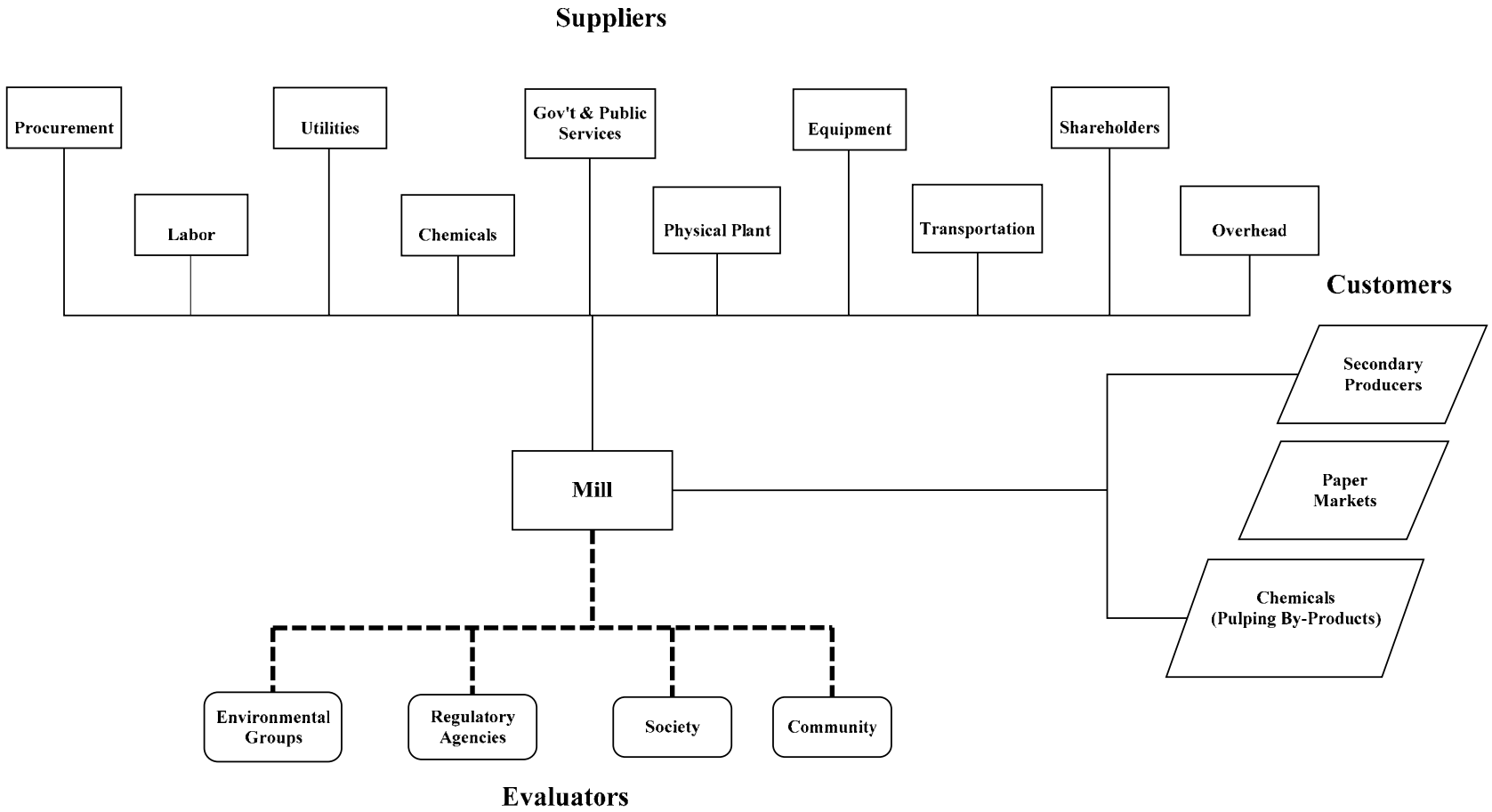

Figure 2.1. Value chain relationships using the mill as center of the model.

Figure 2.2 illustrates the value chain model for the wood procurement department of the mill in the previous figure. The boxes at the top are again direct suppliers, those at the right are direct customers, and those at the bottom are indirect customers and suppliers. The solid line between the procurement box and the mill box denotes a primary relationship between fiber procurement and the mill. Similarly, boxes connected to the procurement box by solid line enjoy a primary relationship among each other and with mill procurement. For example, wood dealers under contract with fiber procurement may be serving the same role for a sawmill, which in turn is a direct supplier of residue chips to the procurement organization of the mill. Those relationships that are primary to procurement are secondary to the mill, as they must flow through procurement before reaching the mill.

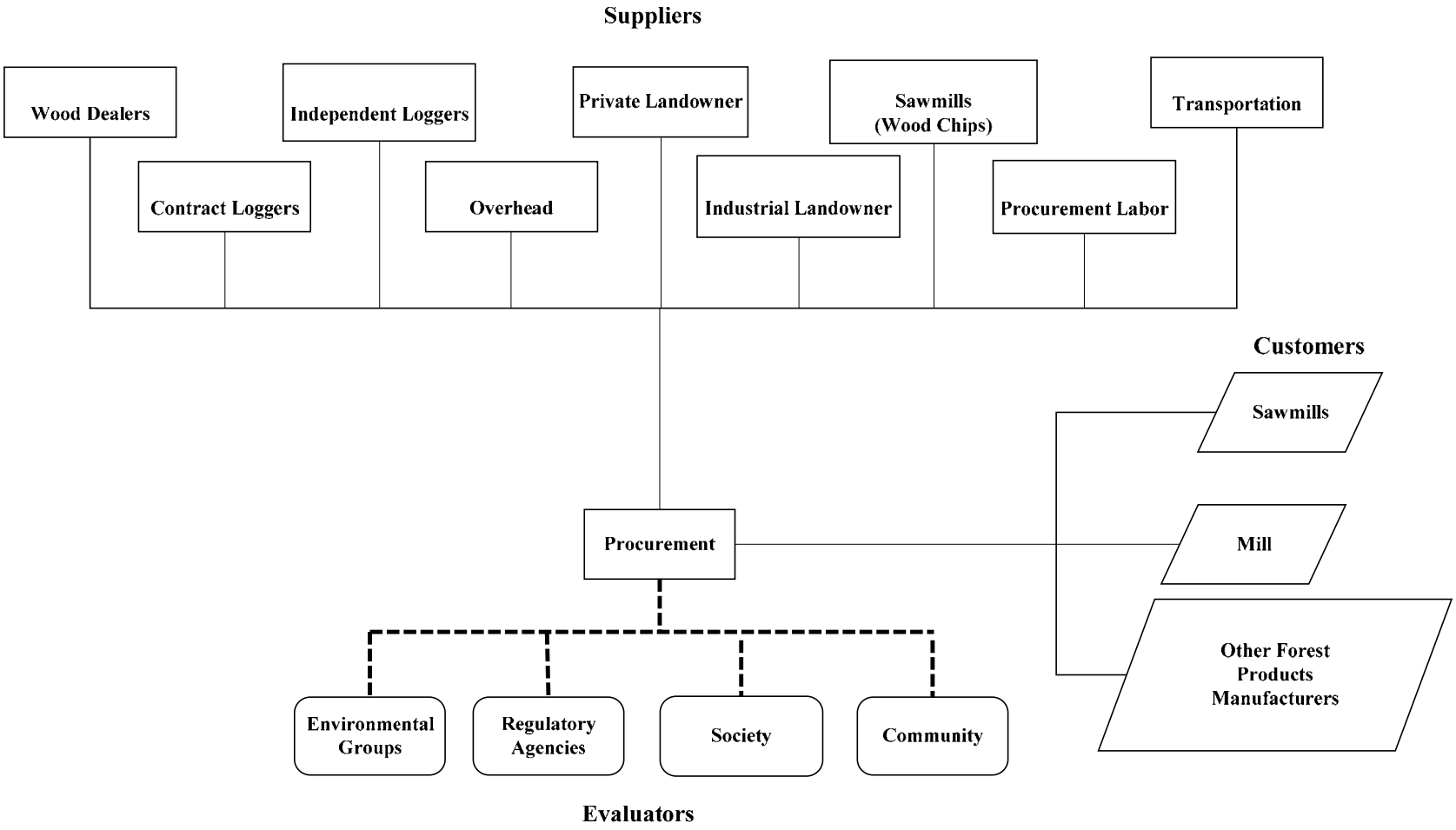

Figure 2.2. Value chain model for wood procurement division of the mill.

The indirect customers and suppliers for fiber procurement fall into the same broad category as for the mill, but are likely quite different groups or segments of larger groups with different or specific interests. Where environmental groups with concerns over air quality and point source water pollution are attracted to the mill, those associated with procurement are more likely to have concerns about endangered species, clearcutting, and non-point source pollution. Figure 2.3 delves one level deeper in the value chain and shows functional relationships for wood dealers, an example of secondary stakeholders of the mill. The position of the boxes relative to the central wood dealer box is the same as in the previous examples. Independent and contract loggers supplying wood through this dealership have a primary relationship with it, a secondary relationship with procurement, and a tertiary relationship with the mill.

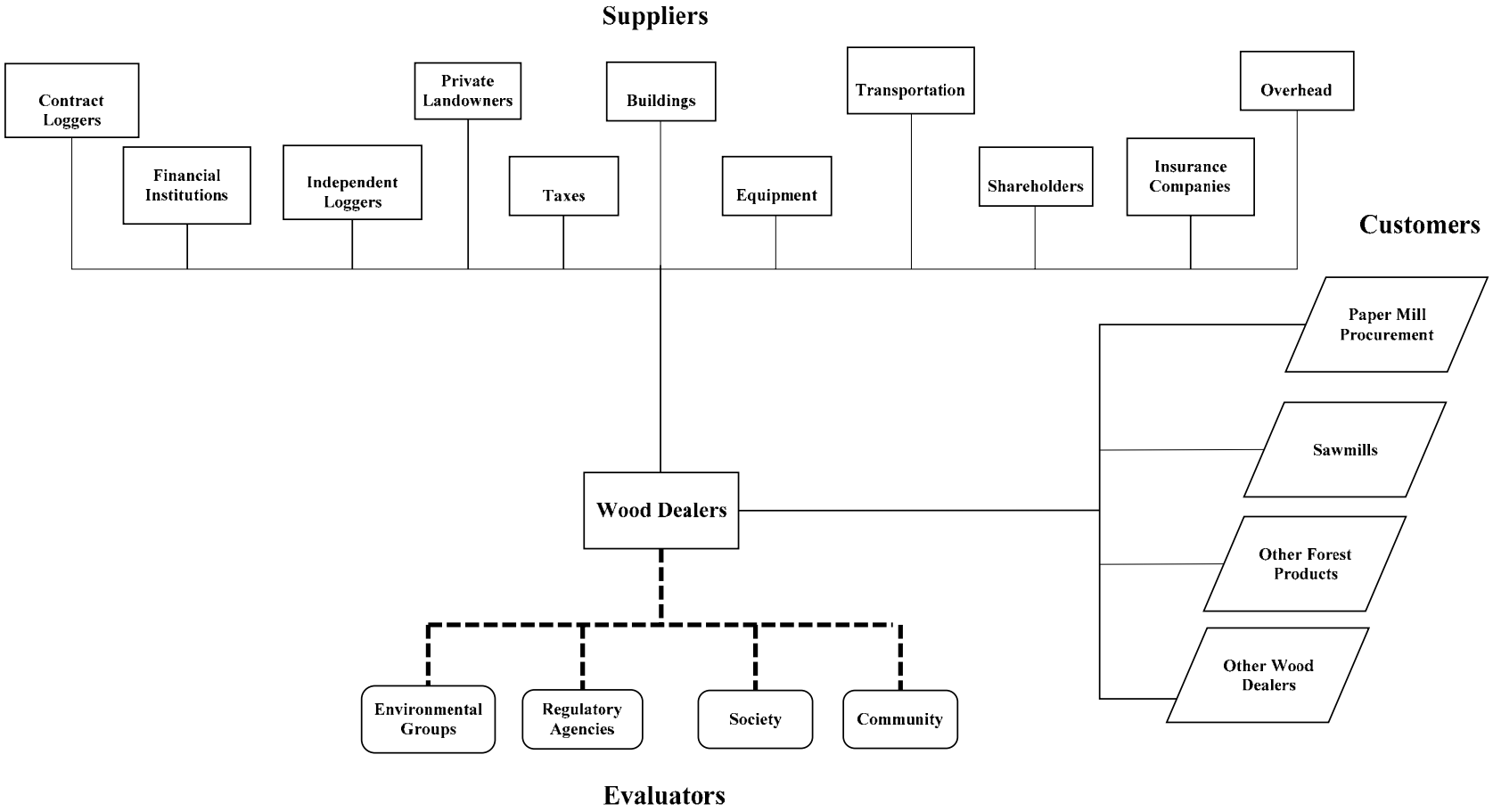

Figure 2.3. Value chain model for wood dealers responsible for supplying harvesting force for the mill.

Indirect customers and suppliers again fall into the same broad categories, but operate on a different scale. As the scope of operation becomes more localized, these do as well. At this level, local chapters of larger environmental groups are important, as are relationships with regional planning groups, county government, local newspapers, and civic groups. The cost of meeting the concerns of these groups is more easily identified. Expenditure which is required to meet the concerns of these groups is a part of normal business practice and supports the firm's position in the local business community and forestry community. The potentially larger costs and less predictable costs are those of lost business opportunities and possible legal proceedings.

Figure 2.4 moves one more link down the chain to the logging contractor who has a tertiary relationship with the mill. The nature of both direct and indirect customers and suppliers change again. Many of the direct relationships at this level are community based and scattered throughout the procurement region and include labor drawn from the local pool, fuel purchased from a local supplier, and equipment purchased from a local dealer. The nature of the indirect customers and suppliers is also more localized. Public relations may focus on the adjacent landowner, government relations on the county road engineer, and environmental concerns on a specific stream segment or wildlife species. Again, the costs become more concrete. Business opportunities are tied closely with local business reputation. Additional costs are quite often in the form of good will, fines for regulatory violations, performance bonds, permits, and insurance costs.

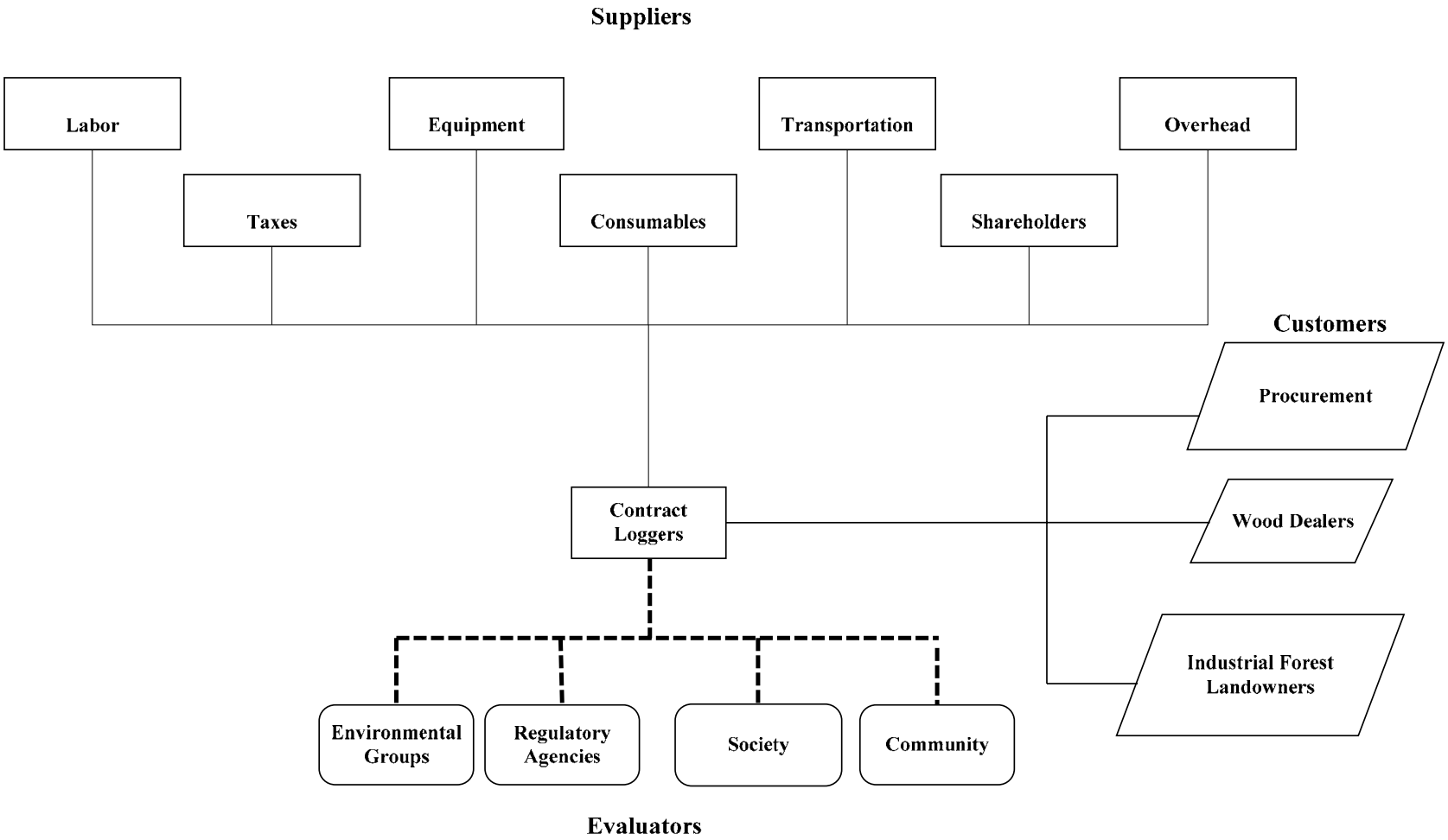

Figure 2.4. Value chain model for contract loggers working through a wood dealership system.

Labor, working for the logging contractor, has a quaternary relationship with the mill, and also has a very personal interest in the paycheck that originates there. The direct suppliers to the labor working for the logging contractor (Figure 2.5) are largely commercial or mercantile and represent a quinary relationship with the mill. The nature of the indirect suppliers and customers also become very localized. The indirect suppliers at this level can make their presence felt through the local business community, through the political process, through the financial system, or simply by refusing to extend services.

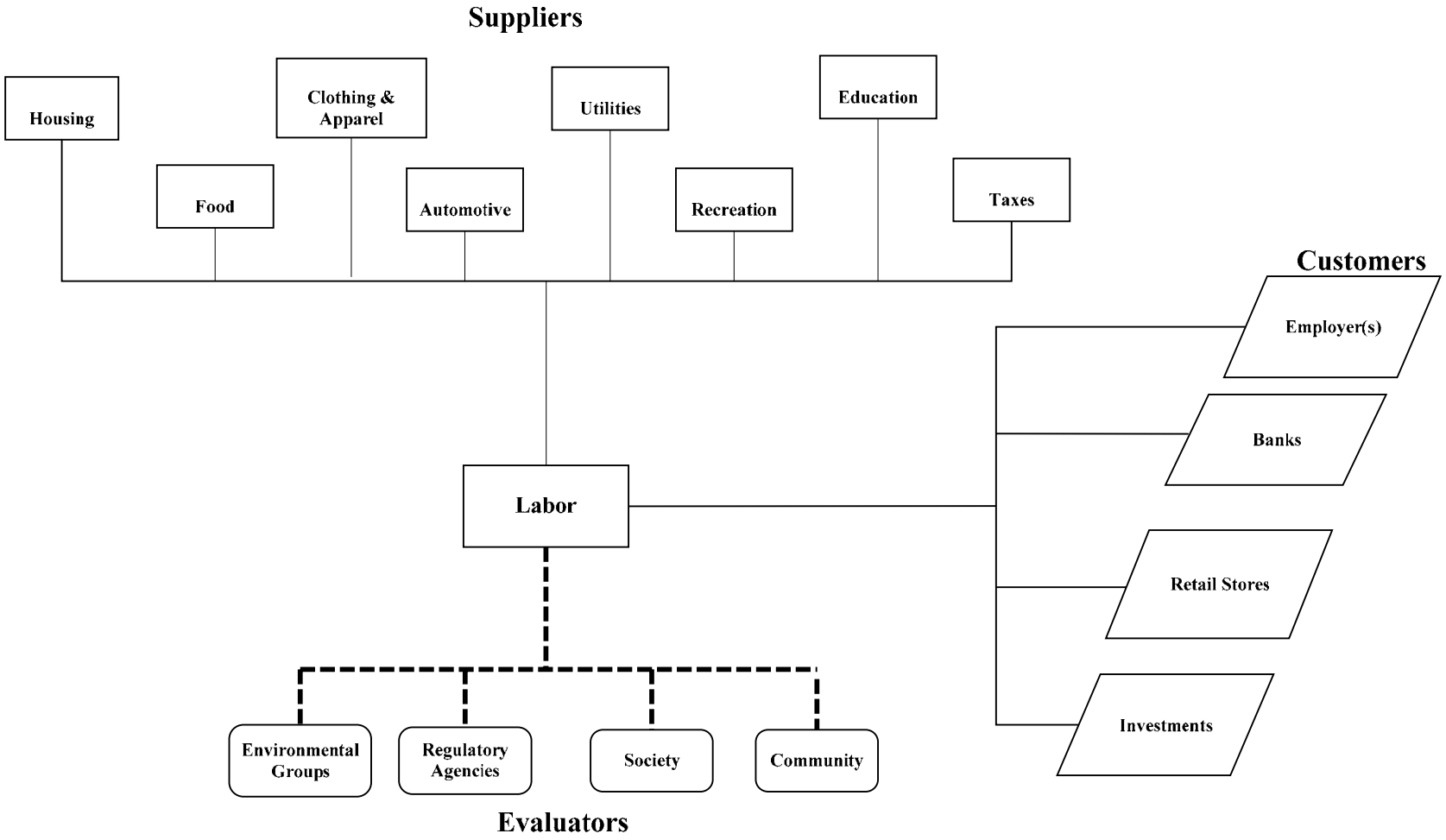

Figure 2.5. Value chain model for the labor component of independent logging contractors.

Conclusion

Today's harvesting sector must deal with rapidly increasing operating costs, unpredictable cash flow, and a general uncertainty of future production capacities. Corporate mergers and acquisitions, as well as constantly changing mill and wood procurement management, have created a cloud of uncertainty regarding the future role of independent contractors in the wood supply system. In this sense, the struggle of farmers trying to provide our country with a steady food supply and independent loggers trying to produce enough raw material to meet our nation's demand for wood fiber are essentially the same. Likewise many of the problems facing agriculture and production forestry are identical, and both sets of problems have the potential to adversely affect the future roles of each profession.

Effective management of the value chain is critical to supply chain management, for if the suppliers of goods and services are not satisfied that they are being properly remunerated, they will withdraw their services. Increasing operating expenses coupled with decreasing prices paid for services rendered affects the entire wood supply system and the ramifications and repercussions can be severe and long-term in nature. The value chains for many industries are relatively short, extending through the town or city where the plant is located. The value chain for forestry usually extends completely across the physical and political landscape, reaching in to the most geographically and economically remote locations. Such complexity warrants further exploration and expansion of this model to accurately depict the wood supply system in detail and the subsequent socioeconomic effects on local and regional communities.

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CHAPTER III

THE ROLE AND STATUS OF THE INDEPENDENT LOGGING CONTRACTOR IN THE WOOD SUPPLY SYSTEM

Introduction

The Southern US wood supply system is a complex and dynamic structure. Laestadius (1990) defined a wood supply system as "the process or mechanism of getting a consistent flow of wood to set of wood-consuming mills, beginning with the severance of the tree at the stump and ending the process at the pulping digester or head saw". Three major stakeholders; the landowner, the logging firm, and the forest products firm or converting facility, comprise the physical system. These are the primary players in the process, each bringing some economic contribution. There can be, and often are, numerous other participants in the system. Wood dealers, contract hauling firms, and consulting foresters are just a few of a myriad of indirect participants in the wood supply process. Their participation is more secondary in nature and is not required as a basic input but rather as a result of the economical, political, and social evolution of the system. For this reason alone, the three major stakeholders are the critical cog in ensuring that the raw material is delivered to the consumer; a stump to the mill process.

The independent logging contractor's role in the system, their operating expenses, and their economic contribution to the local economies in which they operate is not well documented or publicized. The nature of the logging business dictates that they operate away from the public's view. Consumers will often readily acknowledge the demand for wood fiber yet place little, if any, focus on how the final product reaches the shelves at the local hardware, grocery, or office supply store. The logging sector of the wood supply process contributes heavily to social and economic structure of rural economies (Munn and Tilley 2005). A long-term analysis of cost trends will be beneficial for reporting the health and status of the logging sector to the wood consuming industry and advancing current understanding of the overall wood supply system.

Market Structure

While the preservation and growth of equity should serve as the fundamental goal of all businesses, profitability is the means of measuring this goal (Stuart 2005). Sawyer (1985) stated "the pursuit of profits is often regarded as the main motive of firms" (p.81). Simply viewing the financial reports for an individual firm will disclose its basic level of performance. A deeper, more complex exploration of the industry and market structure is imperative for understanding these results. Hence, a structure-conduct-performance approach is useful for understanding industrial forestry and the wood supply system in general.

The structure-conduct-performance method is a common approach used in industrial economics to better understand and predict the performance of a particular industry in terms of profitability, growth, advertising, technical progressiveness, etc.

(Sawyer 1985). According to Hay and Morris (1979), Joe S. Bain, a renowned industrial economist, is widely credited with the development and advancement of this approach. Sawyer (1985), referring to Caves (1967), further explained that market structure is important because it ultimately determines the behavior of firms in the industry. Furthermore, this behavior in turn determines the quality of the industry's performance.

> *"The structure of an industry addresses the relative and absolute size of firms involved, the ease of entry into the industry, and the elasticity of demand for the output of that industry. The conduct of firms covers the objectives of the firms, price-setting behavior, and attitudes to rivals (actual and potential). The conduct of firms, which is expected to be heavily conditioned by the structure of their industry, generates the performance outcome for the industry" (Sawyer 1985, p.8).*

Mead (1966) used a structure-conduct-performance technique to address oligopsony and competition in the Douglas fir (*Pseudotsuga menziesii)* lumber industry. His findings indicated that there was no separate oligopsony theory and such a theory could not be transferred without modification. Oligopsonists tended to buy in markets which were usually geographically narrower than markets in which oligopolists sold (Mead 1966). Mead further stated that the performance aspect of lumber manufacturing was undesirable and in fact the lumber industry was one of the least progressive of 80 manufacturing industries in the US based on a 55-year record of productivity. In other words, his findings documented the association of a competitive structure with unsatisfactory performance while concentrated resource ownership was linked with desirable performance (Mead 1966). Mead's approach placed the emphasis on the mill. This study's primary focal point was on the harvesting firms responsible for transporting

the raw material to the market; essentially approaching a similar industry from the other side of the equation.

The independent harvesting contractor's role in industrial forestry could be considered even more difficult than that depicted by Mead (1966). Caves (1992), in his description of the conduct exhibited by pure competitors, also presented an accurate portrayal of the competition found in the current wood supply system and the loggers' role in this process.

> *"Consider an industry that matches the textbook model of pure competition. In terms of the elements of market structure, it would exhibit very low concentration, insignificant barriers to entry, and no product differentiation. In this environment, the individual firm has no significant freedom of choice. The market sets the price for its product, and it cannot profitably ask a different one. The absence of product differentiation means that the firm has no choices to make about the design or style of its product. No problems arise for setting the advertising budget: The firm by assumption cannot differentiate its product and advertises only to inform buyers of its existence. Pure competition event denies the firm any choice about how efficient it will be! If its many rivals keep their costs as low as possible, it can only do likewise or else be forced out of business as a result of subnormal profits" (p.50).*

Independent Logging Contractor Analysis

Previous research efforts (Loving 1990, LeBel 1993, LeBel 1996, Shannon 1998, Walter 1998, Omohundro 1999, Altizer 1999) and an ongoing study at Mississippi State University (Miller 1999, Stutzman 2003, Jackson 2003) have traced and documented the performance of independent logging firms in the Eastern US. Participating contractors have had difficulties remaining competitive in an increasingly challenging industry. In addition, the Wood Supply Research Institute (WSRI) has acknowledged the need for a

well-documented logging cost index to track rising operating expenses and illustrate the small business owner's continuing struggle to manage a positive cash flow.

Methodology

Data for this study were from a detailed cost and production database of independent logging contractors in the Eastern US (Stuart et al. 2003). Approximately 93 logging firms from 18 states provided data (Figure 3.1). Independent contractors of all forms of business structure and size are represented, and contractors from many different physiographic regions in the Eastern US provided cost and production data. This information is an excellent source to reflect the overall business climate for the intermediate enterprises who are crucial to the viability of the total wood supply system, yet are often ignored using traditional industry research models.

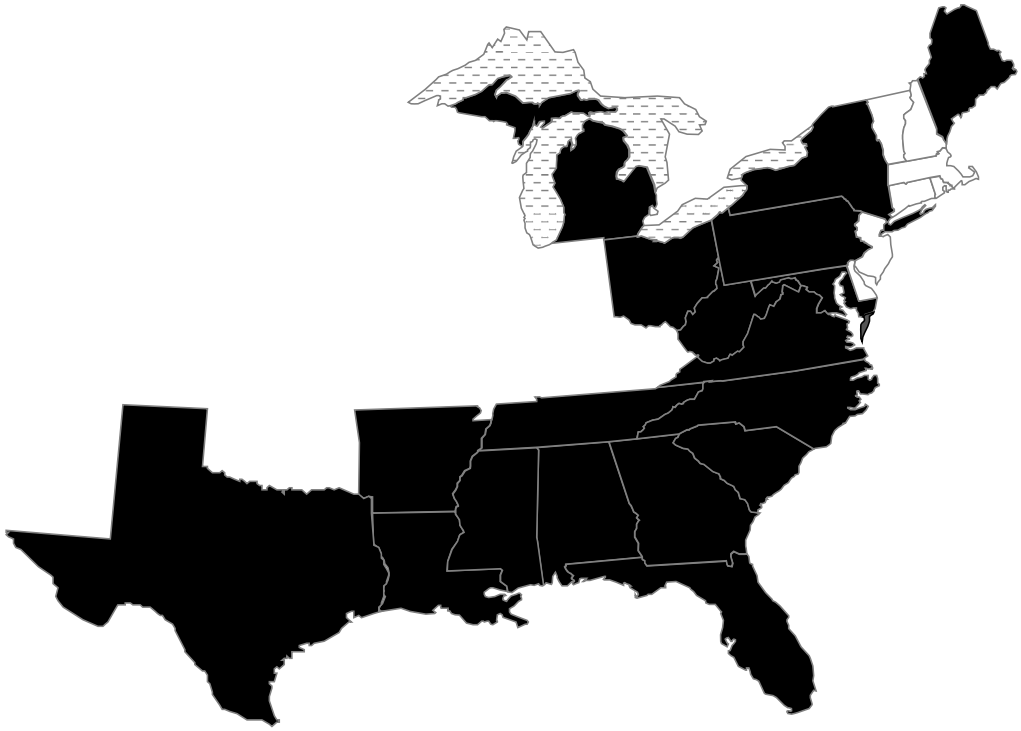

Figure 3.1. US States of business registration for logging contractors participating in long-term logging cost study: 1988-2005.

Data Collection

Research personnel visited the cooperating firms on an annual basis. These appointments typically occurred on-site. Arrangements were made for the transfer of both financial records and production information from the respective businesses. A personal interview with the business owner ensued and demographic sheets were completed. Demographic information, such as the age and education level of the owner, equipment strategy, trucking approach, and method of pay, were discussed.

Financial information was obtained either directly from the participating businesses or from their respective accounting firms. The reporting format and type of data submitted varied depending on the availability and preference of the cooperating

entities. Financial records included, but were not limited to: income statements, balance sheets, tax returns, and customized expense reports. Monthly, quarterly, or annual financial records were obtained, transferred to an electronic format, and consolidated into six cost categories: equipment, labor, consumable supplies, contracted services, insurance, and administrative overhead.

It should be noted that a contracted services expense category varied among all firms. Only those firms that outsourced components of their operation incurred costs, such as trucking or Best Management Practices (BMP) work, in this category. The primary expense was for contract trucking. Contractors differed in their use of contract hauling firms. Some contracted hauling to a wholly-owned sister firm. Others contracted with independent haulers, while still some used contractors on an ad hoc basis on long hauls or for other reasons.

Business owners have adopted different strategies for taking a salary from their business from one year to the next, depending on the business' financial performance for that particular year. As a result of this, salaries were not reported per se, however a flat rate of $20,000 annually plus a production bonus of $.30 per delivered ton was used to assure a minimal, realistic salary was included (Walter 1998). This approach compensated the officer for their managerial role in the company while at the same time recognizing their day-to-day contributions to business operations. The confidential nature of the study and the simple fact that some owners draw more from their business than others justified the need to standardize the officer's salary portion of the project.

The other key information obtained from participating firms is the amount of production delivered for a particular year. Convenience of reporting was critical for the

participating firms; hence, the requested information was obtained in various formats. Weekly or monthly production reports were most desirable with annual figures used as a last resort. Production information was paired with financial figures for a specific time frame and cost per ton or other efficiency ratings were developed.

A diverse population of study participants was important to assure adequate representation of the profession. However, while diversity was paramount to better understand the entire system it can serve as an obstacle for some forms of analyses. The objective was to develop a sample that reflected diversity of firm types and sizes and the contribution of each to the supply of raw material. The nature of study participants; differing managerial and/or equipment depreciation strategies, thinning versus clearcut operations, hardwood versus pine harvest, and coastal plain versus mountain contractors had a huge impact on operating expenses. Often there were not enough contractors in a particular sub-category to warrant an analysis of that segment of the entire study population. All participants deserve to have their story told and their respective business' performance monitored and reported regardless of the potential for an adverse and isolated effect on the dataset.

Long-term Indices

Figure 3.2 illustrates the overall logging cost index between 1995 and 2005 (Stuart et al. 2007). The consumer price index (CPI) and the producer price index for logging services (PPIL), both measures available from the US Department of Labor - Bureau of Labor Statistics, are included for comparison. The CPI is generally regarded as a quick indicator of inflation or cost of living while the producer price index indicates

the price paid for logging services. Stuart et al. (2007) found that the cost of producing and delivering a ton of wood for a consistent sample of the study population had increased 42 % for the study period (unadjusted dollars) while the price paid for logging services as reported by the Department of Labor had declined 10 % for the same time frame. As documented in Stuart et al. (2007) and Altizer (2008), several current developments using these factors are alarming and the long-term impacts could signal difficulty for the logging industry. The fact that the Logging Cost Index exceeds the CPI by 12 % in 2005 is troubling. Even more discouraging is the 10 % overall decline in the price paid for logging services rendered, and the decrease in the proportion of expenditures for capital equipment.

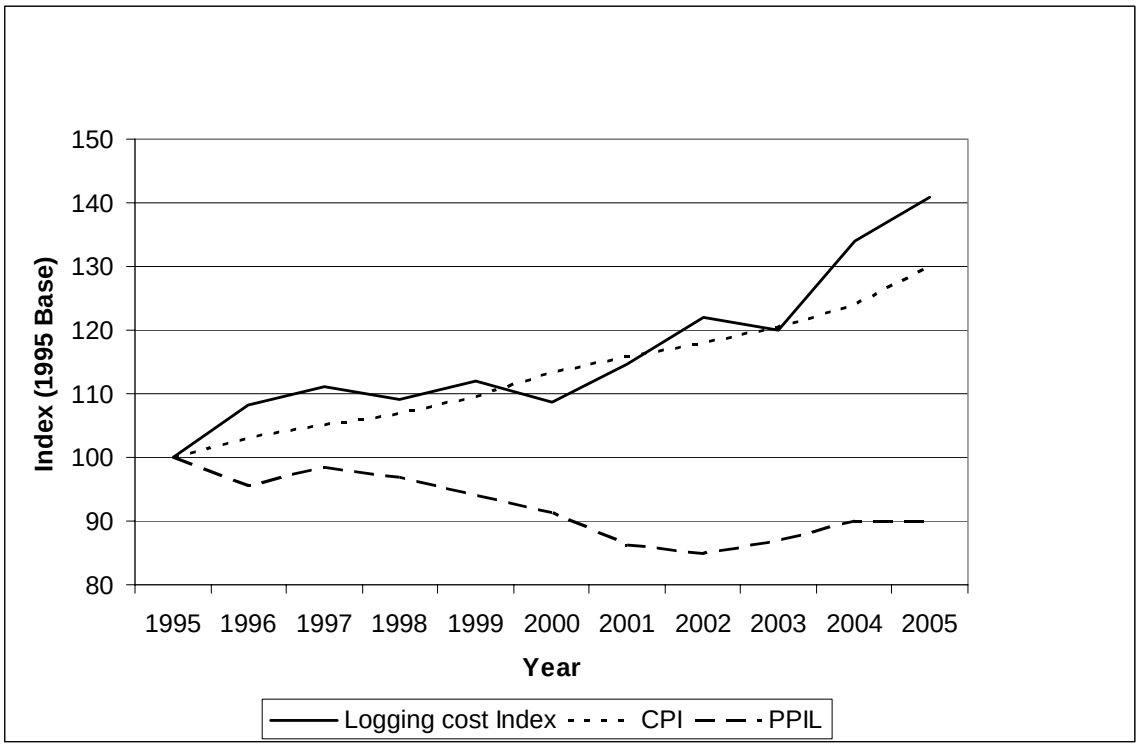

Figure 3.2. Wood Supply Research Institute logging cost index for independent logging contractors in the Eastern US and comparison indices (Source: Stuart et al. 2007).

Logger Dataset: Summary Statistics

The dataset developed by Stuart et al. (2007) was used to analyze operating expenses. These data included 690 business years of data, beginning with the 1988 financial year and concluding with 2005. The specific costs were grouped into six general expense categories: equipment, consumable supplies, labor, contract services, insurance, and administrative overhead. The dataset was analyzed with statistical software package STATA 10 and summary results are reported in Table 3.1.

Table 3.1. Total operating expense data: STATA summary results for 93 independent logging firms analyzed from 1995-2005 .

Variable		Mean	Standard Deviation	Min	Max	Observations
Tons	Overall	80,807	61,469	2,649	373,761	N=690
	Between		61,536	7,692	316,279	n=93
	Within		25,324	-45,323	260,170	T-bar=7.42
Equipment	Overall	$214,591	$172,427	$5,116	$1,190,674	N=690
	Between		$168,049	$7,215	$933,001	n=93
	Within		$97,892	($189,186)	$846,837	T-bar=7.42
Consumables	Overall	$246,951	$224,491	$8,400	$1,635,548	N=690
	Between		$215,935	$17,948	$1,120,834	n=93
	Within		$113,328	($294,923)	$1,097,347	T-bar=7.42
Total Labor	Overall	$389,124	$308,854	$35,117	$1,803,062	N=690
	Between		$310,277	$46,937	$1,659,295	n=93
	Within		$131,160	($174,594)	$1,159,137	T-bar=7.42
Contracted Services	Overall	$270,498	$418,640	$0	$3,579,843	N=690
	Between		$426,178	$0	$2,822,706	n=93
	Within		$216,032	($868,785)	$2,738,553	T-bar=7.42
Insurance	Overall	$40,049	$33,075	$0	$207,995	N=690
	Between		$31,962	$2,102	$160,713	n=93
	Within		$18,464	($18,236)	$182,883	T-bar=7.42
Administrative Overhead	Overall	$31,162	$33,873	$0	$234,423	N=690
	Between		$30,960	$0	$169,044	n=93
	Within		$19,267	($43,078)	$199,585	T-bar=7.42
Total Expenses	Overall	$1,192,375	$1,014,854	$79,631	$6,561,711	N=690
	Between		$1,035,685	$161,087	$5,438,880	n=93
	Within		$473,085	($676,464)	$4,846,710	T-bar=7.42

"Overall" comparisons are indicative of the entire study population and represent the number of total observations (690). "Between" comparisons represent analyses across the number of different firms (93) in the study. "Within" comparisons are firm specific, indicating the typical firm has participated 7.42 years of the 18-year study period.

The firms produced a wide range of volume annually (2,649 tons to 373,761 tons). Standard deviations are large, indicating a high degree of production variability, both between firms and within firms. Again, the general composition of the study population skewed the mean statistics. Means may not be an ideal representation of these data however including them does prove valuable as a concise and convenient format to present a general summarization of the study population. Most firms have undergone significant changes at some point during their participation in the study. Expansion, downsizing, and a combination of adding and eliminating multiple crews dictated by market conditions made it difficult to classify firms by production size over the entire study period. Examining trends on a per unit basis helps minimize the distorting effects of a diverse study population. Table 3.2 contains STATA summary data on a cost per ton basis for the six expense categories.

Table 3.2. Cost per ton data: STATA summary results for 93 independent logging firms analyzed from 1995-2005 .

Variable		Mean	Standard Deviation	Min	Max	Observations
Tons	Overall	80,807	61,469	2,649	373,761	N=690
	Between		61,536	7,692	316,279	n=93
	Within		25,324	-45,323	260,170	T-bar=7.42
Equipment	Overall	$3.02	$2.04	$0.24	$18.37	N=690
	Between		$1.96	$0.36	$11.42	n=93
	Within		$1.24	($1.39)	$12.21	T-bar=7.42
Consumables	Overall	$3.23	$1.64	$0.80	$14.30	N=690
	Between		$1.67	$0.94	$9.33	n=93
	Within		$0.97	($1.21)	$9.58	T-bar=7.42
Total Labor	Overall	$5.27	$2.60	$1.67	$34.35	N=690
	Between		$2.25	$2.37	$14.68	n=93
	Within		$1.73	($4.83)	$24.95	T-bar=7.42
Contracted Services	Overall	$3.19	$3.31	$0	$23.08	N=690
	Between		$3.00	$0	$14.11	n=93
	Within		$2.01	($5.17)	$18.94	T-bar=7.42
Insurance	Overall	$0.57	$0.39	$0	$5.26	N=690
	Between		$0.33	$0.16	$1.94	n=93
	Within		$0.27	($0.88)	$3.89	T-bar=7.42
Administrative Overhead	Overall	$0.44	$0.49	$0	$5.23	N=690
	Between		$0.42	$0	$2.25	n=93
	Within		$0.31	($0.80)	$3.43	T-bar=7.42
Total Expenses	Overall	$15.72	$6.46	$7.80	$69.31	N=690
	Between		$5.73	$9.16	$41.62	n=93
	Within		$4.07	($5.29)	$50.65	T-bar=7.42

Long-Term Trends by Cost Category

Separate cost per ton figures for each expense category were again selected to document long-term trends. The results provided further insight into the intricacies of each cost component and a more detailed explanation or verification of the logging industry. Median values were included for each year since these statistics provide a more accurate portrayal of the dataset and are more resilient to extreme outliers than a mean value.

Equipment

Equipment cost, depreciation plus interest on equipment loans and lease amortization, are a robust measure of firm equity. The median equipment cost per ton for the study population in 1988 was $1.79 in nominal dollars or $2.96 adjusted for inflation to 2005 dollars (Figure 3.3). The equipment cost per ton peaked in 2002 at $3.24 in current dollars or $3.52 inflated (2005 dollars).

The 2002 peak was likely the result of new tax laws adopted in response to the September 11, 2001 terrorist attacks on the United States. The turmoil in the pulp and paper industry resulting from aggregation of firms, off-selling of forest lands, and changing market dynamics for traditional primary paper products (Kraft paper and newsprint) had diminished. The Job Creation and Worker Assistance Act of 2002 outlined the provisions for an additional 30 % first-year bonus depreciation on an asset placed in service after September 10, 2001. The rationale was to encourage companies to reinvest in their businesses (which would in turn provide an economic stimulus), encourage personal and private investment, and instill faith and confidence in the US

economy. Many participating firms, likely acting on the encouragement of market stability and their accountants, used this incentive to update their equipment spread and reinvest in capital in their respective business. For 2005, the equipment cost per ton was $2.59. The overall trend in equipment cost per ton ratings during this time period has declined when reported as a percentage of total operating costs. With the ever-increasing cost of new equipment and fewer financing options available this pattern is indicative of an aging fleet of machinery and a possible reduction in business equity.

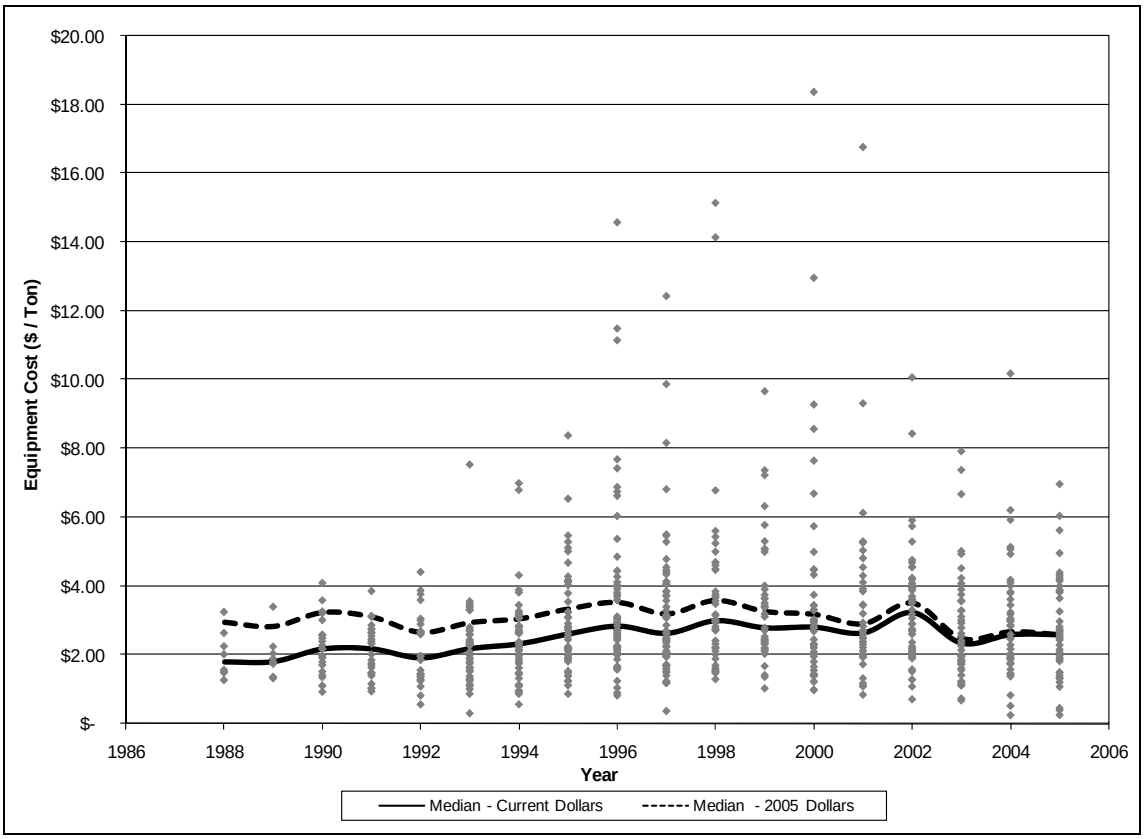

Figure 3.3. Median equipment cost per ton ratings for 93 independent logging firms in the Eastern US.

Consumable Supplies

Figure 3.4 shows cost per ton ratings for consumable supplies. Fuel prices and repair and maintenance costs were the major drivers of this category. In 1988, the cost per ton was $2.72 ($4.49 in 2005 dollars). Between 1988 and 1994 the cost per ton was stable. The period between 1995 and 2005 was less stable, but the rapid increase in fuel cost can be seen starting in 2003.

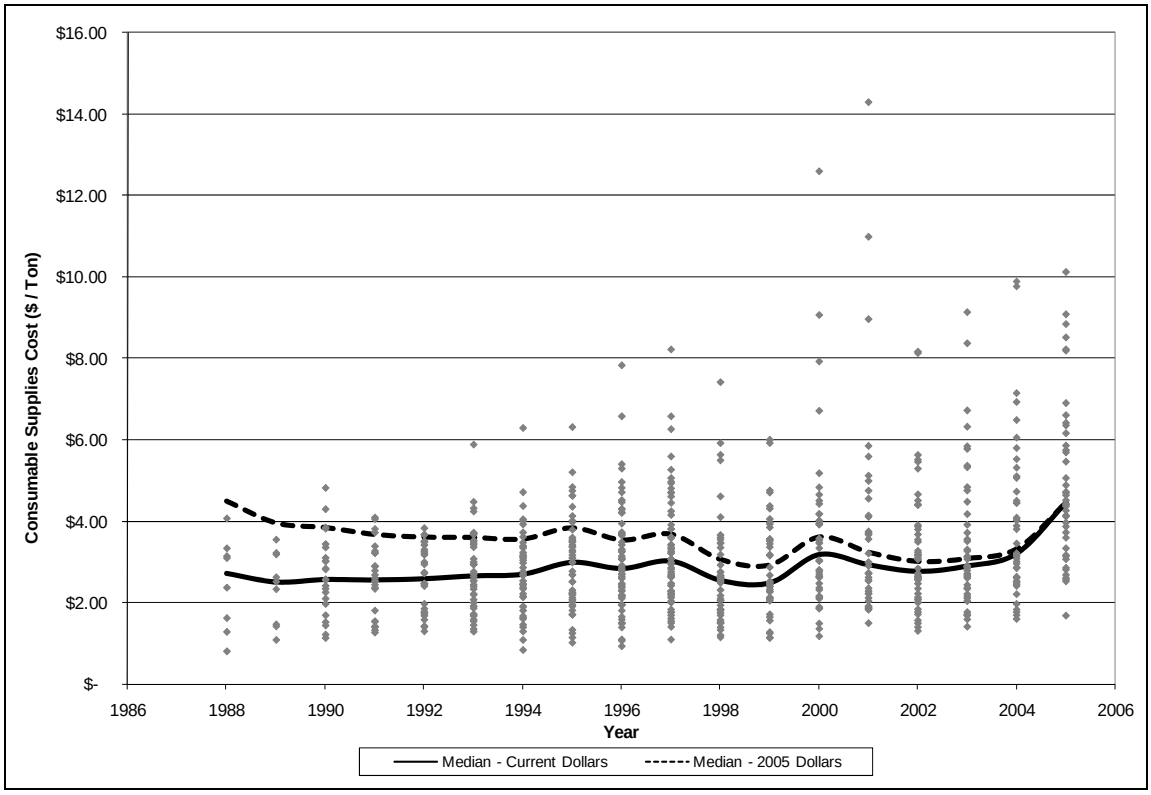

Figure 3.4. Median consumable supplies cost per ton ratings for 93 independent logging firms in the Eastern US.

Historical trends in on-road diesel fuel prices documented these rapid increases (Figure 3.5). The national average for on-road diesel fuel was reported as $1.50 per

gallon on January 1, 2004 and rose to $2.44 on December 31, 2005 (Energy Information Administration 2008). On a more current note, the price reported for December 31, 2007 was $3.35 per gallon. This 123 % increase during the four-year period from 2004-2007 significantly hampered a business' owners ability to remain solvent and maintain a positive cash flow, especially with little or no fuel adjustment included in delivered prices. Logging contractors are certainly not alone in their plight to overcome increasing costs. The trucking and transportation sectors have been hit especially hard with diesel prices eclipsing $4.00 per gallon in the spring of 2008. The key point however is that most other industries confronted with this issue were in a much better position to absorb this added cost by passing it along to the next stakeholder in the supply chain, even to the consumer.

Figure 3.5. Historical trend for on-road diesel fuel prices: national average.

Since many logging contractors elect to subcontract or outsource certain elements of their business (primarily the hauling component) on an as needed basis to concentrate management and equity on primary facets, increases in certain expense categories can be masked and exhibit a certain form of artificial efficiency. Consumable supplies is one such cost category. These costs are still incurred by the independent contractor even though they are accounted for and reported in a different cost category.

Labor

The labor cost per ton ratings indicated one of the most troubling patterns revealed by these data (Figure 3.6). The overall labor price paid per ton from 1988-2005 has shown a steady decrease from $7.23 to $5.47 (2005 dollars). There was no major adoption of new technology that would have reduced the need for, or increased the productivity of, workers during this period. Instead, several unfortunate scenarios were contributing factors. The overall salary or wage for hired labor has failed to keep up with inflation over the study period. Ideally, the price paid for labor should track or exceed inflation in order to attract and retain a steady and reliable workforce. Study data indicate that this was not the case for the logging industry.

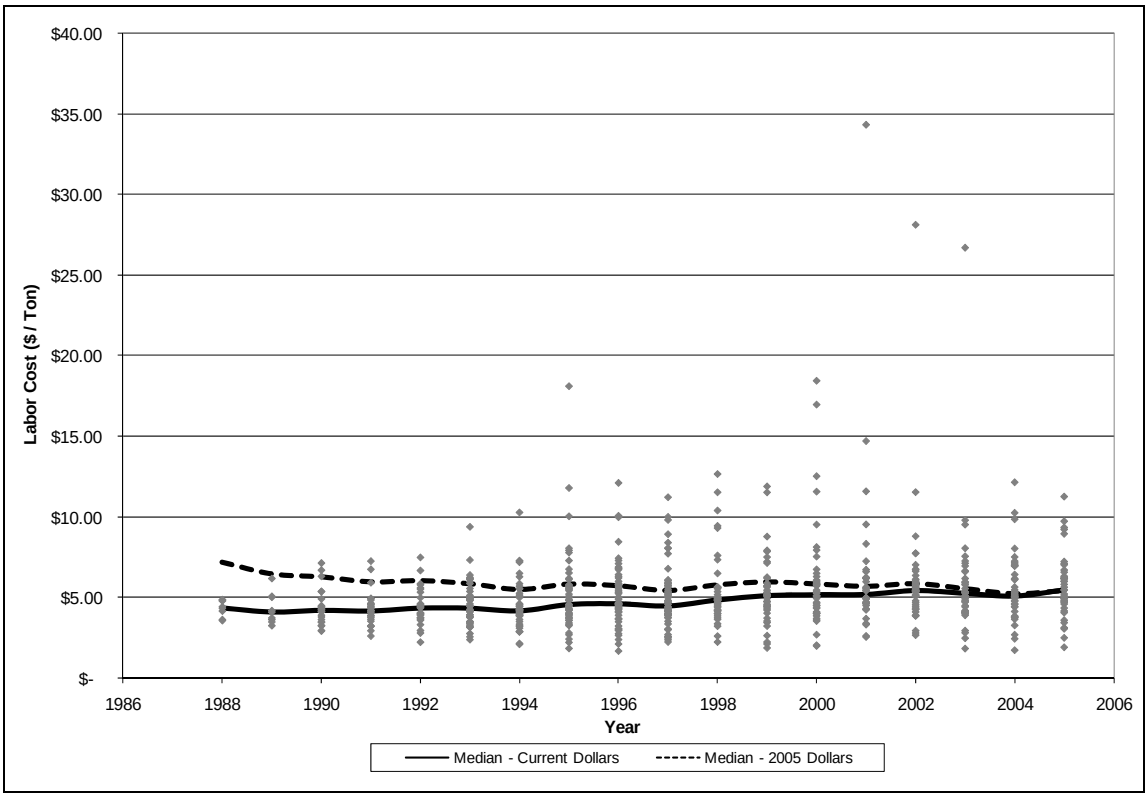

Figure 3.6. Median labor cost per ton ratings for 93 independent logging firms in the Eastern US.

Furthermore, one of the most commonly reported complaints by independent logging contractors was their consistent inability to recruit, train, and retain qualified and skilled labor. Demographic information obtained from participants overwhelmingly indicated an aging workforce with very few young employees entering the field. Of the few that do, virtually all have a family connection to the logging business or the profession in general. Business owners have also struggled to offer any, let alone attractive, benefits packages to eligible employees. Health insurance for logging employees, while once offered, has essentially been eliminated by participating firms. Other employment benefits such as paid vacation, company issued uniforms, and

transportation to and from the job site have also become the exception rather than the norm.

Contracted Services

Contracted Services costs have exhibited the most dramatic per ton increase over the study period. Figure 3.7 documents the increased prevalence of outsourcing over the study period rising from a small $0.63 per ton in 1988 ($1.04 adjusted to 2005 dollars) to $3.29 in 2005. The number of contractors reporting this cost category has significantly increased during this time as well. More contractors are electing to subcontract the trucking element of their operation in order to decrease the investment and legal liability that accompanies using a company-owned fleet to haul the raw material to market. Many contractors will form a separate trucking company as an independent, stand-alone business to handle the trucking needs of the logging company. This simplifies their business model since the cut and skid portion of their operation is entirely different from the hauling component, even if both entities are part of the same business ownership. Establishing a separate trucking firm provides a decreased level of liability for the business owner and offers some workers' compensation insurance advantages, while at the same time affording the business owner the luxury of having some managerial control over the trucking element of their business.

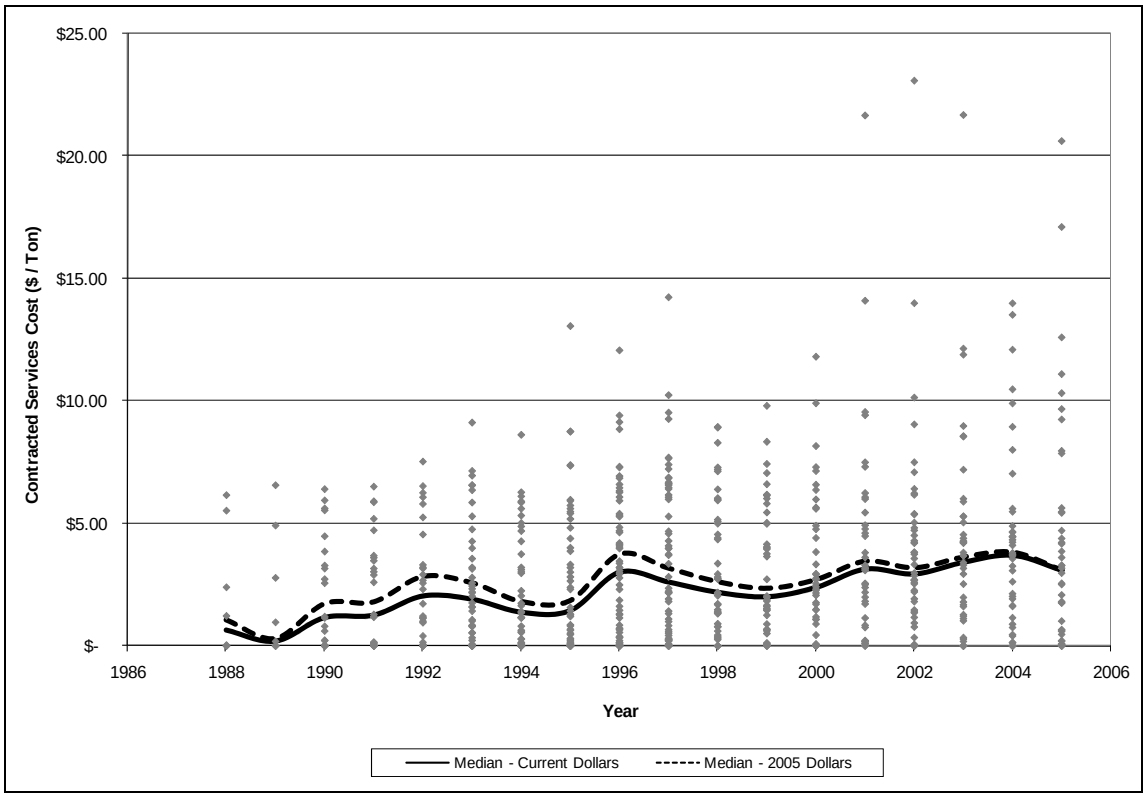

Figure 3.7. Median contracted services cost per ton ratings for 93 independent logging firms in the Eastern US.

Recent spikes in fuel prices have dictated a higher cost per mile charge for contract truckers and many participating contractors have indicated a vanishing supply of eligible and qualified contract truckers. In fact, many short-haul truck drivers are opting to go "over-the-road" in search of the attractive annual salaries offered for long-haul truckers by large national trucking conglomerates. According to Burns (2006), various national trucking associations predict that in five years "the shortage of truck drivers will reach 111,000 in the US", with short-haul contractors suffering the most from this deficit. Occasionally, some other tasks are contracted out but an overwhelming percentage of the contracted services expenses reported were directly related to hauling timber to market.

Insurance

The final two cost categories are the easiest to manipulate by business owners and can be utilized as overall cost control measures. Insurance cost per ton ratings included all types of business based insurance excluding workers' compensation insurance and, on rare instances, employee health care insurance (both forms are included in labor). The overall insurance cost per ton was $0.34 per ton in 1988 ($0.56 adjusted to 2005 dollars) and remained steady and consistent in real dollars concluding at $0.65 per ton in 2005 (Figure 3.8).

Insurance is the cost category relatively easiest to regulate as a cost control measure. Many business owners budget a certain amount for insurance expenses and modify their total coverage to keep expenses within this range. If premiums escalate to a certain discomfort level the business owner can opt to keep mandatory coverage like business liability protection and drop "discretionary" policies such as fire, theft, and vandalism coverage. Many contractors with an aging equipment spread and no outstanding equipment loans often eliminate equipment insurance entirely.

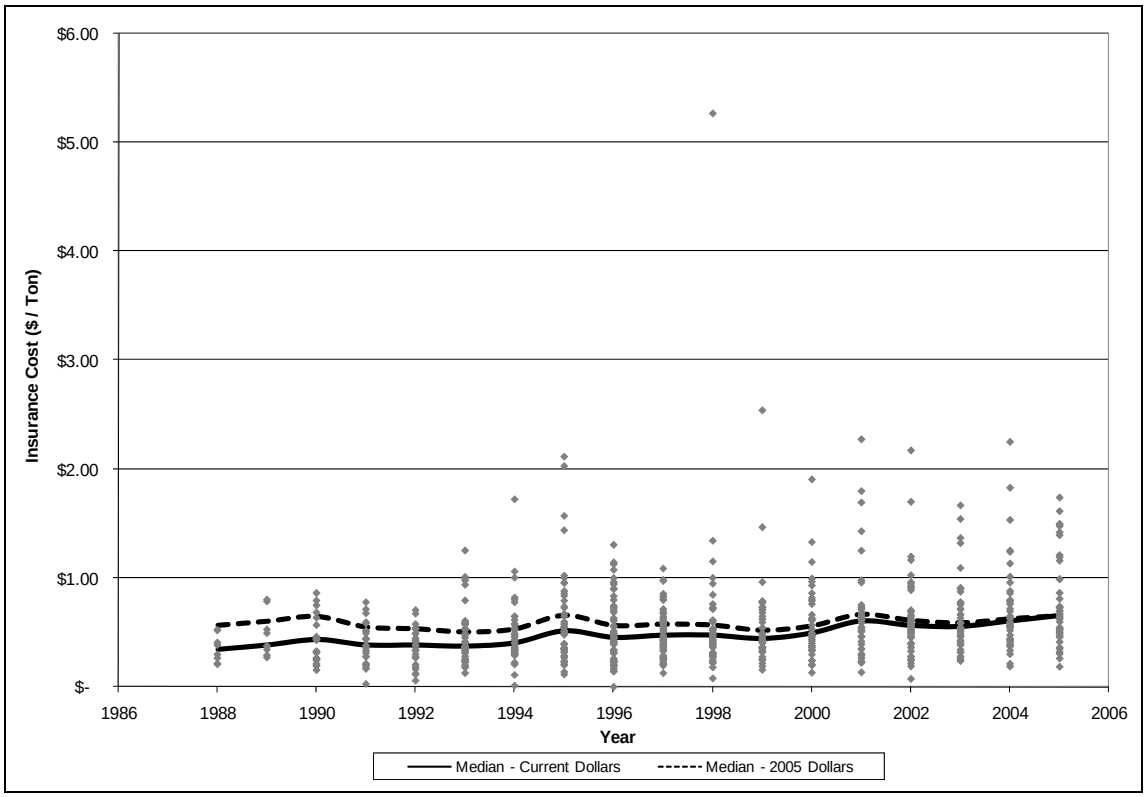

Figure 3.8. Median insurance cost per ton ratings for 93 independent logging firms in the Eastern US.

Administrative Overhead

Administrative overhead expenditures have increased from 1988-2005, beginning at $0.10 per ton in 1988 ($0.17 adjusted to 2005 dollars) and peaking in 1998 at $0.52 per ton in adjusted dollars (Figure 3.9). The cost per ton rating for this category in 2005 was $0.47, representing the highest nominal figure reported during the study period. The most likely reason for the cost per ton increase exhibited in the early to mid 1990's was the result of contractors investing in personal computers, transferring their financial records from paper to electronic format, and increased reporting and record keeping requirements. The subsequent training required for office staff to make this transition has

increased their financial burden in this category. Also, many contractors have realized the importance of seeking the professional services of accounting and legal firms during this time.

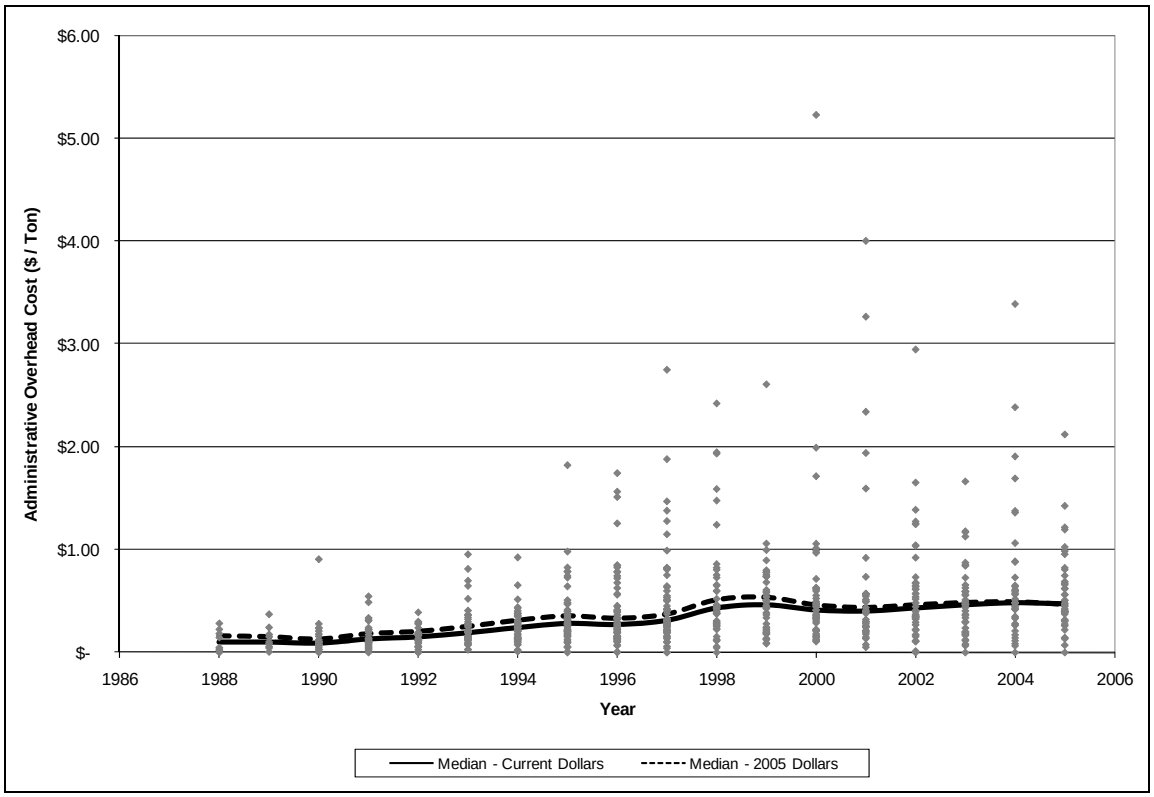

Figure 3.9. Median administrative overhead cost per ton ratings for 93 independent logging firms in the Eastern US.

Total Operating Expenses

An overall cost per ton rating was calculated for the consolidated expense categories (Figure 3.10). The 1998 total cost per ton was $10.99 in nominal dollars, or $18.14 adjusted to 2005 dollars. The highest calculated cost per ton ranking was $18.62 (adjusted to 2005) in 1996. The mid 1990's had the highest total cost per ton rankings.

This is likely due to the increase in demand for services which encouraged investment in new equipment (Figure 3.3) and the inclusion of several Appalachian start-up contractors during this period and their subsequent higher cost per ton expenses resulting from lower volume but higher value production. The final 2005 median cost per ton ranking for all participating contractors was $17.16. Again, a relatively flat run chart for the duration of the study period is not necessarily good for the logger, even though it may seem as good for the landowner and consuming mill. Equipment expenses increase at a rate equal to or greater than inflation to ensure an adequate reinvestment in capital for equity growth and preservation. Labor should trend in a similar fashion to maintain a steady, reliable, and competent workforce.

It is crucial that the issue of rising operating expenses is viewed in the correct light. Often an increased emphasis is placed on cost reduction efforts or increasing efficiency of operations, especially when the customer, in this case pulp and paper, is facing market competition. Eliminating certain costs or driving them from the system is the wrong approach. This mindset makes it much too convenient to transfer problems or costs to other stakeholders in the wood supply system. The problem may go away for a while but inevitably resurfaces. Maximizing efficiency of operations is a laudable goal. However, it is not a panacea for all that ails the wood supply system. The difficulty of managing efficiency is that when the firm is working at or near its maximum productivity, it has little or no surge capacity. When a day is lost due to whether, quota, or equipment down-time, the operation has no "surge capacity" to recover, and must bear the loss. Managing a lean operation is challenging, trimming all the fat is impossible. A considerable degree of variability is inherent in the system: markets, weather, quota,

equipment breakdowns, environmental restrictions, and performance of the global economy. These issues are often beyond the control of the individual business owner but certainly have a drastic impact on business performance. Ideally, without major technology change, or major change in the management of the business system, costs should increase at the same pace as inflation. Trying to suppress costs to maximize efficiency is the wrong approach.

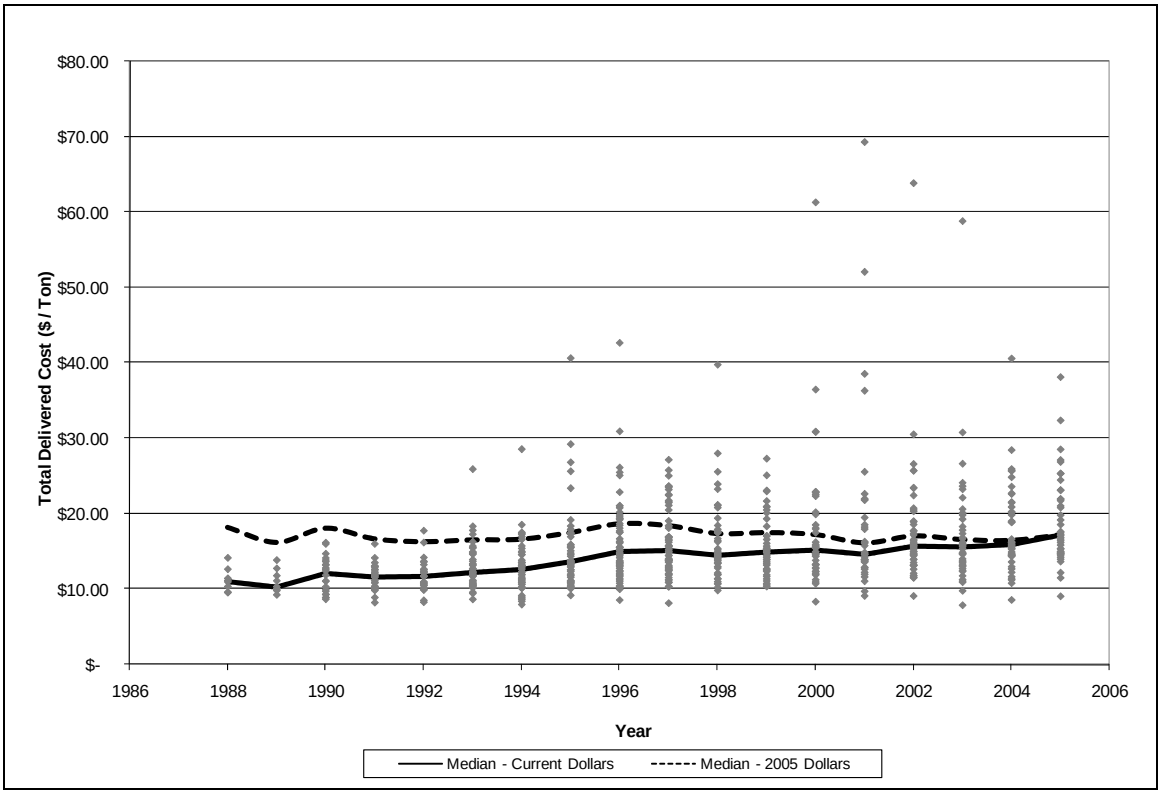

Figure 3.10. Median total cost per ton ratings for 93 independent logging firms in the Eastern US.

Does Individual Firm Size Matter?

It is not profitable for the independent contractor to "ramp up" production to meet a short term demand without the potential for adverse long-term consequences for the business. A ratchet effect undoubtedly occurs once a certain cost structure is met. In order to install a high volume operation one's cash flow must be adjusted accordingly to support this change in business philosophy. Simply switching back and forth between a high volume operation and a production level tailored for an existing cash flow model is not akin to turning a spigot on and off on command. Sinclair et al. (1985) found that firm size, in regard to total sales, was not a reliable gauge for indicating business success. In fact they discovered that bigger is certainly not better when operating in unstable wood markets.

Economies of Scale

Economy of scale is defined as the reduction in unit cost of production as an individual firm increases its capacity or inputs (Keat and Young 2000). This principle is often mistakenly used to justify increasing the size of a logging business with the intent of offsetting the increased capital investment by targeting a high volume operation. Logging operations tend to have few fixed costs, a requirement for this concept to prove accurate. In fact, Ferguson and Kreps (1962) contend that for economies of scale to occur, a large percentage of a firm's costs must be of the fixed variety and division of labor must be high. Businesses which rely heavily on variable costs, like logging firms, generally do not exhibit economies of scale. Essentially the business owner is unable to spread their fixed costs over a large number of units because of the absence of fixed costs

in the operation. Furthermore, most employees engaged in a mechanized harvesting operation are trained to operate each piece of equipment on the job and are viewed as interchangeable. They may be more skilled or productive performing a certain task but will often fill in as needed to alleviate bottle necks or speed up the flow of operations. Division of labor has never been a significant factor.

Figure 3.11 shows a regression analysis performed on the dataset consisting of 690 business years of data for the period 1988-2005. The cost of producing and delivering one additional ton was calculated at $15.21. This figure tracks the median cost per ton ratings discussed earlier for this same time frame and is indicative of no significant, if any, per unit cost incentive for expanding the scale of operation to capitalize on economies of scale.

Examining the R^2 value for the regression equation indicates that 84.8 % of the variation in annual operating expenses can be attributed to production. Variable costs are high for this undertaking so a strong correlation between expenses and production is to be expected. In fact, the dependent variable for this equation of $15.21 per ton and the very small intercept indicates that all costs are variable. Producing more tonnage requires more fuel, manpower, equipment, etc. The 15.2 % variation that is attributed to other factors can be explained by markets, equipment breakdowns, labor shortages, spikes in fuel prices, tract conditions, weather, quotas, etc. These factors are usually beyond the control of the small business owner; however, they do exist and definitely have an impact on efficiency of operations.

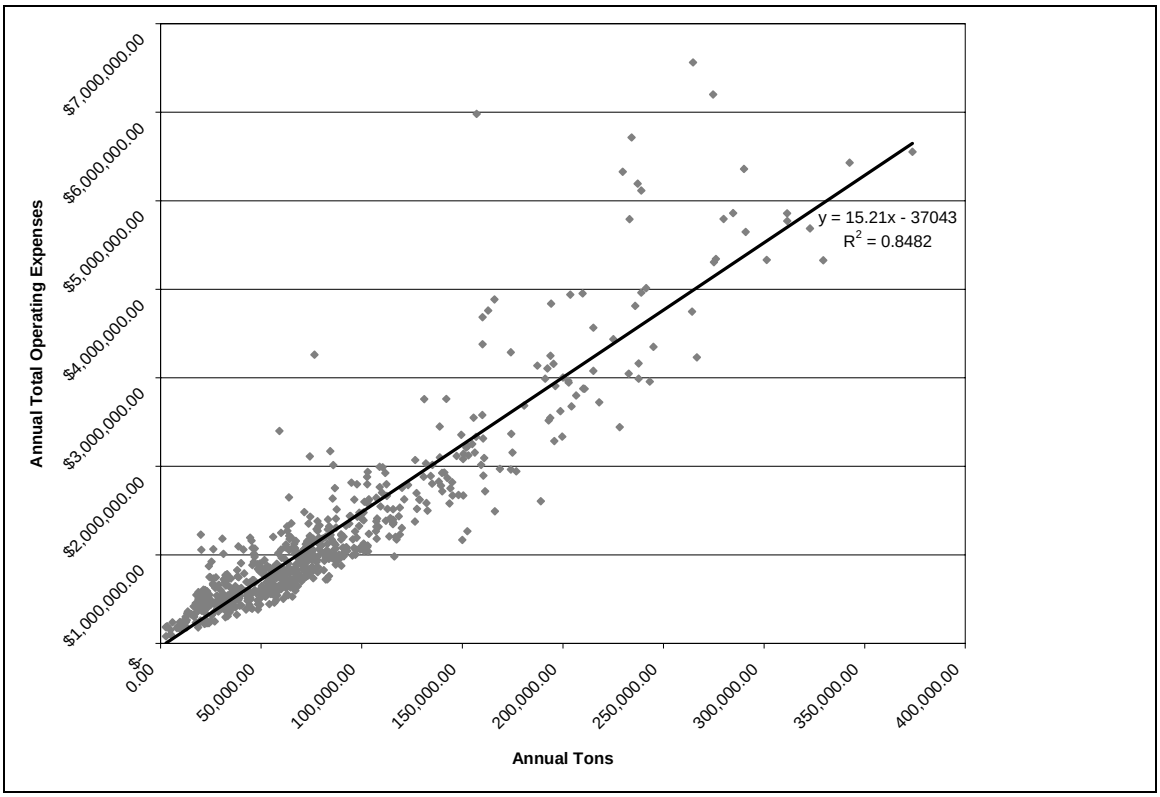

Figure 3.11. Regression analysis of annual operating expenses against annual production for 93 independent logging firms in the Eastern US.

Financial Efficiency by Firm Size

The economies of scale debate can be further supported by Figure 3.12. Five different producers were selected for a gross ratio analysis and categorized according to average volume of annual production. These selected firms were the only participants able to provide corporate income statements over a seven-year time period (1998-2005). A period of at least five years is critical to ensure that a complete depreciation cycle is captured for analysis and discussion. It should be noted that all of these firms were well-established, highly reputable businesses. In fact, the most junior business in this group

was established in 1978. All five firms are still operating as incorporated businesses and the same officers are currently managing operations.

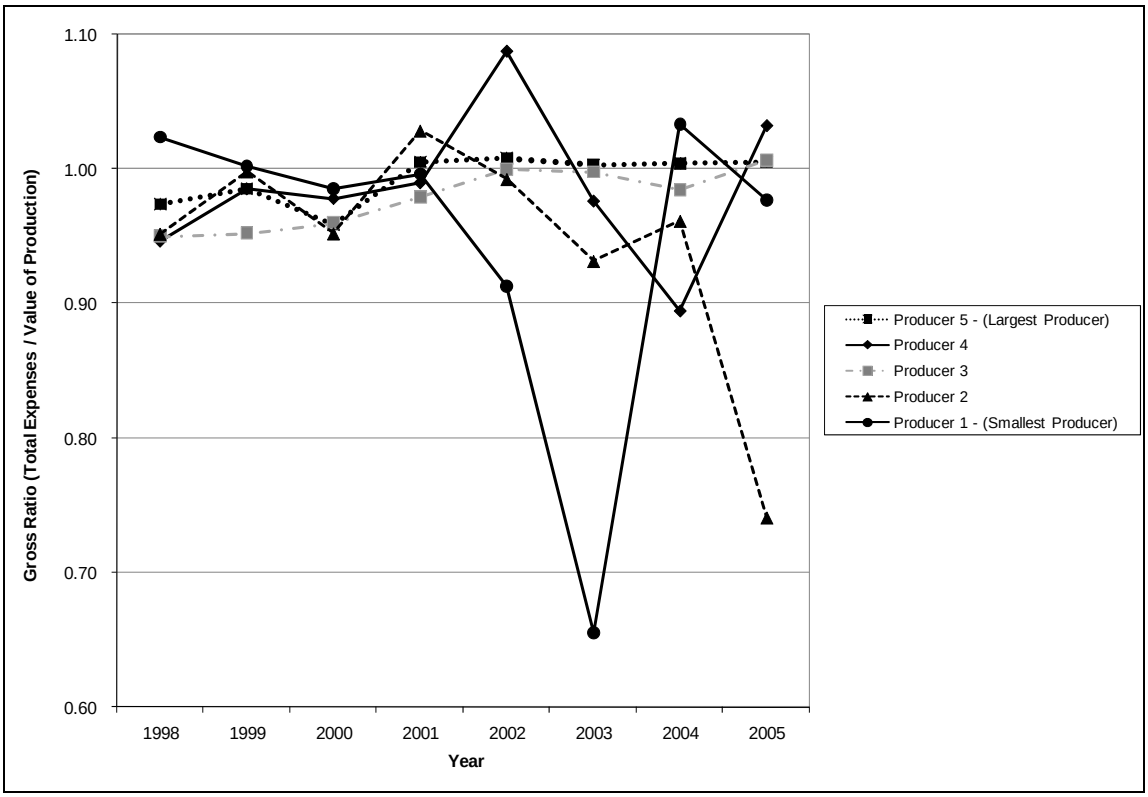

Figure 3.12. Gross ratio values for five independent logging firms in the Eastern US.

The gross ratio measures the cost of producing $1.00 value of output or production and is considered a standard measure for financial efficiency (Olson 1988). It is calculated by dividing the total operating expenses by the value of production (total sales minus cost of goods sold). Different accounting strategies can be employed in regard to gross margins. Olson (1988) warns that individual responses to tax laws and each contractor's unique economic environment can affect a business' margin. The cost of goods sold reported on the income statement for each participant can be treated

differently and impact the gross margin reported for each year. Gross margins are best used for short-run analysis and aid the business owner in deciding how much of a product to produce (Olson 1988). As a result these figures should be used guardedly. Business decisions should not be based on these analyses alone, but they do offer some valuable insight to the outside observer when examining the impact of firm size on business performance.

Producer 1 is the smallest volume producer of the group with the volume progressively increasing to Producer 5, the highest volume producer of the group. While careful consideration must be given to a gross margin analysis for a particular point in time, the trends provided by this sample of logging contractors over time is intriguing. The largest logging firm by volume produced (Producer 5) appears to be in the worst overall condition in terms of financial efficiency. This contractor spent much of the period above the break-even line (1.0), indicative of its annual operating expenses exceeding the revenue generated from logging services. The next largest producer (Producer 4) spent a large portion of the time period abutting the break-even line while posting the poorest margin reported in 2002. For this particular year it cost Producer 4 $1.09 to produce $1.00 value in production. Producer 3's predicament for financial efficiency is not much more favorable than the two largest producers during the time fame studied.

The smallest volume producers, Producer 1 and Producer 2, arguably posted more attractive results than the larger producers. The smallest, Producer 1, enjoyed the most attractive margin for profit in 2003; $0.65 spent for each $1.00 in production value. However, this same contractor was at or above the break-even line only four of the seven

years analyzed. This contractor was able to significantly reduce the operating expenses reported on the income statement for 2003 while maintaining steady levels of production. This is the result of a significant decrease in contracted services paid for this year, likely due to the specific accounting method employed in 2003 to lighten a tax liability. All factors considered, Producer 2 appears to be the most consistently economic efficient contractor studied during this period. Producer 2's gross margin was below the break-even line each of the seven years studied.

While the individual sources of year-to-year variability is difficult to define for each contractor there is reason to conclude that overall there is no clear or distinct advantage to running a higher volume operation based on these data. Arguably the smaller producers have more opportunity to generate a profit on operations than their larger volume counterparts and appear to have more managerial control over their expenses on a year-to-year basis. Perhaps, the most significant factor revealed by these analyses is that all logging contractors studied, regardless of firm size, have little margin for error. The odds do seem to favor smaller contractors more so than higher volume producers. In any event the gross margins reported from this study seem to indicate that the revenue received from logging operations often fails to exceed the operating expenses required to harvest the timber and transport the raw material to market.

Conclusion

Based on the 690 business years of data provided by 93 different logging firms from 1988-2005 the current predicament and outlook for participating firms is bleak. Prices paid for logging services have failed to offset escalating operating expenses, fuel

prices are continuing to skyrocket, new equipment prices have increased exponentially over the study period, and skilled labor is increasingly difficult to attract and retain. As a result of these obstacles many participating firms have implemented changes in their business model in attempt to weather the storm. One such survival technique, increasing the size of operations, is not a panacea.

Many of the most troublesome trends observed occurred over the last several years of the study period. Continuing examination is critical to determine if current patterns hold or if the system rebounds, whether a result of intervention or self-correction. Operating expenses will continue to increase over time. Whether these cost increases will be accompanied by increased remuneration remains to be seen. This is crucial not only to compensate for the effects of inflation but also to compensate business owners for their time and investment in the wood supply system.

The role of the independent logging contractor in the wood supply system is crucial yet not completely understood. The economic and social contributions from these firms are significant in their local communities. Understanding their impact is important and the ability for these businesses to survive is paramount. In order for the wood supply system to function properly the livelihood of the logging contractor, the central element, must remain intact and solvent.

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CHAPTER IV

DESCRIBING LOGGING CASH FLOW AND ITS EFFECTS ON THE WOOD SUPPLY VALUE CHAIN

Introduction

Logging firms contribute greatly to the economies of small communities. These enterprises are collectively one of the largest employers in timber dependent communities. The economic activity generated by a timber harvest provides the community with much of its revenue base (Mississippi Development Authority 2008 ; Abt et al. 2002). Examining the cash flow model of a typical logging firm can provide valuable insight into how these impacts affect the local community and how the corresponding value chain benefits from a properly functioning wood supply system.

Logging contractors provide a degree of stability for the economies of rural communities, especially those with a large agricultural component. Crop related expenditures and revenues tend to follow crop cycles, expenditures over the growing season and revenues at harvest time. Logging is a year round activity. The demand for diesel fuel is approximately the same in January as in June and labor expenditures are similar in March and September.

A comprehensive understanding of the structure of the wood supply system does not exist. It is one of the most poorly documented economic sectors. As a result, it is not easy to asses the performance of a system without a fundamental understanding of the players involved and the interactions existing between them. Exploring these relationships is vital to further our understanding of the system. Any advances in depicting the system in its entirety is an improvement, even if a conceptual approach must be used to advance our understanding.

Influential Factors

Several factors shape the current wood system and likewise will have an impact on the corresponding value chain. One of the first areas that warrants further discussion includes the historical and legal factors that shape the current wood supply system. Documented labor problems or shortages, the most publicized occurring in the Pacific Northwest, have also impacted wood supply markets. Finally, the general public's perception and tolerance of production forestry, whether it stems from fear, lack of awareness, or other emotional sources can significantly shape the structure and future of the wood supply system.

Doomed from the Start?

The continuing debate regarding whether the logging and transportation sectors fall under the agricultural "umbrella" and likewise enjoy the rights and privileges of agricultural enterprises shows no indication of resolution. This confusion can further complicate the interactions among the players in the wood supply system as a whole.

Agriculture and forestry are somewhat unique because their operations take place in the open environment and, in the case of water, result in non-point (distributed) rather than point source environmental effects.

The growing of timber crops has traditionally been considered part of agriculture, primarily because a perennial vegetative crop is produced and many farmers are also forest owners. In fact, only Christmas trees and horticultural stock, with a maturation period of 10 years or less, are considered an agricultural product (United States Department of Agriculture 2007). Timber for manufacturing is not. The intermediary firms, forestry consultants, wood buyers and dealers, independent logging firms, and trucking contractors are involved in the wood supply process also and fall between agriculture and manufacturing.

Perhaps one of the single most missed opportunities for logging contractors was failure to gain anti-trust protection as an agricultural co-op (Forest Resources Association, Inc. 1993). The US Congress failed to include logging contractors in the Capper-Volstead Act of 1922. The purpose of this legislation was to empower agricultural producers suffering from falling prices and making it lawful for farmers to unite to collectively market their products (Volkin 1985). This exclusion has further complicated the agriculture versus manufacturing sector debate and hindered independent logging contractors since its inception.

Labor Problems in the Logging Industry

Several recent studies have documented labor problems within the wood supply system (Daniels et al. 2000 ; Kusel et al. 2000). Most research in this area has focused on

the US Pacific Northwest, primarily due to the media spotlight revolving around the spotted owl controversy of the early 1990's. While the Southern US wood supply system does traditionally differ from that of the Western US, these studies can still provide valuable insight into the current labor climate of the logging profession. Land ownership and topography in the Northwestern US tended to concentrate woods employment into easily identified communities. The Eastern US is quite different; the percentage of public ownership is small, the landform results in an intermixed agricultural, forestry, and small scale manufacturing economies (Stuart 2008).

Kusel et al. (2000) surveyed a sample of 60 displaced woods workers in California after Caudex Lumber Company ceased its woods operations in January 1992 because it was not economically feasible to retain an integrated woods operation. The authors contend that Caudex "outsourced" or subcontracted to independent logging companies. Much of the Pacific Northwestern studies documented the struggles of unemployed forestry workers who were formerly company employees. While company owned logging crews did exist in the Southern US at one time, they have virtually disappeared. They ceased to be a primary source of services with the decline of steam and railroad based operations in the first quarter of the 20th Century and have remained a minor component ever since (Stewart 2004 ; Williams 1989). Today, independent contractors dominate the southern wood supply system (Grace et al. 2003). Following the Caudex layoff in 1992, outsourcing resulted in most company employees becoming independent contractors, and earning less as a direct result of change in employment status (Kusel et al. 2000). In fact, Kusel et al. (2000) stated that reemployed workers lost over 40 % of their combined pre-displacement wages and benefits.

Another study analyzed reemployment programs for dislocated timber workers in Oregon. Daniels et al. (2000) focused on the impact of two government reemployment programs: Oregon's Choices and Options program, designed to help dislocated timber workers cope with job loss; and the Northwest Economic Adjustment Initiative, a federal legislative mechanism which was designed to help timber-dependent communities, businesses, and workers adjust to the changing economic climate. Their findings differed from those of Kusel et al. (2000) since independent contractor status was not an option for dislocated timber workers. Daniels et al. (2000) stated that most of the dislocated timber workers in their study left traditional timber and forestry employment altogether. About 26 interviewees (53 %) secured employment in entirely different industries including wastewater management, truck driving and diesel mechanics, electronic assembly and manufacturing, and entrepreneurial endeavors (Daniels et al. 2000).

Some researchers may argue that timber workers become addicted to their specific form of employment and refuse to make the necessary lifestyle changes to attain financial stability after unwanted career interruptions. There may be some truth to this assumption; however, it should be noted that depression, family responsibilities, professional loyalty, and even pride often cloud one's ability to make rational financial and career choices. An alternative argument can be made that timber workers are usually rural folk, invested emotionally and financially in their family and community. They are often middle-aged or older. The necessity to uprooting, severing ties with family and community, and losing much of their financial investment in property is not to be addressed as casually as it might be for a younger, unattached individual.

Carroll et al. (2000) stated that "in many cases workers and their families do not perceive themselves to have clear choices at times of employment crisis, and decision making often takes place amid excruciating welter of depression, conflicting considerations, and many uncertainties" (p.153). Many timber employees lack advanced formal education, and this can compound their belief that they are not marketable, further lowering their self-esteem and feeling of self-worth. In many instances, timber-based employment is the only viable option within a particular community. Therefore, once the timber industry vanishes, so does the livelihood of the entire community.

It is also important to note that the prevalence of displaced timber workers creates a policy conundrum. According to Carroll et al. (2000), "the displaced workers would lead the chorus of doubters regarding the ability of the government to provide them with meaningful assistance beyond unemployment insurance, the issue of structural unemployment in wood products is more complicated than policy protagonists purport, and that the industry has the workers' interests at heart" (p.155). Many examples of timber displacement today are a direct result of corporate restructuring and cost reduction measures that leave independent contractors burdened with excessive debt and no economically viable employment or investment alternatives. Since logging contractors are one of the three major players in the wood supply process, a fundamental collapse of this sector would critically weaken the entire wood supply system.

Public Perception of Industrial Forestry

Forestry is differentiated from agriculture in that it takes place on a resource that the public considers natural or wild, which evokes emotional interest. The general public

has little difficulty recognizing that an agricultural crop is deliberately produced and takes comfort in the fact that this year's crop will be replaced by another next year. Where the harvest of an agricultural crop alters the landscape for the dormant season, the harvest of a forest crop alters the landscape for years, even permanently in the minds of many. Agricultural crops are commodities produced for and sold on annual markets. Timber, for many non-industrial landowners, is an investment to be converted to currency at some future date dictated by financial need or market conditions (Haney and Siegel 1993). For some forest landowners timber production is not a primary objective (Stewart et al. 2008 ; Measells et al. 2005). Purposes such as managing for wildlife habitat or benefiting from the aesthetic quality of their forest can exceed their interest in financial gain from a timber harvest; but that interest changes depending on year-to-year need for money and a change in ownership. Their reluctance to enter the market may seem insignificant at first but does impact the local wood supply system and must be considered.

Phillips (2002) stated that "… agriculture is unique because it is the only industry, for all practical purposes, in which no producer has any relevance to the overall production. No one is large enough or is strategically placed enough so that he has any appreciable influence over his prices" (p.21). The consequences of this phenomenon are that "agriculture is an industry with a built-in tendency to produce more at lower prices to the point of insolvency for a large number of producers" (Phillips 2002, p.21).

The parallel of production is more appropriate when applied to the service firms associated with forestry than the grower of timber. Just as over production of crops drives prices down, an over supply of service providers suppresses service or contract

rates in a similar fashion. Timber production is different because market power lies with the grower and the crop has a low harvest penalty. When the market is "soft" and timber prices low, the grower does not have to take their crop to market at any predetermined time. The grower can leave the crop on the stump from year-to-year until the market conditions are favorable. In some instances, circumstances beyond the landowner's control can dictate when a harvest occurs. Hurricanes, forest fires, and pest infestations can devastate a tract of timber and force the landowner to sell their crop much earlier and at a significantly lower price than originally anticipated.

Impacts of Logging on Various Economies

Chapter III introduced a long-term logging cost study and some trends revealed from a dataset of participating contractors. Ninety-three different logging firms provided detailed operating expense information at some point during the 1988-2005 time period. This effort resulted in 690 business years of information, reported for six different expense categories: equipment, consumable supplies, labor, contracted services, insurance, and administrative overhead. The total overall economic contribution of these contractors was valued at $822,738,701.82 (nominal dollars). Table 4.1 shows the cost allocation by expense category, both in dollar amount and percentage of total. These consolidated totals will help explain categorical trends in cash flow models introduced later.

Table 4.1. Total contributions by expense category for 93 independent logging firms in the Eastern US: 1988-2005.

Category:	*Amount:*	*Percentage:*
Volume Produced (Tons)	55,756,724.18	---
Equipment	$148,067,838.13	18.0 %
Consumables	$170,395,866.86	20.7 %
Labor	$268,495,263.74	32.6 %
Contracted Services	$186,643,660.22	22.7 %
Insurance	$27,634,142.29	3.4 %
Administrative Overhead	$21,501,930.58	2.6 %
Total Economic Contribution	**$822,738,701.82**	**100 %**

Wood Supply System Value Chain

The participants in this study have contributed almost $1 billion over the study period to local economies across the Eastern US. The impacts from such activity are real and widespread. Rarely is logging viewed as a vital employer in the community, by any but those directly affected. These firms, and their almost $1 billion economic activity, merely scratch the surface of the total economic contributions of the logging industry to communities across the US.

Figure 4.1 shows the basic value chain model for the wood supply system. The landowner, logger, and consuming mill are the primary or direct participants. As such, they provide a product or service that is an essential input into the national economy. There must be trees to harvest, someone to fell and transport the timber, and someone to

process the raw material into a marketable product. These direct participants bring a significant investment to the equation; whether it is real property, personal property, capital, experience, or expertise. The indirect participants also play a significant role; however, the system can function effectively without their involvement. They do not provide a vital role in the value added process yet they depend on the wood supply system's business structure in the same fashion as the direct participants. The model depicts the wood flow (product or service flow) from left-to-right. The backward flow, which is essential for a value chain process, is shown as a right-to-left flow of payment for goods or services (remuneration flow).

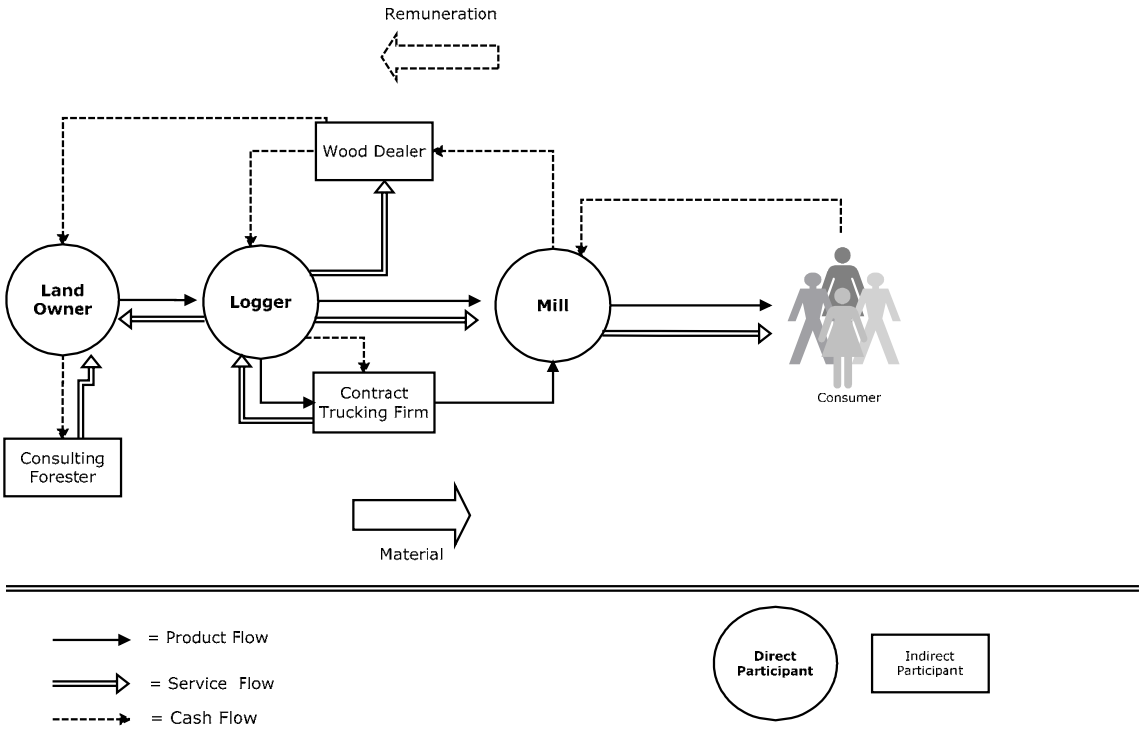

Figure 4.1. Value chain model for the wood supply system.

Logging Contractor

A strong argument can be made that the independent logging contractor is in the most undesirable location in the wood supply system value chain. Using Phillips' (2002) argument for agriculture and applying it to the wood supply system, the logger's position is ill-suited for any form of negotiation or leverage. Stumpage prices, the price that the landowner receives, are published and readily available (i.e. Forest2Market / Timber Mart -South), to anyone considering entering the market, especially if the services of a consulting forestry firm are used. The delivered prices paid by the consuming mill or point of delivery are firm with little if any room for negotiation. Logging cost and productivity study participants routinely claim that any attempt for serious price negotiation are usually met with a chorus of anti-trust claims or assertions. Attempts at forming price pressure organizations have been successfully rebuffed (Forest Resources Association, Inc. 1993).

The difference between delivered price and the stumpage price is routinely viewed as the payment to the logger. This is seldom the case. In fact, the reported values are open to manipulation. Stumpage prices are voluntarily reported by consulting foresters and merchandisers of timber; hence it is in their best interest to report the most favorable prices. Delivered prices are reported by consuming mills, interested in keeping raw material costs down. Consequently, it is in their best interest to report the lower range of prices paid. This has been done to extent that some reporting services have provided measures of the logging share that have been negative (Stuart 2008). As a result the delivered prices were lower than the stumpage prices. Often there are other entities drawing remuneration in the value chain model. Working through a wood dealer or

contract hauling firm is common of participants in the wood supply system that could be considered to have a more indirect role. In any event they seek, and receive, payment for their participation in the process.

From a return on investment perspective, a reasonable case could be made yet again that the logger is in the most unenviable position and receives the least benefit from their respective investment as compared to the other two direct participants. A typical logging firm is a multi-million dollar business, both in capital investment and revenues generated. They have little opportunity to negotiate contract rates, are accountable to both the landowner and the mill, must strictly adhere to environmental standards, all while performing an activity that is often under public scrutiny and attack. The exposure to liability for logging firms is high and workplace hazards are numerous.

Excavating and earth moving equipment can be used for basic road building and home construction applications, as well as some site preparation work. The equipment is specialized, suitable for anything other than logging. This diversity makes it easier to keep equipment productive and meet cash flow obligations. Most logging equipment is uniquely equipped to harvest, process, and haul timber. Fellerbunchers, skidders, loaders, forwarders, cut-to-length harvesters, and log trailers have few, if any, alternate uses. Most of the investment for a logging firm is in depreciable, personal property. The landowner, on the other hand, is heavily invested in appreciable, real property.

Landowner

Landowners provide a critical role and certainly assume risks when investing in timberland. The big difference, however, is that land has a myriad of uses, many of

which will provide the landowner an adequate return on investment. Timber also has a low harvest penalty affording landowners the opportunity to harvest when markets are favorable or withhold it in a down market (Grebner et al. 2005). Withholding timber reduces employment opportunities especially for logging firms, but also affects consulting foresters, wood dealers, contract truckers, and other indirect participants.

Several other factors must be considered with regard to land values. First, land has value; whether timbered, in agriculture, or laying fallow. Second, land values across the region have inflated faster, in inflation adjusted terms, than timber. Finally, timber has a value in place, whether from the value added to the property or as collateral for loans.

Mill

The consuming mill invests an enormous amount of money in capital infrastructure, especially in pulp and paper facilities. A luxury that the mill does have however is that the life of a paper mill is measured in decades, providing major corporations a long time frame to spread their fixed costs and capitalize on economies of size. The logger's investment is in short-lived, depreciable equipment like trucks (three years), loaders and other in-woods equipment (five years), as well as automobiles and computers which are subject to age related obsolescence and hence loss in market value. Mills, to a certain extent, also experience obsolescence, but that obsolescence pertains to subunits of the process allowing modular upgrades rather than complete replacement.

The forest products industry consists of several market sectors. The southern pine lumber industry, for example, produces lumber which is further processed into treated

lumber for use in fencing, decks, and docks. Southern yellow pine is a vital component for engineered wood products such as roof trusses and truss joists and is sensitive to the home building market. Spruce, pine, and fir products are routinely used in home construction and are very sensitive to changes in markets and interest rates. Treated wood products (for fences, decks, docks, landscaping timbers, and other outdoor applications) are sensitive to the housing market but can be sustained during downturns by home improvement projects. Sheet goods (oriented strand board (OSB), structural plywood sheathing, and flooring) is heavily tied to construction markets. Pulp and paper markets include containerboard, white paper (office paper, coated and uncoated free sheet), and newsprint. Many paper products follow the manufacturing economy and react independently of other forest products in response to varying market conditions.

Wood furnishes are interrelated because most timber stands produce products for different markets. The residuals for one process, lumber production, serves as input to another, pulp and paper. A downturn in the lumber market causes a reduction in production which reduces the residue chip supply. If the market for paper remains strong, an increased production of pulpwood is required, even to the extent that small sawtimber is purchased as pulpwood. Market downturns in the forest products sector do occur and companies must confront these challenges head on. A key point is that these market downturns also affect both the logger, and to a lesser extent, the forest landowner.

The intent is not to discount or trivialize the role or investment of the landowner and consuming mill, just to document the structure of the system and the opportunity for inequities. Their investments and roles in the process are vital and essential for the wood supply system to function properly. It is important to document and appreciate their

respective contributions. Examining three key factors: delivered pulpwood prices, published stumpage prices, and harvesting and transport costs derived from Mississippi State University's long-term logging cost project reveals that approximately two-thirds of the delivered price for pine pulpwood goes to the independent logging contractor for cutting and hauling the product to the market and is returned to the local community. The landowner will only reap approximately one-third of the delivered price for his or her investment in the system. The split between the two components changes as the product value increases; approximately a half and half split for chip-and-saw, and for sawtimber, one-third for logging and transport and two-thirds stumpage. All stakeholders are critical for the wood supply system to function properly but the role and investment of each stakeholder in the value chain is different.

Harvesting Cash Flow Analysis

A timber harvest could be viewed as the culmination of the wood supply process. This conversion of standing timber (real property) to logs and pulpwood (personal property) is the catalyst that starts the chain of events that comprise the wood supply system. It ties together all the stakeholders and must occur for the raw material to be transformed from a biologic entity into a desirable product to meet consumer demand. The role of the independent logger is most vital in the conversion process. The cash flow stream for their businesses can provide valuable insight into how the economic activity from a timber harvest affects local communities and how much of the revenue generated stays in local coffers. Figure 4.2 depicts a logging firm's typical cash flow model and indicates the major areas for expense allocation. The rate of retention, the number of

times a dollar is spent and re-spent in the local community, varies across expense categories. Leakage, the process where money leaves the region, is higher for some cost categories than others. Labor expenditures are more likely to turn over several times more than that for tires or fuel.

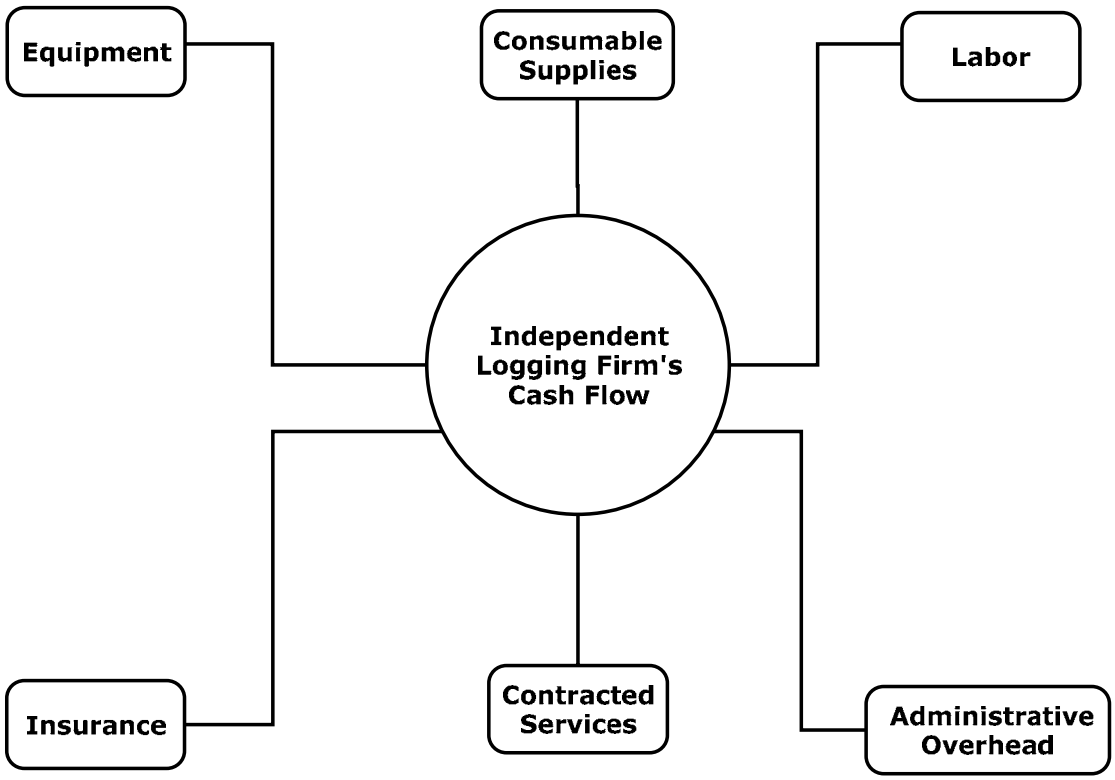

Figure 4.2. Conceptual model of a typical independent logging firm's cash flow.

For many applications it is difficult to differentiate between a local and a regional ecomomy, primarily when examining economic impacts for small study areas. Typically, "local" can encompass both the local and regional levels; and any economy beyond the state level is viewed as a single large entity, regardless of a final destination. Five

different levels of economies are considered for the cash flow analysis portion of this study. They include:

- Local – consists of a particular city, town, county (by zip code).
- Regional – consists of a multiple county level usually defined by the presence of a regional business or social center.
- State – confined to the boundaries of a particular state.
- Multi-state – collection of several contiguous states.
- National – defines of the entire US economy.

Table 4.2 shows common cash flow expenditures for logging businesses and indicates the typical level of impact from this economic activity. The list is not intended to be all-encompassing or exhaustive. It should be considered a snapshot of the economic impacts generated by logging firms using common cash outlays. Clearly, many expenditures can impact several different economies simultaneously and further compound the complexity of the wood supply value chain. Models for each expense category will be presented and the impacts of each outlay on local, regional, state, multi-state, and national economies will be discussed in more detail.

Table 4.2. Common logging cash flow expenditures and scale of economic impact.

Local	Regional	State	Multi-State	National
Bank Loans + Interest	Bank Loans + Interest	-----	Bank Loans + Interest	-----
Property / Ad Valorem Taxes	Property / Ad Valorem Taxes	Property / Ad Valorem Taxes	-----	-----
Fuel	Fuel	-----	Fuel	Fuel
Fuel Excise Taxes	Fuel Excise Taxes	Fuel Excise Taxes		Fuel Excise Taxes
Oil, Grease, Lubricants	Oil, Grease, Lubricants	-----	Oil, Grease, Lubricants	Oil, Grease, Lubricants
Repair and Maintenance	-----	-----	-----	-----
Parts and Supplies	Parts and Supplies	-----	Parts and Supplies	-----
Tools / Expensed Equipment	Tools / Expensed Equipment	Tools / Expensed Equipment	-----	-----
Salaries and Wages	-----	-----	-----	-----
Payroll Taxes	Payroll Taxes	Payroll Taxes		Payroll Taxes
Workers' Compensation Insurance	-----	Workers' Compensation Insurance	Workers' Compensation Insurance	Workers' Compensation Insurance
Contracted Services	-----	-----	-----	-----
Insurance	Insurance	-----	Insurance	Insurance
Office Supplies	Office Supplies	-----	-----	Office Supplies
Legal and Professional	Legal and Professional	-----	-----	-----
Clerical	-----	-----	-----	-----
-----	-----	Professional Fees	Professional Fees	Professional Fees
Penalties / Fines	Penalties / Fines	Penalties / Fines	-----	-----
Charitable Contributions	Charitable Contributions	Charitable Contributions	Charitable Contributions	Charitable Contributions
Training / Education	Training / Education	Training / Education	Training / Education	-----
-----	-----	Travel	Travel	Travel

Equipment

An equipment cash flow model is shown in Figure 4.3. Much of the turnover for equipment depends on the age of the equipment spread. If a piece of equipment is

financed through a small regional bank, a significant portion of money can be expected to stay local. If dealer financing is selected or if bank loans are bundled and sold, a large portion of this expense will leave the region. Most of the money to the purchase of a new piece of machinery will flow through the local dealership and on to the manufacturer. The dealer markup or margin will stay local. A large portion of applicable ad valorem or property taxes will stay local, with a certain percentage going to the state treasury.

Depreciation is the key element for equipment expenditures. Depreciation is not a "true" cash flow expense. It is an accounting method allowing the business owner the opportunity to recover the loss of value of an asset used for business purposes over the course of the year. It is a valuable tool for business management and it is critical that it be used effectively. Most equipment is purchased with money borrowed from a financial institution; the local bank, a commercial lender, or the equipment manufacturer. The interest on these loans is tax deductable. Payments to principal are not. Depreciation is an accounting allowance to shield payments to principal from taxes. Although money never really changes hands, the local economy still benefits from the reinvestment in the existing business. Replacing equipment keeps economic activity growing and these purchases ensure the continuation of the business.

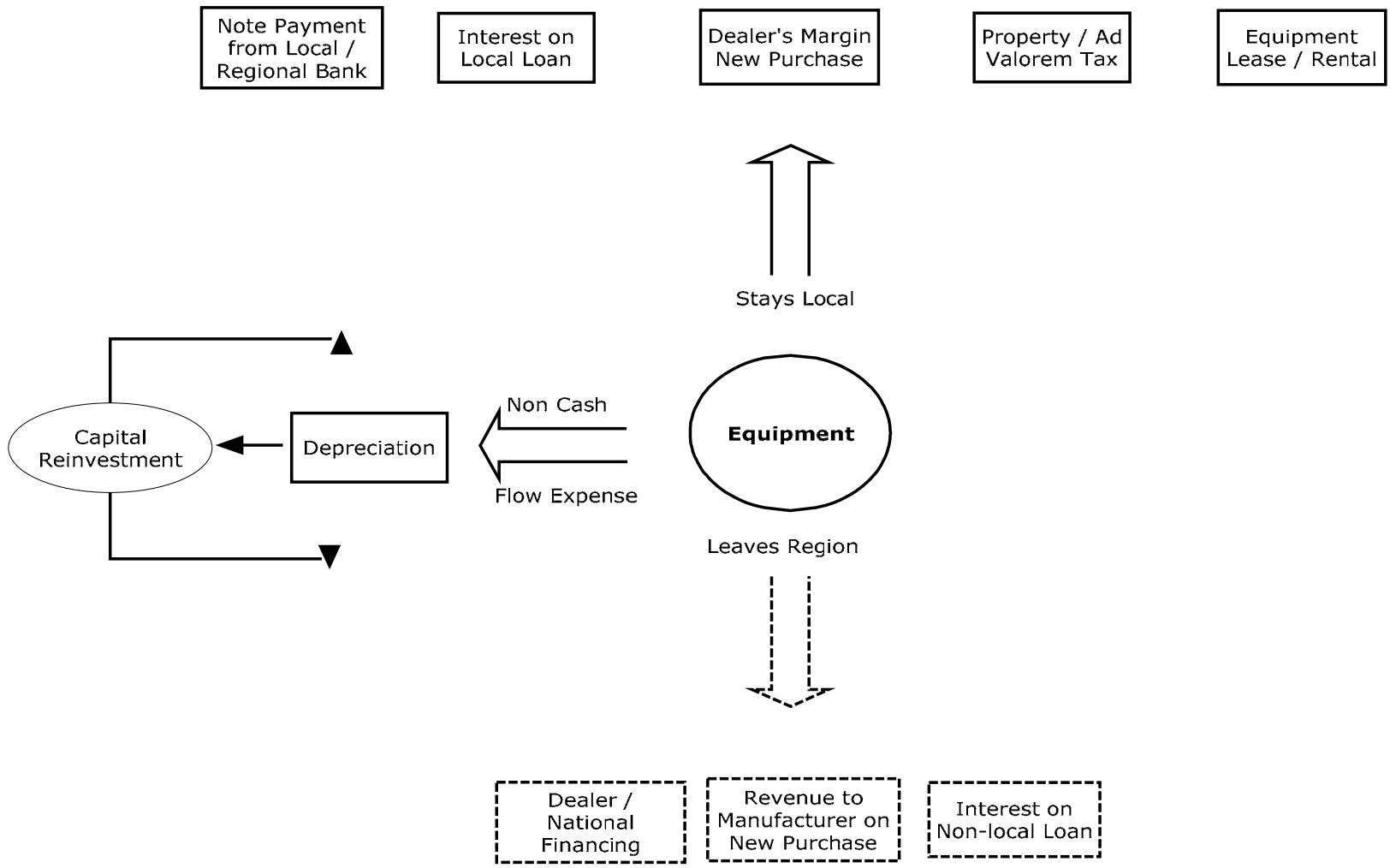

Figure 4.3. Value chain model for equipment expenditures of a logging firm.

Consumable Supplies

Consumable supplies will typically contribute heavily to the local value chain (Figure 4.4). Logging firms rely on fuel, parts, and service suppliers that also serve the local economy. Many of these services, like agriculture, earthmoving, and construction are seasonal. Logging firms tend to operate year-round; therefore their businesses help support these suppliers on an annual basis. Logging businesses maintain a variety of trade accounts, the bulk of which are also with locally-owned, small business ventures. The wear and tear on logging equipment is high hence requiring frequent repairs and adherence to a routine maintenance schedule. This work is almost always done locally by businesses using a local workforce. Parts and supplies are generally ordered through local parts stores or equipment dealerships. The margin between the basic or producer's price and the purchaser's price stays local, with the bulk of these sales leaking back to the place of origin. Virtually all of a mechanic's labor expenses will remain in the community and the dollar turnover from this activity will continue to ripple throughout the value chain.

The purchase of tools and other non-depreciable equipment will also have a positive effect on the local economy and the dollar retention remains favorable. Participants of the wood supply system, especially the logging sector, rely heavily on consumable supplies. In fact, a strong argument can be made that this is single most important cost category affecting the wood supply value chain and the one which distinguishes a logging firm from other local employers.

Fuel purchases, a significant expense to the logging contractor, warrants further exploration. A local retail station owner's profit margin on the sale of diesel fuel or

gasoline is small, sometimes even resulting in a loss (Energy Information Administration 2008). A quick glance at the erratic nature of crude oil prices are a testament to fuel vendor's inability to effectively control retail fuel prices. Bulk fuel sales do offer some cost relief to logging contractors and increase the margin for a local oil company by bypassing the retail fuel stations. In any event, the leakage factor is high for fuel purchases. Excise taxes, both state and federal, imposed on fuel purchases do provide modest revenue to local communities and assist in the construction and maintenance of public roads and are returned to counties in the form of highway funds.

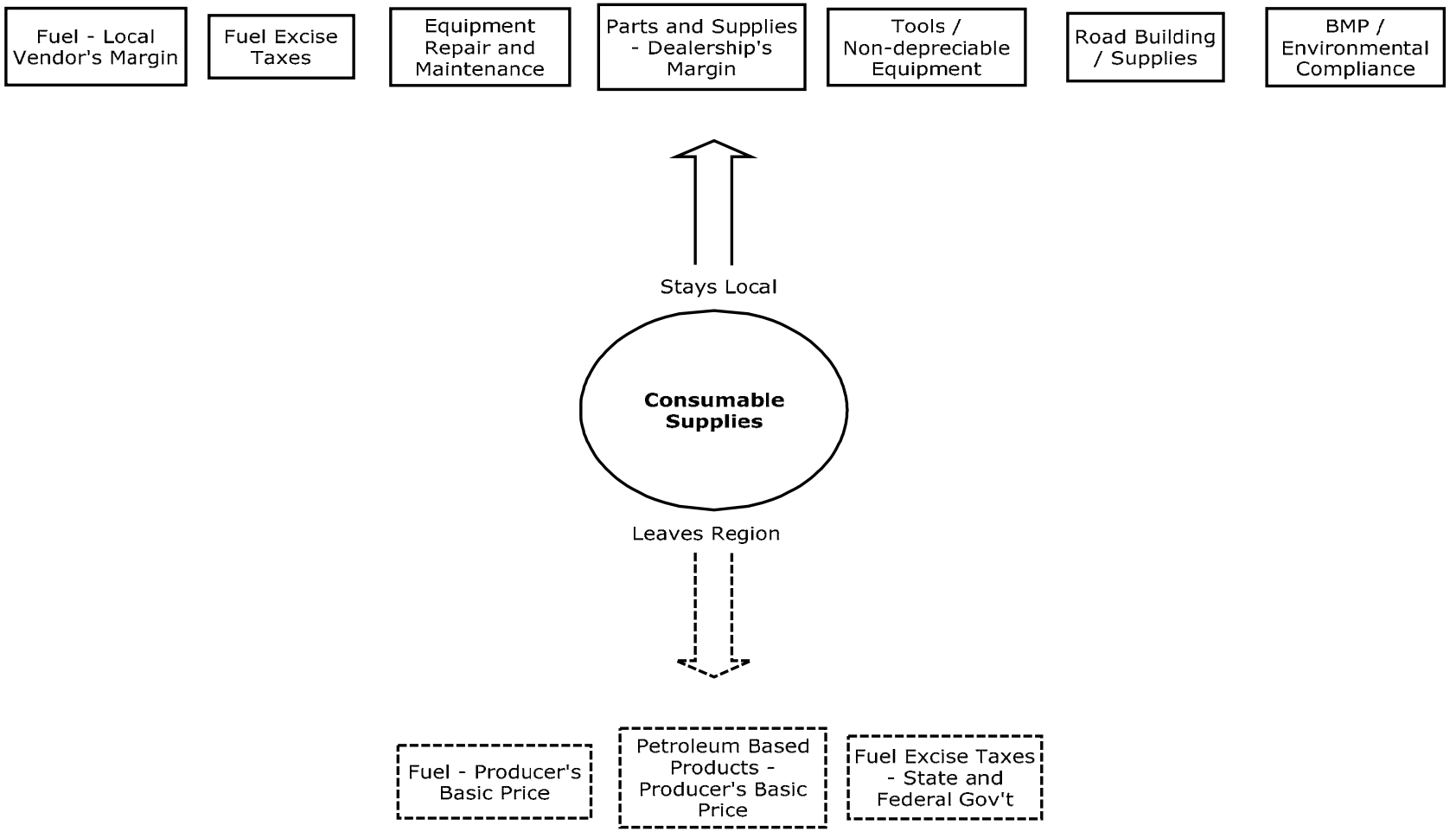

Figure 4.4. Value chain model for consumable supplies expenditures of a logging firm.

Labor

Labor is the largest cost category for logging firms and has the greatest benefit to the wood supply value chain (Figure 4.5). Given the recent advances in computer assisted manufacturing in the lumber and paper industries, manufacturing employment has decreased significantly while that in logging has remained relatively constant. While no definitive number exists to verify the argument, more jobs are provided by the logging and transport firms delivering raw material to the mills than in the mills themselves. Salaries earned by logging employees are largely spent in the local community. In many timber-dependent communities logging firms are the dominant employer and the most highly sought employment opportunities in the area.

Payroll taxes support state and federal programs. Social Security and Medicare support (offset) government social programs that, in turn, return money to the local community and state, albeit to other citizens. Workers' compensation supports payment to local health care providers to offset the medical cost of injuries and provides support for those injured in work related accidents and the families of those rare individuals with fatal injuries suffered on the job.

State and federal unemployment insurance taxes follow an indirect route to re-enter the local economy. A portion returns to the local economy through payments to beneficiaries that often are not paid directly by that beneficiary, the result being a form of income redistribution. An argument can be made that local businesses support rural communities that in turn are beneficiaries of government and insurance programs payments which in turn support the local economy.

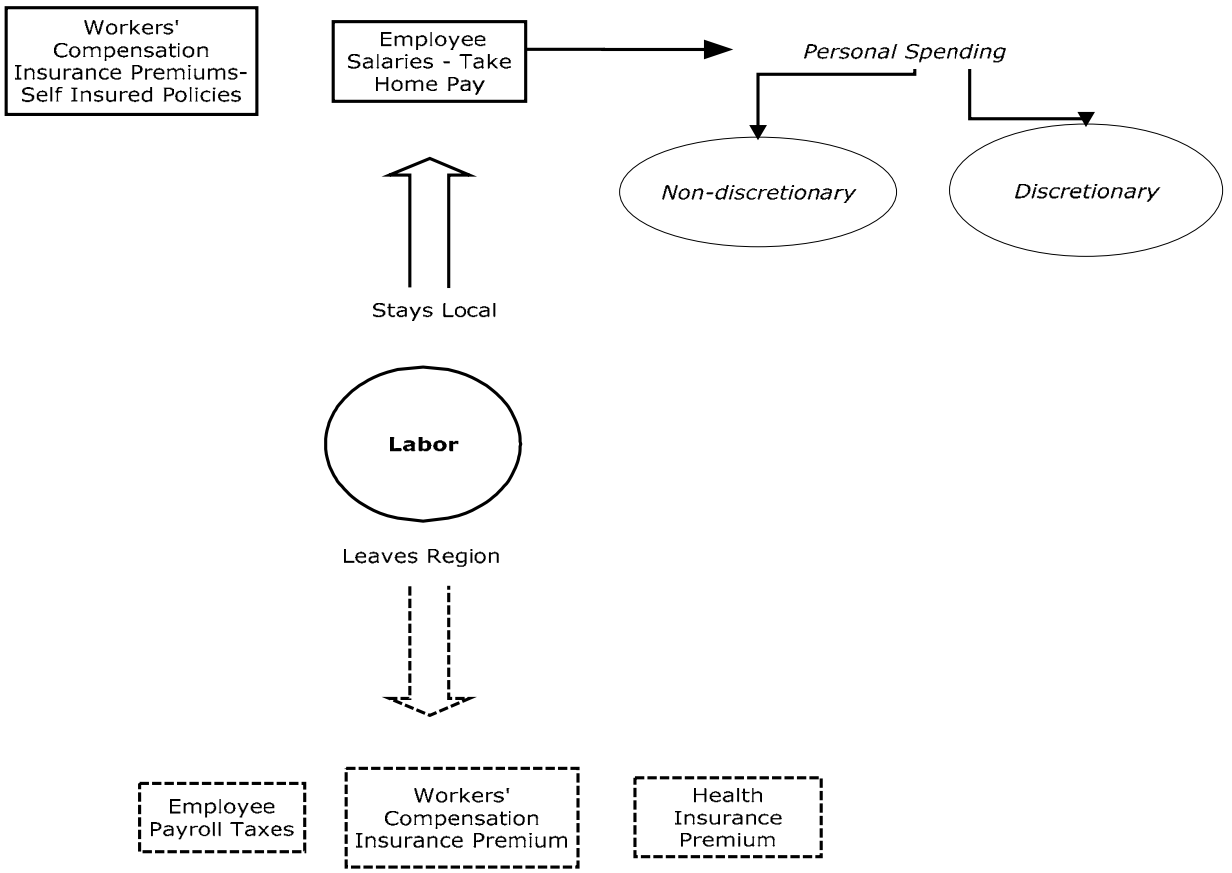

Figure 4.5. Value chain model for labor expenditures of a logging firm.

Personal spending, both nondiscretionary and discretionary, are outlined in detail and depicted in separate diagrams. Non-discretionary personal spending habits for logging employees certainly provide an economic boon to small timber dependent communities. Figure 4.6 depicts these expenditures. People tend to shop at local grocery and convenience stores. They typically seek automobile loans and mortgages from local banks or lending institutions. Their children attend local daycare facilities and usually attend local schools, public or private. Medical and dental services are sought locally unless more advanced and specialized treatment must be sought at hospitals outside the region. Local mechanics, plumbers, and electricians are employed to provide necessary services and maintain lifestyles. This economic activity heavily impacts, supports, and preserves local economies. The dollar turnover for personal spending in small communities is very high and the benefits reverberate throughout the value chain. Leakages do occur, especially resulting from retail margins returning to manufacturers of goods. Utilities are often sought locally but a large portion of these expenditures escape the region. Insurance is commonly purchased locally as well; however, a large percentage of premiums paid return to the home office of the underwriting agency.

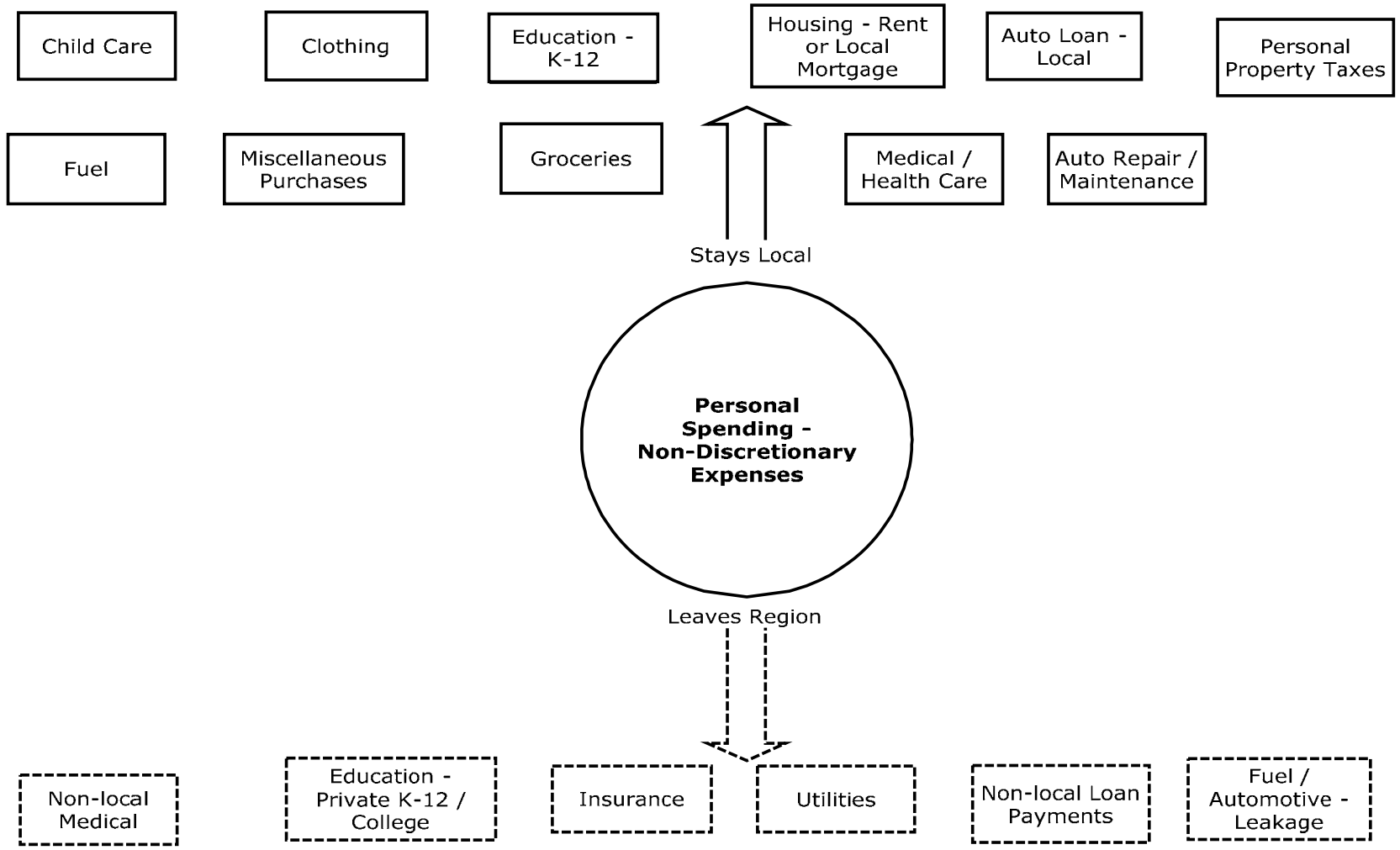

Figure 4.6. Value chain model for non-discretionary personal spending.

Discretionary personal spending is depicted in Figure 4.7. Again, a large portion of these expenditures are retained in local coffers. Most employees drawing paychecks from logging operations fall into the middle class tier of the socioeconomic scale for their respective communities. While the level of disposable income varies greatly among the vast middle class strata of society, most people do find ways to spend money on things they enjoy or want, but do not necessarily need. This diagram provides illustration of typical discretionary spending patterns.

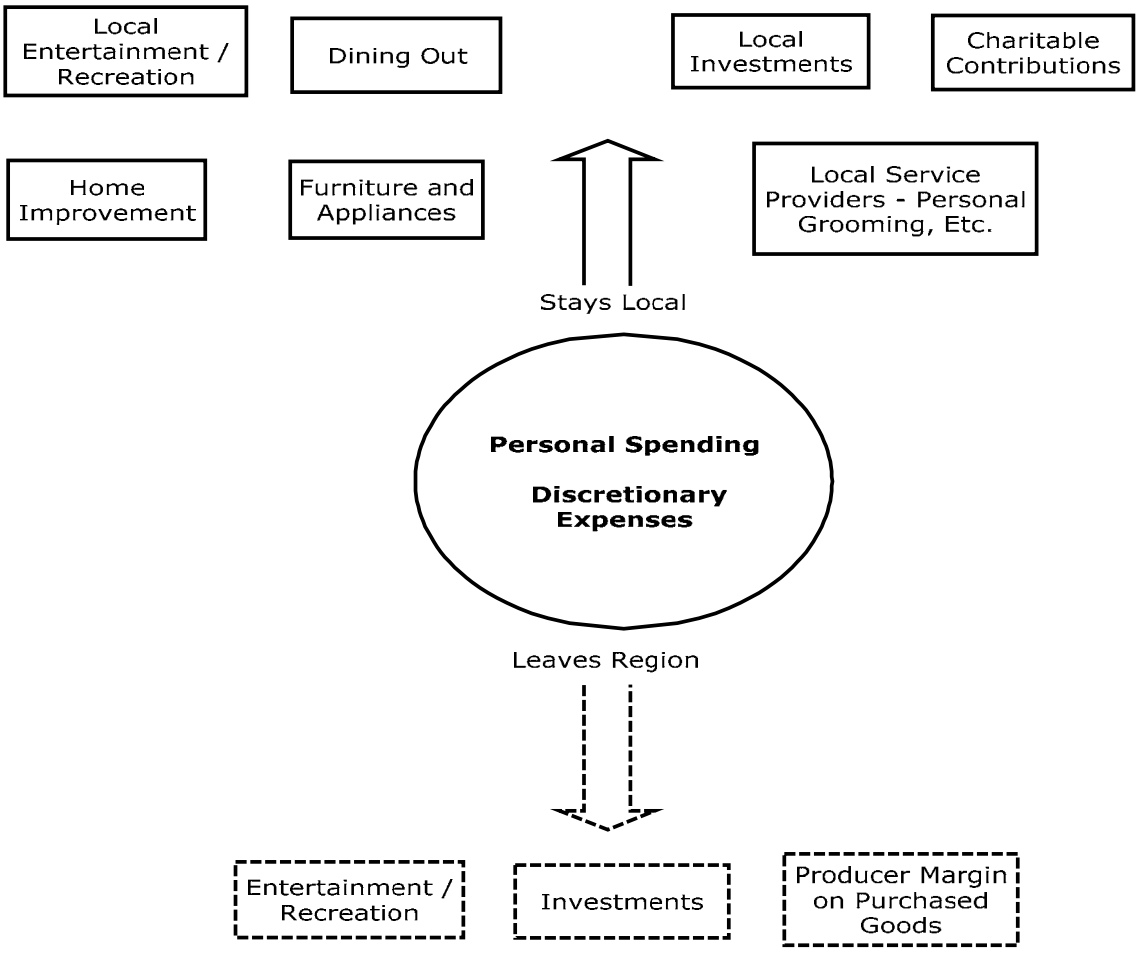

Figure 4.7. Value chain model for discretionary personal spending.

Entertainment expenses can vary greatly as to the level of local stimulus provided for each event. Activities such as dining out or playing golf will offer more local dollar turnover than movie attendance. Only a small percentage of ticket sales are retained by the local theater. Movie theatres, and other entertainment outlets of this ilk, rely heavily on concessions sales for revenue. Charitable contributions can vary greatly as well. Tithing a local church will likely result in more local benefit than a donation to a national organization, even though both measures of generosity are much needed. Investing in a local bank or enlisting the expertise of a local investment firm will contribute more locally than establishing an online account with a large, national brokerage firm.

Contracted Services

Figure 4.8 shows the cash flow process for contracted services expenditures. This category essentially is a duplication of the three expense categories already discussed. An independent contractor using a contract trucking firm will pay a contract rate, commonly on a per mile basis, to the trucking firm. These expenses flow through the value chain in a similar fashion to the equipment, consumables, and labor categories. The truck and trailer are classified as equipment, the contract trucking firm pays consumable expenses on the equipment, and the truck driver earns a salary or wages and distributes his/her income in the same fashion as the employee of the logging contractor.

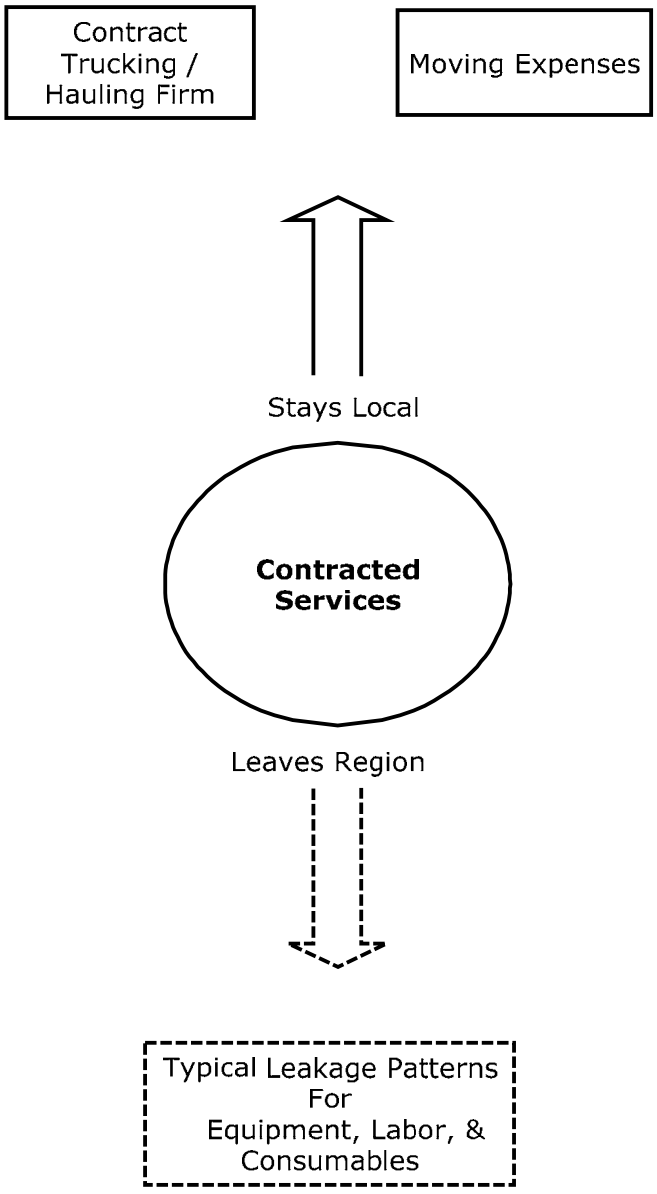

Figure 4.8. Value chain model for contracted services expenditures of a logging firm.

Insurance

Insurance expenditures probably contribute the least to the wood supply value chain (Figure 4.9). Many contractors use insurance expenditures as an overall cost control measure and outlays will fluctuate accordingly. General liability and other business related policies are sought locally, or within the regional economy. Workers' compensation insurance is classified as a labor expense, as is employee health insurance. On personal spending levels insurance demand is commonly met locally; however, the benefit retained in a small community usually consists of a local agent's margin for writing a policy. Insurance money returns indirectly to the local and regional economy in the form of payment for claims. Since logging businesses are local or regional, these cash inflows tend to be local and regional; to a local doctor, body and fender shop, landowner, etc.

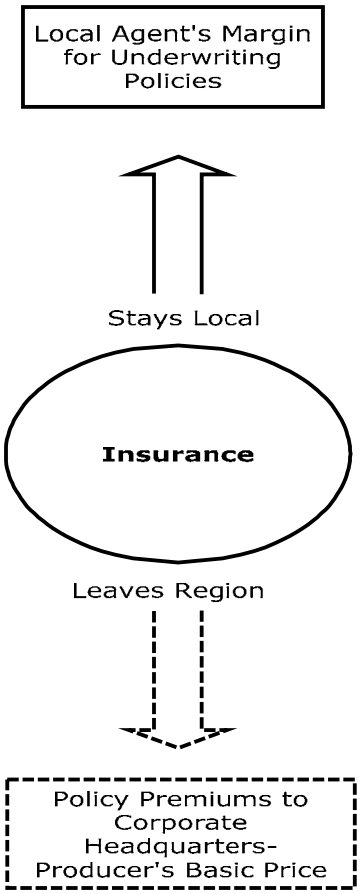

Figure 4.9. Value chain model for insurance expenditures of a logging firm.

Administrative Overhead

Administrative overhead is a broad category defining business related expenses that do not fall under the classification for the other categories. Figure 4.10 details common examples of administrative overhead expenditures affecting a logging firm's cash flow. The increasing use of accounting, legal, and other professional service providers contributes significantly to the local value chain. The local dollar turnover for such services is very high. The expense of maintaining an office, a shop, purchasing office supplies, etc. are local. Meals provided by business owners to employees are

purchased locally. Dues or fees for professional organizations supporting timber harvesting usually are more grass root in nature and most activity occurs on a regional basis. A portion of the revenue collected for expenses such as licenses, fees, penalties, and fines go to local jurisdictions with the remainder often going to state governmental agencies. The main sources of leakage for the administrative overhead category are for utilities and travel related expenses.

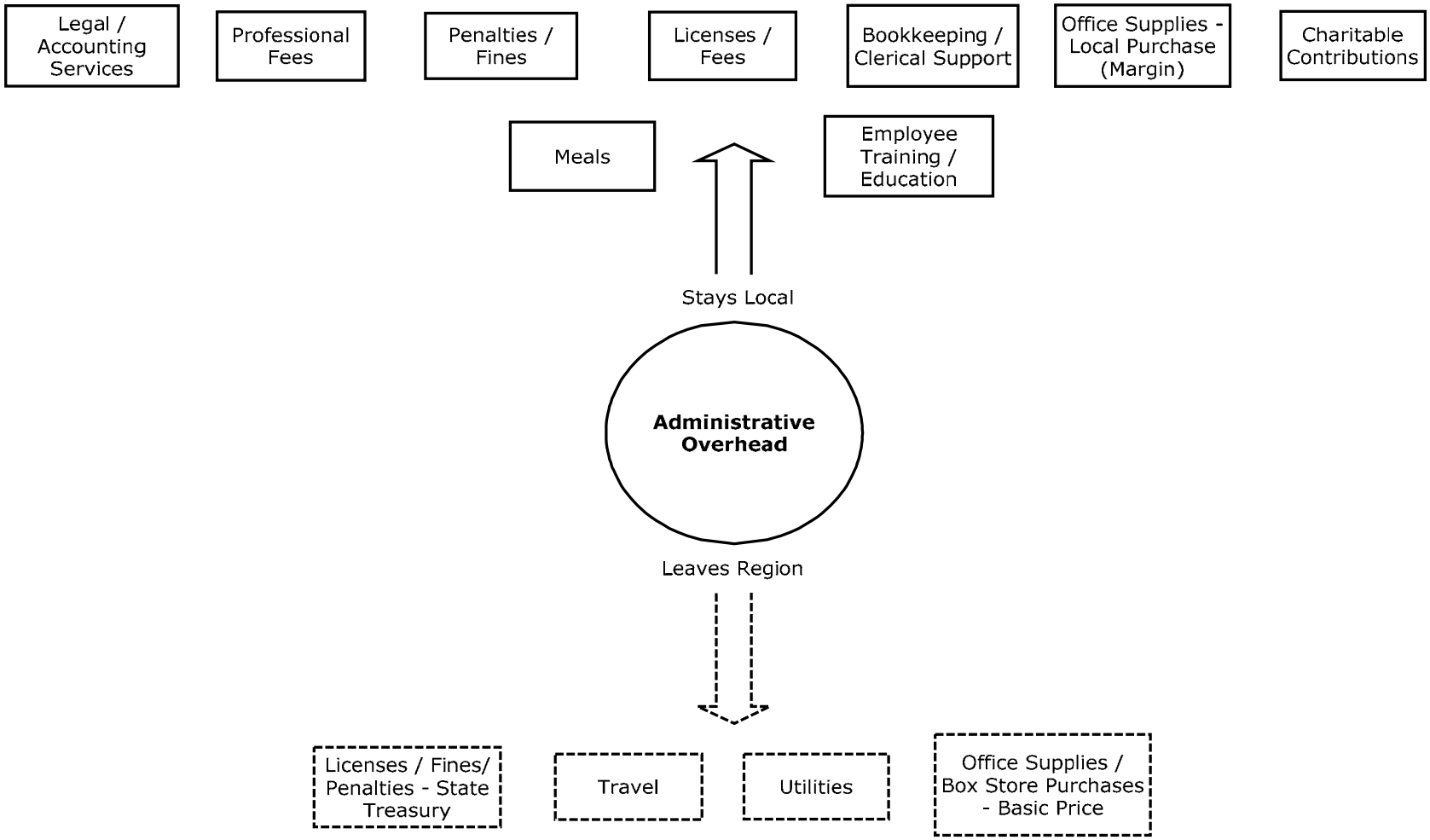

Figure 4.10. Value chain model for administrative overhead expenditures of a logging firm.

Conclusion

It is clearly evident that the socioeconomic impacts or contributions of the wood supply value chain are significant to the local economies of timber dependent communities. The nearly $1 billion of economic activity discussed in this chapter is only the portion generated by the logging contractor and does not encompass the landowners' or the consuming mills' contributions to the overall value chain. Furthermore, this is only a small fraction of the logging firms dotting the landscape. The thousands of other logging firms across the US contribute in the same fashion and their impacts are equally as widespread.

As discussed earlier, some of the expense categories contribute more heavily to the local value chain than other categories. It could be argued that personal income expenditures, both nondiscretionary and discretionary, contribute the most. While this may be a true statement not all labor expenditures flow through the system in the same manner or lead to the same high degree of dollar turnover exhibited by the cash flow analysis of logging firms. Even the expenditures for which only a small percentage remains with the local economy are crucial for community survival. They generate volume, and many retail and service firms are measured by volume as well as margin. For logging, all employees are drawn from the immediate area and tend to spend a large portion of their income locally.

The consumable supplies category is another area in which the wood supply value chain can distinguish itself from other industrial sectors. A steady flow of fuel, parts, and supplies are procured from local vendors, who also tend to purchase locally as well. Such a pattern of economic activity stimulates the local economy and ensures minimal

leakage. The purpose is not to discount the significant contributions of the other stakeholders in the wood supply system or ignore the impacts of other sectors. The role of the independent logging contractor is significant and should be heralded as such.

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CHAPTER V

THE EFFECTS OF HURRICANE KATRINA ON MISSISSIPPI'S WOOD SUPPLY VALUE CHAIN

Introduction

Economic development is a term widely used today in economic and political arenas. It normally evokes a promise of new employment opportunities in the area and a stimulus to the local economy. Usually the focus of economic development is on attracting new industries, those which have not traditionally had a presence in the community, to invest in the region through expansion or relocation. Economic development and industry retention are commonly mutually exclusive terms. Emphasis is often on attracting the trendy or high-profile industry to establish roots in the community often with little regard to keeping an existing industry intact.

The forest products industry's importance to the state of Mississippi is widely recognized with total industry output exceeding $9 billion annually (Munn and Tilley 2005). Munn and Henderson (2002) also documented the value of production forestry to Mississippi's economy. These reports serve as an excellent basis for a more detailed exploration of the socioeconomic impacts of the stakeholders in the wood supply system and its value chain.

The Southern US landscape is dotted with small towns centered on and around production forestry. As the forest products industry goes, so does the livelihood and well-being of these communities. The devastating impacts of Hurricane Katrina made it apparent that very little is known about the socioeconomic impacts of the wood supply value chain either on a local or state-wide level. This catastrophic event served as the impetus for this analysis. Some post-Katrina financial estimates for the timber industry were publicized; however, there was very little detail or understanding of the origin of such figures. Most estimates zeroed in on the number of downed trees or damaged stems, the number of acres affected, etc. Most assistance and focus was centered on the plights of effected forest landowners. Losses and impacts for the logging sector and the mill sector were excluded. Landowners can acquire insurance for the loss of their assets and are still left with the land, which has value exclusive of the crop it yields. The other two stakeholders can not seek insurance compensation for loss of assets due to business failure.

To contrast, the gaming industry in Mississippi was able champion their cause with precision and speed. Lobbyists and friends of the gaming industry approached state officials armed with detailed figures estimating the amount of revenue that the state of Mississippi was losing on a daily basis as a result of the Gulf Coast's crippled gaming industry. Proponents of the forestry community found their arsenal lacking of similar economic and political weaponry. In their defense, the wood supply system is more complex and widespread than the gaming industry. In any event, the need for a better understanding of the magnitude of the socioeconomic impacts of the wood supply system is paramount. Hurricane Katrina was a undoubtedly a devastating event

but the catastrophic nature of its impacts provided an excellent opportunity to examine each component individually yet still piece the system back together for a cohesive view of the wood supply value chain.

Methodology

Three different economic models with significant ramifications for the wood supply system in Mississippi were analyzed using Impact Analysis for Planning (IMPLAN) - Professional 2.0. Each model attempts to document the impacts of a wood supply disruption to the overall value chain for a given community. The three primary stakeholders in the wood supply system were selected as the basis for modeling. All scenarios used for modeling were based on actual events. Therefore, the economic output generated for each model was real and had far-reaching effects on the local economies in which they occurred.

IMPLAN

Impact Analysis for Planning (IMPLAN) is a social accounting software used to analyze the effects of certain scenarios on regional economies. This input-output modeling system is capable of estimating models for 509 sectors. IMPLAN sectors are tied to the North American Industrial Classification System (NAICS) code and the Bureau of Economic Analysis commodity classifications (Olson and Lindall 2004). This system was originally developed by the US Department of Agriculture's Forest Service in cooperation with the Federal Emergency Management Agency and the US Department of the Interior's Bureau of Land Management for estimating the regional

economic impacts of management plans on National Forests (Olson and Lindall 2004). Currently, the Minnesota IMPLAN Group develops the data and provides support to clients for modeling and analysis (Munn and Tilley 2005).

None of the sectors were aggregated for these models due to the objective of the analysis. Emphasis was placed on discovering how wood supply disruptions would impact the value chain in all sectors of the local economy. Each sector is important regardless of traditional relationships with the wood supply system. Aggregating sectors for this project would hide the minute detail of economic activity targeted for discussion and mask the intricacies of regional economics. In fact, Olson and Lindall (2004) do not recommend impact analysis using aggregated multipliers due to its susceptibility to aggregation bias. Furthermore, a dollar generated (or a dollar lost) in a local economy is important and warrants inclusion regardless of the sector impacted.

IMPLAN transactions can be computed on either a commodity or industry basis. The landowner scenario was modeled on a commodity basis since three interest groups: private landowners, industry and investment company landowners, and public landowners each contribute to the market share for timber, albeit with different management objectives. Private landowners may seek to maximize the return on their investment or they may regard their forest much like a savings account, a source of money when a scheduled or unexpected need arises. Industry landowners' primary interest may be to quickly replant the acreage in seedlings and begin the rotation cycle for mill planning. Finally, public lands may be harvested to facilitate wildlife habitat or reduce a fire threat, with a decreased emphasis placed on timber production except for recovery operations. The other two scenarios, the logging firm going out of business

and the mill closure were analyzed on an industry basis since both sectors provide 100 % of the market share for their respective goods or services.

The impacts reported are on a direct, indirect, and induced level. According to Hussain et al. (2008) direct impacts are changes in demand for industry output for the events being analyzed, indirect impacts trace changes in inter-industry purchases as the impacted industries adjust and respond to the new demands of those industries directly affected. Induced impacts reflect the household spending changes as personal income levels increase or decrease stemming from employment and production changes.

Type I and Type SAM (Social Accounting Matrix) multipliers were used to generate the direct, indirect, and induced impacts. Type I multipliers measure the direct and indirect effects of a change in economic activity while Type SAM multipliers document the effects of household income or spending, in addition to direct and indirect impacts, from a change in economic activity (Olson and Lindall 2004).

The local purchase coefficient (LPC) for the logger event and the mill closure event were set using the model regional purchase coefficients (RPC's) obtained from IMPLAN. It should be noted that traditional methods of estimating regional purchase coefficients, including those used by IMPLAN, are widely criticized and believed to be the weakest link of regional input-output modeling software (Lazarus et al. 2002). The RPC for the logger event scenario was 45.5 % local, while 57.0 % was used for the mill closure event. The rationale for this procedure being that a certain portion of the defunct logging firm's cash flow leaves the county (study area). The mill's expenditures will leak from the local economy in the event of a closure in a likewise fashion. These figures are low, indicative of the high degree of leakage afflicting

small study areas. This phenomenon will be discussed later in more detail. The LPC for the landowner event was assumed to be 100 % local since the stumpage value estimates used for impact analysis are an exclusive function of the six-county study area and the results were computed on a commodity basis.

Economic Impact Modeling - Wood Supply Value Chain

Three different event scenarios were chosen for economic impact modeling using IMPLAN software (Table 5.1). The three major stakeholders in the wood supply value chain (landowner, logger, consuming mill) were selected for analysis. Actual events which had a negative socioeconomic impact on certain regions in Mississippi were used as the foundation for modeling. The disruptive scenarios presented in these models document events which have actually occurred and are not theoretical concepts.

Table 5.1. Overview of IMPLAN event scenarios on Mississippi's wood supply value chain.

Sector Name	***IMPLAN Sector***	***Study Area***	***Impact Value***	***Basis***	***Year***	***Local Purchase Coefficient***
Timber Tracts	15	South MS	($32,469,710)	Commodity	2007	100.0%
Logging	14	Perry Co.	($940,000)	Industry	2004	45.5%
Veneer & Plywood Manufacturing	115	Winston Co.	-200 Jobs	Industry	2004	57.0%

Landowner (Timber Supply Disruption)

The first model attempted to address the economic impacts of Hurricane Katrina on the economy from the landowner's perspective. Statewide estimates issued soon after the storm indicated 1.7 million acres of timberland were damaged (Glass and Oswalt 2006). The Mississippi Forestry Commission claimed significant timber damage was sustained on 1.3 million acres and the combined timber damage was estimated at $1.29 billion (Mississippi Forestry Commission 2005).

This approach involved isolating the six counties in south Mississippi affected hardest by Hurricane Katrina: Pearl River, Stone, George, Hancock, Harrison, and Jackson. Although the actual storm made landfall on August 29, 2005 as a Category 3 hurricane, 2007 is perhaps the best year to analyze for the effects on the wood supply system. Timber salvage from this storm continued well into 2006 and harvest volume reports for the years 2005 and 2006 were influenced by these efforts. Salvage estimates concluded in the first half of 2006; therefore, 2007 is the first year without inflated harvest volume from hurricane salvage.

"Harvest of Forest Products" reports produced by MSU Forestry Extension personnel (Measells 2006 ; Henderson 2007) were obtained. The difference in harvest volume totals for the six counties from 2006 to 2007 was calculated. Average stumpage prices were obtained for each of the major product classes and a total economic value was derived for impact modeling purposes (Twillmann and Rangel 2007). Table 5.2 contains the county harvest volume differences from 2006 to 2007. The 2007 harvest volume totals for this six-county region was 936,804.19 tons less than 2006 harvest totals for the four major product classes.

Table 5.2. Difference in harvest volume totals from 2006 to 2007 for six-county study area in South MS.

County	*Pine Sawtimber (Tons)*	*Hardwood Sawtimber (Tons)*	*Pine Pulpwood (Tons)*	*Hardwood Pulpwood (Tons)*	***Total***
George	3,957.00	-280.00	47,195.91	-4,047.11	**46,825.80**
Hancock	-194,692.17	1,236.70	-50,084.91	-26,976.45	**-270,516.83**
Harrison	-180,344.33	-910.03	97,343.25	3,383.33	**-80,527.78**
Jackson	-29,701.50	-2,076.66	-41,328.75	-3,596.00	**-76,702.91**
Pearl River	-315,917.33	-12,062.97	-47,097.82	-19,217.34	**-394,295.47**
Stone	-115,982.16	863.30	-30,717.93	-15,750.22	**-161,587.01**
Total	**-832,680.50**	**-13,229.66**	**-24,690.25**	**-66,203.79**	**-936,804.19**

Price per ton stumpage values were used to compute dollar values for respective product classes for 2007. Averages for the four major product classes were derived for the four quarters reported: Pine Sawtimber ($37.88/ton), Hardwood Sawtimber ($27.45/ton), Pine Pulpwood ($8.04/ton), and Hardwood Pulpwood ($5.53/ton). The respective dollar values by county and product class are shown in Table 5.3. The timber harvest deficit in question deprived this region of more than $32 million of economic activity in 2007.

Table 5.3. Value of timber harvest volume deficit from 2006 to 2007 for six-county study area in South MS.

County	*Pine Sawtimber ($37.88/ton)*	*Hardwood Sawtimber ($27.45/ton)*	*Pine Pulpwood ($8.04/ton)*	*Hardwood Pulpwood ($5.53/ton)*	***Total***
George	$149,891.16	($7,686.00)	$379,455.10	($22,380.50)	**$499,279.76**
Hancock	($7,374,939.40)	$33,947.38	($402,682.66)	($149,179.77)	**($7,892,854.44)**
Harrison	($6,831,443.33)	($24,980.22)	$782,639.73	$18,709.82	**($6,055,074.00)**
Jackson	($1,125,092.82)	($57,004.42)	($332,283.15)	($19,885.88)	**($1,534,266.27)**
Pearl River	($11,966,948.57)	($331,128.46)	($378,666.50)	($106,271.91)	**($12,783,015.44)**
Stone	($4,393,404.33)	$23,697.62	($246,972.13)	($87,098.71)	**($4,703,777.56)**
Total	**($31,541,937.30)**	**($363,154.10)**	**($198,509.61)**	**($366,106.94)**	**($32,469,707.95)**

Logger (Service Disruption)

A second model introduced a disruption in the wood supply system from a logger's position in the value chain. "Logger A" was an actual logging firm headquartered in Perry County, MS. Financial records for this logging firm were obtained for 2004 and linked with the 2004 IMPLAN data file for Perry County. The actual cash flow expenses for "Logger A" are detailed in Table 5.4.

Table 5.4. Actual 2004 annual cash flow expenditures for Perry County, MS logging firm ("Logger A").

Category	*Amount*
Gross Income	**$870,944**
Payroll Taxes	$21,496
Workers' Compensation Insurance	$25,000
Salaries and Wages	$176,349
Repair and Maintenance	$85,931
Taxes and Licenses	$28,325
Rent	$3,406
Interest	$28,325
Depreciation	$174,770
Advertising	$2,604
Donations	$3,755
Taxes - Other	$6,141
Contract Labor	$119,361
Dues	$91
Insurance	$56,989
Fuel	$152,955
Supplies	$36,523
Phone	$9,431
Utilities	$4,129
Postage	$1,000
Accounting Fees	$3,325
Total Operating Expenses	**$939,906**
Net Income	**($78,749)**

"Logger A" was a prominent member of his local community, had owned his business for over 25 years, and had over 40 years of logging experience. Unfortunately, "Logger A" is no longer in business and the 2004 cash flow figures represent one of the last years of business data. Approximate annual production for this firm in 2004 was 72,500 tons. This is an actual business casualty and the subsequent negative economic activity for Perry County, MS serves as a constant reminder of the importance of small business enterprises for local, rural economies.

Converting Mill (Manufacturing Disruption)

Winston County, MS is a community heavily dependent upon the manufacturing sector for employment opportunities. Like many small communities in the rural Southern US, a large percentage of the manufacturing sector is heavily centered on the forest products industry. The county received an economic boost in June 2002 with the announcement that Georgia-Pacific (G-P) would reopen its plywood facility in Louisville creating 200 jobs. This facility, initially opened in 1966, closed in December 2000 costing the region approximately 600 direct and indirect jobs (Jeter 2002).

The third wood supply model attempted to document the importance of the wood supply value chain by analyzing the impacts of this mill closure. This scenario assumed that the 2002 reopening of the Georgia-Pacific plywood facility in Louisville was essentially reversed and closed again during 2004. Such a scenario is entirely conceivable based on the history of closures for this particular mill, not to mention the common occurrence of forest-based mill shuttering throughout the Southern US during

the last decade. The 2004 Winston County, MS IMPLAN data file was selected and losses of 200 plywood manufacturing sector jobs were assumed to be a direct result of this closure.

IMPLAN Results and Discussion

The impact reports generated by IMPLAN contain three main sources of information. "Output Impact" is the single number that represents the value of an industry's total production. "Employment Impact" is the single number of jobs respective to each industry and includes both full-time and part-time employment figures. "Total Value Added Impact" contains four sub-components (Olson and Lindall 2004):

- Employee compensation – total payroll costs of each industry including benefits.
- Proprietary income – payment received by self-employed individuals as income.
- Other property type income – payment for rents, royalties, and dividends.
- Indirect business taxes – excise taxes, property taxes, fees, licenses, and sales taxes paid by businesses.

A listing for Sector 509 - "Owner-Occupied Dwellings" appeared as induced impacts for all three wood supply value chain models. This category is a special sector developed by the Bureau of Economic Analysis and essentially creates an industry out of home ownership. This sector estimates what home owners (or occupants) would pay if they rented rather than owned their homes, and also captures various expenses associated with home ownership such as repair and maintenance, construction, and

closing costs (Olson and Lindall 2004). Interest and mortgage payments are not considered a function for this sector.

The impact reports also included Sectors 25001 - "Foreign Trade" and 28001 - "Domestic Trade". The foreign trade figure represents a particular county's (or event study area's) share or contribution to the US total value of production (or service) that is exported. Similarly, the domestic trade figure will indicate the value of production (or service) that leaks from the study area but remains within US borders.

Caveat

The results generated by IMPLAN for the three wood supply value chain models should be used guardedly. First, the output generated could be considered "a worst case scenario", especially in regard to the loss of jobs reported in the employment impact section. The model calculates the number of jobs affected resulting from the requested change in industry demand. These numbers do not necessarily equate to the number of jobs lost. That is, the negative impact of these events adversely affects the local economy in such an amount that supports or equates to "x" number of jobs lost.

Furthermore, IMPLAN does not distinguish between those employees who re-gain employment in the same sector, become employed in another field entirely, or those who leave the region seeking employment elsewhere. Undoubtedly, some workers will eventually secure a job in the same region over time, some may temporarily draw unemployment until finding comparable work, and some will leave the region entirely pursuing employment elsewhere. The IMPLAN employment

impacts report the number of jobs affected stemming from an economic shock and assumes that these jobs are lost entirely. This assumption is not always accurate.

Landowner

Landowner impact results provided by IMPLAN can be deceiving. Accepting these figures at face value would signify that all of the economic impact attributed to the landowner from a timber harvest would reverberate throughout the study area. This assumption is incorrect. Although timber is an exclusive product or commodity produced in the six-county study area, thereby justifying the 100 % RPC factor, the landowner of record for these tracts of timber does not always reside in the region. A large portion of the economic impact for the wood supply system often leaks from the value chain through absentee landowners. Leakage will occur for the logger and mill segments of the value chain but the local region will benefit from some level of dollar turnover before escaping the community. Absentee landowners' proceeds often will not even enter the area, or only a small portion of the revenue will flow back to the county in the form of severance tax payment from the state.

An analysis of county landowner tax records for the six-county region in South Mississippi showed the prevalence of absentee landownership. Ownership was classified into three categories: private, corporate, and tax exempt. Table 5.5 shows the percentage of total acreage in each county within each ownership classification. Table 5.6 indicates the percentage of acreage which is registered to landowners residing within the six-county study area.

Table 5.5. Land ownership classification as a percentage of total acreage for six-county study area in South MS.

MS County	*Private*	*Corporate*	*Tax Exempt*	*Total*
George	49 %	41 %	10 %	**100 %**
Hancock	57 %	41 %	2 %	**100 %**
Harrison	30 %	63 %	7 %	**100 %**
Jackson	48 %	39 %	13 %	**100 %**
Pearl River	56 %	35 %	9 %	**100 %**
Stone	32 %	26 %	42 %	**100 %**

Table 5.6. Percentage of total acreage registered to owners residing in six-county study area in South MS.

MS County	*Private*	*Corporate*	*Tax Exempt*
George	84 %	45 %	63 %
Hancock	68 %	12 %	89 %
Harrison	97 %	29 %	68 %
Jackson	76 %	21 %	16 %
Pearl River	57 %	4 %	6 %
Stone	75 %	83 %	17 %

The diversity of land ownership in each respective county in the study area was evident. Some counties contain a high percentage of National Forests, some contain high percentages of corporate ownership, while most are predominately comprised of privately owned land. Also, varying degrees of absentee ownership was visible across the three ownership categories. A weighted mean for all ownership categories across the six-county area indicated that approximately 55 % of the total land base was registered to local landowners residing within the designated study region.

For simplification it was assumed that approximately one-half of all IMPLAN impacts computed for the landowner model can be ignored since these values will leak from the region in the form of absentee landowner income. Again the RPC selected for this model was 100 % based on a locally produced commodity. However, the impacts actually benefiting the region were about 50 % of those reported since the results are artificially inflated by treating all owners of timberland as local residents. Some benefits to the region will likely occur from absentee ownership, primarily in the form of severance taxes and payments in lieu of taxes (PILT). These figures are a small percentage of the actual revenue received by landowners. In fact, 2007 PILT payments for the six-county region only totaled $39,562 (National Association of Counties 2008).

Logger and Consuming Mill

The study areas for the logging firm, Perry County; and the mill closure, Winston County, are very small economies. Limiting the economic impacts of a scenario to a county-wide region is rather ambitious for event modeling. Olson and Lindall (2004) warned that small study areas tend to exhibit high levels of leakage.

Such analyses do have value but the impacts generated may not capture all economic linkages. In any event, the Southern US landscape is dotted with logging firms and forest products mills that are the epicenter of the local economy. The socioeconomic core of these counties and small towns erodes when such businesses struggle or fail. These timber dependent communities, and the small entrepreneurs that support them, deserve to have their story told even if the results are open to debate.

Landowner Model (Event Scenario1)

Sector 15- "Forest Nurseries-Forest Products-and Timber Tracts" was selected as the IMPLAN sector for impact analysis for this event. This industry sector is primarily engaged in the operation of timber tracts for the purposes of selling standing timber. The 936,804.19 ton shortfall from Mississippi's timber harvest from 2006 to 2007, a change largely resulting from the recovery of devastation caused by Hurricane Katrina and other past disturbances, served as the inspiration for this model. All figures for this model were reported in 2007 dollars. Table 5.7 provides an overview of the total impacts for the landowner scenario, as well as results for the logger and mill models discussed later.

Table 5.7. Overview of IMPLAN total impacts for three independent event scenarios on Mississippi's wood supply value chain.

Model		*Total Output*	*Total Value Added*	*Total Employment (Number of Jobs)*
Landowner	Direct	($35,314,041)	($11,363,389)	-59.8
	Indirect	($6,219,819)	($2,860,560)	-88.2
	Induced	($3,552,566)	($2,120,483)	-38.5
	Total (2007 Dollars)	**($45,086,424)**	**($16,344,431)**	**-186.5**
Logger	Direct	($940,000)	($117,674)	-1.9
	Indirect	($55,944)	($19,453)	-0.4
	Induced	($19,094)	($12,322)	-0.2
	Total (2004 Dollars)	**($1,015,038)**	**($149,449)**	**-2.5**
Mill	Direct	($38,371,029)	($6,904,242)	-114.1
	Indirect	($12,074,117)	($4,443,544)	-73.6
	Induced	($3,749,342)	($2,273,817)	-44.6
	Total (2004 Dollars)	**($54,194,489)**	**($13,621,603)**	**-232.3**

The immense amount of IMPLAN data generated by conducting three stand-alone and non-aggregated event scenarios necessitated truncating the sector listings and report expanded findings in an appendix format. Appendix A contains an abbreviated listing of the industries deemed by IMPLAN to have a significant impact for the landowner model. The total output for a select few of these industries for each model is shown in Table 5.8.

Table 5.8. IMPLAN industries reporting major output impacts for three event scenarios on Mississippi's wood supply value chain.

Model	*Industry(Sector)*	*Direct*	*Indirect*	*Induced*
Landowner ***(2007 Dollars)***	Logging (14)	($8,327,017)	($1,955,264)	($862)
	Timber (15)	($23,977,674)	($4,075)	$0
	Forestry Support (18)	$0	($2,033,287)	($225)
	Physician Offices (465)	$0	$0	($280,802)
	Owner-Occupied Dwellings (509)	$0	$0	($568,503)
Logger ***(2004 Dollars)***	Logging (14)	($427,892)	($42,452)	($4)
	Forestry Support (18)	$0	($4,052)	($1)
	Monetary Authorities (430)	$0	($2,471)	($1,253)
Mill ***(2004 Dollars)***	Logging (14)	$0	($6,370,885)	($943)
	Forestry Support (18)	$0	($583,882)	($2,359)
	Plywood Mills (115)	($21,890,638)	($1,566,584)	($1,683)
	Wholesale Trade (390)	$0	($1,071,295)	($280,270)
	Truck Transportation (394)	$0	($594,199)	($65,423)
	Hospitals (467)	$0	$0	($264,427)
	Owner-Occupied Dwellings (509)	$0	$0	($825,697)

Output Impact

This timber deficit deprived the southern-most six-county region of Mississippi of $45,086,424 of total economic output. Again, it should be noted that the values reported do not account for absentee landowners and are approximately double the actual impacts on the affected counties. In any event they are discussed as reported by IMPLAN since the reported values do accurately represent the dollar amount lost for the commodity produced in the study area, even if one-half of this value never enters the region.

The direct impact was calculated at ($35,314,041) while the indirect impact for this commodity shortage was ($6,219,819) as other industries adjusted to compensate for this shortfall. The induced or household spending shortfall was ($3,552,566). Table A.1 contains the total output by sector for this model. Only those sectors totaling ($75,000) or greater were tabulated.

It is interesting to note that pulp and paper mills, sawmills, and other forestry based manufacturing seem rather unaffected as a result of the 2007 timber supply decline. While the harvested timber would originate in the six-county region, most of the major markets or converting mills are located outside the area. Most mills were able to adjust by expanding the radius of their procurement zone, that is, going outside their traditional zone of operations to acquire enough wood inventory to meet demand.

Sector 14 – "Logging", ($10,283,143), would expectedly take the largest hit under this scenario. This value is very low considering approximately one-half to two-thirds, depending on the product class, of the delivered price goes to the logging contractor (as discussed in Chapter IV). It would be expected that the logging impacts should, at a minimum, be equal to the landowner's income from timber harvest. Most of the logging

firms that would provide their services if an actual harvest was to take place would likely come from within the study area. Sector 394 – "Truck Transportation" was also vastly underreported at ($99,291). The logging industry is heavily dependent on the contract trucking industry. The number of contract trucking firms needed to meet the demand for almost 1 million tons of additional harvest, approximately 40,000 loads, would greatly exceed the amount allocated to this sector by IMPLAN. Another interesting omission was Sector 18 – "Agriculture and Forestry Support" not receiving any direct impact as a result of this event. It stands to reason that consulting foresters and wood dealers in this area would see a significant reduction in revenue as a direct result of a timber harvest deficit.

Sector 430 -"Monetary Authorities and Depository Credit" also took a significant hit at ($234,008); as did "Commercial Machinery Repair and Maintenance" businesses ($98,253), which amounts to less than the cost of one used fellerbuncher for the entire six-county area. The "State/Local Government-Nondefense" shortfall of $2,743,304 should have included the deprivation of timber severance taxes and other local taxes.

The induced impacts linked to household spending and personal income changes offered some interesting results. The impact on Sector 465 – "Offices of Physicians and Dentists" ($280,802), Sector 467 –"Hospitals" ($111,218), and Sector 481 – "Food Services and Drinking Places" ($279,806) seem the most surprising; likely a result of unemployed workers leaving the region or curbing discretionary spending habits to compensate for reduced income.

Total Value Added Impact

The total value added shortfall for this scenario was calculated as ($16,344,431). The direct value added impact was ($11,363.389) while the indirect effects were reported as ($2,860,560). The induced value added shortage was determined to be ($2,120,483). Value added figures by sector are presented in Table A.2. Again, only those values exceeding ($75,000) are included in the table.

Sector 15 – "Forest Nurseries and Timber" (event impact sector) and Sector 14 – "Logging" exhibited the largest value added deficit at $8,914,649 and $3,025,852 respectively. Most of the other sectors also held form from the total output report to the value added report. Much of this impact was in the form of employee compensation and proprietor's income lost as result of the 936,804.19 ton timber harvest deficit in 2007. The "Power Generation and Supply" impacts were likely the result of a shortage of wood-based residual fuel burned at power plants to generate electricity. This value added deficit was $117,096.

Employment Impact

The employment impacts for this particular scenario indicated a negative effect on 186.5 jobs. Direct impacts accounted for 59.8 of this total, whereas indirect impacts accounted for 88.2 jobs of the total, and 38.5 jobs were attributed to the induced category. Table A.3 presents employment impact results but does not include those sectors with a total partial employment figure (less than 1.0).

Of note, "Timber Tracts", -29.1, and "Logging", -30.7, were the only sectors that revealed a direct employment impact. Indirectly, "Agriculture and Forestry Support

Activities", -53.0, indicated a strong negative employment impact as a result of this event. This sector includes timber cruising activities and the services of consulting forestry firms. A strong case could be made that these impacts should have been classified as direct. The induced impacts shown for "Food Services and Drinking Places", -6.1, were indicative of restaurants reducing labor to adjust for demand changes as personal income was reduced. Surprisingly, "Animal Production" ,-9.7, showed a strong negative response to the economic model. Many farmers are also engaged in timberland management. The continuing link between production forestry and agriculture may cause such a response.

Logger Model (Event Scenario2)

IMPLAN Sector 14 - "Logging" was selected as the sector for impact modeling depicting the logger's role in the wood supply value chain. All figures in this model were reported in 2004 dollars; the year the cash flow expenses were incurred and the year of the IMPLAN county file for Perry County, MS. "Logger A's" 2004 cash flow, $940,000, was used as the basis for the economic model. An abbreviated listing of industry impacts for this model is presented in Appendix B.

Output Impact

The total output impact resulting from "Logger A" going out of business was found to be ($1,015,038). The direct total output was split between the event sector (Sector 14 – "Logging") and the "Domestic Trade" sector. The total indirect impacts were reported as ($55,944). The total induced impact shortfall was $19,094. The total

output impact revealed that Perry County suffered an additional loss of $75,038, on top of the $940,000 loss of cash flow for "Logger A". Several sectors are included in Table B.1 for further discussion.

The amount of the direct output deficit allocated to the "Logging" sector was $427,892 while the "Domestic Trade" deficit was $506,912. The large value for Sector 28001 – "Domestic Trade" accounted for the high degree of leakage IMPLAN attributed to the "Logging" sector. A large portion of this expense includes fuel purchases which are often procured locally but with very little margin retained by local vendors. Equipment parts and supplies are also typically purchased within a short radius of the logging firm's home base yet a large percentage of this sale flows back to the Original Equipment Manufacturer (OEM).

Indirect impacts indicated that Sector 18 – "Agriculture and Forestry Support Activities", Sector 430 – "Monetary Authorities and Depository Credit", and Sector 485 – "Commercial Machinery Repair" were the most adversely affected sectors as a result of the defunct logging business. Some of indirect impacts seem unrealistically low. Sector 394 – "Truck Transportation" was only reported as ($299) while Sector 410 – "General Merchandise Stores" was reported as ($15). These expenses were certainly incurred by the logging firm and undoubtedly these types of expenditures were captured as direct impacts for the "Domestic Trade" sector, primarily a function of a small study area. Induced impacts were very similar to the previous event model. "Banks", "Hospitals", and Sector 509 – "Owner-Occupied Dwellings" revealed the largest impact from this event.

Total Value Added Impact

Table B.2 presents the total value added impacts for this event for select industries. The direct value added impacts were ($117,674), all allocated to the "Logging" sector. The indirect impacts totaled ($19,453) while the induced impacts amounted to ($12,322). Most of the value added direct impact includes the loss of employee income for the business and the proprietor's income for the business owners. Both of these values are very low considering the payroll obligations for a multi-million dollar business, not to mention the officers' salaries for the owner-operators of the business.

Employment Impact

The total employment impact for the logging scenario was -2.5 jobs. Direct impacts accounted for -1.9 jobs, all in the "Logging" sector. The indirect impacts totaled -0.4 jobs, with the remaining employment void attributed to induced impacts from the event scenario. The IMPLAN results drastically underestimated the actual employment impacts resulting from the termination of this business. A total of 10 employees were actually drawing income from this business: 4 in-woods workers, 4 truck drivers, and 2 officers or business owners. The small study area should have little impact on these results. Typical logging firms hire from a shallow labor pool, the radius of which does not extend very far from the shop itself. Almost all employees live in the local community and spend their income in the local economy. IMPLAN generated employment impacts for this particular model seems very low considering the background demographic knowledge of the actual business and its ownership.

Mill Model (Event Scenario 3)

IMPLAN Sector 115 – "Veneer and Plywood Manufacturing" was selected for impact modeling depicting the role of the consuming mill in the wood supply value chain. Georgia-Pacific's June 2002 hiring of 200 employees for the reopening of the plywood mill in Louisville, MS served as the basis for this model. The scenario involved another shutdown of this facility in 2004 eliminating the 200 jobs created two years earlier. All impacts were reported in 2004 dollars. Appendix C contains an abbreviated listing of the industries reporting significant impacts for this model.

Output Impact

The total output impact of closing the G-P plywood plant resulted in a total deficit of $54,194,489 in direct, indirect, and induced impacts. The direct impact totaled ($38,371,029), indirect impacts accounted for ($12,074,117), and induced impacts were found to be ($3,749,342). Select sectors are presented in Table C.1.

The direct output impact was allocated among three sectors; Sector 115 –"Veneer and Plywood Manufacturing", the selected sector for modeling, Sector 25001 –"Foreign Trade", and Sector 28001 – "Domestic Trade". The indirect output of this event significantly affected the "Logging" sector indicating almost a $6.4 million deficit as a result of the mill closure. Knowledge of the wood supply value chain would suggest that the closure of a major forest products facility in the county would directly impact the "Logging", "Agriculture and Forestry Support", and "Truck Transportation" sectors. Much of these direct impacts will leak from the region and be allocated to the "Domestic Trade" sector. However, some level of impact should remain local. Sector 390 –

"Wholesale Trade" incurred slightly more than a $1 million deficit in indirect impact from this event. "Truck Transportation", Sector 394, also suffered from the mill closure with an indirect impact deficit of $594,199. As previously stated, some of this value should have been classified as direct impacts from the mill closure.

The induced output impacts for the mill closure significantly impacted the "Wholesale Trade" sector indicating an impact of ($280,270). Sectors 430 – "Monetary Authorities and Depository Credit" and 509 – "Owner-Occupied Dwellings" indicated a high degree of induced impacts revealing figures of ($153,381) and ($825,697), respectively.

Total Value Added Impact

The total value added impact for the mill scenario revealed a deficit of ($13, 621,603). The direct value added impacts totaled ($6,904,242), the indirect impacts totaled ($4,443,544), and the induced impacts were found to be ($2,273,817). Table C.2 presents the value added impacts for several selected sectors.

The event sector (115) was the only IMPLAN sector showing a direct value added impact. The indirect value added impacts essentially mirrored the indirect output impact for the affected sectors. Sector 112 – "Sawmills" and Sector 114 – "Reconstituted Wood Product Manufacturing" faced deficits of $20,597 and $200,704, respectively, as these sectors would have made adjustment to the changes in demand as a result of the plywood mill closure. Sector 30 – "Power Generation and Supply" revealed an indirect value added impact of ($140,997), indicative of the removal of a mill heavily dependent on electric power from the power grid. All three transportation sectors revealed impacts,

especially the "Truck Transportation" sector. The induced value added impacts were similar to those of the other event models.

Employment Impact

The employment impacts for the mill event included direct impacts of -114.1 jobs, indirect impacts of -73.6 jobs, and induced impacts of -44.6 jobs. The total employment impact for this scenario equated to -232.3 jobs, roughly an additional deficit equivalent to the average salaries of 32 more jobs, in addition to the 200 job losses used as the basis for the model. The employment impacts are shown in Table C.3. Partial employment impacts (less than one) were not tabulated.

The direct employment impacts revealed by IMPLAN are surprising. To generate the event model, 200 jobs were removed from Sector 115 – "Veneer and Plywood Manufacturing". However the employment output indicated that only 114.1 jobs were lost directly as a result of the mill closure. Additionally, 8.2 jobs were lost as an indirect impact of the closure. These employment findings seem confusing and, like the logger's model, raise suspicion about the reliability of IMPLAN employment output.

As expected for indirect employment impacts, Sector 14 – "Logging", took a hit suffering from a loss of 29.8 jobs. "Wholesale Trade" and "Truck Transportation" were indirectly impacted by this event, totaling -4.0 and -5.2 jobs respectively. Significant induced employment impacts included: Sector 410 – "General Merchandise Stores", -2.3 jobs; Sector 465 – "Offices of Physicians and Dentists",-2.4 jobs; Sector 467 – "Hospitals", -3.0 jobs; Sector 470 – "Social Assistance – Except Child Day Care Services", -2.5 jobs; , and Sector 481 – "Food Services and Drinking Places", -4.4 jobs.

Summary of Models

Generally speaking the economic impacts generated for the three models are debatable, especially on a micro level. IMPLAN results failed to document or trace the direct impacts throughout the complete wood supply system. It appeared to have underestimated the effects on at least the local or regional level of timber production. Also underestimated was the contribution of the wood supply sector, perhaps being most accurate for the impacts of the manufacturing sector.

Leakage from the region definitely contributed to the undervalued statistics; however, some degree of direct impacts should be properly allocated to the direct stakeholders in the value chain. The employment statistics for the logger model and the mill closure model are definitely open for deliberation. In any event these impacts, although underestimated, are still quite valuable to illustrate the complexity of the system. It is also important to know how many sectors, seemingly deemed irrelevant, were indirectly affected by a series of adverse events inflicted on direct stakeholders in the wood supply system.

The landowner model revealed the crux of the misunderstanding of the wood supply value chain. The model failed to document the scope of the direct impacts among the stakeholders in the system. Many impacts allocated to the "Logging" sector, the "Agriculture and Forestry Support" sector, and the "Truck Transportation" sector were undervalued based on knowledge of how the system actually operates and most of these values were allocated to the indirect category when they were, in fact, directly influenced by the disruption presented in the model. The real question is whether this was the result of a minor economic event from a regional or national perspective or was it a function of

shortcomings in the data collected and the model derived from these data. The most likely cause is the shortcomings of the Department of Commerce data collection procedures and the fact that both timber production and logging are small businesses found in rural areas.

The logger model impacts are the most questionable overall, largely a result of limiting the selected economy to a county-wide region. IMPLAN did not seem to adequately depict the actual loss of economic activity suffered by the loss of a logging firm. Removing almost $1 million of economic activity from the Perry Co., MS economy should, in turn, result in more indirect impacts than reported by IMPLAN.

Furthermore, the employment impacts seem to be the most perplexing results generated, especially for the logging model and the mill closure model. For the logging model, IMPLAN indicated a negative direct employment impact of approximately 2 jobs and employee compensation impacts of ($46,932) and proprietors' income of ($16,243). These results were staggering considering "Logger A" employed 10 full-time employees, including the 2 officers tasked with business ownership. The actual employment void from losing this business was significantly more dramatic than reported by IMPLAN.

The subsequent loss of employee compensation and proprietors' income reported was also drastically underreported. Traditionally the logging sector depends heavily on the contract trucking industry to deliver the raw material to the appropriate point of manufacture. Trucking, with the recent increases in fuel prices, accounts for approximately one-half or more of the logging and delivery expenditures. IMPLAN largely ignored the "Truck Transportation" sector for the model scenarios used in these analyses. This omission further acknowledges the ongoing misunderstanding of the

logging industry in general, and more importantly, its role and importance to the wood supply value chain.

The employment statistics for the mill closure scenario were also perplexing. To replicate the plywood mill closure, 200 jobs were removed from the appropriate sector to generate the model. The IMPLAN impact results however reported only 114 jobs were adversely affected as a direct result of the plywood mill closure. An assumption that 40 % of those laid-off could find comparable jobs at comparable wages in a small, rural community seems very optimistic. These findings lead one to seriously question the validity of the employment impacts generated by IMPLAN predictive models. The indirect employment impacts for the mill closure seem to trend as expected. This model also experienced the same dilemma presented in the other models with regard to its failure to document all of the direct impacts stemming from the mill closure and tracing these influences throughout the entire value chain.

The regional purchase coefficients (RPC's) selected for impact analysis are critical to achieve proper results. The IMPLAN default RPC's used for both industry based models, logging firm and mill closure, seem artificially low. Conversely, using 100 % local for these scenarios would be too high since not all inputs are procured locally or within the targeted study area. As a result of using the low IMPLAN RPC's, the impact output contained a higher than pragmatic leakage factor. An RPC figure somewhere between the IMPLAN default figure and 100 % local is likely a more accurate statistic for future wood supply modeling.

Hurricane Katrina – Effects on the Wood Supply System

The three IMPLAN scenarios presented are stand-alone models representing the primary stakeholders in the wood supply system. Each scenario, as previously stated, was based on real events and the impacts reported adversely affected the local economies in the areas in which they occurred. This process was selected to make accurate impact assumptions about each model. The impacts for the isolated events will be used to attempt to better understand the impacts of Hurricane Katrina on the entire wood supply system. Unraveling the system and isolating the major components for analysis is important; reassembling the system, tying it all together, and providing a complete and accurate depiction of the entire system is imperative. The wood supply system, and its value chain, is much larger than the independent units comprising the framework. A proper approach is to view the entire system as a cohesive structure instead of stand-alone units.

Landowner

The impacts confronting the forest landowner in the aftermath of Hurricane Katrina are relatively straightforward. The timber harvest deficit of 936, 804.19 tons, representing $32.5 million, for the six-county area could be considered a reasonable starting point. This is an accurate figure for the total loss of timber value for the region. It should be noted that the high occurrence of absentee landowners, as discussed earlier, would drastically affect any subsequent impact analysis and resulting values should be adjusted accordingly. For a region, such as the Southern US, where the ownership of forest land is a variable mix of private (occupant and absentee), institutional corporate

and investment companies, and governmental (county, state, and federal), the leakage from the region through payments to owners outside the area studied should be better defined. The contribution might be accurate at a national or global level but may provide misleading guidance for regional and local planners. In any event Hurricane Katrina can be viewed as afflicting a $32.5 million direct impact to affected landowners in the Southern-most six-county region of Mississippi.

Logger

Although "Logger A" resides in Perry County, MS, one could assume that his firm is located in the study area used for the landowner model for the purpose of standardizing the results for Katrina-related damage. "Logger A" is a typical medium-sized logging firm prevalent across Southern Mississippi. Using the tonnage deficit reported for the six-county region and annual statistics exhibited by "Logger A", a reasonable damage estimate can be calculated.

Approximately 13 logging firms with a similar production capacity to "Logger A" would lose an entire year of production as a direct result of the harvest deficit attributed to Hurricane Katrina in the six-county area hit hardest by the storm. Furthermore, approximately $13 million of annual cash flow expenses for impacted logging firms would disappear from the regional economy. This initial impact would continue to ripple throughout the value chain leading to millions more in indirect impacts. The employment impacts for such an event would equate to 100-150 jobs adversely affected by the storm. The total impact would greatly exceed the $13 million in initial damage. A conservative estimate could also be based on the value of affected timber. As previously discussed,

the logging and transportation sector traditionally represents approximately one-half to two-thirds of the total economic contributions for a timber harvest. This approach would place damage estimates for the logging sector in the $32 - $42 million range.

Converting Mill

Again, the G-P plywood mill used in the IMPLAN model is located outside the study area used for Katrina related damage estimates. This facility will be assumed to be within the borders of the six-county study area for the purpose of estimating Katrina-related disruptions on the normal day-to-day operations of this mill. The harvest deficit will once again be used as the foundation for this approach.

Although much of the timber void affected pine and hardwood sawtimber, products which would traditionally not be destined for a plywood facility, the overall deficit is useful for this approach. The plywood mill's annual timber consumption during 2005 was approximately 450,000 tons. The timber supply disruption caused by Hurricane Katrina in South Mississippi would essentially take this facility off-line for a little more than two years. Another view could be that two forest products facilities with a similar demand for wood fiber would be shuttered for an entire year after the storm. The 200 employee model generated by IMPLAN, with $21.9 million in direct output impact for the plywood sector, could be doubled to compensate for a disruption of 400 mill employees. This approach would estimate Katrina-related direct impacts for the mill in the $45 million range; bringing the total wood supply system estimate well over the $100 million range in direct impacts for the six-county region in South Mississippi. The indirect and induced impacts that would continue to cascade throughout the complex

value chain for the entire wood supply system would be significantly higher, although it is very difficult to pinpoint an exact damage estimate using this approach.

Conclusion

IMPLAN is a valuable predictive instrument for economic impacts but does have limitations. Like any model, its performance is a function of the assumptions and tools used in development and the data upon which it is based. The software does perform admirably in many applications and serves a critical role in aiding policy and economic development decision making. However, for the purposes of this study some impact results are hard to justify and/or explain. It is interesting to note that the closure of a mill employing 200 people resulted in a loss of 232 jobs, 116 % of the direct employee loss, while the closure of a logging business employing 10 people resulted in a loss of 2.5 jobs, only 25 % of the actual jobs affected. These impacts should be in better agreement if the model is to be trusted.

The nature of the wood supply system, and the intricacies of the stakeholders comprising its value chain, reveal some of the deficiencies of using this tool for micro level analyses on small study areas. IMPLAN will likely present a more accurate representation and portrayal of socioeconomic interactions among industrial sectors for state and multi-state economies, especially using an aggregated approach. This study supports the need for a more industry specific input-output model, one which can better document the economic flows in rural settings.

The wood supply system is complex as a stand-alone entity, including the corresponding value chain further adds to the intricacy of the model. IMPLAN is

typically the only system used to assign values to the forest products industry and gauge the impacts of an economic stimulus or disruption. Overall IMPLAN can serve a valuable purpose. Its limitations have already been documented and the impacts resulting from event scenarios should certainly be used guardedly. It is a good economic tool but is far from gospel and should be treated as such.

Critical observers could question the motive of limiting a complex economy to such a small size. Why not generate impact analyses for the entire state of Mississippi instead of a county-wide or multi-county region? Simply stated, because the objective of this research was to analyze small economies within the state level. People live and work locally and most economic development activities occur on a local or multi-county level. It is paramount to understand how socioeconomic impacts, both positive and negative, are distributed throughout the wood supply value chain. The state economy can better absorb the loss of a defunct logging business and has more capacity to overcome the ill effects of shuttering an industrial plant than does a rural county. The wood supply system is comprised of a myriad of such counties and it is imperative to understand how a disruption, deemed trivial on a state-wide level, can devastate many sectors comprising a local economy.

The chaos left in the aftermath of Hurricane Katrina provided and excellent opportunity to advance our understanding of how the wood supply system operates and the scope of its value chain. The damage was catastrophic enough to strip the entire system to its bare core, revealing the internal structure for analysis. All too often each component is discussed in detail as if it operated in a vacuum with little emphasis placed on understanding how everything fits together in one cohesive unit. Damage estimates

attributed to the storm have varied considerably. This attempt tried to go a step beyond the initial damage suffered by forest landowners in South Mississippi and estimate the adverse socioeconomic impacts dealt the other major stakeholders in the wood supply system. The post-Katrina socioeconomic impacts for Mississippi's wood supply system, as portrayed through the entire value chain, are more complex and widespread than many contend.

The impacts of Hurricane Katrina on the southern-most six-county study area in Mississippi were dramatic. The decreased harvest volume attributed to the storm deprived affected forest landowners, either absentee or area residents, of $32.5 million of landowner income. The 936,804.19 ton volume deficit equated to the average annual production capacity of 13 medium-sized independent logging firms, depriving the study region of approximately $45 million of economic activity and 130 jobs. Furthermore, this timber volume deficit also constituted the annual wood fiber demand for two plywood mills. If two such forest products firms were shuttered for an entire year, the direct impacts would affect 400 employees and deprive the region of approximately $42 million of economic activity. Overall, the total direct economic impacts of Hurricane Katrina on the six-county study area in South Mississippi are estimated at approximately $120 million. Ensuing indirect and induced impacts caused by the storm would significantly increase these damage estimates. In fact, the total economic devastation attributed to Hurricane Katrina on the wood supply system, and its value chain, is difficult to gauge and will not be known for years to come.

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CHAPTER VI

CONCLUSION

The wood supply system is a dynamic and complex structure. From the outside it can appear to be a simple, straightforward economic process. Like most simple constructs, it becomes more complex as one learns more about its structure and functioning. Traditionally, key components of the system have been treated as stand-alone entities with very little regard to the performance of the overall system. Previous research efforts have focused on depicting the role of the forest landowner and the wood consuming mill. The center component, the logging contractor, has usually been viewed as a service provider and largely ignored.

A value chain approach is an excellent tool to examine the primary stakeholders' contributions to the wood supply system. All three major participants have an investment in the process and the financial stability of each is crucial for the system to function properly. Many rural communities across the Southeastern US are heavily dependent on production forestry. When the logging industry suffers, so does the livelihood of these communities and their citizenry.

Examining several key long-term trends in the logging profession reveals that the logging profession has reached a defining moment. It is crucial that appropriate measures

be taken to prevent a fundamental collapse of this sector. Outsourcing key components of operations has drastically increased over the last decade. Furthermore, payment for services has increasingly failed to adequately keep pace with operating expenses and skilled labor is difficult to attract when wages fail to keep up with inflation. Fuel prices continue to skyrocket, with no relief in the foreseeable future, and a myriad of survival techniques implemented by business owners to combat the problems facing the industry have proven futile.

Cash flow analyses from logging firms reinforce the point that much of the economic activity generated by the wood supply value chain remains in the local community. The resulting dollar turnover is high and the economic benefits expand exponentially as the populace continues to frequent community establishments and support local vendors. These socioeconomic impacts are undoubtedly a boon to timber dependent communities yet usually do not garner the attention praised on more glamorous professions with higher leakage factors.

The wood supply system, with logging serving as its core, is virtually an invisible industry and is in dire need of an image makeover. The policy confusion over whether production forestry is a manufacturing entity or an agricultural entity means that it may be left out of both censuses. The simple fact that log trucks in many states are allowed permitted weights over the federal 80,000 pound limit on interstates causes log trucks to travel on state and federal non-interstate routes, often escaping notice in the census of transportation. The rural, mobile nature of logging businesses, essentially local micro-businesses in today's economy, also contributes to the anonymity.

Hurricane Katrina ripped through the heart of Mississippi in August of 2005, leaving a devastating wake of destruction. Forestry was targeted as one of the most hardest hit industries yet most attention focused on damage to standing timber and subsequent compensation to affected forest landowners. Such discussion was vital and property owners were certainly deserving of reparation. However, the effects of Hurricane Katrina on the all the participants in the wood supply system, and more importantly, on the ability of the system to function properly was almost an afterthought. This oversight served as the inspiration for introducing a disruption to each direct participant in the wood supply system with the goal of better comprehending how the socioeconomic impacts flowed through the corresponding value chain.

IMPLAN is arguably the standard bearer for economic impact modeling in the forestry sector. The IMPLAN generated results for each model did not adequately represent the actual negative impacts suffered by the value chain when compared with existing external data and specific knowledge of industry interactions. Direct impacts were routinely categorized as indirect and several key sectors were virtually ignored. Absentee landownership, which is high in South Mississippi, was a non-issue for IMPLAN analysis. Much of the economic impact allocated to landowners by IMPLAN may never enter Mississippi or will leave the local economy before making any significant contribution. The employment impacts calculated by IMPLAN were especially baffling for the logger model and the mill closure model. The logging sector impacts were especially undervalued on several occasions.

Future research should focus on developing an input-output system that is industry specific and better designed to document the socioeconomic impacts for single

or multi-county, rural economies. IMPLAN is a valuable software tool for many applications but its limitations become apparent when examining small study areas, especially on a sector by sector basis. Analysts should consider this factor when basing decisions on IMPLAN data involving small study areas, especially with regard to policy making.

It is also paramount to continue research that monitors the health and status of the logging profession and reports this information to the wood consuming industry. Logging business owners are the heart and soul of the wood supply system. They have few people championing their cause and lack an adequate forum to address industry related issues and concerns. They are entrepreneurs in every sense of the word. They own and operate multi-million dollar businesses, heavily support local vendors, and hire from within the local community. Their revenue stream is the framework for the wood supply value chain. These socioeconomic impacts are critical for many timber dependent communities that dot the southern landscape.

The current prognosis for the logging sector is weak; many businesses have succumbed to the pressures of rising costs, razor-thin profit margins, and administrative inefficiencies beyond the control of logging contractors. The wood supply system has the vice of transferring problems to other participants within the system, instead of addressing disconcerting issues head on. This practice, while convenient for some participants, has resonated throughout the wood supply system causing existing problems to fester; eventually leading to new, more complex problems. It is imperative to improve the overall climate of the wood supply system, and ensure the survival of value chain

stakeholders, if our nation's timber industry is to remain competitive in an increasingly competitive global business environment.

APPENDIX A

IMPLAN IMPACTS FOR SELECTED INDUSTRIES:

TIMBER DISRUPTION MODEL

Table A.1. IMPLAN output impact for timber tract disruptive event for six-county study area in South MS (2007 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
13	Animal Production	$0	($185,850)	($2,201)	($188,051)
14	Logging	($8,327,017)	($1,955,264)	($862)	($10,283,143)
15	Timber	($23,977,674)	($4,075)	$0	($23,981,748)
18	Forestry Support	$0	($2,033,287)	($225)	($2,033,513)
30	Power Generation	$0	($60,500)	($112,268)	($172,768)
142	Petroleum Refineries	$0	($327,955)	($100,263)	($428,218)
390	Wholesale Trade	$0	($144,905)	($91,829)	($236,733)
394	Truck Transportation	$0	($50,903)	($48,388)	($99,291)
401	Vehicle Parts	$0	($35,494)	($117,566)	($153,059)
404	Building & Garden supply	$0	($23,342)	($54,015)	($77,357)
405	Food Stores	$0	($23,597)	($69,647)	($93,244)
410	General Merchandise Stores	$0	($38,406)	($80,773)	($119,179)
422	Telecommunications	$0	($29,120)	($81,402)	($110,522)
430	Monetary Authorities	$0	($118,722)	($115,286)	($234,008)
431	Real Estate	$0	($47,835)	($130,282)	($178,117)
437	Legal services	$0	($41,272)	($54,470)	($95,742)
439	Architectural & Engineering Design	$0	($68,136)	($8,976)	($77,112)
465	Offices of Physicians & Dentists	$0	$0	($280,802)	($280,802)
467	Hospitals	$0	$0	($111,218)	($111,218)
481	Restaurants	$0	($7,432)	($272,374)	($279,806)
483	Auto Repair	$0	($103,870)	($83,995)	($187,865)
485	Equipment Repair	$0	($95,514)	($2,738)	($98,253)
509	Owner-Occupied Dwellings	$0	$0	($568,503)	($568,503)
11001	Federal Gov't-non defense	($266,046)	$0	$0	($266,046)
12001	State/local Gov't-non education	($2,743,304)	$0	$0	($2,743,304)

Table A.2. IMPLAN total value added impact for timber tract disruptive event for six-county study area in South MS (2007 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
14	Logging	($2,450,255)	($575,344)	($254)	($3,025,852)
15	Timber	($8,913,134)	($1,515)	$0	($8,914,649)
18	Forestry Support	$0	($1,302,961)	($144)	($1,303,106)
30	Power Generation	$0	($41,005)	($76,091)	($117,096)
390	Wholesale Trade	$0	($99,051)	($62,771)	($161,822)
401	Vehicle Parts	$0	($21,824)	($72,286)	($94,110)
430	Monetary Authorities	$0	($90,758)	($88,131)	($178,889)
431	Real Estate	$0	($33,485)	($91,197)	($124,681)
465	Offices of Physicians & Dentists	$0	$0	($202,991)	($202,991)
481	Restaurants	$0	($3,207)	($117,544)	($120,752)
483	Auto Repair	$0	($54,681)	($44,218)	($98,900)
509	Owner-Occupied Dwellings	$0	$0	($466,475)	($466,475)

Table A.3. IMPLAN employment impact for timber tract disruptive event for six-county study area in South MS (Number of Jobs).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
11	Cattle Ranching	0	-1.3	0	-1.3
13	Animal Production	0	9.7	-0.1	-9.8
14	Logging	-30.7	-7.2	0	-37.9
15	Timber	-29.1	0	0	-29.1
18	Forestry Support	0	-53.0	0	-53.0
390	Wholesale Trade	0	-1.2	-0.7	-1.9
401	Vehicle Parts	0	-0.4	-1.2	-1.6
404	Building & Garden Supply	0	-0.3	-0.7	-1.0
405	Food Stores	0	-0.4	-1.3	-1.7
408	Clothing Stores	0	-0.3	-0.8	-1.1
410	General Merchandise Stores	0	-0.7	-1.5	-2.2
411	Misc. Store Retailers	0	-0.2	-0.9	-1.1
412	Nonstore Retailers	0	-0.5	-0.5	-1.0
430	Monetary Authorities	0	-0.8	-0.8	-1.5
431	Real Estate	0	-0.5	-1.2	-1.7
437	Legal Services	0	-0.4	-0.5	-1.0
465	Offices of Physicians & Dentists	0	0	-2.5	-2.5
467	Hospitals	0	0	-1.1	-1.1
468	Nursing & Residential Care	0	0	-1.1	-1.1
481	Restaurants	0	-0.2	-6.1	-6.3
483	Auto Repair	0	-1.3	-1.1	-2.4
493	Professional Organizations	0	-0.1	-0.9	-1.0
494	Private Households	0	0	-1.2	-1.2
496	Other Federal Gov't Enterprise	0	-0.3	-1.0	-1.2

APPENDIX B

IMPLAN IMPACTS FOR SELECTED INDUSTRIES:

LOGGER DISRUPTION MODEL

Table B.1. IMPLAN output impact for logging disruptive event: "Logger A", Perry County, MS (2004 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
14	Logging	($427,892)	($42,452)	($4)	($470,348)
18	Forestry Support	$0	($4,052)	($1)	($4,054)
30	Power Generation	$0	($381)	($514)	($895)
107	Apparel Manufacturing	$0	($1)	($820)	($822)
112	Sawmills	$0	($455)	($13)	($468)
394	Truck Transportation	$0	($299)	($183)	($483)
405	Food Stores	$0	($17)	($546)	($563)
407	Gas Stations	$0	($17)	($407)	($424)
422	Telecommunications	$0	($578)	($541)	($1,119)
425	Nondepository Credit	$0	($464)	($96)	($561)
430	Monetary Authorities	$0	($2,471)	($1,253)	($3,724)
465	Offices of Physicians & Dentists	$0	$0	($828)	($828)
467	Hospitals	$0	$0	($1,830)	($1,830)
468	Nursing & Residential Care	$0	$0	($634)	($634)
483	Auto Repair	$0	($627)	($282)	($908)
485	Equipment Repair	$0	($1,569)	($9)	($1,578)
499	Other State & Local Gov't Enterprises	$0	($111)	($455)	($566)
509	Owner-Occupied Dwellings	$0	$0	($6,705)	($6,705)
25001	Foreign Trade	($5,196)	$0	$0	($5,196)
28001	Domestic Trade	($506,912)	$0	$0	($506,912)

Table B.2. IMPLAN total value added impact for logging disruptive event: "Logger A", Perry County, MS (2004 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
14	Logging	($117,674)	($11,675)	($1)	($129,350)
18	Forestry Support	$0	($2,329)	($1)	($2,330)
30	Power Generation	$0	($258)	($348)	($607)
107	Apparel Manufacturing	$0	$0	($279)	($279)
405	Food Stores	$0	($8)	($278)	($286)
407	Gas Stations	$0	($11)	($266)	($277)
422	Telecommunications	$0	($292)	($273)	($565)
425	Nondepository Credit	$0	($294)	($61)	($355)
430	Monetary Authorities	$0	($1,889)	($958)	($2,847)
465	Offices of Physicians & Dentists	$0	$0	($575)	($575)
467	Hospitals	$0	$0	($860)	($860)
468	Nursing & Residential Care	$0	$0	($358)	($358)
483	Auto Repair	$0	($321)	($144)	($466)
485	Equipment Repair	$0	($973)	($6)	($979)
509	Owner-Occupied Dwellings	$0	$0	($5,502)	($5,502)

APPENDIX C

IMPLAN IMPACTS FOR SELECTED INDUSTRIES:

MILL DISRUPTION MODEL

Table C.1. IMPLAN output impact for mill disruptive event: G-P Plywood Mill, Louisville, MS (2004 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
14	Logging	$0	($6,370,885)	($943)	($6,371,828)
18	Forestry Support	$0	($583,882)	($2,359)	($586,242)
30	Power Generation	$0	($208,032)	($86,247)	($294,279)
112	Sawmills	$0	($64,339)	($1,527)	($65,866)
114	Reconstituted Wood Product Manufacturing	$0	($387,858)	($876)	($388,734)
115	Plywood Mills	($21,890,638)	($1,566,584)	($1,683)	($23,458,906)
390	Wholesale Trade	$0	($1,071,295)	($280,270)	($1,351,565)
392	Rail Transportation	$0	($114,850)	($9,740)	($124,590)
393	Water Transportation	$0	($14,930)	($8,962)	($23,893)
394	Truck Transportation	$0	($594,199)	($65,423)	($659,622)
430	Monetary Authorities	$0	($129,910)	($153,381)	($283,292)
509	Owner-Occupied Dwellings	$0	$0	($825,697)	($825,697)
25001	Foreign Trade	($7,012,203)	$0	$0	($7,012,203)
28001	Domestic Trade	($9,468,188)	$0	$0	($9,468,188)

Table C.2. IMPLAN total value added impact for mill disruptive event: G-P Plywood Mill, Louisville, MS (2004 Dollars).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
14	Logging	$0	($1,521,371)	($225)	($1,521,596)
18	Forestry Support	$0	($437,955)	($1,769)	($439,724)
30	Power Generation	$0	($140,997)	($58,455)	($199,452)
112	Sawmills	$0	($20,597)	($489)	($21,086)
114	Reconstituted Wood Product Manufacturing	$0	($200,704)	($453)	($201,157)
115	Plywood Manufacturing	($6,904,242)	($494,096)	($531)	($7,398,869)
390	Wholesale Trade	$0	($732,296)	($191,582)	($923,878)
392	Rail Transportation	$0	($70,925)	($6,015)	($76,940)
393	Water Transportation	$0	($5,410)	($3,247)	($8,657)
394	Truck Transportation	$0	($267,070)	($29,405)	($296,475)
430	Monetary Authorities	$0	($99,311)	($117,253)	($216,564)
509	Owner-Occupied Dwellings	$0	$0	($677,510)	($825,697)

Table C.3. IMPLAN employment impact for mill disruptive event: G-P Plywood Mill, Louisville, MS (Number of Jobs).

IMPAN Sector	Sector Name	Direct	Indirect	Induced	Total
13	Animal Production	0	-1.7	-1.1	-2.8
14	Logging	0	-29.8	0	-29.8
18	Forestry Support	0	-10.1	0	-10.2
30	Power Generation	0	-0.7	-0.3	-1.0
114	Reconstituted Wood Product Manufacturing	0	-1.6	0	-1.6
115	Plywood Mills	-114.1	-8.2	0	-122.3
390	Wholesale Trade	0	-4.0	-1.0	-5.0
394	Truck Transportation	0	-5.2	-0.6	-5.7
401	Vehicle Parts	0	-0.1	-1.7	-1.8
404	Building & Garden Supply	0	-0.1	-0.9	-1.0
405	Food Stores	0	-0.1	-1.3	-1.4
408	Clothing Stores	0	-0.1	-0.9	-1.0
410	General Merchandise Stores	0	-0.2	-2.3	-2.4
411	Misc. Store Retailers	0	-0.1	-1.3	-1.4
430	Monetary Authorities	0	-0.9	-1.0	-1.9
437	Legal Services	0	-0.3	-0.7	-1.0
438	Accounting & Bookkeeping Services	0	-0.7	-0.3	-1.0
451	Management of Companies & Enterprises	0	-0.9	-0.2	-1.1
465	Offices of Physicians & Dentists	0	0	-2.4	-2.4
467	Hospitals	0	0	-3.0	-3.0
470	Social Assistance – Except Child Day Care Services	0	0	-2.5	-2.5
479	Hotels	0	-0.5	-0.8	-1.3
481	Restaurants	0	-0.9	-4.4	-5.3
483	Auto Repair	0	-1.6	-1.6	-3.3
493	Professional Organizations	0	-0.5	-1.3	-1.8
494	Private Households	0	0	-2.4	-2.4