TRENDS AND DIVERSIFICATION IN THE FACTORY-BUILT HOME INDUSTRY

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
In
Forest Products

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November, 19th. 2009
Blacksburg, Virginia

Keywords: Factory-Built Home Industry, Manufactured Housing, Market Share, Diversification, Strategy

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ABSTRACT

The factory-built housing industry, while originating from mobile homes, has seen new industry-segments emerge such as, for example, modular, panelized, and pre-cut homes. These new segments have promoted the ability of existing producers to diversify. As producers of factory-built homes merge their production capabilities amongst these industry-segments the structure and the capacity of the industry is profoundly changing. This study looks at both the manufactured home industry-segment as well as the entire factory-built home industry to analyze how the current state of the industry is positioned to drive these foreseeable changes.

Analysis of the manufactured home industry-segment is highlighted by econometric modeling of market share data across manufactured housings' product life-cycle curve. Results of this modeling mimic three periods of product life cycle change that ends with the current market share decline. Being so, it is concluded that manufactured housing firms are currently seeking fight or flight strategies to combat deepening market share losses. Producers of manufactured housing who persist in this industry-segment will confront mounting consolidation whereas producers who flee are likely to undergo strategic transformations.

A mail questionnaire alternatively targeted the U.S. factory-built home industry to assess how diversification currently impacts industry structure and market share positioning. Results of this questionnaire reveal that two-product producers are strategically diversifying to hedge current demand fluctuations in the U.S. residential home market while also promoting market share positions. As a result it is concluded that product diversification positively impacts market share growth within the factory-built home industry.

ACKNOWLEDGEMENTS

I would like to acknowledge the endless contributions of my friend and academic advisor, Urs Buehlmann, whom has helped me grow as a person and a professional. Additionally, I would like to recognize the untold encouragement of my committee members D. Earl Kline, Albert Schuler, and Randall Cantrell.

A critical component to my success should also be contributed to the immeasurable insight of Tim Stiess and Omar Espinoza, and the continued encouragement of my fellow graduate team members; Mathias Schmitt, Kevin Knight, Becky Snider, Bady Ba, Christian Fricke, and Adrienn Andersch. Nonetheless, the most important support has come from my fiancée Anahita Sarvian and my parents Dr. Patrick and Margaret Wherry whom have continued to motivate me throughout my pursuit of this research. The support of my friends, family and colleagues made this endeavor possible.

PREFACE

This thesis contains eight chapters. Chapter One introduces the subject, while Chapter Two a series of stated hypotheses, Chapter 3 elicits a review of literature, and Chapter 4 the methodological approaches this study incorporated to research the factory-built home industry. Chapters 5 and Chapter 6 are manuscripts intended for publication and target the stated Hypotheses of Part One and Part Two, respectively. Chapter 7 highlights additional results from the research of the factory-built home industry and presents discourse on the cumulative research results of this study. Chapter 8 summarizes and concludes the overall thesis' objectives, findings, and limitations of the research. Due to the autonomous nature of the manuscripts that compose Chapters 5 and 6 some duplication of information was unavoidable.

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LIST OF ACRONYMS

AHTP	Advanced Housing Technology Program
BOCA	Building Officials Code Administrators International
CAD	Computer-aided design
CAM	computer-aided manufacturing
CIB	Compendium of Building Performance Models
DAPIA	Design Approval Primary Inspection Agency
DFMA	Design for manufacture and assembly
DOE	U.S. Department of Energy
EDI	Electronic data interchange
ERP	Enterprise resource planning
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
GDP	Gross domestic product
GNP	Gross national product
GSE	Government sponsored enterprises
HUD	U.S. Department of Housing and Urban Development
ICBIO	International Conference of Building Officials
ICC	International Code Council
MRP	Materials requirements planning
NAHB	National Association of Home Builders
NASA	National Aeronautics and Space Administration

NCSBCS	National Conference of States on Building Codes and Standards
NHA	National Housing Agency
OSB	Oriented strand board
PATH	Partnership for Advancing Technology in Housing
RFC	Reconstruction Finance Corporation
SBCCI	Southern Building Code Congress International
SIPS	Structural Insulated Panels
USCB	U.S. Census Bureau

1 INTRODUCTION

1.1 OVERVIEW

The U.S. residential construction sector is a significant constituent of the U.S. economy accounting for roughly five percent of annual Gross Domestic Product (GDP; U.S. Department of Commerce, 2008). Over the past decade, however, the U.S. residential construction sector has endured challenging times. From 2000 to 2006 the U.S. economy flourished, stimulating a frenzy of growth in new residential housing (U.S. Census Bureau, 2009a). However, contrary to this economic boom, the years from 2007 to 2009 saw the U.S. economy undergo a profound recession that deeply impacted not only the U.S. residential construction sector, but also the world economy (Dicks, 2008). This instability in economic success is fundamentally reshaping the U.S. economy and has driven contraction in the U.S. residential construction sector. As retrenchment of the U.S. housing market continues, U.S. home-builders will be forced to rethink their core business strategies.

Two industries comprise the U.S. residential construction sector and are suitably coined the site-built and factory-built home industries. The site-built industry entails all residential structures erected on site from dimensional lumber and engineered building components (Gurney, 1999). Whereas, the factory-built industry is defined by residential structures produced within a manufacturing facility and placed with little or no on-site construction (HUD, 2007). These industries are innately dichotomous in overall economic importance, as site-built construction has accounted for approximately 90 percent of new residential home starts annually (U.S. Census Bureau, 2009b). The dominance of the site-built home industry has fruitfully shaped the structure of the U.S.

residential home sector in its' favor forcing the factory-built home industry to scavenge market share positions in limited markets.

The factory-built home industry is characterized by its' four industry-segments of manufactured, modular, panelized, and pre-cut homes (HUD, 1998). The origins of factory-built housing relate back to the manufactured home of pre-1974 when these home units were classified as "mobile" and more closely resembled travel trailers (Hart et al., 2002, Atiles and Vanderford, 2006; HUD, 1998). As modern times have engulfed the factory-built home industry, manufactured housing has slowly hemorrhaged market share from its' record high 28 percent of the total U.S. residential construction sector in 1969 (U.S. Census Bureau, 2008). The latest emergence of modular, panelized, and pre-cut home construction, however, has helped to spur growth within the factory-built residential housing industry (HUD, 1998; Schuler and Adair, 2003; Woodbridge, P. and Associates, 2003). Opportunities of market expansion and diversification now exist for the factory-built home industry were declining barriers of entry have spurred two-product diversification (HUD, 1998, 2007). Today, as the U.S. residential construction sector continues to contract factory-built home-builders are faced with the critical decision of diversification as means of strategic survival and market share positioning.

The structural shifts occurring in the factory-built home industry as of 2009 are the focus of this research project. To navigate this topic a series of supporting documents have been constructed. A literature review of the U.S. residential construction sector focuses on the factory-built home industry and significant dimensions that have impacted its' formation and existence in the U.S. economy. These dimension relate to the product, process, and market by which the factory-built home industry is defined. Next, a series

of hypotheses are developed that seek to characterize activities occurring within the factory-built home industry. Methods are developed to research and assess these stated hypotheses, whereas, market positioning of the manufactured home industry-segment is evaluated by macroeconomic modeling of the product life cycle (PLC). Secondly, a mail questionnaire of 278 factory-built home industry respondents is used to explore and dissect the strategic interplay occurring in and around the factory-built home industry.

Through these methods of research this project elaborates on previous studies by The U.S. Department of Housing and Urban Development (HUD, 1998, 2000, 2006a, 2007) which have focused on the dynamic complexities of the factory-built home industry and its' current economic position (Harrigan, 1983). This project provides relative feedback as to product life cycle positioning of the factory-built home industry in the context of manufactured housing. Additionally, this project applies existing research by Mason (1939), Bain (1956), Harrigan (1980, 1988), Porter (1980, 2008), and Bernard et al., (2006), which illustrate diversification as a competitive strategy in pursuit of market share positioning to the factory-built home industry. Through the application of competitive theory to observed opportunities in diversification within the factory-built home industry market share growth of diversified factory-built home producers underscores the necessity for competitive strategy. In fact, despite current contractions in the U.S. residential construction sector bourgeoning opportunities are seen for diversified producers of factory-built home

2 HYPOTHESIS

2.1 OVERVIEW

The residential construction sector is influenced by the cyclical nature of the U.S. economy and exhibits expansion and contraction periods in relation to a magnitude of economic variables. In scaling down the focus of these periods of change to a more microeconomic level, specific sector analysis can be developed to fundamentally understand how these expansion and contraction periods affect a product's life cycle and competitive strategy within a specific industry.

The product life cycle (PLC) is an inherent concept pertaining to a market's demand of a specific good and can be measured by its sales over a given period. A stated period is marked by the introduction of a product to market and continues throughout the growth, maturity and declining stages of the product's evolution. Application of this concept to the factory-built housing industry and specifically the manufactured housing industry-segment (HUD-Code & Mobile) provides a product life cycle period that is established with the market introduction of the modern manufactured home in 1959.

The origin of mobile homes resides centuries ago when nomadic Gypsies traveled the Asian continent on horse drawn wagons (Keister, 2006). Since their introduction, "mobile homes" have undergone numerous modifications, primarily in their function as a home dwelling. The modern manufactured home is a far cry from its' humble beginnings as a wooden tent on wheels (Hart et al., 2002).

While the modern industry of factory-built homes originated with manufactured housing, emerging segments of the factory-built housing industry have prompted the ability for producers to diversify to alternative products such as modular, panelized, and

pre-cut houses (Figure 2-1) within the same industry. These alternative products provide opportunity, in the case of a declining product life cycle curve, to shift to related products to maintain and gain further market share within the industry.

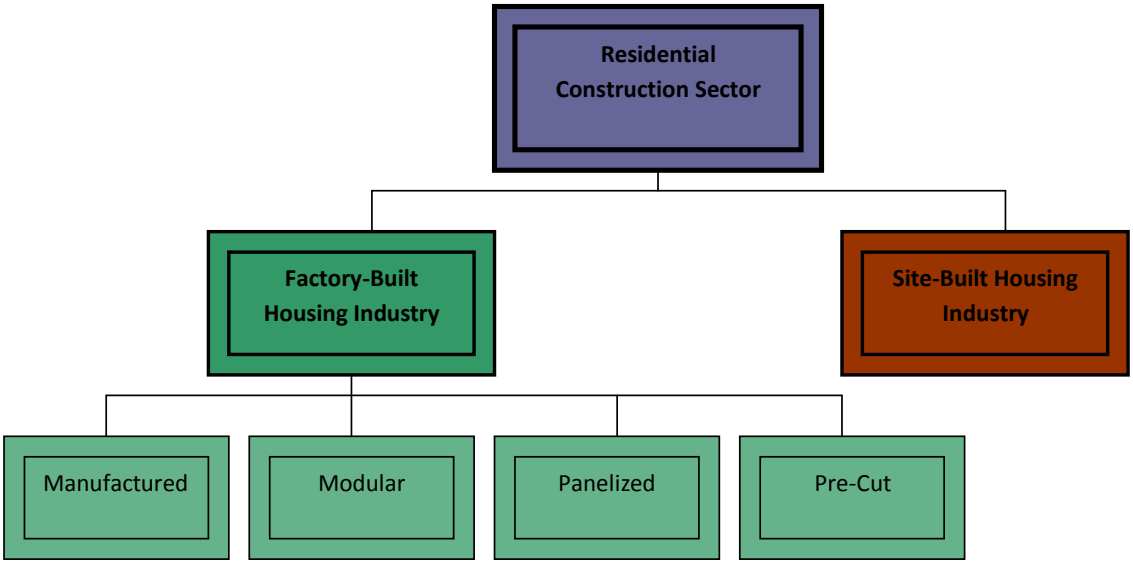

Figure 2-1: Residential Construction Sector Hierarchy

As mobile homes have become modernized, their classification has been embraced as part of the manufacturing realm, providing traceable feedback to their economic impact on the U.S. economy. Using historical sector data dating back to 1959, the manufactured housing industry-segment first saw rapid growth until the 1970's where sales peaked at maturity for nearly half a decade. Post maturity stage, the manufactured housing industry -segment has seen a decline in market share of the U.S. factory-built residential housing market throughout its current product life cycle period. It is hypothesized that over time, two diverging groups of U.S. factory-built residential housing market participants have emerged. On one side, companies that are diversifying to alternative products (modular, panelized, pre-cut) within the factory-built market and on the other side companies that are not diversifying to alternative factory-built housing

products . Today, the former is seeing an increase in their market share of the factory-built housing industry , whereas the latter is seeing a decline in market share within the factory-built housing industry. The purpose of this study is to evaluate the position of the manufactured housing industry-segment, as a benchmark for the factory-built home industry, with respect to the product life cycle and the U.S. residential construction sector. Furthermore, this study will look to determine if market share improves as factory-built home companies diversify to alternative factory-built housing products.

2.2 HYPOTHESIS OBJECTIVES

Part 1: Product Life Cycle Positioning of the Manufactured Home Industry-Segment

The manufactured housing industry-segment has seen a decline in its' market share of the U.S. residential construction sector throughout its' current product life cycle period.

Part 2: Trends and Diversification in the Factory-Built home Industry

Factory-built home companies that are diversifying their production to alternative housing products have increased their market share within the market definition of factory-built housing

3 LITERATURE REVIEW

3.1 INTRODUCTION

The residential housing sector elicits far-reaching ties to economic welfare of the U.S. economy. These linkages often dictate the growth and wane of the nation's economy, primarily due to the overwhelming financial magnitude this sector carries. Most recent estimates value annual residential investment near 72 billion, or nearly four percent of the nation's gross domestic product (GDP) (U.S. Department of Commerce, 2009). Although economically massive, this trade is heavily fragmented, particularly within the two primary divisions of this sector (HUD, 2000). To further understand the undulating market of residential construction, it is essential to illustrate these divisions and their responsibilities to the sector.

3.2 RESIDENTIAL CONSTRUCTION SECTOR

The two prime divisions of the residential construction sector are coined as site-built and factory-built residential construction (Figure 3-1). Proportionately these two

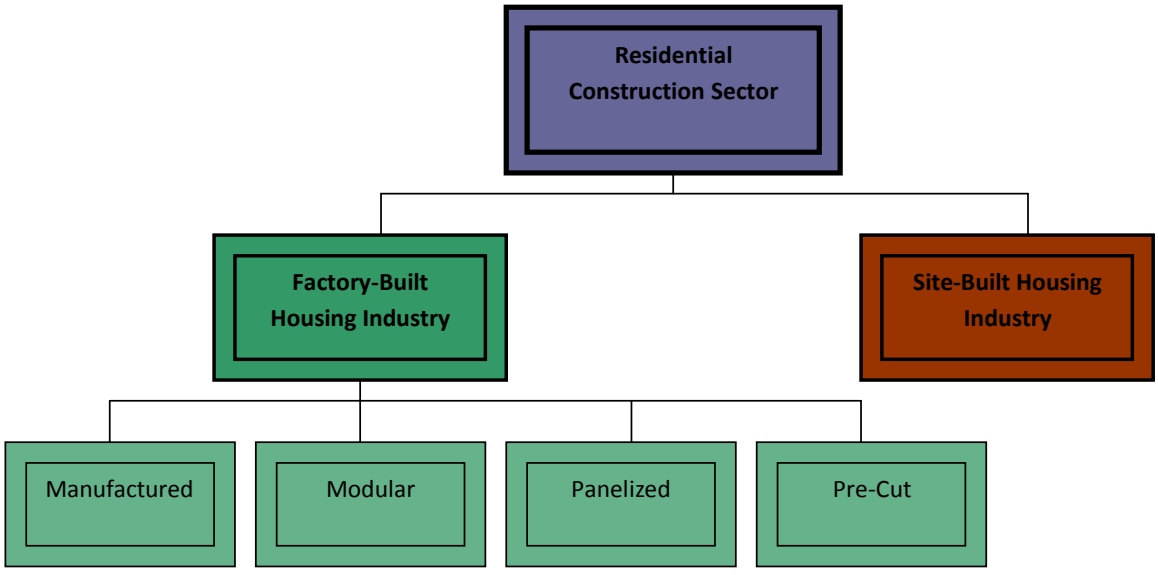

Figure 3-1: Residential Construction Sector Hierarchy

industries are non-equivalent, with site-built construction accounting for 1.2 million or approximately 90 percent of all new home starts in 2007, whereas factory-built homes subsisted at a level of 149 thousand units or ten percent of the new residential home starts (U.S. Census Bureau, 2008b, 2009a). This dominance of site-built home construction has deep-rooted cultural ties to American society and has thus been a stable fixture for hundreds of years (Obiso, 1997). Only during the past decade has industrialized housing begun to gain market share in the U.S. residential construction sector (HUD, 1998).

Advances in materials and innovative technology, backed by the U.S. Government, have bolstered the infusion of factory-built residential construction in the U.S. market since the 1950's (HUD, 2003; Schuler and Adair, 2003). These advances have prompted increased attention and competition amongst factory-built home manufactures that strive to compete with site-built construction (Beamish et al., 2001). The factory-built housing industry maintains several industry-segments of industrialized building techniques. These techniques range in process, application and regulation (HUD, 1998, 2006a, 2007). The four primary segments of factory-built housing are manufactured, modular, panelized and pre-cut homes. Each of these segments will be defined in Section 2.3.

3.2.1 FACTORY-BUILT HOUSING INDUSTRY

As of 2000, HSH Associates reported that eight percent of the U.S. population, or 22 million people, lived in manufactured homes (HSH, 2008). However, recent market data shows a decline in manufactured home shipments and placements since 1998 (U.S. Census Bureau, 2009d; MHI, 2008b). Rising unit cost for manufactured homes during the past ten years have delayed potential homebuyers from entering the market especially during times of market instability (Newman and Fleming, 2006). As the holder of the

largest market share of factory-built residential construction, the manufactured home segments' stagnation during the past decade raises major concerns for the factory-built housing industry (MHI, 2008b; HUD, 2003).

Despite depressed times for the manufactured home segment, this industry-segments' fortunate position as an industrialized producer of new residential construction has allowed firms in this segment to maintain a unique economic structure (HUD, 2007). In focusing directly on the manufacturing and production of home units, firms in this industry-segment have circumvented a majority of the financial crises associated with the residential construction industry during recent times (Rice, 2009). Comparatively, the site-built home industry has had direct ties to the development of land and the retailing of its' product, which have been a major source of fiscal obligation and risk in a despondent housing market (HUD, 1998). The ability and potential of the manufactured housing segment to reposition itself during these economic contractions is favorable, however the fundamental issue of consumer perception must first be addressed (HUD, 2007).

A major industry-specific problem, beyond the ever-present economic factors, has been an influx of research and public opinion corroborating the common belief that manufactured homes are a subpar housing option, focused primarily on a low-income, uneducated, rural populace (Beamish et al., 2001; HUD, 1998; Newman and Fleming, 2006; West, 2006). A driving force to reposition this stigma is being addressed with the adoption of a progressive manufacturing and engineering mindset (HUD, 2000), a paradigm shift that has also been seen across the automotive, shipbuilding and aircraft industries, and looks to provide a cost-effective, quality product (Kieran and Timberlake, 2004). In general, a two-tiered approach must prevail over first, the economic deflation

of manufactured housing demand and secondly produce a quality product that overcomes the negative connotation so commonly associated with this industry-segment.

3.3 PRODUCT

3.3.1 DEFINITIONS OF CONSTRUCTION TYPES: RESIDENTIAL HOUSING

A review of the current state of residential construction reveals the existence of two distinct classifications within the residential construction sector. (1) Factory-built, with four sub-classifications (Figure 3-1; HUD, 2000) and (2) Site-built, often called "stick-built".

3.3.2 FACTORY-BUILT HOMES

Factory-built home building is a method of residential construction that utilize dimensional lumber and building components to construct walls, floors, and roof frame structure within a manufacturing facility (HUD, 1998). Distinct variations in building techniques and regulations are prevalent within the factory-built home classification and can be seen across the four sub-categories of factory-built homes which includes: manufactured; modular; panelized; and pre-cut housing.

3.3.2.1 MANUFACTURED

Manufactured homes are a style of factory-built home construction that applies factory-built techniques to residential home construction. Manufactured home production uses large multi-piece units of a home that are pre-assembled in the factory and shipped to the final destination on a metal chassis (HUD, 1998). Completed manufactured homes are generally composed of several pre-constructed units that must comply with housing codes within the location of the manufacturing facility (HUD, 1998).

3.3.2.2 MODULAR

The modular category is a style of home building construction that incorporates standardization, compatibility and durability into the manufacturing process to ensure building code assurance and overall sustainability. Modular homes are constructed of individual wall, floor or roof systems, which are then transported to the final destination and assembled rapidly on a solid foundation. Modular home units must comply with local building codes (HUD, 1998).

3.3.2.3 PANELIZED

Panelized home construction utilizes standardized wall components to prefabricate the housing unit. Structural Insulated Panels (SIPs), and/or other standard panel products are used to form three-dimensional units that can be installed in-factory or onsite. These units, regardless of construction location, must comply with local building codes (HUD, 1998).

3.3.2.4 PRE-CUT

Pre-Cut homes are comprised of an assembly system that is produced in a factory and shipped unassembled to the delivery site (Gurney, 1999). Pre-Cut systems are built on solid foundations, generally consist of minimal attachments, and are easy to construct (Obiso, 1997). Common Pre-Cut home systems are log, kit or dome homes must comply with local building codes (HUD, 1998).

3.3.3 SITE-BUILT HOMES

Site-built homes are considered the classic residential construction method. Site-built homes are constructed using dimensional lumber to assemble the wall, floors and roof frame structures. All components of the site build house are constructed onsite and

are then covered with panelized lumber material (plywood or Oriented Strand Board). Engineered wood products have become prevalent in "site-built" method in the recent decade (Gurney, 1999).

3.3.3.1 KEY DIFFERENCES

The primary distinction between site-built and factory-built homes is the onsite foundation requirements for these structures (HUD, 1998). This characteristic is often superfluous to the untested eye of the consumer; however the site-built construction industry has long used and promoted this characteristic as a main distinction and key safety factor for their product (HUD, 1998). Comparatively, the manufactured housing sub-sector has been adapting to the placement of their product on permanent foundations. As of 2007, 26 percent of manufactured homes were placed on permanent foundations compared to 13 percent a decade earlier (U.S. Census Bureau, 2009b).

Focus group studies have shown that consumer perceptions side with site-built construction when quality and safety are concerned (Beamish et al., 2001). The stigma of low-quality and unsafe living units has long been associated with factory-built homes, predominantly those that are classified as manufactured homes (Beamish et al., 2001). Historical documentation of natural hazards affecting site-built and factory-built home show that the subset of manufactured homes are much more susceptible to damage and serious injury of inhabitants due to the lack of the home being secured to a proper foundation (HUD, 2003). Advances in factory-built home construction over the past decade have focused on the ability of factory-built units to affix to a permanent foundation, improving the safety of the home as well as providing means of titling the property as real estate (Newman and Fleming, 2006). The U.S Census Bureau reports

that 25,000 of the 95,000 (26.3 percent) new manufactured homes placed in 2007 were secured to a permanent foundation and therefore titled as real estate (U.S. Census Bureau, 2009c), whereas a decade earlier it is shown that only 43,000 of the 336,000 (12.7 percent) new manufactured homes were placed in this manner (U.S. Census Bureau, 2009c). By constructing a permanent foundation for a factory-built unit to attach, owners of factory-built homes have the advantage of obtaining conventional mortgage financing, homeowner's insurance, and FEMA flood insurance, a benefit that manufactured homes predecessors did not have (Newman and Fleming, 2006; Apgar et al., 2002).

As an added benefit in securing the home as a permanent structure, the need for foundation skirting, an undesirable element that is commonly found on manufactured homes, is eliminated (HUD, 2003). Foundation skirting is a commonly used feature that conceals the undercarriage of a manufactured home (Collins, 2001).

3.3.4 RESIDENTIAL CONSTRUCTION REGULATIONS

3.3.4.1 OVERVIEW

Residential construction regulations in the U.S. are critical in assessing the scope of capabilities allowed to site-built and factory-built homebuilders. Previous classifications of site-built and factory-built homes differ when regarding the application of building code regulations (Hullibarger, 2001). Major model building codes regulate site-built, modular, panelized and pre-cut homes, whereas manufactured homes are regulated under the preemptive National Manufactured Housing Construction and Safety Standards Code (HUD-Code)(Figure 3-2; HUD, 1998, 2003; Atiles and Vanderford, 2006; Apgar et al., 2002).

3.3.4.2 HUD-CODE

The National Manufactured Housing Construction and Safety Standards Act was authorized by The Department of Housing and Urban Development (HUD) and passed by Congress in 1974 (HUD, 1998, 2003; Atiles and Vanderford, 2006; Apgar et al., 2002). As of June 15th, 1976 all manufactured homes, previously regarded as mobile homes, were to be built to universal specifications detailed in this act (Atiles and Vanderford, 2006). The HUD-Code regulates the design, construction, strength, quality and durability of manufactured homes (HUD, 2000). Independent third-party inspectors or state agencies regulate and enforce the HUD-Code and are overseen by the National Conference of States on Building Codes and Standards (NCSBCS) (Hullibarger, 2001). Additionally, all aspects of the completed home including heating, plumbing, fire resistance, air conditioning and electrical systems are regulated under HUD-code performance standards (HUD, 2003). The standards that the HUD-Code was initially established to enforce are now part of a larger program that looks to promote technological progress, innovative development and the diffusion of these products within the industry (HUD, 2000).

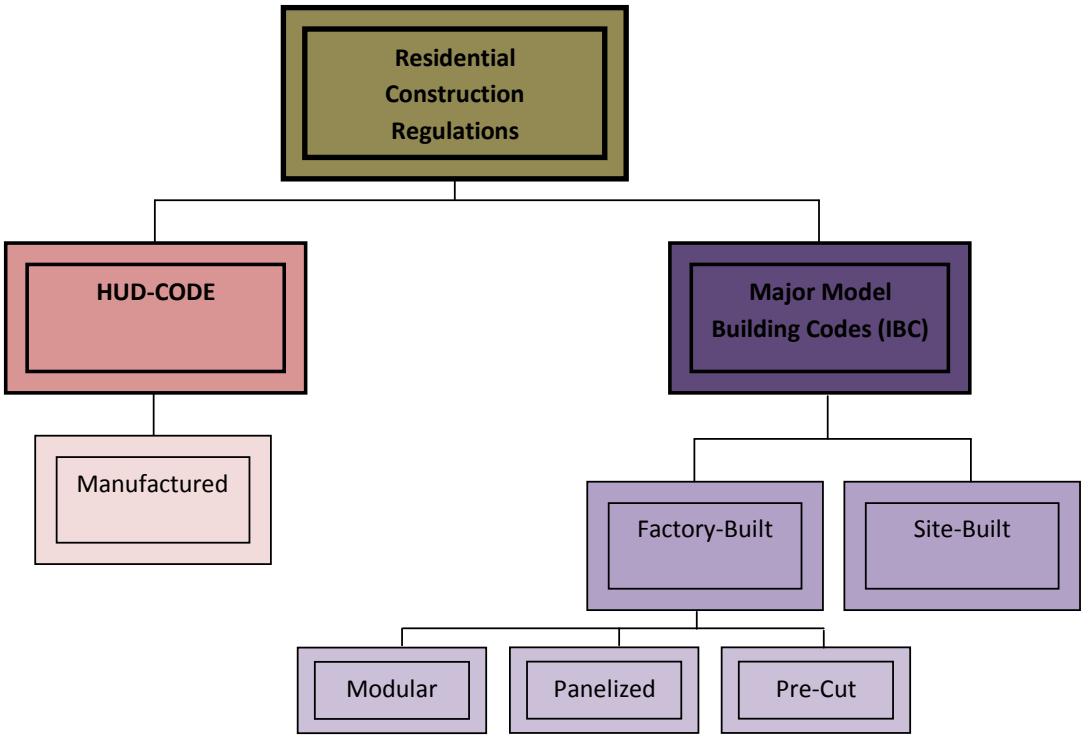

Figure 3-2: Residential Construction Sector Regulatory Hierarchy

3.3.4.2.1 INDEPENDENT THIRD-PARTY INSPECTORS AND STATE AGENCIES

All manufactured home producers operating under the HUD-Code must undergo a three-tier certification process that begins with the creation and implementation of a quality assurance program and manual prior to the construction of any manufactured units (Hullibarger, 2001). The second tier of the certification process requires that the design proposals of all manufactured units intended for sale pass through the Design Approval Primary Inspection Agency (DAPIA) (Hullibarger, 2001; Atiles and Vanderford, 2006).

"This agency approves engineering design of the home, the manufacturer's quality assurance manual for its plant and coordinates onsite approval with a third party inspection agency known as the Production Inspection Primary Inspection Agency (IPIA)" (Hullibarger, 2001, p. 28).

The IPIA provides the last tier of inspection during the manufacturing process, certifying that each stage of production meets the design manual specifications and quality assurance standards (Atiles and Vanderford, 2006). Overall, these inspection processes are intended to provide a standardized method of code application and quality insurance for each manufactured home, a detail that is shown by the application of a HUD-Code seal on each completed and inspected unit (Hullibarger, 2001; HUD, 2003).

3.3.4.3 MAJOR MODEL BUILDING CODES

The regulatory systems for site-built and factory-built homes differ from manufactured homes in that these structures are regulated by state and local jurisdictions (HUD, 1998). State and local regulatory building codes are not mandated by a national code and therefore can vary from state to state and locality to locality. Historically building codes have seen positive improvements over time with the recent adoption of a nationally recognized building code system (International Code Council, 2009).

Building codes were developed in the early 1900's (Hullibarger, 2001). The U.S. initially operated on a set of major model building codes that were highly regionalized and geographically autonomous (Martin, 2005). These codes were oriented into three sub regions. The Building Officials Code Administrators International (BOCA), were codes used on the East Coast and the Midwest, whereas the Southern Building Code Congress International (SBCCI) pertained to the Southeast and the International Conference of Building Officials (ICBIO) regulated the West Coast of the U.S. (HUD, 1998; Martin, 2005). The collective governances of the regional regulatory councils teamed up in 1994 to create the International Code Council (ICC), a non-profit organization that has developed the International Building Code (IBC) structure and the International

Residential Code (IRC) (Listokin and Harris, 2004; International Code Council, 2009). The IBC provides site-built, modular, panelized and pre-cut homebuilders with a national standard of building code regulations now seen across all 50 states including Washington D.C (Listokin and Harris, 2004; International Code Council, 2009).

3.3.4.3.1 SITE-BUILT HOME REGULATIONS

New site-built home construction is regulated by one of the major model building codes (Hullibarger, 2001)and is overseen by state and local agencies (HUD, 1998). The International Code Council has urged for national standardization of these localized codes through the implementation of the IBC, however several states have originally opted for alternative methods of home building regulations (Listokin and Harris, 2004). As of 2005, the California Building Standards Commission voted to accept and recognized the International Building Code (IBC) as the state building code standard (International Code Council, 2009). California was the last remaining exception to national acceptance of the International Build Codes and had originally opted to enforce the National Fire Protection Association (NFPA) 5000 code (Listokin and Harris, 2004).

3.3.4.3.2 FACTORY-BUILT HOME REGULATIONS

Factory-Built homes are one (pre-cut), two (panelized) or three-dimensional (modular) home units that are designed and assembled off-site at a manufacturing facility (Hullibarger, 2001). These homes are regulated by the same state and local structural, mechanical, plumbing, and electrical codes as site-built homes (HUD, 1998). During the construction process and when placed on their permanent foundations, they are inspected for code compliance. The construction process allows engineered quality aspects to be incorporated in each unit, providing structural integrity for transportation to its' final

destination. A major benefit of a factory-built home is its ability to be constructed and assembled rapidly on-site and thus avoids any complications associated with climate, labor or vandalism (Atiles and Vanderford, 2006). Additionally, the factory environment, in which these units are produced, promotes waste reduction and ensures strict product quality. These benefits lead to a reduction in environmental impact, which has been found to be substantially below that of site-built construction (HUD, 2000). Additionally, site-built construction's environmental impact is far greater than factory-built homes. Research has shown that "*manufactured wood and dimensional lumber contributes to one-third of residential construction solid waste*" (Gavilan and Bernold, 1994, p. 536), products that are heavily used in today's site-built construction.

3.4 PROCESS

3.4.1 RESIDENTIAL CONSTRUCTION AND MANUFACTURING

3.4.1.1 OVERVIEW

Innovative architecture and building construction have played a significant role in the development and growth of factory-built housing throughout history (Richard, 2005). As early as the nineteenth century, builders began to look towards factory-based fabrication to overcome the labor-intensive on-site techniques of their predecessors and transform building construction to a controlled and systematic function (Herbert, 1978). Although these advances were promising, innovations have seen a continual struggle between architects and engineers (Kieran and Timberlake, 2004).

Architects have sided with appearance, whereas engineers have focused on economy and purpose (Kieran and Timberlake, 2004; Bergdoll et al., 2008). The disposition of architects has allowed society to place them as the leaders of construction,

however “less than 2 percent of all single family dwellings are designed by architects" (Swaback, 1971, p. 332). Through this realization, the residential construction sector has been left open to the evolution of industrialization (Kieran and Timberlake, 2004). Factory-built housing has combined two seemingly contradictory elements of construction by placing artistic means (architect) within the process (engineering) of manufacturing (Swaback, 1971). It is through the development of industrialization that architecture and engineering have coexisted (Kieran and Timberlake, 2004; Bergdoll et al., 2008).

3.4.1.2 INDUSTRIALIZATION

The first major push for factory-built housing was seen in the early 1800’s, with several unique and independent events occurring across the globe (HUD, 2000).

British settlers in Western Australia used components of industrialized housing in a period between 1827 and 1840 with the introduction of the Manning portable colonial cottage (Herbert, 1978; HUD, 2000; Bergdoll et al., 2008). This structure, designed for ease of assembly, required little to no onsite work and could easily be established by unskilled labor (Herbert, 1978; Bergdoll et al., 2008). The simplistic and rigid structure was ideal for the influx of emigrants settling the Australian outback and provided immediate temporary housing (Herbert, 1978). The success of this structure was followed by its' gradual decline in popularity. As a colonial presence was established, the need for temporary shelter subsided and the Manning portable cottages were eventually abandoned (Herbert, 1978).

Shadowing the British colonization of Australia was the North American gold rush (HUD, 2000). Akin to the first methods seen throughout the Australian outback, building

techniques, reliant to off-site construction, enabled housing to be constructed on the East coast of the U.S. and transported to California (Herbert, 1978; HUD, 2000). These structures helped temporarily house the influx of emigrants to the West and due to their success, were predominantly used as field barracks during the American Civil War 1861 to 1865 (HUD, 2000),

Beyond the rudimentary nature of prefabricated housings' role in colonization was its dramatic impact on the development and design of today's modern architecture (Bergdoll et al., 2008). This transition towards a progressive method of residential building brought the attention and notoriety of many acknowledged architects, each of who, in their own manner, looked into the potential of industrialized home prefabrication (Herbert, 1978; Bergdoll et al., 2008). Design and innovation in residential construction flowed freely from the prefabricated home industry during the 1930's (Bergdoll et al., 2008). This avant-garde ideology prompted radical changes in traditional residential construction bringing about what is now known as the "*American Beaux Arts*" period (Obiso, 1997; HUD, 2000). This era pushed aside the static temperament of American home building, allowing residential construction innovations to transpire into the modern methods known today (Obiso, 1997). These pioneering methods broke standard practices and wrestled creative thought away from the vernacular of residential construction and into the modern era of industrialization (Kieran and Timberlake, 2004).

3.4.1.3 INNOVATION AND MODERN INDUSTRIALIZATION

Innovation has been the means for continued progression into industrialization throughout residential constructions' modern history (Richard, 2005; Thomke and Von Hippel, 2002). The developing undertone of cost reduction, quality, and standardized

building techniques started to appear in the 1930's and has flourished into industrialization during current times (Kieran and Timberlake, 2004). Industrialization is fundamentally based on producing efficient quantities of a quality product in a factory environment (Noguchi, 2003). The production of a large quantity of units divides an investment into small manageable fractions; thereby reducing the fixed production costs of a single unit down to a marginal amount (Richard, 2005). The diffusion of innovative processes along with the application of innovative products allows items, that were once exceedingly pricey, to be affordable to a larger audience (Richard, 2005; Thomke and Von Hippel, 2002; Noguchi, 2003; Kieran and Timberlake, 2004).

This concept of affordability is abundant in government legislation and housing program initiatives (Martin, 2005). Programs such as "*Operation Breakthrough*" and the Partnership for Advancing Technology in Housing (PATH) have become increasingly successful at promoting innovation throughout the residential construction industry, but especially in factory-built housing (Martin, 2005; HUD, 2000).

3.4.1.4 FACTORY-BUILT HOUSING

The innovative ability of builders to decrease construction costs while improving the quality of factory-built housing has enticed consumers into the residential housing market throughout history (Noguchi, 2003; Smith, 2008). Manufactured homes have been the most successful endeavor into industrialized housing in the U.S. (Skillern and Wolfram, 2005), particularly during the 1990's, when manufactured homes represented 1,683,000 (19 percent) of the total 8,830,000 housing units constructed from 1994 to 1999 (U.S. Census Bureau, 2008b). The ability of factory-built homes to provide

affordable, quality housing was fundamentally the reason for the industry's success (Beamish et al., 2001).

Factory-built home manufacturers have relied on new materials, industrialized construction techniques and standardization to moderate costs and maintain affordability (HUD, 2006a). Howard T. Fisher was the first to create a system of prefabricated panels to standardize the building process (Obiso, 1997; HUD, 2000).These panels were designed to assemble in a variety of configurations in order to meet the needs of different clients (Handlin, 1985). Cost reduction through standardization prompted architects' need for an engineer's perspective to home building (Kieran and Timberlake, 2004).

3.4.2 ENGINEERING

3.4.2.1 QUALITY, COST, AND TIME

Costs and time were the underlying drivers of manufacturing performance throughout modern industrialization (Maani, 1994). In the past several decades these drivers have shifted with current generations of global manufacturing firms concerning themselves with production efficiencies, flexibility, and the constraints of quality and time (Kumar and Motwani, 1995).

"Global competition in manufacturing and changing consumer demand are resulting in a trend towards great product variety and innovation, shorter product life cycles, lower unit costs and higher product quality" (Rogers and Bottaci, 1997, p. 147).

The development and refinement of manufacturing techniques and their drivers has brought forth the ability to provide mass-customization (McDermott et al., 1997). As the scope of mass-customization rises beyond the common manufacturing constraints, new levels of flexibility, speed and variety will govern manufacturing techniques (Schlie and

Goldhar, 1995). The opportunistic nature of the factory-built housing industry has allowed the diffusion of mass-customization in its manufacturing processes (HUD, 2006a).

3.5 MARKETS

3.5.1.1 RESIDENTIAL HOUSING

The residential housing industry has played a decisive role in the movement of the U.S. economy and continues to demonstrate its' clout with direct ties to the Nation's current economic recession (Sullivan and Sheffrin, 2003). The Chairman of the Federal Reserve, Dr. Ben S. Bernanke, solidified this relationship in a March, 2007 hearing of the Joint Economic Committee of the U.S. Congress (Joint Economic Committee, 2007). Dr. Bernanke described the substantial slow down of the residential housing market starting mid-2005 as the catalyst for a rapid succession of economic events including the drastic decline of new single-family home starts and sales (Joint Economic Committee, 2007).

As of 2001, the residential housing industry accounted for 40 percent of the Nation's GDP growth with housing demand predicted to exceed the construction of two million units annually through 2010 (Schuler and Adair, 2003). However, it is now evident that this growth has come to an end and a market correction is occurring. Due to these changing times, a majority of American families are today struggling to stay afloat finically, as they heavily invested in the twenty trillion dollars of residential assets that lie in the balance of the current recession (Coy, 2008).

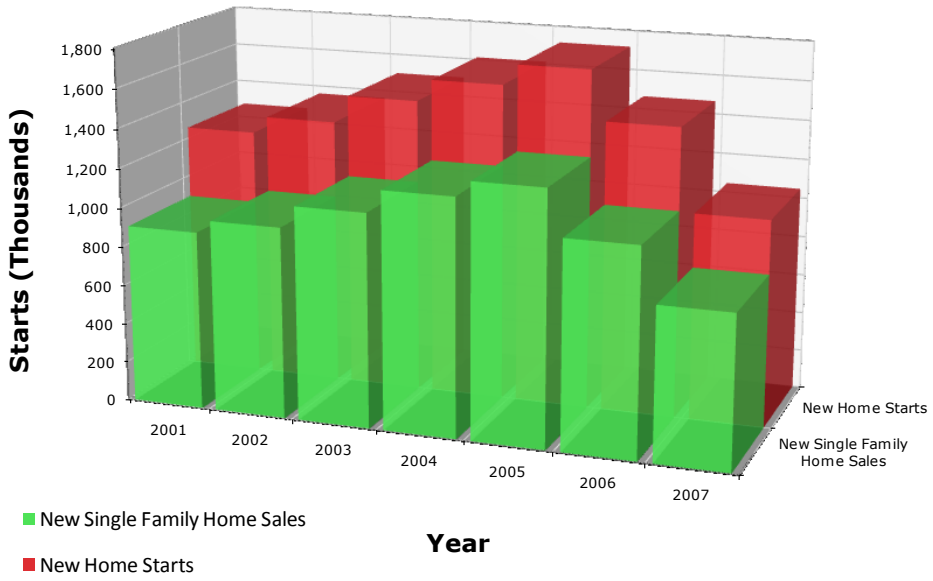

Figure 3-3: New Single Family Housing Starts and Sales: (2001 - 2008; U.S. Census Bureau, 2009c)

Figure 3-3 depicts the weakening residential housing industry. Housing market indicators show new residential housing starts down from a decade high of 1,716,000 in 2005, to a decade low of 1,046,000 in 2007 (U.S. Census Bureau, 2009c). Additionally, new single-family home sales have followed this downward trend, with 2007 sales figures at a mere 776,000 units versus the 1.28 million units sold in 2005 (U.S. Census Bureau, 2009c). As the landscape of the nation's economic outlook changes and the certainty of the residential construction market with it, related U.S. residential construction industries are facing deep seeded contractions and restructuring (The Congress of the U.S., 2008).

3.5.1.2 MANUFACTURED HOUSING INDUSTRY

In 1959, the mobile home segment was introduced to the U.S. residential home sector essentially giving birth to the factory-built home industry. Over the next decade

and a half of economic growth, this sub-segment developed rapidly with annual shipments soaring to just under 600,000 units in 1973 (U.S. Census Bureau, 2008a). However, a sweeping drop in shipments between the years of 1973 and 1974 recalibrated the manufactured home industry-segment. In 1974, new manufactured home shipments hovered at 338,000 units (U.S. Census Bureau, 2008a). Throughout the 1970's, 80's and 90's demand for manufactured homes remained steady, with annual shipments perched at the 200,000 unit mark (MHI, 2008b; U.S. Census Bureau, 2008a). Subsequently, manufactured home builders saw several positive years of growth in the late 1990's which took shipments back 370,000 annual units (U.S. Census Bureau, 2009c).

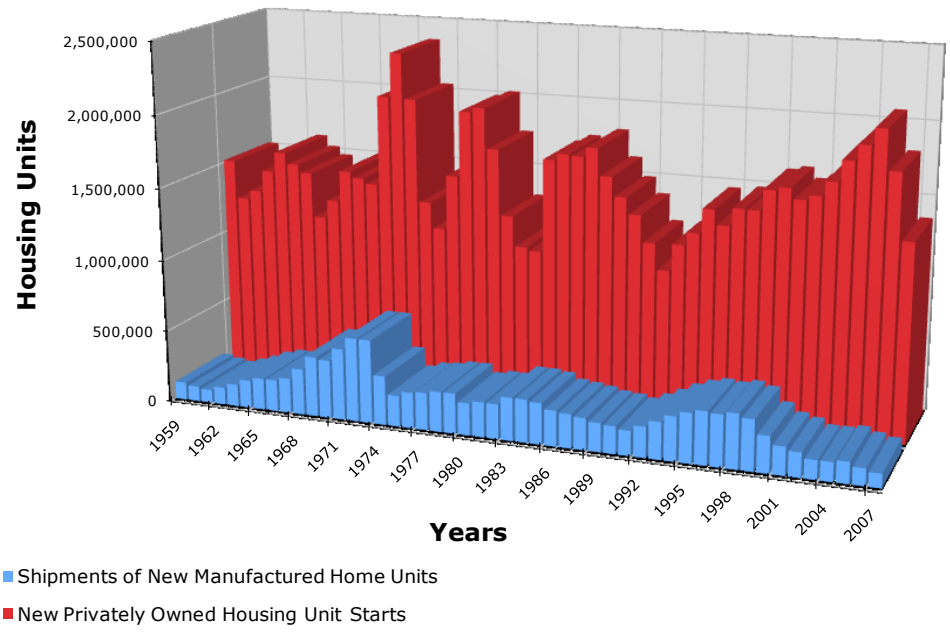

Figure 3-4: New Residential Home Starts and New Manufactured Home Shipments (1959 - 2007; U.S. Census Bureau, 2008a, 2009a)

This growth, however, was short lived and manufactured home shipments dove from 370,000 to 95,700 units annually from 1998 through 2007 (U.S. Census Bureau, 2008a, 2009c). As of 2008, the U.S. manufactured housing industry-segment shipped just over 81,000 home units, its lowest output on record (Figure 3-4; U.S. Census Bureau, 2008a).

Over the past decade up to 2005, as new residential construction reached record highs, the manufactured housing industry-segment inversely deteriorated (U.S. Census Bureau, 2009c, 2008a). Strikingly, this period of declining manufactured home shipments equated to manufactured homes prices increasing by 64 percent (Newman and Fleming, 2006).

Despite the improvements in factory-built housing, site-built homes have remained dominant as constant fixture in residential construction market over the last decade (U.S. Census Bureau, 2009c, 2008a). Over 90 percent of all homes constructed in the U.S., over the last decade, have been site-built homes (Gupta, 2006). The remaining percentage of the U.S housing market falls within the four sub-sectors of factory-built housing, with the most recent trend moving towards modular and panelized systems, where previously manufactured homes had dominated (HUD, 2007).

Currently the median age of a manufactured home in the U.S. is 21 years (U.S. Census Bureau, 2009d). The U.S. Census reported in 2005 that 908,000 (10 percent) of the 9.2 million housing units constructed between 2000 and 2004 were manufactured homes, a decline from the previous five years (1995-1999) (U.S. Census Bureau, 2005). From 1995 to 1999 manufactured homes represented 1.7 million (19 percent) of the total 8.8 million housing units constructed (U.S. Census Bureau, 2005). If this trend continues, these figures reflect an aging stock of manufactured homes that are near their

lifespan and will subsequently be demolished and replaced by alternative forms of residential construction.

3.5.1.3 REGIONAL MARKETS

Table 3-1 illustrates the four primary regions of the U.S., the Northeast, South, Midwest, and West, as established by the U.S. Census Bureau (U.S. Census Bureau, 2008c). Each region is heavily influence by their socio-economic, financial, social, and demographic factors. These inherent aspects of regional markets are the major source behind disproportionate demand trends for residential home construction throughout the U.S. (Anonymous, 2009). A 2007 regional population comparison shows the South representing 37 percent, the West 23 percent, the Midwest 22 percent, and the Northeast 18 percent of the total U.S. populace (U.S. Census Bureau, 2009f).

Table 3-1: Regions and Divisions (U.S. Census Bureau, 2008c)

NORTHEAST	MIDWEST	SOUTH	WEST
New Jersey	Illinois	Alabama	Alaska
New York	Indiana	Kentucky	California
Pennsylvania	Michigan	Mississippi	Hawaii
Connecticut	Ohio	Tennessee	Oregon
Maine	Wisconsin	Delaware	Washington
Massachusetts	Iowa	District of Columbia	Arizona
New Hampshire	Kansas	Florida	Colorado
Rhode Island	Minnesota	Georgia	Idaho
Vermont	Missouri	Maryland	Montana
	Nebraska	North Carolina	Nevada
	North Dakota	South Carolina	New Mexico
	South Dakota	Virginia	Utah
		West Virginia	Wyoming
		Arkansas	
		Louisiana	
		Oklahoma	
		Texas	

3.5.1.4 MARKET SHARE

From 2000 to 2002 the U.S. saw levels of 1.57, 1.6, and 1.7 million new home starts (U.S. Census Bureau, 2009a) in each year, respectively. The steadiness of the U.S. home market during the early 2000's was broken by a frenzy of construction activity from 2003 through 2005 when new home starts exceeded 1.9 million units for two consecutive years (U.S. Census Bureau, 2009a). Such a boom had not been seen in the U.S. since 1971-73 when home starts topped a record high 2.0 million units (U.S. Census Bureau, 2009a). Since 2005, all four census regions have shown declines in new residential home starts (Figure 3-5; U.S. Census Bureau, 2009a).

Despite a declining economy, the Southern region of the U.S. has experienced the highest levels of residential home construction over the past five years, surpassing even the substantial suburban growth of the Western states. The Southern region was responsible for an average of 49 percent of all new housing starts from 2003 to 2007 and has maintained its dominance even as market volumes have decreased substantially (U.S. Census Bureau, 2009a).

Immigration deeply impacts the nature of regional housing markets through rapid increases in adult populations which drive up home demand (Schuler and Adair, 2003). The growth of the South has been exacerbated by a major influx of domestic and international immigration, a trend that is also prevalent in the Western region (Apgar et al., 2002; Schuler and Adair, 2003). Since 2000, the two most progressive growths in population have been seen by Florida, Texas, and California, all of which play are major components in the Southern or Western regions (U.S. Census Bureau, 2009e).

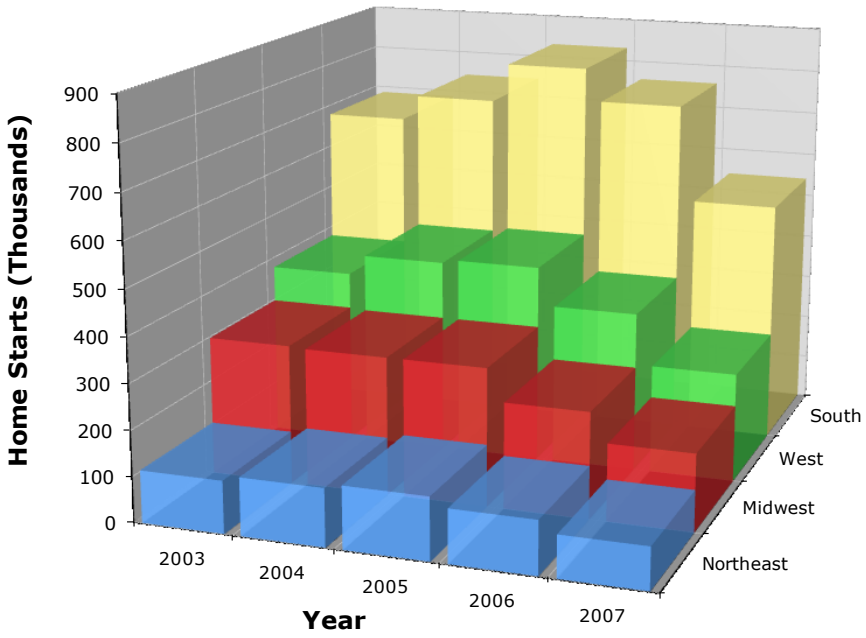

Figure 3-5: New Privately Owned Housing Unit Starts By Region (2003 – 2007; U.S. Census Bureau, 2009a)

3.5.1.5 MANUFACTURED HOUSING MARKET SHARE

Regional markets have helped to characterize and develop the factory-built home industry and its sub-segments . These differences stem from each region's unique socio-economic, financial, social, and demographic make-up (Beamish et al., 2001). Noticeable regional differences throughout the industry-segments of manufactured and modular homes can be seen in industry data from 2003 to 2007 (NMHC, 2008; U.S. Census Bureau, 2008a).

The South has long stood as the preeminent region for the manufactured home industry-segment (Figure 3-6). On average the South has accounted for 57 percent of all U.S manufactured home shipments since 2003 (U.S. Census Bureau, 2008a). On a regional scale, manufactured home shipments represent approximately 11 percent of all

new home starts in the South, and just over four percent of all home starts nationally in 2007 (U.S. Census Bureau, 2008a, 2009a).

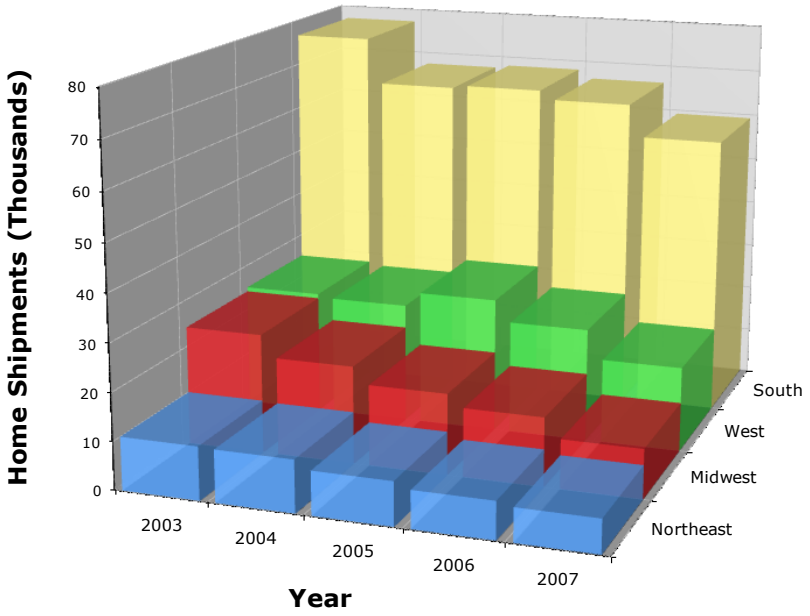

Figure 3-6: Manufactured Home Shipments by Region (2003 - 2007: U.S. Census Bureau, 2008a)

3.5.1.5.1 MODULAR HOUSING MARKET SHARES

As a striking comparison to regional disparities of the manufactured home industry-segment, the regional markets for modular home construction are relatively equivalent. Figure 3-7 shows modular home shipments across the four U.S. census regions.

The Northeast has proven to be a key starting point for the acceptance and vitalization of modular housing construction (Bady, 1996; Kochera, 1998). Modular homes have accounted for 10 percent of all new homes started in the Northeast from 2003 through 2007 (NMHC, 2008). This proportion is far beyond the added U.S. regions, in which modular home construction barely breaks five percent of annual regional home starts (NMHC, 2008). This inconsistency in regional market share for

modular home construction is due to the beneficial urban infill capabilities that modular construction provides (Apgar et al., 2002). In urban areas, vandalism, transportation access, and labor issues are dilemmas that are simply addressed by the speed and ease of

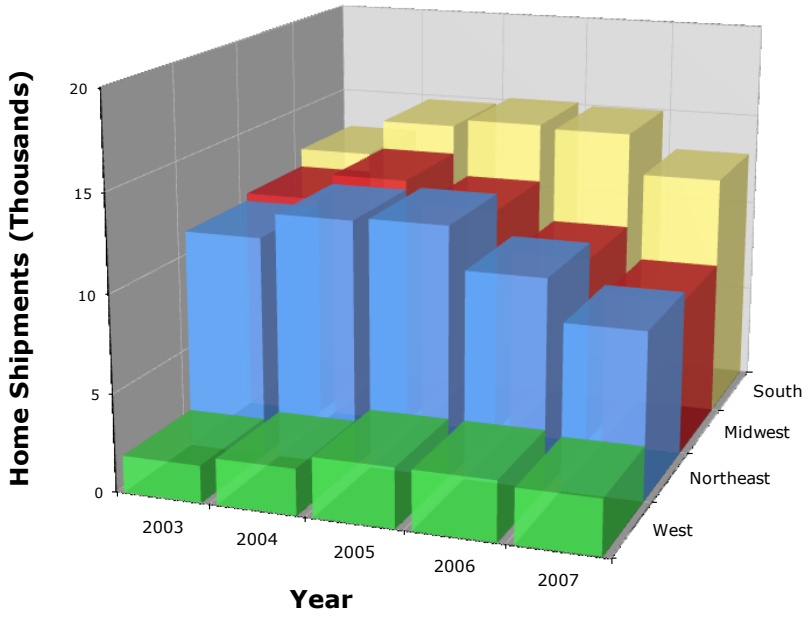

Figure 3-7: Modular Home shipments by Region (2003 - 2007; U.S. Census Bureau, 2009c)

modular instillation (HUD, 2006a; Abate, 2005; Sustainaissance International, Inc., 2008). In rural communities of Southern, Western and Midwestern states, these urban issues are not as prevalent, however inroads are being made in the form of market share growth (Collins, 2001).

3.5.1.6 DEVELOPING MARKET SHARE

In dissecting new residential construction (site-built, manufactured and modular) by regional market shares, the significance of geographic factors as barriers of entry for specific types of new residential construction are exposed. To establish elevated levels of

manufactured and modular home construction nationwide, these barriers must be recognized and successfully targeted (HUD, 2006a).

The modular home sub-sector has begun to reap the rewards of the successful implementation of their product based on regional market needs (Kochera, 1998). This success can be seen in the emerging market share of modular home construction in the Northeast and its potential in the West (Apgar et al., 2002; Collins, 2001). As technologies advance, the ability for homebuyers to discern between site-built and factory-built homes will continue to diminish (HUD, 2007). For the manufactured home industry-segment to succeed in the residential housing market, manufactured homebuilders must show that their product provides the same social and financial rewards of quality homeownership as their competitors, while offering the capabilities desired by each distinctive geographical region (HUD, 2006a).

3.5.2 CONSUMERS

"The introduction of the Housing Act of 1949 recognized the importance of housing to society and established "the goal of a decent home and suitable living environment for every American family (HUD, 2006b, p. 1)."

3.5.2.1 PSYCHOGRAPHIC VARIABLES

Consumer preference is intrinsic to the socio-economic characteristics of the target demographic for the new residential housing market (Sirgy et al., 2005; Beamish et al., 2001; Newman and Fleming, 2006). Marketing professionals often refer to these socio-economic characteristics of personality, values, attitudes, interest and lifestyle as psychographics (Senise, 2007). Due to psychographics' close connection between consumer preferences; fueled by financial and social values, trends in these categories are

often a primary indicator of the residential housing market (HUD, 2007; Sirgy et al., 2005).

3.5.2.2 FINANCIAL PRESSURES

Preferences fueled by the financial outlay a homebuyer faces directly relate to the potential for the purchase to provide future returns (West, 2006; Stein, 2008). A typical home is the largest asset, approximately fifty percent of a family's net worth on average, and therefore future value is highly scrutinized when purchase is considered (Hood, 1998; Dent, 2004). Even though financial considerations are critical to homebuyers, trends show the average new single-family home is growing in square footage and amenities (U.S. Census Bureau, 2009c, 2008d).

These amenities provide functionality and aesthetics that are greatly influential on consumer purchasing preferences (Obiso, 1997; Gupta, 2006). However, the comforts of a luxury home are often priced at a premium and greatly add to the overall cost of a home (U.S. Census Bureau, 2009c). Recently, enhancements in engineering and technology have ensured that these features are provided at much lower costs when purchased as part of a factory-built home (HUD, 2007; Mansfield, 2009). The ability of factory-built homes to provide affordable quality construction while maintaining exceptional appearance allows homeowners to maintain their financial interests while pursuing their social expectations (Beamish et al, 2001; Kochera, 1998; Newman and Fleming, 2006).

3.5.2.2.1 INCOME

U.S. Census Bureau data shows that the real median household income for the U.S. has increased 30 percent from 1967 through 2003, with the peak occurring in 1999 at an approximate level of $45,000 (U.S. Census Bureau, 2009b). This increase in household

income has, however, been un-equivalent to the drastic inflation of residential housing prices (U.S. Census Bureau, 2009c). 2004 Census data shows that throughout the period of 1960-2000, median home prices have doubled from $58,000 to $119,600 (U.S. Census Bureau, 2009c). This rapid acceleration continued through 2008, with median homes prices doubling again over an eight-year period (U.S. Census Bureau, 2009c, 2008d). Throughout the past two decades, the detrimental effect of these shifts in the median home price versus median income has been observed in the affordability index of residential housing (U.S. Census Bureau, 2009b).

3.5.2.2.2 HOME PRICES

Affordability is the measure of homeownership costs relative to income (Beamish et al., 2001). Improvement in homeownership between the 1980's and the 1990's were due to substantial improvements in affordable housing policy (HUD, 2006b). The inception of the Affordable Housing Demonstration Program of the early 1980's proved that federal policy would be the leveraging factor against housing cost inflation (Beamish et al., 2001). Unfortunately, federal homeownership policies could not match home price inflation long term, causing a steep growth in home prices from the early 1990's into 2006 (Figure 3-8: Beamish et al., 2001). This swell in median home prices thus prompted government backed action to provide moderate-income homebuyers with attractive mortgage options to sustain demand (Atiles and Vanderford, 2006; Cox W., 2002; HUD, 2006a).

As of 2008, Fannie Mae and Freddie Mac, government sponsored enterprises (GSE), have shouldered the burden of high-risk mortgages and their potential default (Strother and Koven, 2008; West, 2006; HUD, 2006a; Beamish et al., 2001). This

financial situation is a direct effect of the actions that were pursued through federal policies put in place during the past decade (Strother and Koven, 2008; Beamish et al., 2001). Since the decline of government backed mortgages, the U.S. Department of Housing and Urban Development (HUD), through research with the National Association of Home Builders (NAHB) has shown that innovations and programs that support affordable mortgages will only be effective through the increased supply of affordable homes (HUD, 2007; 2006a; Genz, 2001; Anonymous, 2009). To provide affordable housing at levels commensurate with income and housing prices, government policies must redirect their focus towards sustainable methods (HUD, 2003, 2006a). Factory-built housing offers the potential to provide long-term availability of cost-effective housing from the perspective of construction and ownership (Cox W., 2002).

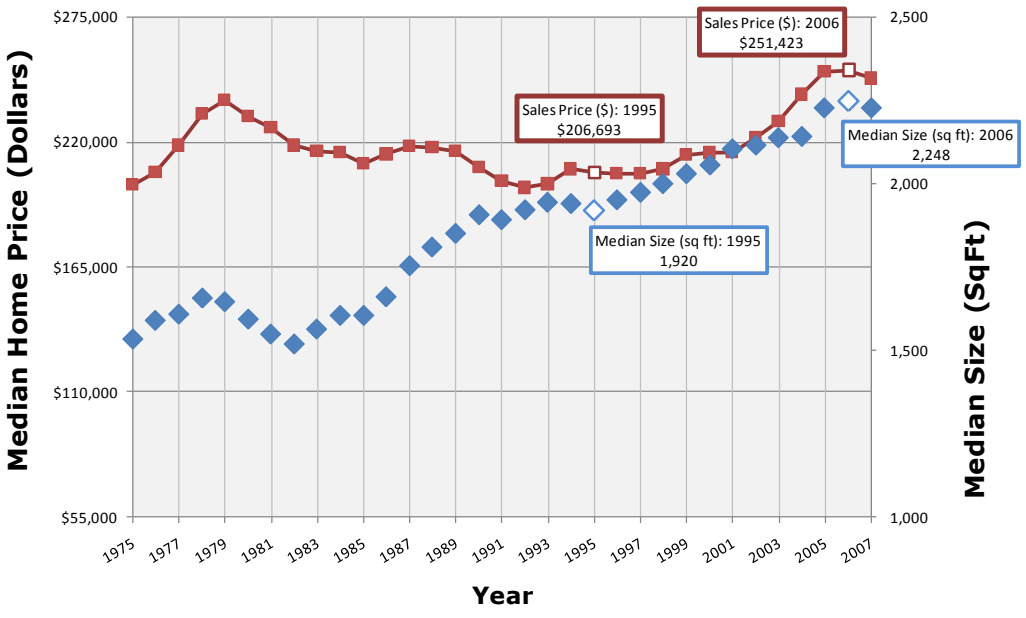

Figure 3-8: U.S. Median Home Price and Median Home Size (1975 - 2007; U.S. Census Bureau, 2009c)

3.5.2.3 SOCIAL PRESSURES

Social perceptions are a main force facing factory-built homebuilders when attempting to capture market share (HUD, 2007). On a national scale, communities and residents alike have shown that they have a long-standing bias against factory-built housing, especially manufactured homes (HUD, 2006b; Beamish et al., 2001). Recent consumer preference studies conducted by The U.S Department of Housing and Urban Development have shown that "*several long held negative attitudes regarding manufactured homes were improperly categorized in large part by a misinformed public as trailer or mobile homes"* (HUD, 2007, p. 11). These studies by HUD (2007) and Beamish et al. (2001) additionally report that many non-manufactured home residents believe that *"Manufactured housing attracts transient people with unconventional lifestyles*"(Beamish et al., 2001, p. 1)". These unwanted communal aspects depreciate community values and directly tie negative financial implications to social perceptions through depreciating home values and community standards (Genz, 2001; HUD, 2007). In a 2002 report, provided by the Neighborhood Reinvestment Survey, community development agents reported that their knowledge of factory-built housing ranked fair to low (Apgar et al., 2002). As the basis for examination of the factory-built housing industry and most importantly, manufactured homes, community perceptions stand out as the critical factor in promoting industrialization of residential construction (HUD, 1998, 2006b, 2007, Atiles and Vanderford, 2006).

3.5.2.4 DEMOGRAPHIC VARIABLES

The major determinants of market environment are age and income (Schuler and Adair, 2003). These determinants must be developed to show the relevant nature of demographics in predicating consumer participation in the residential housing market.

3.5.2.4.1 AGE

The prognostic measure of population cohorts and their participation towards given activities allow foresight into economic stimulus (Dent, 2004). Recent fluctuations in demographics show that Americans are ageing (Schuler and Adair, 2003; Dent, 2004; Stein, 2008). The 2002 Census shows growth in the U.S. population in the 55 years plus grouping through 2020, however all other age groups show potential for decline (U.S. Census Bureau, 2009e).

The rate of homeownership steadily increases as a population ages and becomes more financially capable (Schuler and Adair, 2003; Stein, 2008). According to the 2005 Census Bureau study, homeownership rates are highest amongst the age groups of 45 to 54 (70.4 percent) and 55 to 64 (80.0 percent) (U.S. Census Bureau, 2009g). In current times, these two age groups signify the trailing edge of the baby boomer cohort (1945-1964) and prove to be a main reason why national homeownership is now at the current level of 67.8 percent (Callis and Cavanaugh, 2008; Wilden, 2002). Although this trend has positive implications for the residential housing market as a whole, the factory-built housing industry proves to be an affordable option amongst fixed income households (HUD, 2003). The American Housing Survey (2009d) conducted a study showing distinguishably high levels of manufactured home ownership amongst the older age brackets (age 55-65+) in comparison to all other housing units, a finding supported by

previous residential sector research conducted by Apgar et al. (2002). Furthermore, during the 1990's, heightened periods of the manufactured home ownership proved potent in attracting an older age grouping with 29 percent, or 1,758,539 households being in the 60 years or older age grouping (Wilden, 2002). As population groups age, and home ownership levels continue to increase amongst the age cohort of 55 years and above, opportunity for market expansion seems prominent for factory-built home manufacturers (Wilden, 2002).

3.5.3 FINANCIAL

3.5.3.1 THE RESIDENTIAL CONSTRUCTION INDUSTRY

The American dream is homeownership (Cox W., 2002; Lubell J. M., 2005). Today, more than of any time in history, Americans have illustrated their urge to pursue this dream (U.S. Census Bureau, 2009g). The U.S Census Bureau reported homeownership rates approaching 70 percent as of 2005, a level that had merely broken 60 percent earlier in the century (Callis and Cavanaugh, 2008; U.S. Census Bureau, 2009g). The housing boom of the early 2000's has given way to a subsequent bust in homeownership that started in mid to late 2007 (U.S. Census Bureau, 2009g). This deflation has caused a backlash throughout the financial portion of this sector, creating widespread foreclosures and a crippled housing market (Center for Responsible Lending, 2006; RealtyTrac, 2009).

In the first two quarters of 2009, the unemployment rate has risen from 5.8 percent to 9.6 percent (U.S. Bureau of Labor Statistics, 2009), home foreclosures, at 10 percent of the home market, have surged beyond levels seen during the 1980's recession (RealtyTrac, 2009; Center for Responsible Lending, 2006), and the U.S. real gross

domestic product has declined at a rate of 6.4 percent in 2009 (U.S. Department of Commerce, 2009). The impact of foreclosures have been felt deeply across the residential construction industry, especially in the site-built home market (Anonymous, 2009; RealtyTrac, 2009). Deep exposure to delinquent mortgages has brought unsold home inventories to record highs and home sale prices plunging (Rice, 2009). The manufactured home industry has not been left unscathed by this current credit crises and is still in the midst of recalibrating from a previous financial meltdown in the mid 1990's (HUD, 2006a).

The manufactured home sub-sector fared the worst during this previous sub-industry collapse in the mid 1990's and is still sinking (U.S. Census Bureau, 2008a).

> *"Lenient qualification standards have generated the highest rates of delinquency and foreclosures in two decades, but manufactured housing defaults are much higher still with 12 percent of manufactured housing loans going into default, a rate four times higher than that for conventional loans* (Genz, 2001, p. 402)".

During the period of 1990 until 2002, industry estimates show that nearly 75,000 manufactured homes were reposed due to loan defaults (Apgar et al., 2002). Fortunately the factory-built home industry, primarily the sub-sector of manufactured home builders, has taken decisive steps to improve industry performance during these difficult financial times (Woodbridge, P. and Associates, 2003; Kochera, 1998). The adaptation of real estate mortgages are replacing antiquated chattel loans (Atiles and Vanderford, 2006). Chattel loans (personal property loans) provided sub-prime financing with interest two to three times greater than conventional real estate loans (Genz, 2001; Newman and Fleming, 2006). As Factory-built homebuilders look to readjust target markets for their products (Rice, 2009), product improvements and strategic management can be employed

at the industry level (Bady, 1996; Kochera, 1998; Woodbridge, P. and Associates, 2003). However, long-term success looks to be in the hands of the Federal Reserve and its monetary policies (Marshall and Marsh, 2006).

The Federal Reserve has been struggling to counteract the deteriorating housing market with cuts to the federal funds rate, the rate that determines the cost of borrowing money, since August 2007 (The Congress of the U.S., 2008). Their hope is to create a market that is favorable to lending, pursued through local banks, thus stimulating to the economy (U.S. Department of Commerce, 2009). Figure 3-9 illustrates these changes to the Federal Funds rate and how they weigh against historical changes. It is notable that in the past year, rate cuts have exceeded 3 percent, dropping from 5.02 to 1.92 (The U.S. Federal Reserve, 2009).

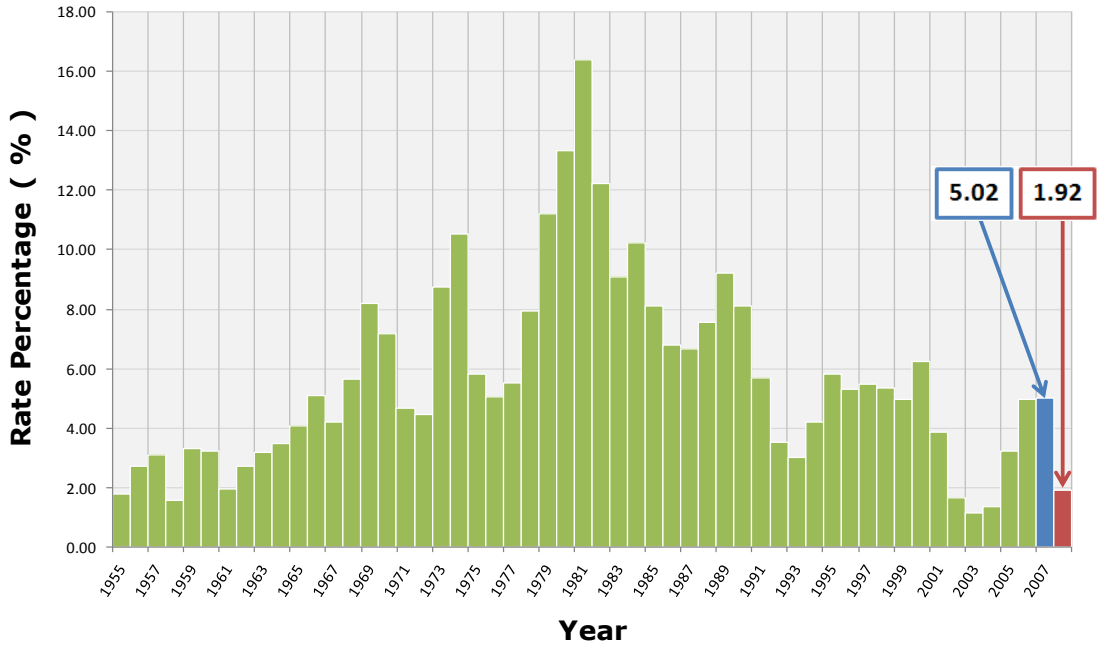

Figure 3-9: U.S. Federal Funds Rate (1955-2008; The U.S. Federal Reserve, 2009)

3.5.3.2 HOMEOWNERSHIP

The prospect of owning a single-family home concerns two main categories of the residential housing sector. These sector-categories are those of new or existing homes. Careful consideration must be given to either option when considering homeownership (Apgar et al., 2002). The financial duty of homeownership is often the most difficult obstacle for individuals looking to purchase a home (Lubell J. M., 2005; Cox W., 2002). The depth of variables lends themselves to confusion; forcing many home buyers to entrust a great level of financial prudence to their fiduciary institution (HUD, 1998).

When considering the purchase of an existing home, many aspects of the legal and financial obligations are simplified compared to the steps involved with building a home (HUD, 1998). Today factory-built homes offer traditional means of purchase and titling, thus offering the same asset value that site-built real estate presents (Newman and Fleming, 2006; Apgar et al., 2002).

3.5.3.2.1 NEW HOME CONSTRUCTION

The alternative to purchasing an existing single-family home is the construction of a new home. The legal, financial, and organizational obligations involved with building a new home far exceed those of an existing home purchase (HUD, 1998). The primary requirements of new single-family home construction are concerned with the land, construction, and financial costs (Hullibarger, 2001; HUD, 1998).

Funding and legal work are chronologically the first and most critical steps to home purchase and can vary in several aspects (Chambers et al., 2009). Home loans, equity loans or personal funds can be used to obtain the financing necessary to purchase the home from the current owner (Newman and Fleming, 2006; Hullibarger, 2001; HUD,

1998, 2006a; Apgar et al., 2002). Once the means of funding are obtained, generally through a mortgage, inspections are conducted and contracts are negotiated (Hullibarger, 2001; HUD, 2006a). If an agreement is reached, home insurance is assessed and a title is completed (Hullibarger, 2001; HUD, 1998).

Loans taken out to finance a combination of both property and home-structure are deemed real estate loans (Newman and Fleming, 2006; West, 2006; Chambers et al., 2009). Real estate loans are typical to site-built construction as well as modular, panelized, and pre-cut homes (HUD, 1998, 2007). In addition to real estate loans, manufactured homes offer the ability to pursue alternative-financing agreements, otherwise known as chattel loans, issued for purchase of a structure (Apgar et al., 2002; Newman and Fleming, 2006; Atiles and Vanderford, 2006). These loans are generally offered at a higher rate, possibly two to three times higher than real estate loans and typically have a shorter duration (Atiles and Vanderford, 2006; Wilden, 2002; Woodbridge, P. and Associates, 2003). Chattel loans have become increasingly less common since the mid-nineties as homebuyers move away from personal property loans and towards real estate loans that provide the potential for asset appreciation (Atiles and Vanderford, 2006; Wilden, 2002; Woodbridge, P. and Associates, 2003). Real estate loans are offered in a multitude of variations and are now constructed to include manufactured homes (Atiles and Vanderford, 2006; HUD, 2001). Prospective homeowners can finance the purchase of a manufactured home through large national lenders who offer lending possibilities based on site preparation, permits, parcel and structural payments (Apgar et al., 2002). As manufactured homeownership becomes increasingly beneficial, more owners will convert what was originally considered a

community-based structure into a private real estate investment (Newman and Fleming, 2006).

Acquisition of land and the preparation of the site are the initial steps taken when looking to place a new single-family home (Hullibarger, 2001; HUD, 1998). A major barrier to homeownership is found in the direct upfront cost associated with new private-land purchase (HUD, 1998). Research conducted by the U.S. Department of Housing and Urban Development (1998) shows that the purchase of private land makes up approximately 30 percent of the final sales price of a home whether site-built, modular, or manufactured. However, homeowners who place their homes, generally manufactured units, in land-lease communities are less adverse financially in initial cash outlays than those who chose to excavate a tract of land for new home placement (Hullibarger, 2001; HUD, 1998; Apgar et al.,2002). Although the option of land-leased communities are financially forthcoming in regards to upfront costs, long-term reductions in housing expenditures are established with private land placement (Hullibarger, 2001; HUD, 1998; Apgar et al.,2002).

Fundamental to the affordable nature of factory-built homes is their ability to intrinsically reduce construction lead-time, on-site labor hours, and construction waste (HUD, 2001). Comparative price analyses of site-built, modular, and manufactured homes have been conducted through the U.S. Department of Housing and Urban Development (1998). These analyses revealed distinct savings obtained through factory-built home construction (HUD, 1998; Apgar et al., 2002).

The greatest area for cost savings when constructing a new home is the structure itself (HUD, 1998, 2007). Manufactured and modular homes are constructed almost

completely in a factory setting and provide increased efficiencies, quality, and durability when compared to site-built homes (HUD, 1998, 2001). Site-built homes face major cost constraints with labor, climate, construction waste and the potential for vandalism (Atiles and Vanderford, 2006; HUD, 1998, 2001; Newman and Fleming, 2006). Current progressive manufacturing techniques used in the construction of factory-built homes are now able to maximize efficiencies and minimize waste in labor, materials and resources (HUD, 2006a). This focus towards cost-minimization within the manufacturing process greatly reduces operating expenditures for the producer and is then passed on to the consumer (HUD, 1998, 2000; Obiso, 1997).

3.5.4 GOVERNMENT

3.5.4.1 OVERVIEW

The long history of the U.S. Federal government's involvement with the residential housing industry is in large part tied to the creation of the Reconstruction Finance Corporation (RFC) in 1932 (HUD, 2008a, 2008b). In the midst of the Great Depression, President Hoover established the RFC, a partnership of private banks, in hopes to alleviate the many struggling illiquid banks by providing loans in exchange for collateral (Butkiewicz, 1995). The creation of the RFC allowed the Federal government to intervene in the financial workings of the nation (Walker, 1991). Through legislation and policy reforms, the RFC's strict lending practices were slowly dissolved, thus beginning a tumultuous battle against political controversy and suspect lending practices (Butkiewicz, 1995). The introduction of the New Deal, backed by President Franklin D. Roosevelt, merged the RFC and Federal Deposit Insurance Corporation (FDIC), which provided loans to agriculture, housing, exports, businesses, governments and other financial

matters (Nash, 1959). Although the RFC was pivotal in changing a struggling economic landscape, its' turbulent and often underhanded political role was the cause for its' abolishment by Congress in 1953 (Walker, 1991).

During the 1930's the Federal banking system was reconfigured and the Federal Housing Administration (FHA) was established (HUD, 2008b). Over the next century, and as the U.S. pulled through the final stages of World War II in 1945, the need for housing regulation and support was felt (HUD, 2008b). In response to this need for stability, President Harry S. Truman introduced the Housing Act of 1949 (HUD, 2008b; Nash, 1959; Walker, 1991). The Housing Act of 1949 was the preliminary breakthrough that promoted community development programs and government sponsored housing works (Lang et al., 2008). A major component of the Housing Act of 1949 was The National Housing Agency (NHA), which was to cover all non-farm housing programs (HUD, 2008b).

The creation of the Department of Housing and Urban Development (HUD) in 1965, by the Department of Housing and Urban Development Act, was further proof to the ongoing transformations of the Federal housing agency (HUD, 2008b). HUD is comprised of various operating units focusing on specific sectors of housing and urban development in the U.S. (HUD, 2008b). These units range from Housing through Community planning, Fair and Equal Opportunity Housing, Public and Indian Housing and the financial features of Ginnie Mae (HUD, 2008b). The overall objective of these units is to provide the nation with ability to pursue the American dream of owning a home (Cox W., 2002; Lubell J. M., 2005; HUD, 2008b).

3.5.4.2 HOUSING PROGRAMS

Government programs sponsored through the Department of Housing and Urban Development and other related organizations have long looked to promote affordability, sustainability and innovation in the residential home construction industry (Beamish et al., 2001; HUD, 2000). Industrialized housing naturally provides such qualities and thus has been the chosen vehicle for the federal government's endeavors into such fields (Beamish et al., 2001; HUD, 2003). Several important government programs have been implemented successfully over the past century, including *Operation Breakthrough* and the *Partnership for Advancing Technology in Housing*(Beamish et al., 2001; HUD, 2000). These two programs have shaped a strong framework for the future development of innovative and affordable housing options (HUD, 2000).

3.5.4.3 OPERATION BREAKTHROUGH

Operation Breakthrough, established in 1969 and funded through to 1972, was the Federal government's first attempt to provide initiatives that promoted industrialized housing opportunities to private sectors through public policy (Beamish et al., 2001; HUD, 2000; Martin, 2005). These initiatives targeted the fragmentation of the housing market and the non-unified nature of U.S housing codes(HUD, 2000; Martin, 2005). The economic success of Operation Breakthrough was thwarted by the scale of production, aggregated market demands and regionalized building regulations (Wallis, 1991; HUD, 2000; Martin, 2005). The lasting effects of this housing initiative were depleted through low levels of consumer perception, highly capitalized barriers of entry and the instability of government policy to provide financial backing (Wallis, 1991; Martin, 2005; Beamish et al., 2001;).

3.5.4.4 PARTNERSHIP FOR ADVANCING TECHNOLOGY IN HOUSING (PATH)

This partnership was established in 1998 between the Departments of Housing and Urban Development, Energy, Commerce, and Agriculture (HUD, 2006a). Additionally, support has been added by the Environmental Protection Agency and National Science Foundation as well as numerous private-sector industries (HUD, 2006a). The four main objectives that PATH looks to pursue are affordability, energy efficiency, durability, disaster resistance, and safety (HUD, 2006a; Beamish et al., 2001;). Through these objectives the overall goal of the agency is "*to develop approaches, innovative housing component designs, and production methods that will reduce 50% of the time needed to move quality products to market* (HUD, 2000, p.29)."

PATH looks to use the downfalls of previous housing programs to overcome forthcoming obstacles (HUD, 2000). A prominent point in PATH's strategy is the involvement of future private sector users (Martin, 2005). These participants pilot the development process of innovation and thus offer a unique level of flexibility to the development process (Martin, 2005). Intrinsically the full-cycle involvement of public, private, and consumer sectors are necessary and vital to breaking through to sustainable housing innovations (Beamish et al., 2001; HUD, 2003, 2006a; Martin, 2005.

4 METHODOLOGY

4.1 OVERVIEW

The goal of this research is to empirically evaluate the current position of the manufactured housing industry-segment as a benchmark for the factory-built home industry. Additionally, this study will investigate if factory-built home producers have diversified from their native factory-built home industry-segments to additional factory-built home industry-segments. For example, Colony Homes of Shippenville, Pennsylvania, a manufactured home producer who only produced manufactured homes in 2002, but now produces both manufactured and modular homes in 2008 (Colony Homes, 2009). Three methods of data collection were established to provide this information:

1.) Literature review of the U.S. residential construction sector and supporting micro and macro-economic data.
2.) Historical economic data on the residential construction sector and manufactured home industry-segment obtained from the U.S Census Bureau and the Manufactured Housing Institute (MHI).
3.) A mail questionnaire targeting the factory-built home construction industry with industry contacts provided by the National Association of Home Builders (NAHB), the Manufactured Housing Institute (MHI) and the Automated Builder Magazine.

The literature review and historical data act as secondary data sources whereas the mail questionnaire provides primary data for this study.

4.2 DATA SOURCES

4.2.1 SECONDARY DATA

4.2.1.1 LITERATURE REVIEW

A Literature review was used to present the dynamic nature of the U.S. residential construction sector. To gather a general sample of supporting evidence on the topics of residential construction, industrialization, architecture, and engineering, information from government agencies, trade organizations and scholarly contributions work were used.

The U.S Department of Housing and Urban Development (HUD) supported by its Office of Policy Development and Research, and the National Association of Home Builders Research Center (NAHBRC) provided sector reports detailing industry and segment analysis. The Manufactured Housing Institute (MHI) and the National Modular Housing Council (NMHC) provided reports and documentation on sector and industry performance, regulations, and analysis. Other sources including scholarly work focusing on manufacturing, business, economics, forest products, construction, architecture and urban planning were also consulted.

4.2.1.2 HISTORICAL DATA

The population of interest for this study's market share analysis of the manufactured home industry-segment was the U.S residential construction sector and manufactured (mobile home) manufacturers.

NAICS code 23611 defines the residential building construction sector as:

"Establishments primarily responsible for the construction or remodeling and renovation of single-family and multifamily residential buildings. Included in this industry are residential housing general contractors (i.e., new construction, remodeling, or renovating existing

residential structures), operative builders and remodelers of residential structures, residential project construction management firms, and residential design-build firms (NAICS, 2008a)."

The scope of the historical data is restricted to the population of NAICS code 23611: Residential building construction that includes the sub-population of NAICS code 321991: Manufactured home (mobile home) manufacturing under U.S. Census Bureau methodology (NAICS, 2008b; U.S. Census Bureau, 2008g).

NAICS 321991 defines the manufactured home (mobile home) industry-segment as:

"*Establishments primarily engaged in making manufactured homes (i.e., mobile homes) and nonresidential mobile buildings. Manufactured homes are designed to accept permanent water, sewer, and utility connections and although equipped with wheels, they are not intended for regular highway movement* (NAICS, 2008b)."

The code classifications listed previously (NAICS 23611, 321991) encompass all new residential construction in the U.S. that fall under site-built and manufactured home construction.

According to the 2007 economic census, the residential construction sector (NAICS code 23611) had approximately 198,530 establishments with approximately 900,000 employees (U.S. Census Bureau, 2008e).

The sub-industry, manufactured home (mobile home) manufacturing (NAICS code 321991) was comprised of 65 companies operating a combined 372 establishments that employed approximately 42,000 people (MHI, 2008a; U.S. Census Bureau, 2008f).

4.2.2 PRIMARY DATA

4.2.2.1 MAIL QUESTIONNAIRE

4.2.2.1.1 POPULATION

The population of interest for the mail questionnaire included firms operating in the U.S residential construction sector under the specific classification of factory-built home construction. Trade data for the factory-built home industry was obtained from The National Association of Home Builders, The Manufactured Housing Institute, and the Automated Builder magazine.

4.2.2.2 MAILING LIST

A mailing list was generated with information provided by the National Association of Home Builders Building Systems Council (National Association of Home Builders, 2009a) as well as the Manufactured Housing Institute's Developer Resources (MHI, 2009) and the Automated Builder Magazine's Engineered Homebuilders Directory (Automated Builder, 2008).

Contact information provided by the National Association of Home Builders stemmed from the Building Systems Council (NAHB, 2009) and encompassed modular, panelized, log and concrete homebuilder directories. The mailing list was composed of company names, address, and contact information. Each sub-sector of the master directory was assigned a unique source locator code to aid in tracking abilities throughout the survey and the data analysis. Further analysis of business demographics, response rates, and incorrect address information could then be tracked back to the original data source. The corresponding source locator codes for each individual company contact are 1.) Building Systems Council; 2.) Modular; 3.) Panelized; 4.) Log & Kit; and 5.)

Concrete. The industry directories were aggregated and refined to remove all international listings, associations, guilds, institutes, and research centers. A total of 249 company contacts were generated from the five directories.

The Manufactured Housing Institute's (MHI) web based developer resource guide provided a second source of industry contact information (MHI, 2009). Industry listings, provided by MHI, focused solely on manufactured homebuilders within the continental U.S. All company contacts provided through the MHI resource were assigned a unique source locator (6). International company contacts and duplicate entries from NAHB, MHI, and The Automated Builder magazine were eliminated during the compilation process. The MHI source provided 21 additional industry contacts.

Automated Builder Magazine's engineered homebuilder directory provided the third source of contact information (Automated Builder, 2008). Contacts from this directory were firms operating in the factory-built housing industry that includes the industry-segments of manufactured, modular, panelized, structural insulated panels, log, timber frame, and special units home construction. Due to the listing format of Automated Builder's directory, each sub-sector was not issued a unique source locator code. Automated Builder's listings were translated to the existing master mailing list along with a source locator code. The source code (7), was assigned to each contact generated from this source. All international listings were eliminated during the translation process. A total of 85 company contacts were generated from this directory.

Overall, a total of 355 company contacts were generated during the compilation of the seven industry directories. All incomplete company contact listings were updated through an online search via Manta company profiles & company information (Manta,

2009). Manta's online business listings were cross-referenced from existing data, such as company name, address, city, state, zip and telephone number. Of the twelve listings that were incomplete from their original source, ten were completed through this method. The remaining two partial contacts were dropped from the mailing list. The final mailing list thus comprised 353 complete company contacts.

4.2.2.3 SAMPLE SIZE

The final mailing list generated a sample size of 353 firms. This small sample size was the determinant in offering the mail questionnaire to all members of the final mailing list provided by the NAHB, MHI, and the Automated Builder Magazine. All 353 firms were sampled with an expected response rate of 30 percent or approximately 105 responses, based on the mail questionnaire application methods and follow up techniques chosen (Rea and Parker 2005; Dillman et al., 2009).

4.3 DATA COLLECTION

4.3.1 SECONDARY DATA

4.3.1.1 HISTORICAL DATA SETS

Historical data for the market share analysis of the manufactured home industry-segment was obtained from the U.S. Census Bureau (U.S. Census Bureau, 2008a; 2009a). The U.S. Census Bureau's historical data tracks new privately owned residential housing starts from 1959 to 2008 as well as shipments of new manufactured homes from 1959 to 2007.

4.3.2 PRIMARY DATA

4.3.2.1 MAIL QUESTIONNAIRE

A mail questionnaire directed at U.S. factory-built home industry within the U.S. residential construction sector was developed in cooperation with the USDA Forest Service, National Association of Home Builders Research Center, and Virginia Polytechnic Institute and State University. The structure of the mail questionnaire focused on five key business dimensions that impact the U.S. factory-built home industry. These dimensions were extrapolated from an extensive literature review that focused on industry demographics, financial considerations, governmental policy, market structure, and the manufacturing process. Three types of questions were used to assess the five dimensions of the questionnaire: 1.) categorical scale; 2.) seven-point interval scale; and 3.) open-ended (Rea & Parker, 2005). In addition to the formal questionnaire, a set of operational definitions were established for the five partitions of the residential construction sector and were included in the questionnaire packet. The operational definitions included the site-built, manufactured, modular, panelized, and pre-cut home construction.

4.3.2.1.1 MAIL QUESTIONNAIRE PRETEST

After internal review and obtaining feedback from industry specialists at the USDA Forest Service, and NAHB Research Center, a pretest mailing of the mail questionnaire was administered to a randomly chosen sample group of 20 industry participants listed in the final address list to test for clarity, comprehensiveness and acceptability (Rea and Parker, 2005). The pretest mail questionnaire was comprised of an undisguised questionnaire addressing corporate-level decision makers in the factory-built housing

industry. Each of the twenty recipients received a personalized cover letter, and a mail questionnaire that included a unique tracking number and a first-class pre-paid return postage to encourage responses. After a two-week period, all non-respondents were contacted by telephone and asked to answer verbally thirteen selected questions (Rea and Parker, 2005).

Upon analysis of the responses received, minor revisions were made to the mail questionnaire to address issues discovered (Rea and Parker, 2005). APPENDIX A shows the final mail questionnaire.

4.3.2.2 FIRST MAIL QUESTIONNAIRE

The final mail questionnaire (APPENDIX A) was comprised of an undisguised questionnaire addressing corporate-level decision makers in the factory-built housing industry (Dillman et al., 2009; Rea and Parker, 2005). The first questionnaire was mailed on May 22, 2009 (Rea and Parker, 2005).

Each recipient received a personalized cover letter (APPENDIX B), a mail questionnaire that included operational definitions of sector and industry-segments, and a business reply mail page (APPENDIX C) to encourage response. Each packet contained a cover letter, mail questionnaire, and was assigned a unique identification number. This identification number expedited the envelope packing process, aided response monitoring and provided a method for follow-up actions on non-respondents (Biemer and Lyberg, 2003; Rea and Parker, 2005).

A timeline was established that consisted of two written forms of communication with respondents at the one-week and four-week marks in the response period (Figure 4-1).

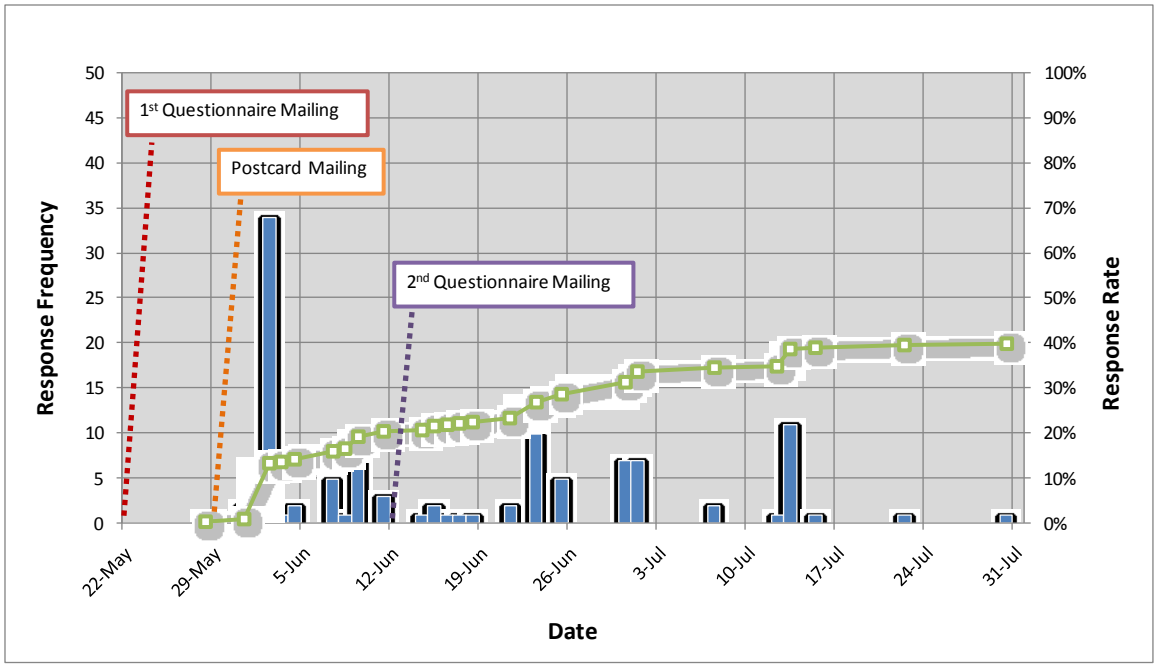

Figure 4-1: Questionnaire Timeline

4.3.2.3 FOLLOW UP CONTACT AND SECOND QUESTIONNAIRE

A one-week reminder postcard (APPENDIX D) was sent out to all non-respondents reminding them of the importance of their response. After an elapsed three-week period, all non-respondents were mailed a second follow-up mail questionnaire. The second questionnaire was identical to the first mail questionnaire except that it was printed on an alternative colored paper (Rea and Parker, 2005). After a six-week period, thirty non-respondents were contacted by telephone and asked a series of four verbal demographic questions (Dillman et al., 2009; Rea and Parker, 2005). Verbal responses to these questions were recorded and entered into the data spreadsheet.

4.4 DATA ANALYSIS

4.4.1 SECONDARY DATA

4.4.1.1 HISTORICAL DATA SETS

Historical data sets of new residential housing starts and shipments of new manufactured homes from 1959 to 2008 were downloaded via the U.S. Census Bureau website (U.S. Census Bureau, 2008a; 2009a). All data was converted to units in thousands. An index, or proportional ratio, of U.S. manufactured home shipments to new site-built residential home starts was adapted from the U.S. Census Bureau data (U.S. Census Bureau, 2008a, 2009a). Home starts rather than completions or sales were used in this ratio measure due to the greater time frame available with the "*starts*" data set. Additionally, it is noted that home starts are approximately 4 percent higher than completions on an annual basis (U.S. Census Bureau, 2008c). The U.S. Census Bureau reports housing activity in the manufactured home industry-segment as home shipments. This proportional measure depicts an annual market share percentage of the U.S. manufactured housing industry-segment and is represented by equation 1, where new manufactured home shipments is χ_i , new residential home starts is Y_i , market share percentage is P_i , and i represents the year (1959 - 2008).

$$P_i = \left[\frac{\chi_i}{\mathrm{Y}_i + \chi_i}\right] * 100 \qquad \textbf{(1)}$$

Once the segmented market share data sets were generated by means of equation 1, an additional two-step method of data transformation was performed. The economic periods of *Post War Prosperity (1959-1973), Deregulation (1974-1992),* and *The New Economy (1993-2008)* were overlaid with the market share data sets. All three eras were marked by macroeconomic changes in government policy, particularly the government

laden Keynesian period (*Post War Prosperity*), and the contrasting, laissez-faire period (*Deregulation)* (Carson, 1980; Snowdon and Vane, 2005; French, 1997).

This amalgamation process created three distinct economic data sets ranging from 15 years to 19 years in length. Secondly, an ordinal time series, ranging from 1 to 19, and titled "*Year of Economic Period*" was overlaid with the existing economic data sets. Results of the economic period allocation and ordinal transformation created a pivot-table that measured *years of the economic periods* across the *economic periods.*

The market share data sets were accessed by the Statistical Analysis System Institute (SAS) JMP 8.0 software package (SAS, 2008). The continuous market share data was analyzed through a segmented generalized linear regression analysis. The generalized linear regression analysis was used to determine the slope parameter of each time series data set for the three corresponding economic eras. The generalized linear regression model is as expressed by equation 2, where $\hat{y}$ is the predicted response, $\hat{\beta}_0$ is the intercept, $\hat{\beta}_1$ is the slope, x is the independent variable and ε is the random error term (Ott and Longnecker, 2001).

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x + \varepsilon \quad \textbf{(2)}$$

All data sets were tested for the formal assumptions of regression analysis that included; a linear relationship with all expected values equal to 0; and all errors having equal variance ($p = 0.565$), independence, and are normally distributed (Ott and Longnecker, 2001).

4.4.2 PRIMARY DATA

4.4.2.1 MAIL QUESTIONNAIRE

Mail questionnaire data was collected, coded and entered into a Microsoft Excel 2007 spreadsheet (Microsoft, 2007). All entries were coded based on date received, reference number, binary, seven-point interval scale, nominal, ordinal or open-ended responses. The coded spreadsheet document was accessed by *JMP 8.0* statistical software (SAS, 2008). Additionally, location data used throughout the mail questionnaire and analysis was based on regional definitions provided by the U.S. Census Bureau (U.S. Census Bureau, 2008c).

High-level analysis of survey responses was performed via frequency distributions, cross-tabulated contingency tables, and descriptive statistics (Dillman et al., 2009; Rea and Parker, 2005). Drill down analysis was performed on the dimensional factors of industry demographics, economics and finance, governmental policy, market structure, and the manufacturing process. Dimensional data was rigorously tested using non-parametric statistics. A Wilcoxon Rank-Sum test was used to analyze means between dimensional response factors.

Lastly, non-response bias was tested for 30 of the 167 non-respondents who were randomly selected and contacted via telephone (Rea and Parker, 2005). Four demographic questions were asked of each non-respondent contacted. Results of this data collection were analyzed using chi-squared tests for proportions and two-sample t-tests for means (Table 4-1; Ott and Longnecker, 2001; Sall et al., 2005).

Table 4-1: Non Response Bias

#	Question	Test Statistic	P-Value	Test Type
3	Is the manufacturing of factory-built homes your primary business (e.g. largest portion of revenue generated)?	1.031	0.309	Chi-Square
4	What type of factory built home is your primary business (e.g. largest portion of revenue generated)?	7.522	0.057	Chi-Square
13	Total Sales: 2008	1.799	0.128	t-Test
14	Do you collaborate with any government organizations or programs (i.e. (PATH) The Partnership for Advancing Technology in Housing)	0.6599	0.416	Chi-Square

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5 MANUSCRIPT I

PRODUCT LIFE CYCLE POSITIONING AND THE MANUFACTURED HOME INDUSTRY-SEGMENT

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Keywords: new residential construction, factory-built homes, manufactured housing, generalized linear regression, product life cycle

JEL Codes: M11, M20, M21, M30, N, N0, N60, O14, R31

5.1 ABSTRACT

The U.S. factory-built residential housing industry, while originating from mobile homes (e.g. manufactured homes), has seen new industry-segments emerging that promote the ability of producers to diversify from manufactured homes to alternative products such as modular, panelized, and pre-cut homes. This research looked at manufactured home producers as a benchmark for analyzing the current economic state of the industry and investigated competitive strategies producers in this industry-segment employ. The analysis concludes, through macroeconomic modeling, that manufactured homes are in the declining stage of the product life cycle. As market share continues to decline, firms operating in this industry-segment seek to either hedge their losses through product diversification strategies or remain focused on strategically repositioning the manufactured home segment.

5.2 INTRODUCTION

The U.S. residential construction sector is influenced by the cyclical nature of the U.S. economy and has exhibited expansion and contraction periods in relation to a multitude of economic variables (Sullivan and Sheffrin, 2003). The most recent business cycle has left both the U.S. credit and the residential housing markets reeling. In the first two quarters of 2009, while the unemployment rate has risen from 5.8 percent to 9.6 percent (U.S. Bureau of Labor Statistics, 2009), home foreclosures, at 10 percent of the home market, have surged beyond levels seen during the 1980's recession (RealtyTrac, 2009; Center for Responsible Lending, 2006), and the U.S. real gross domestic product has declined at a rate of 6.4 percent in 2009 so far (U.S. Department of Commerce, 2009). Currently, these events fundamentally reshape the U.S. economy and drive change within the U.S. residential construction sector.

The U.S. residential construction sector consists of site-built and factory-built residential construction producers. Site-built construction consists of residential structures erected on site using mostly dimensional lumber and engineered building components (Gurney, 1999), while factory-built construction is defined as residential structures constructed within a manufacturing facility utilizing dimensional lumber and engineered building components, followed by transporting the entire structure or segments to the final site (HUD, 2007). In terms of economic importance, these two industries are non-equivalent, with new site-built construction accounting for approximately 1.25 of the 1.35 million new residential home starts in 2007 (U.S. Census Bureau, 2008a, 2009h; Manufactured Housing Institute, 2008). Alternately, less than

96,000 new residential home shipments were produced by the factory-built home industry during the same year (U.S. Census Bureau, 2008a).

In the current century, moderate years of residential construction were seen during the 2000 to 2002 economic cycle. These years saw new home construction maintain levels of 1.57, 1.6, and 1.7 million new home starts (U.S. Census Bureau, 2009a). The steadiness of the U.S. home market during the early 2000's was broken by a frenzy of construction activity in 2005 and 2006, when new home starts exceeded 1.9 million units for two consecutive years (U.S. Census Bureau, 2009a, 2009f). Such a boom had not been seen in the U.S. since 1971-73 when home starts topped a record high 2.0 million units (U.S. Census Bureau, 2009a, 2009d, 2009e). However, after these two years of frenzied activities in 2005 and 2006, the current economic depression reduced the number of new home starts to levels not seen since the savings and loan crisis of 1981 - 82, with 1.35 million and 0.905 million home starts in 2007 and 2008, respectively (Moore, 1983). In 2009, estimated residential home starts will reach just over 0.59 million units (U.S. Census Bureau, 2009b) a new all time low in U.S. residential home starts.

The purpose of this article is to empirically evaluate the current competitive position of the manufactured housing industry-segment. Investigation of market share, through generalized linear regression modeling, will provide a framework for product life cycle analysis within the manufactured housing segment. Estimated model parameters will offer a deeper understanding of the changing U.S. factory-built residential construction industry and interpret how the manufactured housing segment's product life cycle position will play a decisive role in future strategic business decisions.

5.3 LITERATURE REVIEW

With the state of the U.S. residential construction sector in flux, many homebuilders are readdressing their business strategies. Strategic thought in business rests in the application of theory to practice, a well-suited trait of the product life cycle (PLC). The PLC is an inherent concept pertaining to a market's demand of a specific good over time and can be measured by its sales over a given period (Polli and Cook, 1969). A period is defined by the introduction of a product to market and continues throughout the growth, maturity, and declining stages of a product's evolution (Cox, 1967). Fundamentally, the trend and timeline of the product life cycle are not fixed measures and can be thwarted through efforts geared towards market penetration, development, diversification, and/or application of products to new markets (Day, 1981). Such reinvention has been seen across consumer markets in both durable and non-durable goods. Church and Dwight Company's reinvention of the Arm and Hammer Baking soda is a classic example of rediscovering a products' potential through market development. Morton Salt Company used diversification strategies to pursue new markets for their existing product, food salt. In the durable-goods category, Swatch Group, LTD, a producer of luxury time pieces, with a branch competing in the lower-priced market-segment (Swatch), faced dwindling market share in the international watch industry throughout the mid-seventies by increased competition from Japanese manufacturers focused on manufacturing efficiency (Swatch Group, 2009). Swatch struggled to compete in the lower end market and thus decided to make a conscious effort to become competitive. They turned their attention towards their low-end products' life cycle (Bouquet and Morrison, 2006). Using PLC assessment combined with strategic marketing, industrial advances in design and manufacturing, Swatch watches emerged as the market-segment leader in quality and

style, a position they held for more than a decade now (Swatch Group, 2009, Bouquet and Morrison, 2006).

In this study, PLC analysis is used to detect shifts in market success and business strategy (Peter and Donnelly, 2001) amongst the U.S. residential construction sector. While the U.S. residential construction sector has endured fluctuating economic cycles over numerous decades, these cycles have proven the resilience of the sector through steadily increasing homeownership rates since the 1960's (U.S. Census Bureau, 2009k). Individual success within the sector by the site-built home industry, however, has been at the expense of the factory-built home industry, which has seen market shares decline rapidly over the past decades (Agarwal, 1997; Phillips and Kirchhoff, 1989).

This manuscript explores the shifting relationship between the manufactured home and the factory-built home industry. Earlier studies on supply, demand, and policy concerning manufactured housing focused on prescriptive recommendations for change, such as lending practices based on real estate titling and demand elasticity of consumer preferences towards manufactured homes within the factory-built home industry (Marshall and Marsh, 2006). First, a framework for strategic analysis inspects the manufactured housing sector's market share of the residential construction sector as a driver of product life cycle positioning. Secondly, a discussion of diversification and growth strategies is presented for business development within the factory-built home industry.

5.4 DATA SCOPE

Producers in the factory-built home industry now face the dual assessment of product life cycle positioning and diversification within a transitioning macroeconomic

climate. Factory-built homebuilders, to construct a market evaluation, need a diagnostic scope. This scope will be created through a focused range of sector data presented in this research.

This manuscript focuses on regression based analysis due to readily available data of the U.S. residential construction sector and the statistical strength of regression modeling (Ott and Longnecker, 2001). Alternative methods of analysis, such as expert forecasting and industry surveys, did not capture the desired quantitative foundation that regression based analysis was able to provide.

The focal point of this manuscript is the current economic era, coined *The New Economy* (French, 1997). This era encompassed the U.S economy from 1993 through 2008 and will be the backdrop for analysis of the manufactured housing industry-segment during that time. In addition to *the New Economy*, two preceding economic eras will be referenced to in this manuscript. These two eras, as is *the New Economy*, are marked by macroeconomic changes in government policy, particularly the government laden Keynesian period known as *Post War Prosperity* from 1959 to 1973, and the contrasting, laissez-faire period of *Deregulation,* from 1974 to 1992 (Carson, 1980; Snowdon and Vane, 2005; French, 1997).

The population for this study is the manufactured home industry-segment, NAICS code 321991 (manufactured home manufacturers; U.S. Census Bureau, 2009h, 2009i). Shipment data for the manufactured home industry-segment and home start data for the U.S. residential construction industry was obtained through the U.S. Census Bureau and entails economic data collected between 1959 and 2008. Auxiliary supporting data on manufactured home manufacturers was obtained from the Manufactured Housing

Institute (MHI). Data collected from this source was used to verify sector classification as well as NAICS data provided by the U.S. Census Bureau, among other things.

5.5 ECONOMIC FRAMEWORK, AND MODEL

Data collected from the U.S. Census Bureau provides a high level economic view of the fluctuating nature of the U.S. residential construction sector. Primary data analysis on the Census data concluded that further data development would be needed to allow a clear determination of market fluctuations over the given time series (Gort, 1963). An index, or proportional ratio, of U.S. manufactured home shipments to U.S. residential home starts was constructed from the U.S. Census Bureau data. This proportional measure depicts an annual market share percentage of the U.S. manufactured housing segment compared to the U.S. residential construction sector and is represented by equation 3 where new manufactured home shipments is χ_i , new site-built residential home starts is Y_i , market share percentage is P_i , and i represents the year (1959 - 2008; Harrigan, 1983).

$$P_i = \left[\frac{\chi_i}{\mathrm{Y}_i+\chi_i}\right] * 100 \quad \textbf{(3)}$$

Attention was paid to the conflicting data comparisons found by the ratio of manufactured home *shipments* and residential home *starts*. However, tested methodological similarities validated this ratio use (HUD, 2007). Methodology provided by the U.S Census Bureau (U.S. Census Bureau, 2008b) indicates manufactured home shipments are completed home units, sold directly to consumers or indirectly through dealers to end users; whereas new site-built residential starts are owned home units held by private investors (U.S. Census Bureau, 2008c). Theoretically, these definitions

provide a supply side perspective of the finished goods produced by the site-built residential construction industry, therefore providing a framework for parallel comparison. Nonetheless, readers should be aware that differences between the measures obtained for manufactured home shipments and site-built residential home starts exist.

A continuous market share data table was constructed using equation 3 and U.S. Census Bureau data from 1959 through 2008 (U.S. Census Bureau, 2008a, 2009a). Market share data was tested for normality using a Shapiro-Wilk W Test ($\alpha = 0.05$). Results indicated the data was normally distributed ($p = 0.0537$).

A two-step method of data manipulation was performed on the continuous market share data set constructed by means of equation 3. The previously discussed economic periods of *Post War Prosperity (1959-1973), Deregulation (1974-1992),* and *The New Economy (1993-2008)* were allocated to the market share data set. This allocation process created three distinct economic data sets ranging from 15 years to 19 years in length. Secondly, a chronological year based time-series, ranging from 1 to 19, and titled "Year of Economic Period" was overlaid with the economic data sets (Ott and Longnecker, 2001; Ostrom, 1990). Results of the economic period allocation and year based time-series manipulation created a pivot-table that measures on the vertical axis the year of the economic period whereby horizontally displaying each of the three economic periods.

5.5.1 GENERALIZED LINEAR REGRESSION

Linear regression analysis is a common analytical technique that uses mathematical modeling to approximate a response based on factors and parameters across a given range of data (Sall et al, 2005). This study looks at the factor, *year of the economic period*, and

its' relationship to the response, *market share of the manufactured home segment*. This relationship between the factor and response is expressed through the slope parameter (Ott and Longnecker, 2001). The slope parameter directly indicates the change in market share occurring across the specified economic era (Kent, 2001). For this study there are three distinct ranges of data, also known as segments, which were previously defined as the economic eras of *Post War Prosperity (1959-1973), Deregulation (1974-1992),* and *The New Economy (1993-2008)*. Market share data for the manufactured home segment was modeled by generalized linear regression analysis to establish the slope parameter for each of the economic eras. Overall, the objective of this analysis is to provide a comparison of slope parameters across the three economic periods that recount to the changes seen across a products' life cycle.

Additionally, the three established market share slope parameters of the manufactured home segment data will be used in conjunction with a theoretical PLC curve. Correlative assessment of the slope parameters to the PLC will be evaluated by overlaying graphical representations of each (Huang and Tzeng, 2008). Correlative relations between the slope parameters of the regression models and the PLC curve will be discussed as a foundation for strategic market actions of the manufactured home segment and the factory-built home industry.

5.5.2 SEGMENTED REGRESSION ANALYSIS

The objective of comparing regression models across multiple ranges of data is not uncommon. These models have a broad historical background in applied functionality ranging from shipbuilding to advanced medicine (Muggeo, 2003). Appropriate terminology for this analytical technique has been coined as segmented regression

analysis, or knotted spline theory (Hudson, 1966; Kimeldorf and Wahba, 1970). Objectively, this analysis seeks to define break-points, or joints, in continuous data sets thus rendering the series segmented (Hudson, 1966). Application of these joint locations to a linear model provides insight into the non-constant relationship of the data series (Muggeo, 2003). Advanced practices in segmented regression analysis typically look beyond these independent models in an attempt to integrate a generalized theory (Feder, 1975; Farley and Hinich, 1970; Kimeldorf and Wahba, 1970; Hudson, 1966). However, this analysis is mathematically complex and partially ill-suited for direct application to the overall need this research (Feder, 1975). Therefore, this study will utilize a straightforward application of segmented regression analysis, where predetermined series joints are located at the intersection of economic segments and the independent regression models remain autonomous for comparison purposes (Huang and Tzeng, 2008).

Secondly, contrary to fully quantitative techniques used in marketing research analysis (Muggeo, 2003; Feder, 1975; Hudson, 1966), this study looks to apply qualitative models, based on a quantitative framework, to a segmented PLC curve, a methodology previously explored by Huang and Tzeng (2008) in the context of forecasting shipment levels of high-technology products throughout their PLCs. A modified approach to the methods of Huang and Tzeng (2008) will be used in this study as the methodology will not incorporate a full quantitative model but rather a mixed model, similar to that of Solomon et al. (2000). The quantitative model for this study is the previously outlined market share composition and the qualitative model is the theoretical PLC curve. The quantitative regression models will be analyzed for their

slope orientations, and applied to the qualitative PLC curve (Solomon et al., 2000). Overall, this mixed model analysis provides a comparative application of segmented linear regression parameters to an equally segmented PLC curve (Anderson and Zeithaml, 1984). Once the hypothesized correlation between slope orientation and the PLC is obtained, further discussion on the manufactured housing segment's PLC position and future market strategy will be presented.

5.6 ECONOMIC MODEL, DATA, AND RESULTS

Economic dissection of the continuous time series data provides the opportunity for era introspection using segmented generalized linear regression analysis comparative to that used by Huang and Tzeng (2008), Solomon et al. (2000), and Sood et al. (2009). The generalized linear regression model is expressed by equation 4, where $\hat{y}$ is the predicted response, $\hat{\beta}_0$ is the intercept, $\hat{\beta}_1$ is the slope, x is the independent variable, and ε is the random error term (Ott and Longnecker, 2001).

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x + \varepsilon \quad \textbf{(4)}$$

All three segmented data sets were tested for the formal assumptions of regression analysis, e.g. linearity, homoscedasticity, independence, and normality (Ott and Longnecker, 2001). Figure 5-1 displays graphically the linear relationship of the dependent ($\hat{y}$) and independent (x) variables across the three data segments. All eras display linearity in respect to predicted and actual responses. Figure 5-2 graphically depicts data homoscedasticity for the three economic segments through plots of predicted responses paired against response residuals. tables

Table 5-1 provides the results of assumption testing for normality and data independence. Normality testing was conducted using the Shapiro-Wilk W Test and resulted in non-normal distributions for the economic data segments of *Deregulation* ($p = 0.02$), and *The New Economy* ($p = 0.01$), whereas Post War Prosperity revealed normality ($p = 0.06$) (Ott and Longnecker, 2001). Data transformations were not used to normalize data sets as it was critical that the data remained constant across the segmented series for data comparison purposes (Harrigan, 1983). Durbin-Watson testing for independence revealed serial correlation amongst data in all three economic segments. Therefore an autoregressive model was tested using Yule-Walker estimates model parameters across the three economic periods. Results of this testing revealed model parameters did not change with the introduction of a autoregressive lag-1 error component (Sall et al., 2005). It was concluded that although overall testing revealed that the economic data sets did not conform to all of the regression assumptions the models were sufficient for modeling as they did not reveal any time series limitations (Sall et al., 2005). Additionally, existing research presents evidence that the regression models will still provide proper estimation of the slope parameters for this study's' theoretical comparison between econometric and product life cycle models (Ryan and Porth, 2007; Solomon et al., 2000).

5.6.1 RESULTS

Table 5-2 illustrates regression analysis results through goodness of fit statistics, and ANOVA testing output. Regressions statistics yielded goodness of fit measures for periods 1 and 3 (*Post War Prosperity* and *The New Economy*) of $R^2 = 0.90$ and 0.77, respectively. These values indicate that there is slight amount of residual variance around the linear regression models for periods 1 and 3. However, resulting F-test values prove

model significance for both *Post War Prosperity* ($p < 0.001$) and *The New Economy* ($p < 0.001$; Ott and Longnecker, 2001; Sall et al., 2005). Alternatively, period 2 (*Deregulation)*, returned a poor goodness of fit measure ($R^2 = 0.098$) and thus an ANOVA F-test result of non-significance ($p = 0.192$). Detailed introspection into the sum of squared regression and residuals values, for the period of *Deregulation*, concluded that residual variance was a major component of total model variance. Therefore, the horizontal mean line of the data range provides a more accurate estimate of manufactured housing market share than that of the estimated linear model (Ott and Longnecker, 2001).

Post hoc analysis of the three economic periods uses the prior ANOVA results in conjunction with the regression model parameter estimates, found at the bottom of Table 5-2, to further develop a conclusion for the manuscript hypothesis. Figure 5-3, the segmented economic regression model and the product life cycle curve, will be used throughout post hoc analysis to illustrate the relationship between the segmented regression models and the theoretical PLC curve.

The *Post War Prosperity* linear model shows a significant ($p = < 0.001$) slope parameter estimate of 0.017. This parameter result, when converted to a percentage, indicates a 1.7 % positive increase in market share of the U.S. residential construction sector for each successive year of the period *Post War Prosperity*. Figure 5-3 shows the *Post War Prosperity* linear model in comparison to the growth stage of the PLC curve. Secondly, the linear model for the period of *Deregulation* displays non-significance ($p = 0.192$). Non-significance was expected throughout this economic segment as it further substantiates the slope coefficient relationship between the market share data and the PLC curve. Overall, due to the non-significant ANOVA and slope parameter tests, it is

concluded that market share data from the *Deregulation* period has a slope of zero and is therefore comparative to the maturity stage of the PLC curve (Peter and Donnelly, 2001). Lastly, the linear model for *The New Economy* was tested for slope significance. Parameter estimates return a significant ($p = <0.001$) slope parameter of -0.014, signifying a -1.4 % market share of the U.S. residential construction sector change for each additional year of *The New Economy*. Figure 5-3 illustrates the relationship between the linear model of *The New Economy* and the declination stage of the PLC curve.

5.7 IMPLICATIONS

Lackluster industry growth in the maturation stage of the product life cycle is shadowed by an impending turndown throughout industry declination (Harrigan, 1983, 1980). Industries fear the fate of decline, as it is the eulogy to industrial demise and vanishing profitability (Porter, 2008; Harrigan, 1980). However, as Harrigan (1980) notes, market potential for firms in a declining industry still exists where end game strategies of competitive advantage hedge on market positioning and the sophisticated navigation of exit barriers (Porter, 2008).

In comparing the results of this manuscript to those of previous studies by PATH (2003), and HUD (1998, 2006, 2007), on manufactured housing, it is apparent the industry-segment has lost market share effectiveness of the U.S. residential construction sector over the past decade and is currently enduring its' forlorn song of decline. Results found in this manuscript however are seemingly counter to industry sentiment, which as of the late 1990's, resonated with conceit as manufactured home producers believed they had "*Locked up*" the affordable housing market (HUD, 1998, p.116). Existing research (Apgar et al., 2002; Hood, 1998; HUD, 1998, 2006, 2007) has dauntingly highlighted the

capacity of manufactured housing to boost homeownership levels in the U.S. Whereas the results of this manuscript show declining market shares for U.S. manufactured housing and a steadily improving yet fluctuating U.S. homeownership rate (U.S. Census Bureau, 2009g). This drastic divergence between manufactured housing and the U.S. homeownership rate reflects a changing market dynamic. The manufactured home industry-segment can no longer rest on their belief that the affordable housing market is theirs to take without a fight. Highlighting this shift in market dynamics was the recent boom of U.S. residential construction, which inevitably led to lax credit standards, sub-prime lending (Center for Responsible Lending, 2006). This availability of lending allowed what were once prospective manufactured home owners to purchase "affordable" site-built homes (Woodbridge, P. and Associates, 2003). As homeownership levels rose from 2000 through 2005 the manufactured home industry-segment lost roughly 10 percent of market share in the U.S. residential home sector (U.S. Census Bureau, 2008a, 2009a). These drastic losses are a sign that the manufactured home industry-segment has lost its' strategic edge in the U.S. residential construction sector (Porter, 2008; Harrigan, 1988). Nonetheless, over the past decade, the emergence of alternative forms of factory-built home construction (e.g. modular, panelized, and pre-cut home construction) has helped spur bourgeoning growth within the factory-built home industry. However, this industry-segment growth has further bled away market share from manufactured home producers (Bady, 1996; Kochera, 1998). Today, manufactured homes account for merely 81,000 annual new residential home shipments, equating to an approximate 60 percent market share of the factory-built home industry and a 9 percent share of the overall residential construction sector (Manufactured Housing Institute, 2008; U.S. Census

Bureau, 2009c). With predictions slating annual factory-built home production to exceed nearly 500,000 units by 2020, substantial growth is expected across alternative forms of factory-built home construction (Woodbridge, P. and Associates, 2003) with little or none benefiting the manufactured home producers.

The U.S. residential construction industry has been reshaped during the recent U.S. credit crisis that started in 2007 (Center for Responsible Lending, 2006; RealtyTrac, 2009). Since then, foreclosures have risen to record levels (RealtyTrac, 2009). As foreclosed homes enter the market, new home prices are driven down due to oversupply (Center for Responsible Lending, 2006). The manufactured home industry-segment thus will suffer even deeper market share losses as market prices of foreclosed homes equalize with those of the niche market of affordable manufactured homes (Apgar et al., 2002). Existing literature asserts that this loss of market share will either drive producers of manufactured homes out of this industry-segment towards alternative forms of factory-built homes (Harrigan, 1983, 1980), or force survival through economies of scale, consolidation, and dwindling industry-segment profitability (HUD, 1998; Harrigan, 1980).

Currently, the implications of diversification and consolidation are being seen throughout the factory-built home sector, primarily in the industry-segments of manufactured, modular, and panelized homes. The pre-cut home industry-segment, however, is not added to this discourse, as it is a negligible niche component of factory-built market share and to this point has been sheltered from any dramatic industry changes (Kochera, 1998; U.S. Census Bureau, 2009c). The market shares of manufactured, modular, and panelized home industry-segments, however, are substantial

in respect to the factory-built home industry and the greater U.S. residential construction sector.

A heavy trend towards consolidation has already been seen within the industry-segment of manufactured homes (HUD, 1998; Woodbridge, P. and Associates, 2003; Reed Construction Media, 2009). HUD (1998) reported that the number of manufactured home firms have steadily dwindled since the 1970's while at the same time output per firm has significantly increased from approximately 800 annual units per firm in 1977, to approximately 2,500 units per firm in 2002 (HUD, 1998; Woodbridge, P. and Associates, 2003). The magnitude of consolidation occurring in the manufactured home industry-segment is best demonstrated by Clayton Homes of Maryville, Tennessee, which accounted for 36 percent of the 81,945 manufactured home industry-segment shipments in 2008 (Reed Construction Media, 2009). Comparatively, if this market share were to be captured by the largest site-built production home builder, Pulte Homes of Bloomfield Hill, Michigan, annual home completions for this single builder would have exceeded 294,000 units, or 14 times Pulte Homes' 2008 volume (Reed Construction Media, 2009; U.S. Census Bureau, 2009c). As new market entrants such as Pulte Homes look to gouge themselves on market share of the factory-built home industry, the manufactured home industry-segment looks to further lose its' dwindling market share position. Implications of these drops would further exacerbate the consolidation issues faced by large manufactured home producers, who operate on the basis of economies of scale (Harrigan, 1983; Wernerfelt and Karnani, 1987).

Alternatively, the modular and panelized industry-segments are furthering their attractiveness to new entry through long-run growth potential seized from market share

losses of the manufactured home industry-segment and from the much larger site-built home industry. Modular and panelized homes have existed since the 1800's, however, their direct market impact on the factory-built home industry was not seen until the early 1990's (Herbert, 1978). Since then, the modular home industry-segment has flourished in both market share and new participant entry (HUD, 1998; Woodbridge, P. and Associates, 2003). Market share for the modular home industry in the factory-built housing market rose from just over 30 percent in 1992, to 46 percent in 2002 (U.S. Census Bureau, 2009c). Interestingly, the primary entrants to the modular home industry-segment have been manufactured home producers whom are diversifying or switching production away from their native manufactured home industry-segment (HUD, 1998; Woodbridge, P. and Associates, 2003). Supporting this trend of selective diversification, Reed Construction Media (2009) reported that 21 of the top 25 U.S. manufactured home producers have now converted at least 15 percent of their production capacity to modular home production. This strategic diversification guides researchers to believe that the barriers of entry between manufactured and modular home production are limited and therefore easily exploitable (Harrigan, 1983, 1980; Bain, 1956).

In addition to the modular housing industry-segments' growth through manufactured home builders' diversification strategies, the panelized home industry-segment has expanded market share over the decade (Schuler and Adair, 2003). However, unlike the modular home industry-segment, the growth that the panelized home industry-segment has seen was cultivated mainly from within the site-built home industry (Schuler and Adair, 2003; HUD, 2007). In 1997 the panelized home industry-segment captured a 7 percent market share of the U.S. residential construction sector, while by

2001 that market share had grown to 15 percent (Schuler and Adair, 2003; Woodbridge, P. and Associates, 2003). Noticeably this growth has come from site-built production homebuilders who have shown a distinct interest in the efficiency and quality of panelized construction (HUD, 2007). Remarkably, site-built production homebuilders carry the market share potential needed to advance the panelized home industry-segment to notoriety. However, this market share has become compacted amongst industry leaders in recent years, as consolidation has flourished in site-built construction during poor economic times (Lurz, 2009). Exemplifying this concept of consolidation, existing research shows that the top ten production builders netted combined annual closings of 90,000 homes or 8 percent market share of U.S. residential home starts in 2008 (Schuler and Adair, 2003; Reed Construction Media, 2009; Lurz, 2009). As consolidation continues to confront production home builders, experts believe that the existing trend of panelized home construction amongst site-built home builders will continue (Schuler and Adair, 2003; Woodbridge, P. and Associates, 2003; Kochera, 1998; Bady, 1996). Indeed, increased acceptance of panelized building systems by homebuyers, may also lift the fortunes of today's factory-built home industry.

5.8 CONCLUSIONS

This manuscript utilizes the manufactured housing industry-segment as a benchmark for the simultaneous implications of product life cycle decline and strategic diversification within the factory-built home industry. Through macroeconomic analysis of the manufactured home industry-segments' market share of the residential construction sector this study concluded that manufactured homes are currently experiencing a period of declination as described by the product life cycle (PLC) curve's decline stage. The

PLC curve acts as a theoretical guide to product based life cycle commonalities that include the introduction, growth, maturity, and the eventual decline of a products' demand in a market. The inherent link between the manufactured home industry-segment and its' product, manufactured housing, allows this manuscripts' analysis to achieve its' conclusion that the manufactured home industry-segment is declining.

The current state of decline in the manufactured home industry-segment has come not only as the result of elicit changes to both the U.S. residential construction sector and the factory-built home industry, but also through major strategic advancements by rival industry-segments. Within the factory-built home industry, repositioning amongst the modular and panelized industry-segments has led to further market share losses for the manufactured home industry-segment. As a direct result, manufactured home producers have been strained to cope with market share decline that is forcing drastic industry consolidation to survive economies-of-scale based competition. As barriers to exit surmount in the manufactured home industry-segment, producers of manufactured homes will seek further diffusion into surrounding industry-segment of the factory-built home industry. Currently, this diffusion has been seen in the modular home industry-segment, driven by low barriers to entry.

Alternatively, additional strain has been placed on the manufactured home industry-segment through recent advancements by site-built homebuilders into the factory-built home industry. These new entrants to the factory-built home market have targeted panelized home systems as means of increasing their competitive business edge in the production home market. As these site built homebuilders develop market share in the panelized market, further market share problems will impact the manufactured home

industry-segment. Overall, the manufactured home industry-segment is faced with a series of daunting tasks that start first with the realization that market demand for manufactured homes is declining and that further growth in the factory-built home market is not easily captured by the manufactured home industry-segment.

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5.10 CAPTIONS FOR FIGURES

Figure 5-1-- Linearity - Predicted response plotted by actual response

Figure 5-2-- Variance - Predicted response plotted by response residual

Figure 5-3-- Segmented economic regression models and the product life cycle curve

5.11 CAPTIONS FOR TABLES

Table 5-1--Assumptions Testing

Table 5-2-- Generalized Linear Regression on Economic Eras

5.12 FIGURES

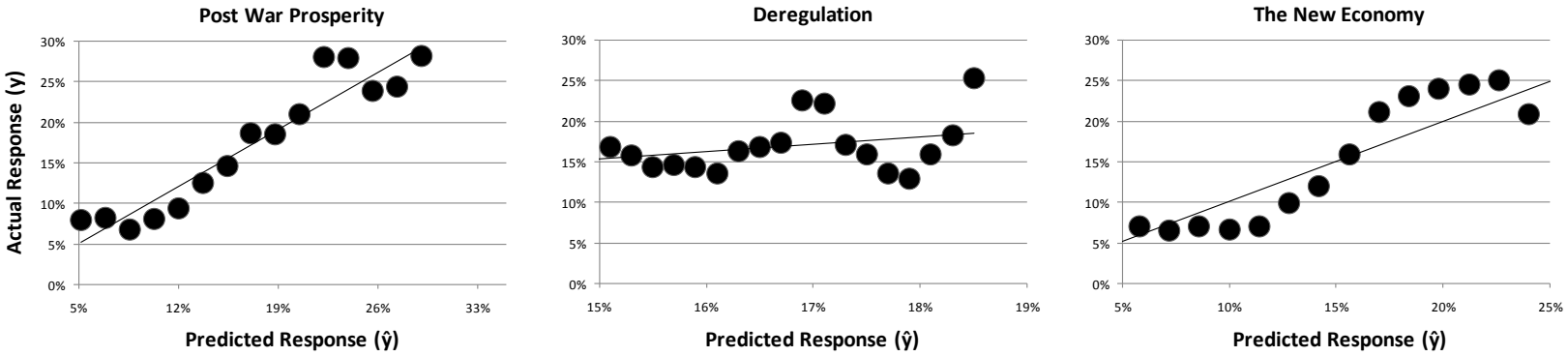

Figure 5-1: Linearity - Predicted response plotted by actual response

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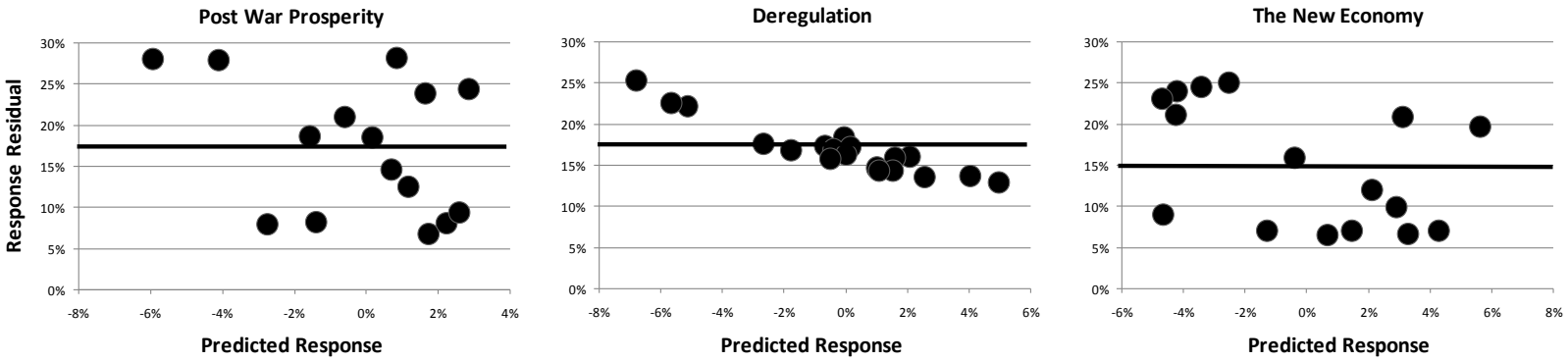

Figure 5-2: Variance - Predicted response plotted by response residual

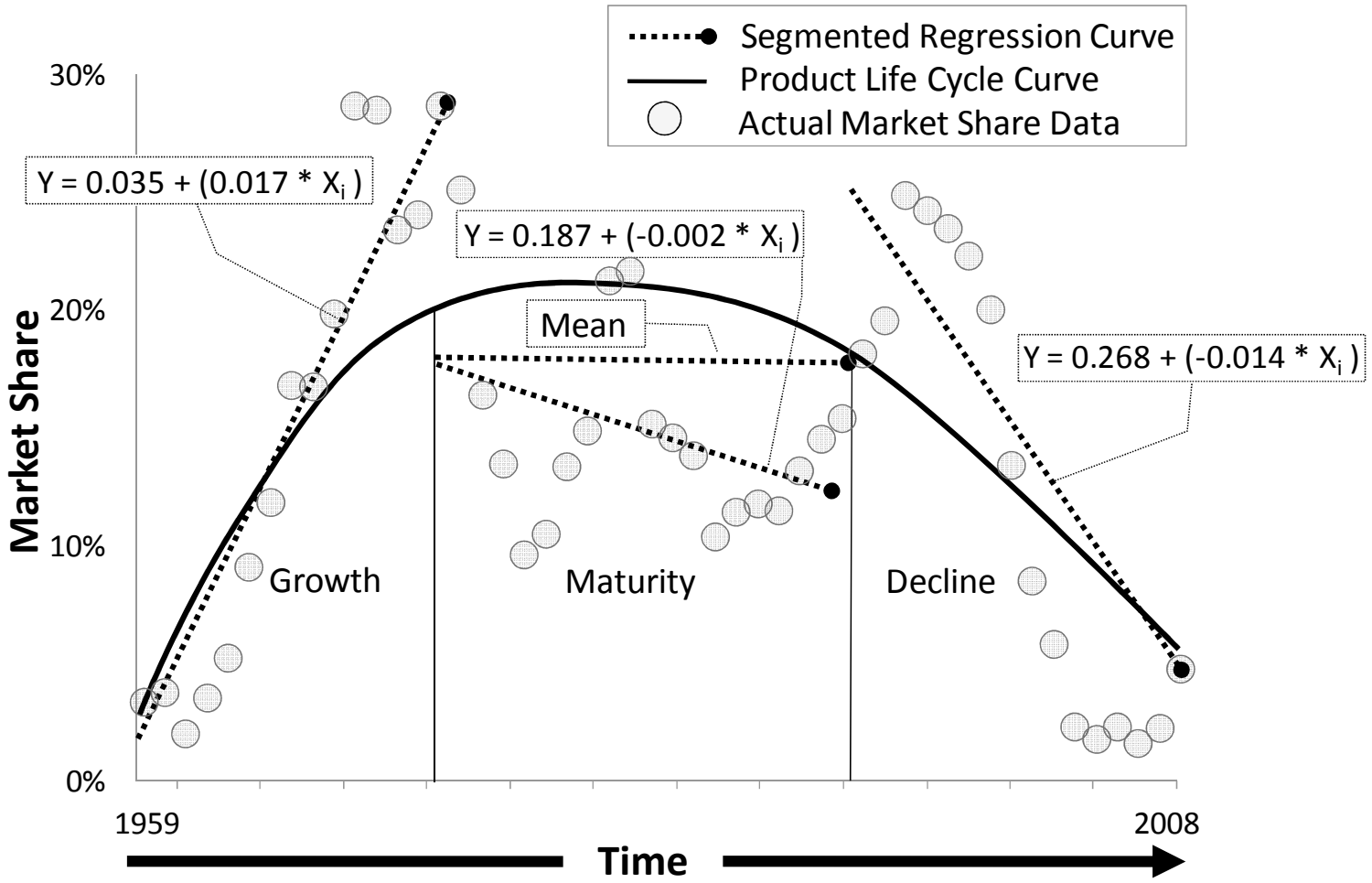

Figure 5-3: Segmented economic regression models and the product life cycle curve

5.13 TABLES

Table 5-1: **Assumptions Testing**

Economic Period	Post War Prosperity *1959-1973*	Deregulation *1974-1992*	The New Economy *1993-2008*
ASSUMPTION TESTING			
NORMALITY TESTING			
Shapiro-Wilk W Test			
W	0.89	0.87	0.84
Prob < W	0.06	0.02	0.01
Parameter Estimates			
Location (μ)	0.17	0.17	0.15
Dispersion (σ)	0.08	0.03	0.07
INDEPENDENCE TESTING			
Durbin-Watson			
DW	0.13	0.70	0.10
Prob < DW	< 0.0001	0.0004	< 0.0001

Table 5-2: Generalized linear regression on economic eras

GENERALIZED LINEAR REGRESSION RESULTS

	Post War Prosperity			**Deregulation**			**The New Economy**		
Regression Statistics	*1959 - 1973*			*1974 - 1992*			*1993 - 2008*		
Observations	15			19			16		
R^2	0.900			0.098			0.778		
Standard Error	0.027			0.032			0.036		
ANOVA	*Regression*	*Residual*	*Total*	*Regression*	*Residual*	*Total*	*Regression*	*Residual*	*Total*
Sum of Squares	0.083	0.009	0.092	0.002	0.017	0.019	0.065	0.019	0.084
Mean Square	0.083	0.001		0.002	0.001		0.065	0.001	
F		116.765			1.843			49.183	
P-value		< 0.001			0.192			< 0.001	
Regression Model	*Intercept (β_0)*		*Slope (β_1)*	*Intercept (β_0)*		*Slope (β_1)*	*Intercept (β_0)*		*Slope (β_1)*
Coefficient	0.035		0.017	0.187		-0.002	0.268		-0.014
Standard Error	0.144		0.002	0.015		0.001	0.019		0.002
P-value	0.030		< 0.001	< 0.001		0.192	< 0.001		< 0.001
t Stat	2.434		10.806	12.290		-1.358	14.024		-7.013
Lower 95%	0.004		0.014	0.155		-0.005	0.227		-0.018
Upper 95%	0.066		0.021	0.220		0.001	0.309		-0.010
Slope Comparison									
Slope coefficient	positive			neutral			negative		
PLC coefficient	positive			neutral			negative		
PLC period	Growth			Maturity			Decline		

6 MANUSCRIPT II

COMPETITIVE STRATEGY AND DIVERSIFICATION IN THE FACTORY-BUILT HOME INDUSTRY

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Keywords: factory-built home industry, competitive strategy, diversification, market share, strategic survival

6.1 ABSTRACT

Drawing on competitive strategy, this study elaborates on existing models of diversification in the U.S. factory-built residential construction sector. We test these models using survey data from 278 sector participants. Results show that sector participants are currently undergoing radical shifts induced by market forces that are encouraging diversification while advancing market share positions in the U.S. residential construction sector. In addition, post-hoc analysis concludes that firms that have pursued advanced diversification have substantially gained market share but have adversely overexposed themselves to the declining market for U.S. residential construction.

6.2 INTRODUCTION

The magnetism of an industry lies in its' ability to provide sustained profitability, or attractiveness, to its' participants. However, profitability is not allocated equally amongst all. Therefore, a participants' success is measured by its capacity to engage competitive strategies that enhance industry positioning and thus profitability (Porter, 1980). Past empirical research has largely detailed competitive strategies of industries within a sector (Harrigan, 1983). However,the logic of competitive strategycan also be applied to the core of an industry's structure (Bain, 1956).

In industries of poor profit, competitive forces are intense, and firms of all types battle to sustain productivity (Porter, 1980; Bain, 1956; Mason, 1939) while at the same time industry-segments struggle for market positioning based on cut-throat competitive strategies (Porter, 1980; Mason, 1939). Alternatively, in industries of high profit, relaxed competitive forces allow many firms to enjoy sustained profitability (Porter, 1980, 2008). Since industry structure is not static, and the competitive forces that shape strategy are in constant flux, the true test of a firm's competitive strategy is its' ability to endure, or to adapt, to changes brought on by shifts in industry structure (Porter, 1980).

In the case of a multi-segment industry, shifts in business structure can trigger dynamic changes amongst its' supporting segments (Bernard *et al.*, 2006). This segment divergence is often categorized by the lure of multi-product diversification and/or product switching to industry-segments of higher profitability (Harrigan, 1980; Bernard *et al.*, 2006). Through the dynamics associated with this inner-industry product switching and diversification, we can critically investigate and define how firms of quasi-related products compete in today's economy (Porter, 1979; Bernard *et al*., 2006).

In this paper we will draw on Porter's (2008) model of competitive forces to hypothesize how competitive strategies and market positioning are shaped by structural industry shifts. We will then test these hypotheses through a questionnaire targeting firms of a multi-segment industry. Using this data, post-hoc analysis will explore the inherent nature of competitive forces as drivers of competitive strategy, industry positioning, and market share growth.

6.3 THE U.S. RESIDENTIAL FACTORY-BUILT HOUSING INDUSTRY

Over the past decade, annual investment in residential construction has accounted for approximately five percent of the Gross Domestic Product (GDP) in the U.S. (U.S. Department of Commerce, 2008). When related financial outlays such as rent payments, utilities, and furnishings are added to the residential investment component, annual net input soars to approximately twenty percent of the U.S.GDP (Schuler and Adair, 2003).

U.S. homebuilders are the lone purveyors of the U.S. residential construction sector. However, the U.S. residential construction sector has under gone a significant trough in the most recent business cycle. This market-swing has forced homebuilders towards readdressing their core business strategies. These strategic decisions concern building quality, production costs, and construction lead-times that fundamentally divide the two industries competing in the residential construction sector; site-built and factory-built home builders(Noguchi, 2003; Kieran and Timberlake, 2004). For the purpose of this study, the site-built residential classification entails all residential structures erected on site from dimensional lumber and engineered building components (Gurney, 1999). Whereas, factory-built construction is defined as residential structures produced within a

manufacturing facility and placed with little to no on-site construction (**Figure 6-1**; HUD, 2007).

The U.S. residential construction sector has struggled to adopt innovative advancements in materials and methods that promote increased quality, reduced production costs and minimized lead-times (Obiso, 1997; Lefaix-Durand*et al*., 2006). The dominant and well established site-built residential construction industry has withstood attempts to industrialize their production throughout modern history and has remained focused on a deep-rooted craftsman-style approach to quality, cost, and time (Obiso, 1997; Kieran and Timberlake, 2004). Nonetheless, the burgeoning factory-built residential construction industry, founded on the success of the affordable manufactured home, has applied the techniques and efficiencies of industrialization to a range of innovative building systems extensively (HUD, 1998). However, due to the factory-built home industry's intrinsic bond to affordable housing, producers have struggled nationally and remained heavily regionalized in the rural South and Midwest (Gurney, 1999; U.S. Census Bureau, 2009a, 2009b; Bady, 1996).

Today, reputable builders within the factory-built home industry have advanced beyond manufactured homes, and are pursuing methods of modular, panelized, or pre-cut home production (HUD, 2007). tables

Table **6-1** provides the definitions for these industry-segments of the factory-built home industry, including that of manufactured housing. These innovative building methods embrace quality and consistency through the usage of subassembly components that help mitigate lead time, material waste, and production cost (Schuler and Adair, 2003; HUD, 2007). Nonetheless, on the basis of market share, these modern home

systems have provided little impact on the U.S. residential construction sector due to marketing inadequacies, among other things (Woodbridge, P.and Associates, 2003; Lefaix-Durand *et al.*, 2006; Schuler and Adair, 2003).

The diverse combination of building systems offered by the factory-built home industry matches the dynamic requisites of the U.S. housing market in terms of scope of application. Panelized home construction is well suited for inner-city and urban renewal projects that require minimized site-exposure and rapid assembly time (Woodbridge, P. and Associates, 2003; HUD, 2007; Abate, 2005), while suburban and rural communities, seeking advancements in homeownership and affordability, favor manufactured (often also called modular) homes, as they provide the quality and durability of a site-built homes at a fraction of the overall cost (HUD, 1998, 2006, 2007; Abate, 2005). Nonetheless, market penetration for panelized and manufactured homes has been hindered by state and local municipalities fluctuating in their adaptation of the major model building codes (HUD, 2007; Woodbridge, P. and Associates, 2003). Also, manufactured homes have faced antiquated zoning regulations based on bygone perceptions(HUD, 1998,2007; Woodbridge, P. and Associates, 2003). Nevertheless, recent advancements in building and zoning regulations have helped to erode these barriers to market entry for the all industry-segments (HUD, 1998). Clearly, the market potential for factory-built homes is expansive and growing with today's homebuilders looking to strategically combat rising material costs and pending labor shortages (Schuler and Adair, 2003; National Association of Home Builders, 2006). These strategic actions, however, require firm leaders to understand industry structure, identify the competitive

forces driving change, and anticipate future industry shifts created by these forces (Bain, 1956; Mason, 1939; Porter, 1980; 2008).

6.4 THE ROLE OF COMPETITIVE FORCES

The Bain-Maison paradigm(Bain, 1956; Mason, 1939), as suggested by Porter's theory of competitive forces (Porter, 1980),presents industry structure and long-run profitability as the response factors of how economic value is dispersed amongst industry participants (Porter, 2008). Thus, the allocated proportions of economic value are in continual flux as the dynamics of the competitive forces oscillate over an industry's life-cycle (Porter, 2008; Harrigan, 1983). The strategic capacity of an organization relies on its' ability to assess not only the current state of competition but also the projected impetus of industry movement along its' life-cycle (Mason, 1939; Porter, 1980). Nonetheless, the present and future forces of competition must be understood and leveraged by industry participants to gain and solidify their competitive strategies (Porter, 1980, 2008; Harrigan, 1983).

Competitive strategy can be seen as the means by which long-run profitability is attained (Mason, 1939; Porter, 1980). Generic strategies pursued by firms developing their competitive edge over rivals take inherently different paths to profitability; however, all actions revert to a common origin, or choice-point. This choice-point aims at a focused pursuit of competitive advantage through directed strategy. Likewise, firms that do not chose a distinct path often risk below-average returns due to market mediocrity (Porter, 1980). Strategically, the choices firms make can follow the routes of cost-leadership, differentiation, or focus (Porter, 1980; 2008; Harrigan, 1983). Each path

offers advantages based on industry structure as well as company strengths and weaknesses (Porter, 2008). Although, a strategic path must be chosen concisely, this path must be intermittently reassessed, as industry structure and therefore, competitive forces, fluctuate across the cycles of introduction, growth, maturity, and decline (Harrigan, 1980).

Industry structure as a static entity is simple in concept and form (Bain, 1956). Participants of an industry operate based on competitive forces that interact with surrounding objects known formally as suppliers, buyers, new entrants, and substitute products (Porter, 1980, 2008; Harrigan, 1983). These interactions are bound through geographic region and product scope (Porter, 2008), creating the theoretical boundaries in which competition can exist (Porter, 1980). Statically, these concepts are concise, however, when placed on a life-cycle continuum, their weighted balance shifts (Porter, 1980; 2008). As influence is transferred between competitive forces, the strategic abilities of firms must shift accordingly. Porter (2008) describes these shifts in industry structure as the highlight of organizational strategy, allowing firms to ascertain promising new strategic positions that were once not available (Porter, 1980). Thus, the exploitation of the five forces of competition (suppliers, buyers, new entrants, substitutes, and rivalry) can generate industry transition towards new ways of competing (Porter, 2008).

Lastly, Porter's (1980) model of competitive forces drives to the heart of industry attractiveness when assessed in the context of multi-segment industries. Existing research by Bernard *et al.*(2006) illustrates the urge for firms to extend their competitive advantages beyond their intrinsic industry-segment when market share is readily attainable. Additionally, Harrigan (1980, 1983) explores the concept of multi-product

diversification in an alternative light, where firms selectively diversify into quasi-realted industry-segments in a strategic attempt to shed an unprofitable industry-segment (Harrigan K. R., 1983). In either case of strategic diversification, the competitive advantages of a firm are carried surreptitiously into an adjacent industry-segment giving the firm a direct competitive advantage (Harrigan, 1980; Bernard *et al.*, 2006).

6.5 PAST RESEARCH ON ORGANIZATIONAL STRATEGY

Existing studies pertaining to organizational strategy have looked at competitive advantage and forces amongst industrial organizations in an attempt to clarify a multitude of firm and industry interactions. Seven main publications, Mason (1939), Bain (1956), Porter (1980, 2008), Harrigan (1980, 1988), and Bernard *et al.* (2006), have established a preeminent role in the realm of organizational strategy research. The first of these authors, Mason (1939), brought to the forefront a complex theory of industrial organization and competition shaped by economic stricture. He concluded that firms operating within an industry constrained market profitability and allocate market power according to market share. Mason's analysis, however, was limited in its' application, as it failed to push beyond empirical organizational structure and towards the underlying forces that intrinsically drive organizational strategy (Porter, 1981).

Bain's (1956) research on the conditions of organizational strategy looked to further enhance Mason's (1939) empirical work. However, no direct-links were established until later research by Porter (1981). Bain's emphasis placed on the significance of barriers to entry in determining competitive advantage amongst industry rivals, brought forth the concept of empirical extrapolation of inter-industry rivalries. Bain believed that oligopoly industries, where a limited number of large participants competed, were expert

examples of his theories to market entry. This structural concept pitted the rivalry of oligopolies against each other in a struggle to control price while limiting new market entrants. Congruent empirical research by Bain (1956) verified the notion of conditions to industry entry, thus promoting the framework for further research on strategic forces.

Porter's (1980, 2008) efforts followed Mason (1939) and Bain's (1956) research closely. Porter looked to the theory of strategy as the conceptual and perceptual framework for research. The capacity for insight provided by Porter's research gave industrial organizations a broad view of empirical and theoretical studies. Generic frameworks generated through industrial application showed distinct paths for competitive advantage (Porter, 1980). Organizational strategies stemming from the guidelines of competitive advantage proposed by Porter (1980) aim to provide industry participants with structured thought (Porter, 1980, 2008). Porter's most renowned research is that pertaining to the five competitive forces of organizational strategy (Porter, 1980).Through his research the primary concepts of inter-industry rivalry and external-industry threats, act as a starting point for deeper empirical understanding of industry fluctuations (Porter, 1980, 2008).

Finally, existing research by Harrigan (1980, 1988) applies theory to practice in case studies focused on life-cycle stages and strategic planning within industrial organizations. These applications mimic both the pre and post analysis conducted by this manuscript, as Harrigan's (1980, 1988) research addresses selective diversification amongst related industry-segments. While Harrigan's publications are thorough in their dissection of industry dynamics, the publication "*Multi-Product Firms and Product Switching*" by Bernard *et al.* (2006) provides further support of this manuscripts'

development of diversification and organizational strategies within the factory-built home industry. Economically and strategically, Bernard *et al.* (2006) captures the essence of inner-industry product switching through its massive, yet detailed portrayal of empirical census data of U.S. manufacturing firms from 1987 to 1997.

6.6 THE IMPORTANCE OF THE PRESENT RESEARCH

Exploring organizational strategy across the factory-built home industry is a critical extension of prior research. Existing government and industry studies (HUD, 1998, 2001, 2006, 2007; Woodbridge, P. and Associates, 2003) have principally focused on the homogeneous industry-segments (manufactured, modular, panelized, and pre-cut) of the factory-built home industry (tables

Table **6-1Figure 6-1**). However, none have dissected in depth the strategic interplay occurring between them. Based on current U.S. residential sector conditions, the implication of these strategic shifts occurring in and around the factory-built home industry are immense. On one hand, research shows that manufactured home producers are currently facing a declining industry-segment (Wherry and Buehlmann, 200x). Whereas, existing literature chronicles the rapid acceleration of market share for the industry-segments of modular, panelized, and pre-cut home construction (Schuler & Adair, 2003; HUD, 1998, 2007; Woodbridge, P. and Associates, 2003). Overall, the current attractiveness of the factory-built home industry leaves avenues for strategic diversification amongst industry-segment leaders and firms pursuing new competitive strategies. Through the application of Porter's (1980, 2008) model of competitive forces, and the supporting literature of Mason (1939), Bain (1956), Harrigan (1980, 1988), and Bernard *et al.* (2006),this study will present active insight to the competitive strategies of

producers in the factory-built home industry as well as a discourse on future industry growth.

6.7 THEORY AND HYPOTHESIS

Existing studies have focused on the organizational strategies of industries as the dialogue for analysis (Porter, 1980; Harrigan, 1988, 1980). The models presented in past research by Mason (1939), and Bain (1956) have offered a common theory of economic stricture by which firms operate and are influenced. Porter (1980) then found that these theories, when combined as a conceptual framework, give applicable insights into competitive advantage, industry structure, and the five competitive forces. Existing research by Harrigan (1988, 1980) has further developed this framework of organizational strategy in the context of a life-cycle continuum. However, Bernard *et al.* (2006) has met theory with pragmatic observation, thereby providing a benchmark for industry structural change, strategic diversification, and market attractiveness (Bernard *et al,* 2006; Porter, 1980; Harrigan, 1988, 1980).

We expect that the U.S. factory-built home industry is currently undergoing a shift in industry structure imposed by a strategic reformation of the U.S. residential construction industry (Bain, 1956; Mason, 1939; Porter, 1980; Harrigan, 1988, 1980; Bernard *et al.,* 2006). This shift is expected to consolidate industry leaders in the declining industry-segment of manufactured housing (Porter, 1980; Harrigan, 1988, 1980), while driving endogenous and exogenous growth (Bernard *et al.,* 2006) amongst the dynamic markets of modular, panelized, and pre-cut homes. Overall, this structural industry shift will drive internal and external producers to advance industry positioning,

in the form of market share, through competitive strategies that exploit diversification into quasi-related inner-industry-segments.

The research Hypothesis then is*: Factory-built home companies that are diversifying their production to alternative factory-built home products have increased their market share within the market definition of factory-built housing.*

6.8 RESEARCH METHOD

6.8.1 QUESTIONNAIRE DESIGN

A mail questionnaire directed at U.S. factory-built home industry within the U.S. residential construction industry was developed in cooperation with the USDA Forest Service, The National Association of Home Builders Research Center, and Virginia Polytechnic Institute and State University. The structure of the mail questionnaire focused on five key business dimensions that impact the U.S. factory-built home industry. These dimensions were extrapolated from an extensive literature review that focused on industry demographics, financial considerations, governmental policy, market structure, and the manufacturing process. Three types of questions were used to assess the five questionnaire dimensions: 1.) categorical scale; 2.) seven-point interval scale; and 3.) open-ended (Rea and Parker, 2005). In addition to the formal questionnaire, a set of operational definitions were established for the five industry-segments of the residential construction industry and were included in the questionnaire packet. The operational definitions included the site-built, manufactured, modular, panelized, and pre-cut home industry-segments.

The sample group mailing list was derived from industry directories provided by the National Association of Home Builders Building Systems Council (National

Association of Home Builders, 2009a), the Manufactured Housing Institute's developer resources (Manufactured Housing Institute, 2009), and The Automated Builder magazine's Engineered Homebuilders directory (Automated Builder, 2008). The industry directories were aggregated and refined to remove all international listings, associations, guilds, institutes and research centers. A total sample size of 353 company contacts was generated during the compilation process. All incomplete company contact listings were updated through an online search via Manta company profiles and company information (Manta, 2009).

After professional review from industry experts, the sample questionnaire was administered on April 29, 2009 to a random sample of 20 respondents to test for clarity, comprehensiveness and acceptability (Rea and Parker, 2005; Dillman *et al*., 2009). Each of the twenty recipients received a personalized cover letter and mail questionnaire that included a unique tracking number and first-class pre-paid return postage to encourage responses. All non-respondents were, after a two-week period, contacted by telephone and asked to verbally answer thirteen preselected questions (Rea and Parker, 2005).

6.8.2 SAMPLE DESCRIPTION

Analysis of the sample questionnaire results revealed minor issues that were addressed and revised (Rea and Parker, 2005). A follow-up mailing was dispersed to the remaining 333 factory-built industry participants on May 22, 2009 (Dillman *et al*., 2009; Rea and Parker, 2005). Each recipient was assigned a unique identification number and received a personalized cover letter, a mail questionnaire, and a business reply mail page to encourage response.

The total sample size of this study was 333 companies with 167non-respondents. During the response period, 55 companies were discovered to be out-of-business or non-contactable and therefore deemed unusable. The number of unusable sample units was subtracted from the initial sample size which was re-tabulated to include 278 factory-built home companies. Data collection and analysis was conducted with the software programs from the Statistical Analysis System Institute (SAS) JMP 8.0 software package (SAS, 2008) and Microsoft Office Excel 2007 (Microsoft, 2007).

6.8.3 DATA COLLECTION

During the ten-week response window, two forms of additional communication were established with the sample group. A one-week reminder postcard was sent out to all non-respondents reminding them of the importance of their response (Rea and Parker, 2005). Prior to the one-week reminder postcard only one response was tabulated. 56 responses were received over the subsequent two weeks following the follow-up postcard. All non-respondents after the third week were mailed a secondary follow-up mail questionnaire printed on an alternative colored paper (Rea and Parker, 2005). An additional54 responses were tabulated between the fourth and tenth weeks. Two periods of notably heavy responses were seen in the fifth and sixth weeks.

To test for non-response bias, thirty-three of the 167 non-respondents were randomly selected and contacted via telephone (Rea and Parker, 2005). Four demographic questions were asked of each non-respondent contacted. Results of this data collection were analyzed using chi-squared tests for proportions and two-sample t-tests for means (Ott and Longnecker, 2001; Sall *et al*., 2005). Results of these tests

indicated no significant difference in demographic response between respondents and non-respondents.

The adjusted response rate of the mail questionnaire was 39.9 percent. Of the 111 total responses, 64 respondents positively answered as manufacturers of factory-built homes. Occasional missing values across the questionnaire's dimensions yielded some data sets that do not sum to 64.

Response rates, when viewed from the perspective of reference sources offered useful insight to the structure of the study. Reference sources were linked to industry directories provided by the National Association of Home Builders Building Systems Council (National Association of Home Builders, 2009a), the Manufactured Housing Institute's developer resources (Manufactured Housing Institute, 2009a) and Automated Builder magazine's Engineered Homebuilders directory (Automated Builder, 2008). Response rates were tabulated for each directory based on respondents verification that they are a manufacture of factory-built homes. MHI provided eight respondents, all which were manufacturers; Automated Builder offered 34 respondents of which 31were manufacturers; and NAHB returned 60 respondents with 27 identified as manufacturers of factory-built homes.

6.8.4 MEASURES

Demographically, respondents were measured based on location, total annual shipments, total annual sales, total full time employees, types of products produced, and targeted customers' income. Demographic data sets were collated and analyze for further introspection. Location data was based on regional definitions provided by the U.S.

Census Bureau (U.S. Census Bureau, 2008b). Supporting analysis was measured by questionnaire responses relating to target markets and diversification strategies.

6.9 RESULTS AND DISCUSSION

6.9.1 INDUSTRY STRUCTURE AND DYNAMICS

Results of this study revealed that factory-built home producers were reasonably equally distributed across the four census regions (Table 6-2). However, shipments of factory-built homes (Table 6-3), reported by the 64 questionnaire respondents, were widely disproportionate with respect to the unique industry-segments of the factory-built home industry. This dispersion of market capacity is the core of this manuscripts research on the diversification and competitive strategies of the divergent industry-segments of the factory-built home industry. Based on survey respondents only, manufactured home producers accounted for a 67 percent share of the total 32,652 factory-built home units shipped in 2008 by questionnaire respondents, while posting a per-firm annual output of 2,187 home units shipped (Table 6-2). Alternatively, pre-cut home producers generated only 3 percent of total home units shipped in 2008, an average of 72 home units shipped per-firm. Modular producers showed per-firm home shipments of 195 units in 2008, but managed to capture a 17 percent share of total home units shipped in the factory-built home industry. Lastly, panelized home producers accounted for the remaining 13 percent of total home units shipped in 2008 and produced an average of 329 home units per panelized home producers.

By and large, questionnaire results parallel those of existing empirical studies by U.S. Census Bureau (2008a, 2009c) and The U.S. Department of Housing and Urban Development (HUD, 1998, 2007). HUD studies have publicized a distinct trend in

consolidation amongst manufactured home producers since 1977, when the average per-firm output of the industry-segment was 873 annual units. Since then, this pattern of consolidation has continued to manifest throughout the manufactured home industry-segment. Whereas today, the average shipment output per firm within the manufactured home industry-segment is 300 percent greater seen in the 1970's (HUD, 1998). In further substantiation of the trend towards consolidation, amongst the manufactured home industry-segment, a study of the factory-built home industry, by Reed Construction Media (2009), showed that as of 2008, 21 of the top 25 factory-built home producers were firms fabricating manufactured homes as their primary product (e.g., manufactured home revenues exceed 50 percent of total revenue). Additionally, these 21manufactured home firms captured a 97 percent market share of the manufactured home industry-segment and a 68 percent market share of the factory-built home industry in 2008 (Reed Construction Media, 2009). This massive oligopolistic consolidation of the manufactured home industry-segment inherently has led to competitive strategies based on economies of scale and a focused imbalance between the five competitive forces (Porter, 1980, 2008; Mason, 1939; Bain, 1956). Barriers to entry for consolidated industries are nearly insurmountable due to heavily entrenched market leaders and cut-throat industry-segment competition (Bain, 1956). Whereas, the outward competitive advantages of consolidated magnitude extends beyond direct rivals and into the surrounding quasi-related industry-segments (Porter, 1980; Bernard *et al.*, 2006; Harrigan, 1983). Taken as a whole, the organizational strategy of economies of scale has played to the support of manufactured home producers, whom, amongst its' factory-built home industry compatriots, is poised

for continued industry domination, internal or external to its' native industry-segment (Porter, 1980, 2008; Harrigan, 1983).

Contrary to the drastic consolidation of the manufactured home industry-segment, fragmentation has generally typified the modular, panelized, and pre-cut industry-segments of the factory-built home industry (Woodbridge, P. and Associates, 2003). However, a penchant towards upward consolidation has begun to appear in the modular industry-segment in recent years (HUD, 1998). Nonetheless, the idiosyncratic geographic advantages retained by producers of modular, panelized, and pre-cut homes have provided a degree of competitive advantage to these industry-segments (Bernard *et al.,* 2006, Porter, 1980). This contrast between the manufactured home industry-segments' consolidation and the modular, panelized, and pre-cut home industry-segments regional competitive advantages is significant in further discourse regarding organizational strategy, market share changes, and the interplay of the factory-built home industry-segments.

Historically, only manufactured home producers have presented cross-regional production capabilities within the factory-built home industry. Whereas, modular, panelized, and pre-cut home builders have been disintegrated and regionalized due to asymmetrical building code application on a state and local level (Listokin and Harris, 2004; HUD, 1998, 2006, 2007). Nevertheless, recent trends in standardized building codes and the accessibility of off-site building inspections, conducted at the manufacturing source, have minimized barriers to market entry and have encouraged multi-regional growth amongst modular, panelized, and pre-cut industry-segments (Listokin and Harris, 2004; Porter, 1980; Bain, 1956). Currently, multi-regional

expansion has only beenevidentamongst the modular industry-segment. Whereby, four modular firms have atleast one home production facilityin two plusregions (Table 6-3). As a significant component to past industry structure, theregulatory barriers to multi-regional market entryhave offeredseveraldivergent,but noteworthy,perspectives on competitive strategy and industry-segment growth within the factory-built home industry (HUD, 1998; Woodbridge, P. and Associates, 2003). First and foremost, the modular, panelized, and pre-cut market-segments were bestowed a boundary of regionality which wasmoderatelyresistant to new entrantthreats, product substitutions, and intense competition amongst exisiting competitors (Porter, 1980, 2008). However,thelong-term profitability and growth potentialsof modular, panelized, and pre-cut home firms werestifledby the fragmented confines of theseregional markets (Porter, 1980, 2008). This mutedapproach to competition has allowed firms of competiting industry-segments (i.e., manufactured homes) to captureindustry-market sharein an industry devoid of product substitution (Porter, 1980, 2008). Today, the prospect ofsustained multi-regional competition by the modular, panelized, and pre-cut home industry-segments look to redefine the factory-built home industry throughdivergent organizational strategies aimed at both market share growth and defined competitive strategies.

6.10 POST HOC ANALYSIS: DIVERSIFICATION AS A STRATEGIC DECISION

6.10.1 MULTI-PRODUCT DIVERSIFICATION

In concurrence with the emerging competitive strategy of multi-regional growth by the modular, panelized, and pre-cut industry-segments, a mounting competitive strategy of two-product diversification has become apparent amongst manufactured home producers (HUD, 1998; PATH, 2006; Woodbridge, P. and Associates, 2003). Existing

literature by The U.S. Department of Housing and Urban Development (HUD; 1998), and Woodbridge, P. and Associates (2003) has keyed explicitly on the growing impact this competitive strategy has on market share proliferation in the factory-built home industry.

Based on existing structural characteristics of the factory-built home industry, our questionnaire looked at the topic of diversification from the perspectives of existing factory-home building methods and shared production capacities across the multiple industry-segments of the factory-built home industry. The first perspective took data of individual factory-built home firms and analyzed the methods by which they produced home units across a time span of six years. Data was then categorized into one, two, and three product producers and aligned to show dynamic changes across the five-year period. Table 6-3 displays the results of these cross-tabulated data sets.

In examination of the Table 6-3, several noticeable tendencies were seen across the one-, two-, and three-product producer categories. The most apparent of these tendencies was the imbalanced allocation of single product producers across the industry compared to the distribution of two- and three-product producers. Whereby, the single product category was comprised predominantly of modular, panelized, and pre-cut home producers. Nonetheless, only 3 producers of manufactured homes were cited throughout the six-year period, of which they accounted for a mere 6 percent of total industry participants. The second notable tendency was the restrained level of inactivity of firms entering or leaving the single product manufactured industry-segment and the three product manufactured, modular, and other industry-segment. However, of particular interest were the noticeable changes seen amongst the one-product producers of modular

and panelized homes and that of two-product producers in the manufactured and modular industry-segment. Total industry change in single product producer category between 2002 and 2005 was 10 percent and 2 percent between 2005 and 2008, respectively. Two product producers showed noticeable change as well from 2002 to 2005 with a total industry gain of 8 percent in the manufactured and modular industry-segment. Total industry change slowed however from 2005 to 2008 with a 2 percent gain. Interestingly, two product producers in the manufactured and other category died out from 2002 to 2005.

Empirical studies by Harrigan (1980, 1983, 1988), and Bernard *et al.* (2006) have focused on the strategic forces driving two-product diversification in the U.S. manufacturing sector. When comparing results shown in Table 6-4 to that of other U.S. manufacturing industries studies by Bernard *et al.* (2006), commonalities can be assessed. In the U.S., production changes have generally related to both, product adding and dropping, while total sector or industry-sector transitions have been less common (Bernard *et al*., 2006; Harrigan, 1983). This observation reflects changes seen in the one- and two-product categories whereby producers perceivably add or drop products, or in this case industry-segments, to leverage changes in the overall U.S. residential home market. Additionally, it is conceivably rare that factory-built home firms go outside of the common industry-segments to diversify, as seen with only 6 percent of total industry producers having "other" products in their repertoire in 2002 and 3 percent in 2005 and 2008. Overall, industry-segment diversification is outwardly present in the U.S. factory-built home industry despite a declining U.S. residential market from 2005 through 2008.

Although growth has noticeably slowed across the single and two-product producer categories, expansion is likely during further housing market upswings.

In further dissecting the potential for diversification as means of seeking further market share growth in the factory-built home industry, the groupings in the two-and three-product producer categories highlight potential conduits for industry change. Across all producers in the factory-built home industry a dichotomous tendency in diversification was seen. Growth segments of diversified producers generally group themselves into categories of like production types, where production techniques and industry technologies were similar. In industry-segments where production techniques and technologies are analogous, such as those of modular and manufactured housing, competitive forces are significantly minimized, allowing producers the ability to exploit market attractiveness and transition between industry-segments (Porter, 1980, 2008; Harrigan, 1983).

Harmonious to the strategy of related diversification lies the ability of larger producers, operating generally through the competitive strategy of economies of scale, to surreptitiously carryover their native cost-leadership positions to prospective inner industry-segments (Bain, 1956; Harrigan, 1983, 1988; Bernard *et al.*, 2006).This transition by magnitude can often occur quickly, especially in declining industries (i.e., manufactured housing) where mounting barriers to exit force rapid divestment (Harrigan, 1988). To emphasize this concept, Table 6-5 offers a unique longitudinal comparison of data from both questionnaire respondents and factory-built industry-leaders across diversified manufactured and modular producers (Reed Construction Media, 2009). Analysis does not contain reference to two-product firms operating in the panelized and

pre-cut due to limited data availability. However, further pursuit of these composite industry-segments are noted for their bourgeoning market share potential (Schuler and Adair, 2003; HUD, 2007). Results displayed in Table 6-5 specify several notable changes in production proportions across industry-leading multi-product producers and questionnaire respondents. Clearly, a designation is given that two-product firms operating in the manufactured and modular composite industry-segment are gearing production away from manufactured housing. Production shifts by manufactured housing producers towards the modular industry-segment from 2002 to 2008 averaged 4 percent by questionnaire respondents and 8 percent by factory-built home industry leaders. This strategic shift in dual production proportioning elicits further insight into the competitive strategies of diversified producers in the factory-built home industry. As changes in market conditions impact supply and demand of products, producers of multiple products hedge manufacturing capacities to help offset these shifts (Harrigan, 1983, 1988). Alternatively, a small grouping of firms has continually enhanced their exposure to the manufactured industry-segment through increases in manufactured home production proportioning from 2002 to 2008. Increased production activity in the manufactured home industry-segment aligns with potential competitive strategies of some very large and consolidated manufactured home producers whom have become entrenched participants in the manufactured industry-segment. As economies of scale have driven up barriers to industry-segment exit for these consolidated producers competitive strategies now force a continued fight for market positioning even as industry-segment demand declines (Porter, 1980, 2008; Harrigan, 1983, 1988).

6.10.2 MARKET SHARE POSITIONING

Market share positioning is of fundamental importance to industry structure and competitive strategy (Mason, 1936; Porter 1980). Firms which have chosen strong competitive strategies understand that markets cannot be won on every front and often follow a path of limited but focused success (Porter, 1980). A focused strategy targets market weakness and exploits market segments where other firms cannot compete (Porter, 1980). Alternatively, firms which have grown rapidly but not maintained focus see only temporary success as market competitors (Porter, 1980). These concepts apply to the two dichotomous trends in market share activity amongst one-, two-, and three-product producers from 2002 to 2008 (**Table 6-6**). During this period, rapid growth in total home shipments and market share was seen for both one- and two-product producers. Whereas three-product producers saw both total home shipments and market shares decline significantly. This recalibration of market structure highlights the abilities of one- and two product to pursue market share growth while exposing the weaknesses of three-product firms.

By and large, changes to industry market share structure indicate that competitive strategies have shifted in the factory-built home industry between 2002 and 2008. Currently, producers operating in volume-based competition have been drastically impacted by the recalibration of the greater U.S. residential construction sector. Counter to this change, however, is the emergence of mid-level two-product producers who have diversified but have remained innately focused on a small range of products. In limiting market exposure these mid-level diversified firms have proven greater advantage in a rapidly fluctuating marketplace (Porter, 1980). This notion of selected diversification navigates the common competitive pitfall of attempting to be everything to everyone

(Porter, 1980). In the case of competitive advantage, firms in the factory-built home industry look to further their success through diversification and a focused strategy that bounds market share but solidifies market existence.

6.10.3 Diversification for Market Share Growth

The critical objective of this research on the factory-built home industry culminates with the compilation of the distinct but unique perspectives of diversification as a competitive strategy towards advancing market share. It has been shown that companies in the factory-built home industry are clearly pursuing market share through strategies of diversification. However, the alternative has been shown which illustrates companies that seek over-diversification (i.e., three-product producers) are inversely affecting their ability to sustain market share, especially in depressed economic periods. This convergent concept is put to practice in Figure 6-2, which illustrates market share return in the context of product diversification. The average market shares of one-, and two-product producers are demonstrated across the six-year period of 2002 through 2008. Whereas, three-product producers are illustrated but not included in statistical testing due to their limited sample size ($n = 2$). A Wilcoxon Rank Sum Test compared market shares between the six-year period of 2002 to 2008. Results of this testing concluded that diversified two-products producers significantly ($p = 0.028$) improved market share positioning in 2008 when compared to one-product producers in the factory-built home industry. No significant difference was found, however, in the subsequent years of 2002 and 2005. The increasing disparity between average market share for one- and two-products producers can be attributed to several major changes in the U.S. residential construction sector and the U.S. factory-built home industry from 2002 to 2008. First,

large volume producers have displayed an apparent overall downward trend in market share positioning fueled by a deep recession in the U.S. economy that has reduced demand across the U.S. residential construction sector (Seiders, 2009). Research by Reed Construction Media (2009) validates this perception, reporting that a 6.4 percent decline was seen amongst 14 of the top 15 U.S. factory-built home-builders from 2005 to 2008.Secondly, producers that have diversified but have avoided excessive market exposure (Porter, 1980) have taken advantage of lax barriers to entry between comparable industry-segments (Bain, 1956; Bernard *et al.,* 2006), allowing for product diversification to occur and hedge demand fluctuations across industry-segments (Porter, 1980, 2008). Ultimately, the interrelatedness of the factory-built home industry will further induce industry-segment diversification (Bernard *et al.,* 2006) beyond what has been seen with two-product manufactured and modular home producers. This concept is already in action as nearly all manufactured and modular home producers in one-, two-, and three-product producer categories indicated in open-ended responses in our questionnaire that they were actively pursuing avenues towards panelized home production.

6.11 CONCLUSIONS

Empirical and theoretical research by Mason (1939), Bain (1956), Harrigan (1980,1983,1988), Porter (2008), and Bernard *et al* (2006) was used to dissect the complex strategic interplay occurring between industry-segments of the factory-built home industry. Results detailing industry shifts corroborated previous findings by HUD (1998, 2001, 2006, 2007). However, deeper analysis was sought to outline changes in production output by diversified producers of factory-built homes. Porter's five forces of

competition were used to give insight to the changing dynamics of production proportioning and the competitive strategies of diversified factory-built home participants (Porter, 1980). It was concluded that diversified two product producers of manufactured and modular homes were using their diversified production abilities to hedge fluctuations in demand within their two industry-segments along the six year timeline.

This study expands our knowledge of the factory-built home industry beyond earlier research by The U.S. Department of Housing and Urban Development (HUD) (1998, 2001, 2006, 2007) and Woodbridge, P. and Associates (2003) which chronicaled the demographic characteristics of the factory-built home industry and shifts by manufactured home producers towards diversified production capabilities. These previous studies however stopped short of defining how competitive strategies of factory-built home firms affect industry structure and market share positioning. This study pursued these concepts of industry structure and diversification across the dichotonmous factory built home industry in order to define how diversification was occurring and how it impacted overall market share positions. Additionally, this study pursued annual shipment and market share data of questionnaire respondents for support and development of the hypothesized topic of diversification as a competitive strategy. Dichotomous movements in total shipments and market share were seen amongst one-, two- and three-product producers. However, the overall factory-built home market was most significantly impacted by fluctuations in three-product producers who accounted for 40 to 60 percent of market share from 2002 to 2008.Market share decline in the three-product producer category showed clearly that market share was being absorbed by one- and two-product producers as market shares tumbled from 2002 to 2008.

Overall, diversification as a competitive strategy to gain market share positioning proved to be statistically significant between one-product and two-product producers in 2008, proving that diversification increases market share. However, market share data shows that diversification beyond two products in the factory-built home industry can potentially relate to market share decline, particularly in a challenging economic period.

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6.13 CAPTIONS FOR FIGURES

Figure 6-1--U.S. Residential Construction Sector Hierarchy

Figure 6-2--Diversification and Market Share Return: 2002 - 2008

6.14 CAPTIONS FOR TABLES

Table 6-1--Factory Built Home Industry-Segments Definitions

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6.15 FIGURES

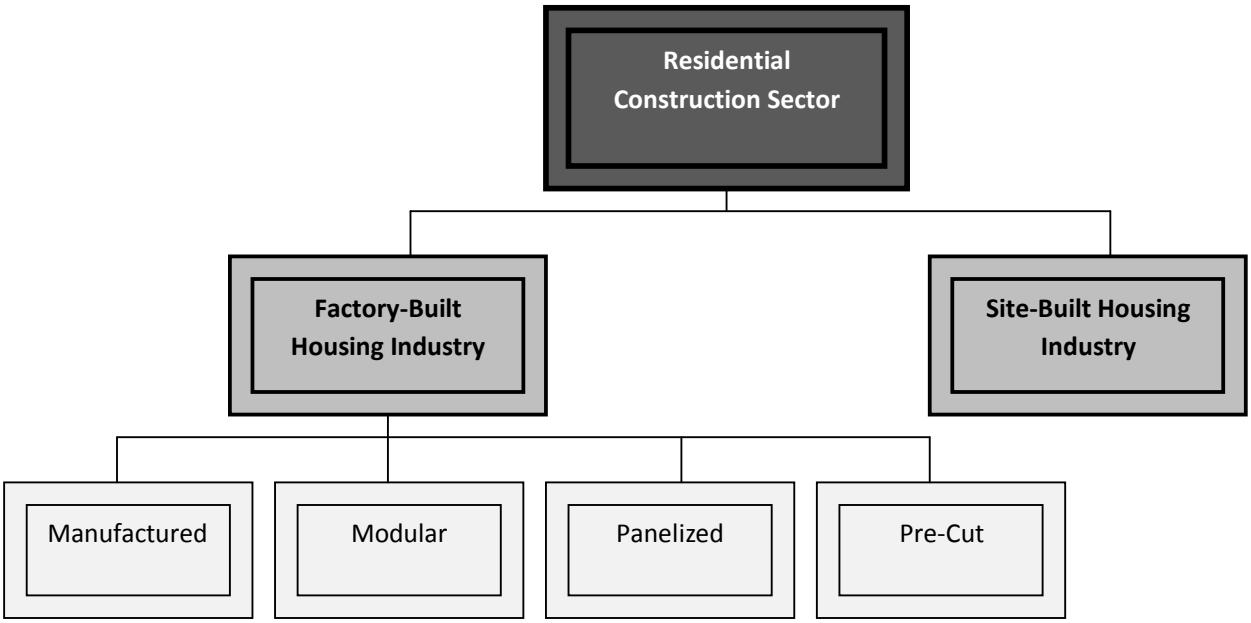

Figure 6-1: U.S. Residential Construction Sector Hierarchy

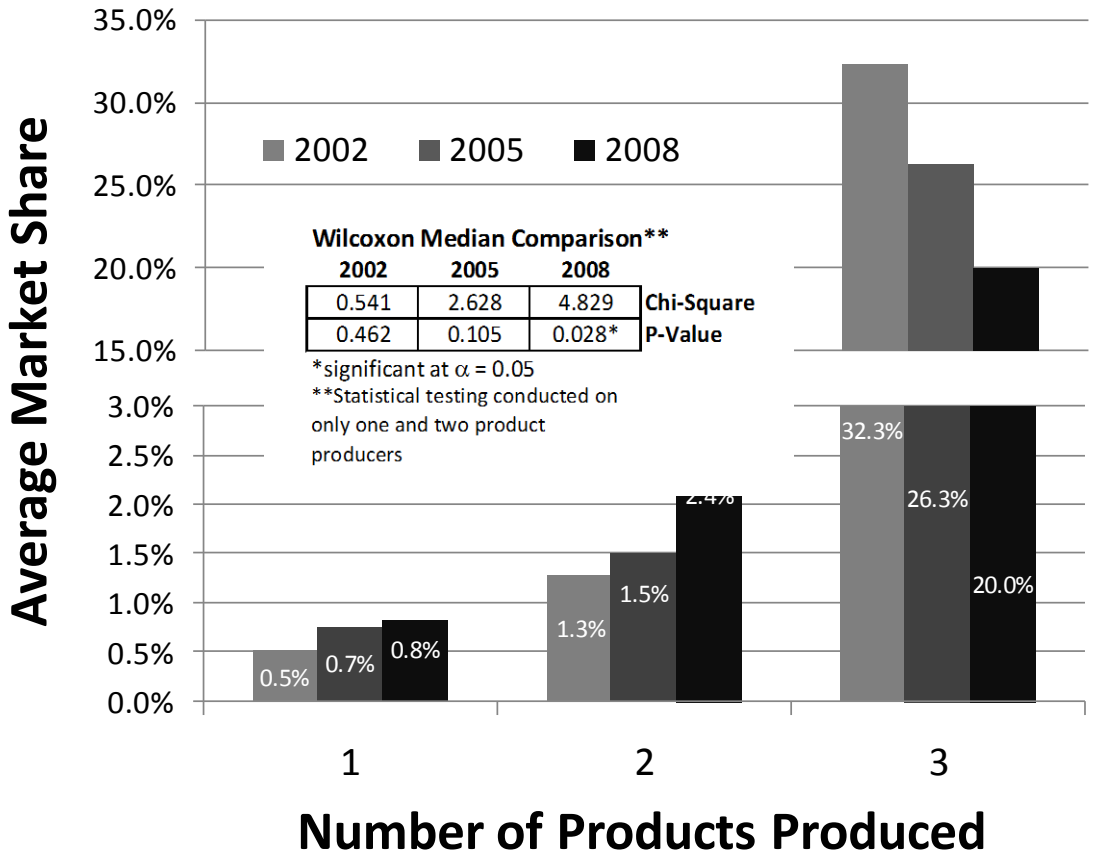

Figure 6-2: Diversification and Market Share Return: 2002 - 2008

6.16 TABLES

Table 6-1: Factory Built Home Industry-Segments Definitions

<table>
<tr><th colspan="2">Pre-Cut</th></tr>
<tr><td colspan="2">A home assembly system that is precut to exact size, length and quantity in a factory and shipped unassembled to the building site (U.S. Census Bureau, 1997; O'Brien et al., 2001). These units are built on solid foundations and must comply with local building codes. Common systems are timber-frame, log, kit and dome homes (O'Brien et al., 2001).</td></tr>
<tr><th colspan="2">Panelized</th></tr>
<tr><td colspan="2">Building systems package that utilize a series of standardized two-dimensional components to construct walls, floors, roof panels, and interior partitions (PATH, 1998). Components, including roof trusses, are prefabricate in a factory and shipped to the building site unassembled (U.S. Census Bureau, 1997; O'Brien et al., 2001). Structural Insulated Panels (SIPs), and/or other standard panel products are used to form the three-dimensional housing unit onsite. These units, regardless of construction location, must comply with local building codes (HUD, 1998).</td></tr>
<tr><th colspan="2">Modular</th></tr>
<tr><td colspan="2">Three-dimensional units that are constructed of individual wall, floor, ceiling, or roof systems, which are then transported to the final destination and assembled rapidly on a solid foundation (PATH 1998; U.S. Census Bureau, 1997). The final home structure, comprised of multiple module units, must comply with local building codes (HUD, 1998; O'Brien et al., 2001).</td></tr>
<tr><th colspan="2">Manufactured</th></tr>
<tr><th>HUD-Code</th><th>Mobile</th></tr>
<tr><td>Large three-dimensional units that are pre-assembled in the factory and shipped to a destination on a metal chassis. Final housing units are composed of either single or multiple pre-constructed units and can be placed on either permanent or temporary foundations. Units are regulated by local jurisdiction at the manufacturing facility and by the national HUD-Code (O'Brien et al., 2001).</td><td>A specific subset of manufactured homes that were built prior to the National Manufactured Housing Construction and Safety Standards Act of 1974 (Atiles and Vanderford, 2006; Apgar et al., 2002; Hullibarger, 2001).</td></tr>
</table>

Table 6-2: Location and Product Types

	Primary Product Type					
Location	Manufactured	Modular	Panelized	Pre-Cut	**Total**	Percent
West	2	4	2	1	9	14%
West and Midwest	2	1	-	-	3	5%
Midwest	-	9	4	2	15	23%
Midwest and South	1	-	-	-	1	2%
South	3	4	4	4	15	23%
South and Northeast	-	3	-	-	3	5%
Northeast	1	8	3	5	17	27%
National	1	-	-	-	1	2%
Total	10	29	13	12	**64**	
Percent	16%	45%	20%	19%		

Table 6-3: Total Shipments: 2008

Respondents Total Shipments: 2008

		Questionnaire			Census	
Primary Product	Respondents	Shipments	Percent	Per Firm Average	Shipments	Percent
Manufactured	10	21,867	67%	2,187	81,900	67%
Modular	29	5,645	17%	195	23,000	19%
Panelized	13	4,277	13%	329	11,900*	10%*
Pre-Cut	12	863	3%	72	5,100*	4%*
Total	**64**	**32,652**	**100%**	**-**	121,900	**100%**

* estimated based on historical market share proportions

Source: U.S. Census Bureau, 2008a, 2009c

Table 6-4: Factory-Built Home Industry Composite:2002-2008

Factory-Built Home Industry Composite: 2002 - 2008

One-, Two-, and Three-Product Categories

Product Types	2002	2005	2008
Manufactured	3	3	3
Modular	19	21	22
Panelized	9	12	12
Pre-cut	10	10	10
Single Product Total	**41**	**46**	**47**
Manufactured and Modular	4	8	9
Manufactured and Other	1	0	0
Panelized and Pre-cut	2	2	2
Two Product Total	**7**	**10**	**11**
Manufactured, Modular, and Other	2	2	2
Three Product Total	**2**	**2**	**2**
Total Industry Producers	**50**	**58**	**60**

Table 6-5: Change in Two-Product Production: 2005-2008

Change in Two-Product Production: 2005 - 2008

Questionnaire Respondents			Industry Market Share Leaders	
Modular	**Manufactured**	**Producer**	**Modular**	**Manufactured**
2005-2008	2005-2008	#	2005-2008	2005-2008
10%	-10%	1	8%	-8%
-3%	3%	2	16%	-18%
-7%	7%	3	12%	-12%
30%	-30%	4	-20%	20%
3%	-3%	5	22%	-22%
-50%	50%	6	14%	-14%
10%	-10%	7	5%	-5%
23%	-23%	8	7%	-7%
17%	-17%	9	4%	-4%
4%	-4%	Average	8%	-8%

* Green indicates positive production change

**Red indicates negative production change

Source: Reed Construction Media, 2009

Table 6-6: Total Shipments and Market Share: 2002-2008

Product Types		Annual Home Shipments			Annual Market Share			Market Share Change	
		2002	2005	2008	2002	2005	2008	2002 - 2005	2005 - 2008
Manufactured	Manufactured	1,214	1,967	1,628	2.3%	3.8%	5.0%	1.5%	1.2%
Modular	Modular	5,397	6,321	4,264	10.2%	12.3%	13.1%	2.0%	0.8%
Panelized	Panelized	3,772	6,203	4,277	7.2%	12.0%	13.1%	4.9%	1.1%
Pre-cut	Pre-cut	1,092	1,356	796	2.1%	2.6%	2.4%	0.6%	-0.2%
One-Product Producers Total		**11,475**	**15,847**	**10,965**	**22%**	**31%**	**34%**	9.0%	2.8%
Manufactured and Modular	Manufactured	4,186	6,159	7,150	7.9%	12.0%	21.9%	4.0%	9.9%
	Modular	1,293	2,215	1,381	2.5%	4.3%	4.2%	1.8%	-0.1%
Manufactured and Other	Manufactured	691	-	-	1.3%			-1.3%	0.0%
Panelized and Pre-Cut	Pre-Cut	*213*	213	67	0.4%	0.4%	0.2%	0.0%	-0.2%
Two-Product Producers Total		**6,383**	**8,587**	**8,598**	**12%**	**17%**	**26%**	4.6%	9.7%
Manufactured, Modular and Other	Manufactured	34,848	27,074	13,089	66.1%	52.6%	40.1%	-13.6%	-12.5%
Three Product Producers Total		**34,848**	**27,074**	**13,089**	**66%**	**53%**	**40%**	-13.6%	-12.5%
Questionnaire Respondents' Total		**52,706**	**51,508**	**32,652**	**100%**	**100%**	**100%**	-	-

7 FURTHER RESULTS

7.1 OVERVIEW

Beyond the existing results provided in Chapter 6, auxiliary data was collected via this study's mail questionnaire that further emphasized the differences seen between producers of factory-built homes. The configuration of the factory-built home industry indicates there are two distinct groupings of U.S. factory-built home producers; those who produce one-or those who produce two- factory built home products. One product producers are companies which have maintained an exclusive industry-segment approach to the factory-built home industry and have not yet diverged from their native core product. The scope of the products for the one-product category includes manufactured, modular, panelized, and pre-cut homes. Alternatively, the two-product category is comprised of companies operating across industry-segment boundaries whereby firms produce factory-built homes in more than one industry-segments (i.e. a manufactured and modular home producer).

The structure of the mail questionnaire focused on five key business dimensions that affect the U.S. factory-built home industry. These dimensional factors were defined as business demographics, economics and finance, government, marketing, and production (Figure 7-1). Each of these dimensions will be presented in the subsequent section in the effort to highlight how industry structure influences activities of one-and two-product producers of factory-built homes.

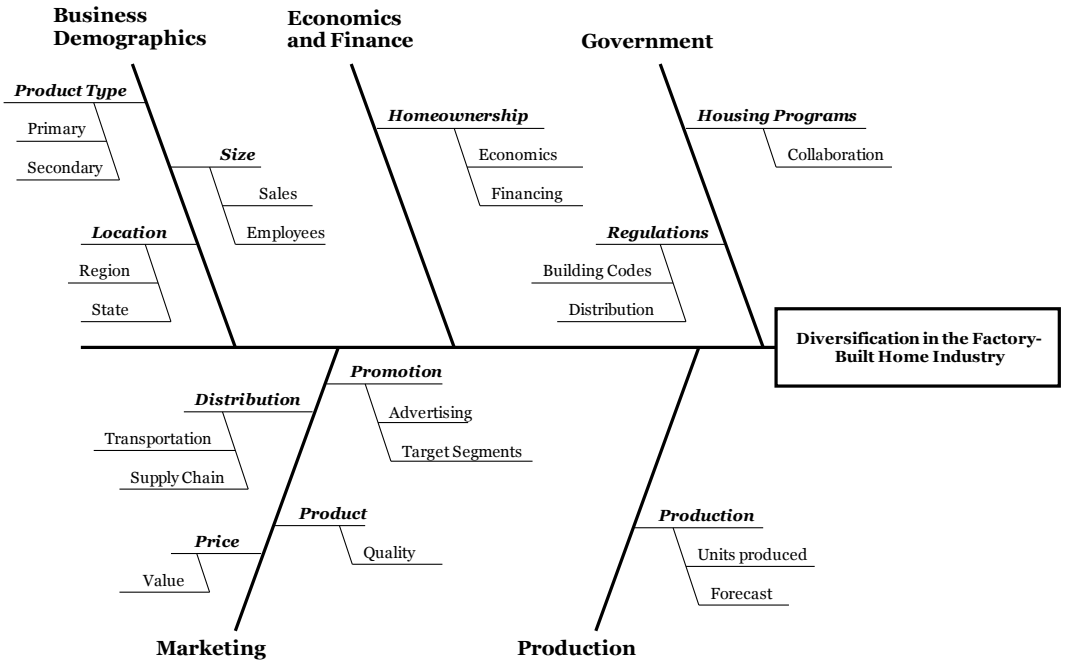

Figure 7-1: Mail Questionnaire Dimensions

7.2 BUSINESS DEMOGRAPHICS

Demographically large disparities were seen between one- and two-product producers in average total annual sales from 2002 to 2008. Figure 7-2 displays average total annual sales of one-and two-product producers. Average total annual sales figures indicate that two-product producers were on average two-and-a-half times larger than those seen in the one-product-producer category. A distinct surge in average total annual sales is seen between 2002 and 2005 while average total annual sales constricted between 2005 and 2008. The rate of change for total annual sales from 2002 to 2005 were not significantly ($p = 0.81$) different for one-and two-product producers at $\alpha = 0.05$. However, from 2005 to 2008 the rate of change for total annual sales was significant ($p = 0.043$) between one- and two-product producers. Two-product producers lost nearly four

times the amount of total annual sales that one-product producers did during the period from 2005 to 2008.

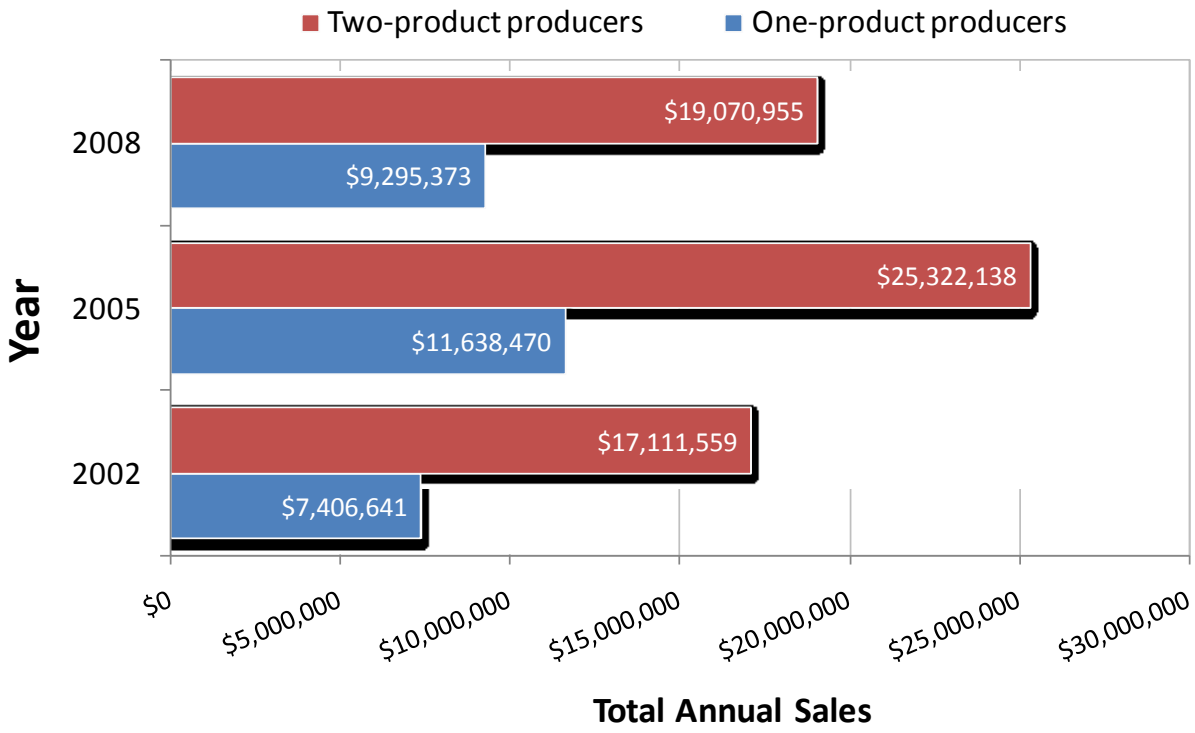

Figure 7-2: One- and Two-product Producers' Average Total Annual Sales: 2002 - 2008

Production output displayed by average total annual shipments for the one- and two-product producers showed a clear pattern of growth followed by contraction from 2002 to 2008 (Figure 7-3). The magnitude of growth and contraction in average total annual shipments seen by one-product producers was not significantly greater ($p = 0.84$, $p = 0.06$) than that seen by the two-product producer category. However between 2002 and 2005 one product producers returned an average total annual shipment growth of 27 percent while two-product producers grew by only 10 percent. One-product producers returned a 3 percent growth rate in average total annual shipments over the six-year

period while two-product producers lost just under one-half of a percent in average total annual shipments.

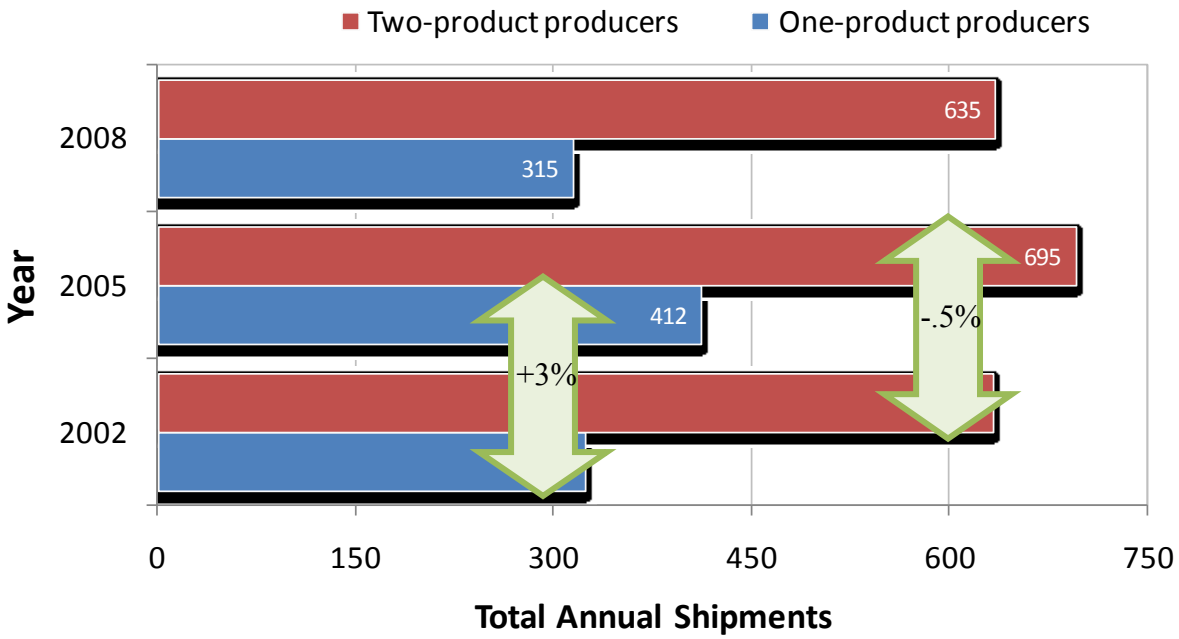

Figure 7-3:One- and Two-product Producers' Average Total Annual Shipments: 2002 - 2008

7.3 ECONOMICS AND FINANCE

Economics and finance based questions targeted one- and two-product producers in regards to changes in housing production from 2002 to 2008. Figure 7-3 depicts the changes in output experienced by one- and two-product producers from 2002 to 2008 whereas Figure 7-4 displays how producers interpreted these output fluctuations. Producers of one- and two-products were significantly ($p = 0.03$) different in their responses to questions pertaining to the affordability of site-built homes impacting their total annual shipments from 2002 to 2008 when tested by a Wilcoxon Rank-Sum Test. Two-product producers believed that the affordability of site-built homes greatly

impacted their total annual shipment during the stated six-year period. Adding to this perception, significant differences ($p = 0.048$) were observed in responses between one- and two-product producers concerning an overall change in demand for new residential construction causing their total annual shipments from 2002 to 2008 to decline. On average two-product producers indicated that they were more greatly affected by changes in the U.S. residential home market than one-product producers.

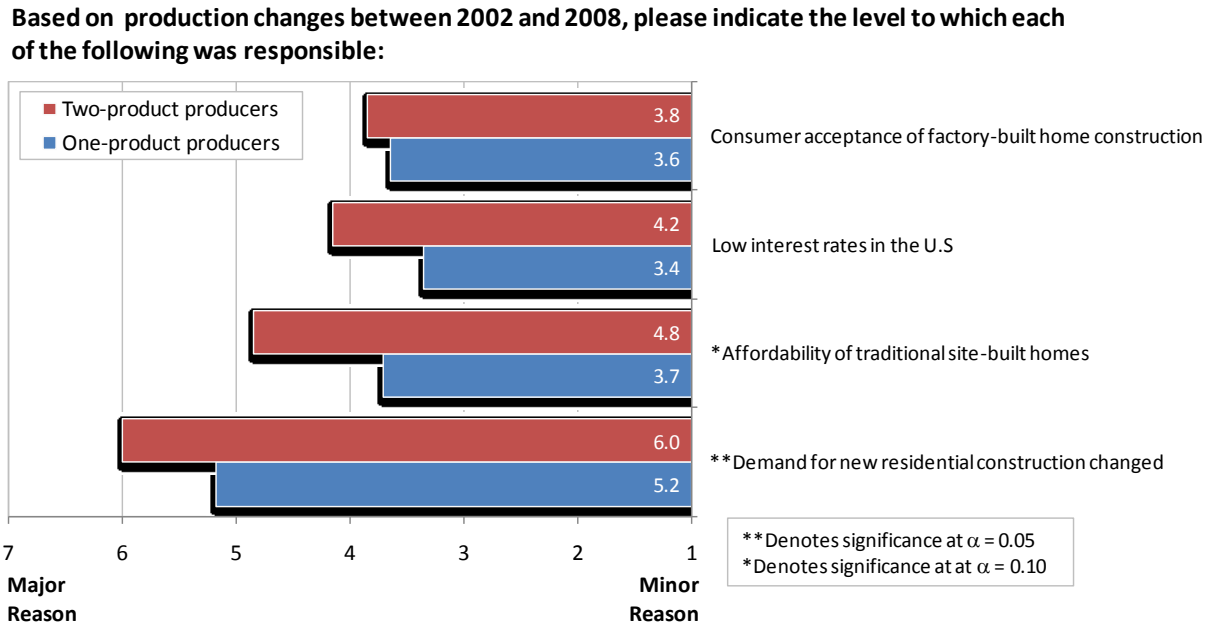

Figure 7-4: Economic and Financial Perspectives: One- and Two-product Producers

7.4 GOVERNMENT

The government dimension looked primarily at the effects of how housing programs and building regulations influenced one- and two-product producers' ability to pursue innovation and distribution of their' product(s). Figure 7-5 illustrates the average responses of producers in both the one- and two-product categories. A clear trend is present showing that two-product producers, on average, perceive government interactions with industry to be higher than those perceived by one-product producers.

Additionally, questions showing positively stated attributes rated lower than questions that had negatively stated attributes. No significant differences were found between responses of one- and two-product producers in respect to government influence on innovation and distribution in the factory-built home industry.

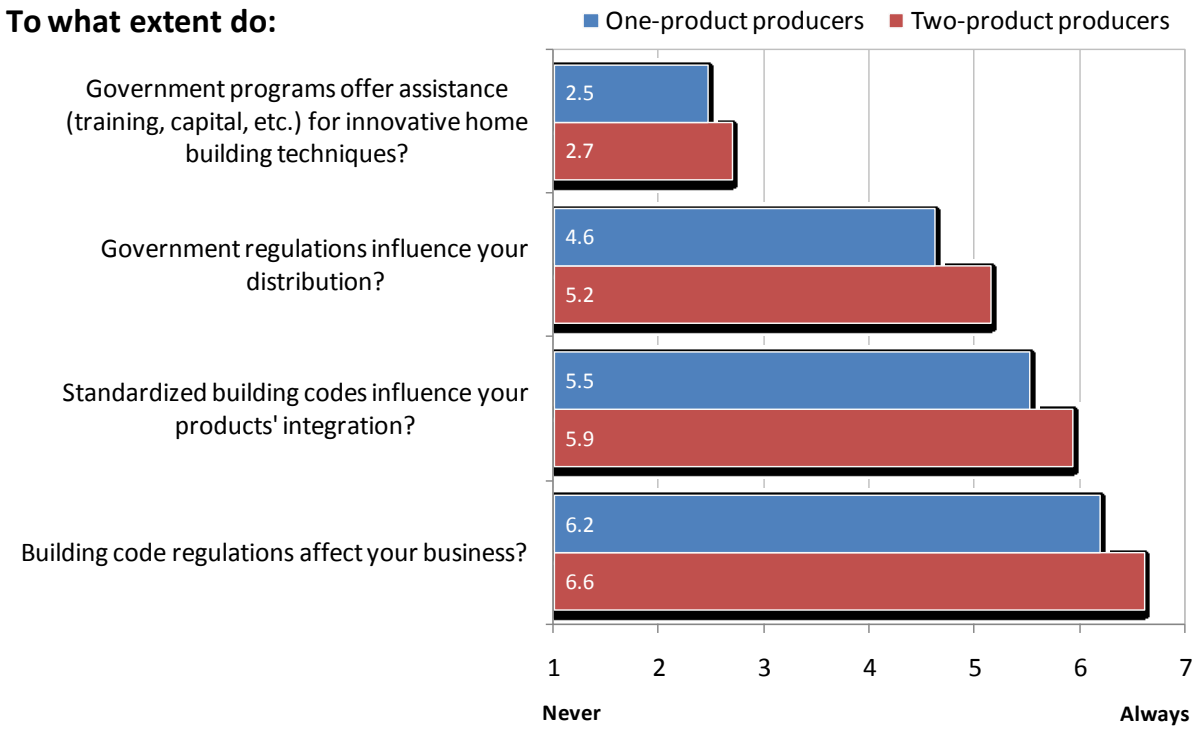

Figure 7-5: Government Influence on Innovation and Distribution: One- and Two-product Producers

7.5 MARKETING

The last dimension of questionnaire analysis focuses on marketing and concepts relating to supply-chain activities. In the context of this analysis the supply-chain function of the factory-built home industry is incorporated into the marketing dimension. Figure 7-6 illustrates the rate by which one- and two-product producers pursue supply chain activities. These activities range from raw material suppliers through distributors and installers. Overall, two-product producers showed greater pursuit of supply-chain

functions. Whereby a significant difference ($p = 0.03$) was calculated between responses of one- and two-product producers and their pursuit of relationships with raw material suppliers and distributors. Most notably, the greatest supply-chain relationship was sought with builders and installers of factory-built homes. Interestingly, producers in both categories rated sub-assembly and component sourcing amongst the lowest activities pursued.

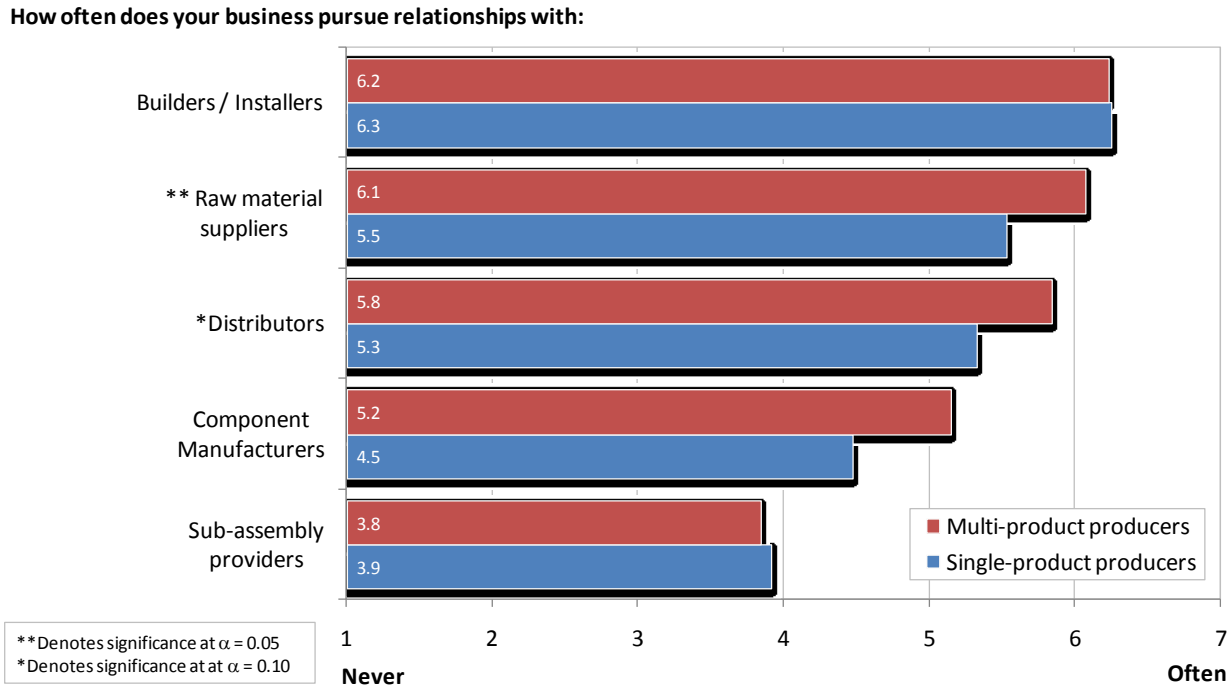

Figure 7-6: Supply Chain Relationships: One- and Two-product Producers

7.6 FURTHER DISCUSSION

In evaluating the auxiliary results collected via this study's mail questionnaire it can be concluded that this analysis further solidified existing research by The U.S. Department of Housing and Urban Development (HUD; 1997, 2000, 2007) relating to business demographics, economics, finance, government, marketing, and production capacities in the factory-built home industry. The perspective of this analysis, however,

was unique as these results pursued the concept of diversification on a broad scale rather than by categorizing producers solely into their primary industry-segments. The structure of the mail questionnaire focused on five key business dimensions that affect the U.S. factory-built home industry. Each dimension showed that one- and two-product producers respond differently to fluctuations in industry structure.

Demographic and production based assessments of the factory-built home industry produced results that coincided with existing research by HUD (1998, 2000, 2007) and Woodbridge, P. and Associates (2003) which chronicled the tribulations of the U.S. residential construction sector as well as the factory-built home industry through the early 2000's. Similar patterns of boom and bust were seen in this study's total sales and shipments data across one- and two-product producers. Interestingly, total annual shipments growth was only seen in one-product producers over the six-year period from 2002 to 2008. Total shipment growth amongst one-product producers has plausible connection to intense regional development seen in the U.S. during the recent housing boom (U.S. Census Bureau, 2009a) as a large proportion of one-product producers operate in limited regional markets (HUD, 1998). Nonetheless, it should be noted that although total shipment growth was seen for one-product producers from 2002 to 2008, average total annual sales declined by almost 2 million dollars per producer. This result indicates that average home prices decreased across the six-year period, a trend also seen in U.S. new home prices during the same period (U.S. Census Bureau, 2009b).

Questionnaire results highlighting the economic and financial dimension of the factory-built home industry detailed differences seen between responses of one- and two-product producers. Changes in production outputs from 2002 to 2008 were perceived

differently by one- and two-product producers who underwent divergent trends during this six-year period. Two-product producers saw a slight decline in total production output, which inevitably translated to higher perceived influences from economic and financial factors. The greatest differences in response amongst one- and two-product producers were detected amongst questions relating to the affordability of traditional site-built homes and changes in demand for new residential construction. Two-product producers indicated that the decrease in demand for new residential construction was the greatest influence on their production output from 2002 to 2008. Two-product producers most likely faced difficult challenges to compete with the site-built home market during the recent downturn in U.S. residential construction. Increases in foreclosures drove home prices down (Center for Responsible Lending, 2006) while simultaneously excess inventories of unsold homes drove demand for new residential construction downward (U.S. Census Bureau, 2009). Supply and demand of new residential construction will, however, readjust towards equilibrium as the inventory of unsold home are absorbed by a slowly churning residential home market.

The dimension of government plays a crucial role in the factory-built home industry as many of the current barriers to new market entry are due to regulatory challenges and slow acceptance of innovation within the industry (HUD, 1998, 2000). Major model building codes regulate site-built, modular, panelized and pre-cut homes, whereas manufactured homes are regulated under the preemptive National Manufactured Housing Construction and Safety Standards Code (HUD-Code)(HUD, 1998, 2003; Atiles and Vanderford, 2006; Apgar et al., 2002). These codes have long acted as substantial barriers to factory-built home producers attempting to grow beyond their state and local

borders (HUD, 1998). Today these barriers still exist as two-product producers indicated that building regulations almost always affect their business. Additionally, both one-and two-product producers indicated that government programs nearly never offered assistance in the form of training or capital towards innovative home building techniques. Programs such as the Partnership for Advancing Technology in Housing (PATH) have attempted to break through this perception, however, involvement from public, private, and consumer sectors are necessary and vital for breakthroughs to occur in progressive building code regulation and innovation (Beamish et al., 2001; HUD, 2003, 2006; Martin, 2005).

Marketing and the supply-chain both play fundamental roles in the structure and success of the factory-built home industry (HUD, 2000). Producers of factory-built homes have a perceivably keen notion of this dimension's importance and have shown this in their pursuit of relationships within their supply-chains. Respondents showed that a developed relationship with builders and installers is the single most import aspect of their business's success. However one- and two-product producers differed in respect to their pursuit of relationships with raw material suppliers and distributors. Overall, this divergence is due to the structure and method by which these two dichotomous segments of the industry operate (HUD, 2000). However, on either side, strong supply-chain networks are needed to operate in the factory-built home market, a concept shown by all questionnaire respondents.

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8 SUMMARY

8.1 OVERVIEW

Organizational theory places constraints on the life-span of an industry and its' products (Harrigan, 1988). The life-span constraints of an industry relate directly to industry structure and the competitive forces that fundamentally characterize it (Porter, 1980, 2008). As competitive forces shift industry structure, market voids are exposed for strategic exploitation (Porter, 1980). Analysis was developed to fundamentally understand how these shifts affect a product's life cycle and how competitive strategy looks to exploits voids within the factory-built home industry.

This study had two specific hypothesized objectives. These objectives were:

1. Product Life Cycle Positioning of the Manufactured Home Industry-Segment

   To determine if the manufactured housing industry-segment has seen a decline in its' market share of the U.S. residential construction sector throughout its' current product life cycle period.

2. Trends and Diversification in the Factory-Built home Industry

   To determine if factory-built home producers that are diversifying their production to alternative housing products have increased their market share within the market definition of factory-built housing.

8.2 PRODUCT LIFE-CYCLE POSITION OF THE MANUFACTURED HOME INDUSTRY-SEGMENT

The product life-cycle (PLC) curve has been used by strategist and marketing professionals to quantify the life-cycle continuum of a product or industry based on demand (Harrigan, 1988, 1980). A market's demand of a good can be measured by its

sales over a given period (Peter and Donnelly, 2001) A stated period is marked by the introduction of a product to market and continues throughout the growth, maturity, and declining stages of the product's evolution. In the case of manufactured housing, market introduction occurred with the "mobile home" or "travel trailer" and underwent numerous modifications as a home dwelling prior to its' market acceptance (Hart et al, 2002). Therefore, application of the PLC concept to the factory-built housing industry and specifically the manufactured housing industry-segment (HUD-Code and Mobile) provides a PLC curve that commences with its growth stage in1959.

The first objective of this study was to determine if the manufactured housing industry-segment has seen a decline in its' market share of the U.S. residential construction sector throughout its' current product life cycle period. An econometric approach was taken to modeling manufactured housings' market share of the U.S. residential construction sector, whereby a series of generalized linear regression models were used to place trends to the market share data. Market share was the ratio of total manufactured home shipments to total new residential home starts from 1959 to 2008. Results of this econometric analysis provided three distinct models that mimicked the hypothesized PLC stages of growth, maturity, and decline. Slope coefficients and their significance tests were used to indicate the directional trend of each stage. Post War Prosperity showed a significant positive slope ($p < 0.001$, +1.64), while Deregulation returned a statistically non-significant positive slope ($p = 0.229$, +0.24), and The New Economy returned a significant negative slope ($p = 0.002$, -1.09). It was thus concluded that the manufactured home industry-segment had undergone its' growth stage during *Post War Prosperity (1959 - 1973)*, its' maturity throughout *Deregulation (1974 - 1992)*

and as of *The New Economy* the manufactured home industry-segment was undergoing the decline stage of its' PLC.

8.3 COMPETITIVE STRATEGY AND DIVERSIFICATION IN THE FACTORY-BUILT HOME INDUSTRY

The second objective of this study was to determine if factory-built home producers (e.g. producers of manufactured, modular, panelized, and/or pre-cut residential housing) that are diversifying their production to alternative housing products have increased their market share within the market definition of factory-built housing. A mail questionnaire directed at U.S. factory-built home-producers addressed this research objective. A sampling of 333 U.S. factory-built home producers yielded 167 non-responses and 55 non-contacts for which addresses were incorrect or companies were no longer in business. An adjusted population of 278 U.S. factory-built home producers yielded a response rate of 39.9 percent with 111 total respondents. Of the 111 total responses, 64 respondents positively answered as producers of factory-built homes.

Demographically respondents were regionally balanced across the four U.S. Census regions. However, the dispersion of total shipments amongst respondents heavily favored factory-built home producers who's primary product were manufactured homes. Manufactured home producers accounted for 67 percent of total annual shipments in 2008. Whereas, modular producers accounted for17 percent, panelized accounted for 13 percent, and pre-cut 3 percent. Proportionally the demographic results from the mail questionnaire paralleled U.S. Census Bureau data (U.S. Census Bureau, 2008a, 2009c) and existing reports by The U.S. Department of Housing and Urban Development (HUD; 1998, 2007).

The factory-built home industry was diverse amongst one-, two-, and three-product producers in regards to total producers in each category when viewed across the six-year time series of 2002 through 2008. However, only the one- and two-product producer categories saw categorical change across the specified longitudinal time span. One-product producers increased in industry presence by 12 percent from 2002 to 2008 while two-product producers increased by 10 percent. The increases seen in one- and two-product producers are directly linked to innate tendencies of U.S. manufacturers to add or drop products as a competitive strategy. These strategies looked to leverage changes seen in the U.S. residential construction industry from 2002 through 2008. Existing research by Harrigan (1980, 1983, 1988) and Bernard et al. (2006) support this supposition of product adding and dropping as a competitive strategy while identifying that such strategies have been heavily pursued in the U.S. manufacturing sector over the past three decades.

Further detailed analysis of the changes in production reported by questionnaire respondents followed two-product producers of manufactured and modular homes from 2005 to 2008. A comparison of production proportioning changes between questionnaire respondents and market share leading firms in the factory-built home industry revealed that diversified firms are hedging split-production abilities. Aggregated changes seen across 9 diversified producers indicated the production shifts were positively in favor of modular production from 2005 to 2008. This hedging was seen as a competitive strategy (Harrigan, 1983) focused on both offsetting demand losses in the declining manufactured housing industry-segment while developing entry to a new market as means of promoting market share growth. Alternatively, only a few diversified firms shifted production

capacities towards the manufactured home industry-segment from 2005 to 2008. The actions of these firms relate to measures taken by entrenched producers (Porter, 1980) who are unable to overcome industry-segment exit barriers and therefore have to pursue volume based competitive strategies to survive in a consolidating industry-segment.

Dynamic analysis was performed on respondents' total home shipment and market share data to develop a framework for diversifications' effect on market share positioning over the six-year period of 2002 to 2008. Total home shipments for one-, two-, and three-product producers took divergent paths over this period indicating that market reactions by one and two-product producers versus that of three-product producers where innately dissimilar in challenging economic times. Astounding market share growth was seen in the two-product category of manufactured and modular homes where manufactured homes were the primary product. Additionally, strong growth of nearly 5 percent was seen in the one-product panelized category from 2002 to 2008. Growth in these categories paralleled the overall trend of the U.S. economy through 2005 however exceeded expectations in 2008. Total shipments and market share gains for two-product producers in 2008 were most likely a result of three-product producers losing 62 percent in total shipments and 26 percent of market share between 2002 and 2008. Nonetheless, the divergent trends seen in total home shipments and market share between one-, two-,and three product producers indicates that product diversification does effect market share positioning. However, limited diversification provides a clearer focus towards market share growth in challenging economic times.

Overall, the critical objective of the questionnaire research culminated with non-parametric statistical comparisons of market shares between one- and two-product

producers in the factory-built home industry. Results of this testing concluded that diversified two-products producers significantly improved market share positioning from 2005 to 2008 when compared to one-product producers in the factory-built home industry. The significance in market share growth amongst two-product producers is attributed to the overall ability of diversified producers to seek market opportunities on a larger but focused scale. Nevertheless, the capacity to hedge demand fluctuations across multiple industry-segments is a widely pursued competitive strategy in the factory-built home industry. However, the challenge to avoid overexposure to industry wide fluctuations in demand mount as firms diversify more and more extensively leading to potentially lethal consequences in challenging economic times.

8.4 FURTHER RESULTS

Auxiliary results of this study took an alternative perspective to those of the previous research objectives outlined above. Questionnaire responses based on five predetermined business dimensions allowed for aggregated comparisons of one- and two-product producers in the factory-built home industry to be deployed. Each of the five business dimensions (business demographics, economics and finance, government, marketing, and production) were analyzed to examine how structural changes to the factory-built home industry effected one- and two-product producers. Collectively, analysis of the auxiliary data showed similar findings to existing research by The Department of Housing and Urban Development (HUD; 1998, 2000, 2007) and the previous chapters of this research. Nonetheless, some notable differences in responses were observed between one-and two-product producers when asked about recent industry demand fluctuations and supply-chain relationships. It is surmised that these differences

in response are due to the divergent strategies of small and large volume firms in the factory-built home industry. Generally speaking, one-product producers averaged smaller volume of total home shipments from 2002 to 2008. Whereas, two-product firms sustained a larger, multi-regional approach to total home shipments and thus increased shipments. This dichotomy amongst factory-built home-builders exposes two-product producers to demand fluctuations in the U.S. residential construction sector while insulating one-product producers within their limited regional markets. Based on these divergent competitive strategies it is expected that two-product firms pursue supply chain relationships that boost costs leadership abilities and allow competition in larger U.S. markets. While alternatively, one-product firms look to continue their regional dominance through solidified networks of builders and installers

8.5 CONCLUSIONS

This study investigated the factory-built home industry in its' critical juncture with the single greatest decline ever experienced in U.S. residential home construction history. Research methods focused on the factory-built home industry's multilateral structure to dissect product life cycle (PLC) positioning and competitive strategies of the industry.

First, econometric models of time series data were used to classify the product life cycle (PLC) position of the manufactured home industry-segment from 1959 to 2008. Results from econometric modeling of manufactured housings' market share of the U.S. residential construction industry mimicked those of a PLC curves' evolution from growth through the decline stage. Slope coefficient comparisons of the PLC curve and econometric models provided conclusive evidence that the manufactured home industry-segment is currently in the decline stage of its' PLC. Challenges faced by declining

industry-segments include consolidation, diversification, and new market entrants. All of which are exacerbated by progressive overall market share losses.

Research conducted through a mail questionnaire of the factory-built home industry investigated the role of diversification as a competitive strategy in gaining market share positioning. Results of this sampling concluded that diversification, as a competitive strategy to gain market share position, was employed differently by one-product (i.e. a company only competing in the manufactured housing market) and two-product (i.e. a company competing in the manufactured and modular housing market) producers in 2008. However, market share data showed that diversification has its' limitations. As over-exposure to market instability can ultimately lead to significant market share losses in challenging economic times.

Additionally, supplemental research offered insights on the effects imposed by market fluctuations on the structural dimensions of the factory-built home industry. Targeted analysis placed one- and two-products producers in aggregated form to provide quantitative insight to the dichotomous structure of the factory-built home industry. Overall two-product producers are more susceptive to oscillations in the U.S. residential construction sector due to their size and structure. Whereas one-product producers are relatively insulated to market booms-and-busts by their smaller fragmented regional positioning.

8.6 LIMITATIONS TO THE STUDY

This study was developed to assess the factory-built home industry from several perspectives. These perspectives took the form of econometric modeling and a mail questionnaire of the factory-built home industry. Each of these methodological

techniques are bound by the dynamic scope of their data. The reader should acknowledge these data bounds when interpreting this study's results. Important limitations of this work are:

- Market share was the ratio of total manufactured home shipments to total new residential home starts from 1959 to 2008.
- Statistical results for Chapter 5 should be viewed with caution due to the small data ranges ($n < 30$) pursued across each economic period. Additionally, segmented regression analysis results are used only as qualitative approach to produce a straightforward macroeconomic framework for the manufactured home industry-segment and should not be used quantitatively to extrapolate predicted levels of market share for the manufactured home industry-segment without further exploration of time-series analysis.
- Generalized linear regression assumption testing, for the continuous market share data set, returned results of normality. However, the segmented economic ranges displayed notable discrepancies in their measure of normality, linearity, homoscedasticity, and independence. These incongruities should be noted and dealt with in further research using such industry data.
- Positive serial correlation was present amongst manufactured housing's market share of the U.S. residential construction sector data. However, autoregressive lag-1 testing showed that there were no significant effects contributed to the slope parameter estimate or data trend due to this correlative effect. Yule-Walker slope parameter estimates for autoregressive models showed only minor divergence from the originally stated generalized linear models' slope parameters.

- Questionnaire data is subject to non-parametric sampling due to small ($n < 30$) categorical sampling of two-,and three-product producers. However it is believed that this study captured a non-biased representation of factory-built home producers.

8.7 FUTURE RESEARCH

Based on the limitations of this work, future research should be pursued by the development of a larger questionnaire sampling of the factory-built home industry where limitations of sample size do not bound the dynamics of the analysis. The study would again focus on the disparity in market share growth between one-, two-, and three-product producers. However, this methodology would allow researchers to investigate diversification and competitive strategy in a broader context giving more significance to the applied nature of the research.

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APPENDIX A: MAIL QUESTIONNAIRE

Study of Trends and Diversification in the Manufactured Housing Industry

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Virginia Tech
Blacksburg, Virginia 24061

If you have any questions or concerns, please contact
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Fax: 540-231-8868
Email:gvnwhrry@vt.edu

Residential Construction Industry Definitions – Throughout this questionnaire, the use of the term "factory-built" and other types of residential construction are made. Please refer to the definitions below:

Site-Built Homes

Classic residential building construction using dimensional lumber to construct wall, floors and roof frame structures. Most components of the typical site-built house are constructed onsite and covered with panelized material (plywood or OSB). Remaining building components are manufactured off-site, in production facilities, and transported to the building site.

Factory-Built Homes

Pre-Cut Homes

A home assembly system that is precut to exact size, length and quantity in a factory and is shipped unassembled to the building site. These units are built on solid foundations and must comply with local building codes. Common systems are timber-frame, log, kit and dome homes.

Panelized Homes

Building systems package that utilize a series of standardized two-dimensional components to construct walls, floors, roof panels, and interior partitions. Components, including roof trusses, are prefabricate in a factory and shipped to the building site unassembled. Structural Insulated Panels (SIPs), and/or other standard panel products are used to form the three-dimensional housing unit onsite. These units, regardless of construction location, must comply with local building codes.

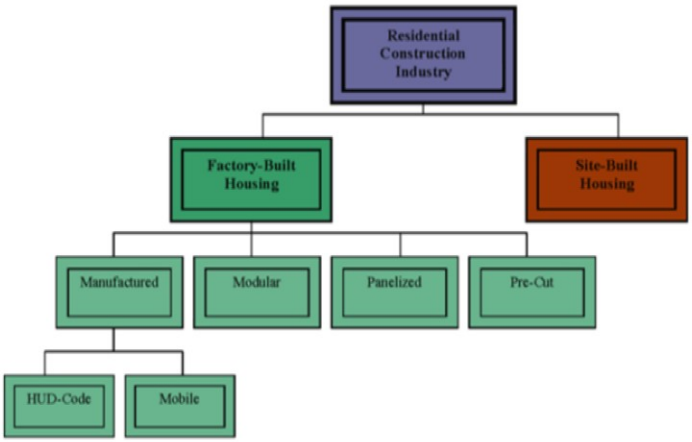
Modular Homes

Three-dimensional units that are constructed of individual wall, floor, ceiling, or roof systems, which are then transported to the final destination and assembled rapidly on a solid foundation. The final home structure, comprised of multiple module units, must comply with local building codes.

Manufactured Homes

HUD-Code	*Mobile*
Large three-dimensional units that are pre-assembled in the factory and shipped to a destination on a metal chassis. Final housing units are composed of either single or multiple pre-constructed units and can be placed on either permanent or temporary foundations. Units are regulated by local jurisdiction at the manufacturing facility and by the national HUD-Code.	A specific subset of manufactured homes that were built prior to the National Manufactured Housing Construction and Safety Standards Act of 1974.

Residential Construction Industry Chart



Objective

The objective of this study is to analyze the current state of the factory-built home industry and investigate if producers of manufactured homes are diversifying from their manufacturing capabilities five years prior to alternative forms of factory-built home construction today. The responses given to this questionnaire should be to the best of your knowledge to ensure accuracy. The responses given are confidential and no company information will be disclosed. Filling out this questionnaire will take approximately 20-30 minutes. Your input is critical for helping the industry to better understand future market opportunities. As a participant in the study, you will receive a summary of the results before publications are made. Your help and time are greatly appreciated. Thank you for your willingness to participate. If you have any questions or concerns, please do not hesitate to contact us.

1. Based on the definitions provided on the previous page, Do you manufacture factory-built homes?

   ▫ Yes

   ▫ No

   If No, please seal and return. Thank you for your time.

2. Based on the definitions provided on the previous page, what type of factory-built homes do you produce?

   ▫ Manufactured ▫ Pre-Cut

   ▫ Modular ▫ Other:

   ▫ Panelized

3. Is the manufacturing of factory-built homes your primary business (e.g. largest portion of revenue generated)?

   ▫ Yes

   ▫ No

4. What type of factory built home is your primary business (e.g. largest portion of revenue generated)?

   ▫ Manufactured ▫ Pre-Cut

   ▫ Modular ▫ Other:

   ▫ Panelized _____

5. Is your company a single or multi-facility operation?

   ▫ Single facility If Single-facility, **please skip question 6**

   ▫ Multi-facility

6. If multi-facility, how many manufacturing facilities do you operate?

   Please specify: _____

7. Please circle (on the map below) the region where your manufacturing facility is / facilities are located

8. Please indicate your company's total sales for:

2002	2005	2008
_____	_____	_____

9. Please indicate the total number of full-time employees (management, sales, manufacturing, etc.) in your company during:

2002	2005	2008

10. Do you collaborate with any government organizations or programs (i.e. (PATH) The Partnership for Advancing Technology in Housing)

    ▫ Yes

    ▫ No If No, **please skip question 11**

11. If yes to **question 10**, please list the organizations or programs:

    _____

12. To what extent do:

	Never						Always
Government regulations influence your distribution?	1	2	3	4	5	6	7
Building code regulations affect your business?	1	2	3	4	5	6	7
Standardized building codes influence your products integration into the home building industry?	1	2	3	4	5	6	7
The costs of new technology affect your ability to diversify to alternative products?	1	2	3	4	5	6	7
Government programs offer assistance (training, capital, etc.) for innovative home building techniques?	1	2	3	4	5	6	7

13. Please mark with an **X** (on the diagram below) the location of your primary product (e.g. largest portion of revenue generated) based on total sales dollars ($).

14. Based on the information provided in **question 13**, into which product life cycle stage would you place your primary product (e.g. largest portion of revenue generated):

In one year:

□Introduction □Growth □Maturity □Decline

In five years:

□Introduction □Growth □Maturity □Decline

In ten years:

□Introduction □Growth □Maturity □Decline

15. Has your business considered diversifying to other methods or types of factory-built home construction?

□Yes If yes, please explain: _____

□No

16. Please indicate the total number of units produced and sold in each industry segment during the following years:

	2002	2005	2008
Pre-Cut			
Panelized			
Modular			
Manufactured			
Other: _____			
Total			

17. Based on the information provided in **question 16**, please indicate your specific industry **definition of a production unit**:

□ Two-dimensional □ Three-dimensional incomplete □Three-dimensional completed □ Other: _____

18. Based on the information provided in **question 16**, did units produced and sold between 2002 and 2008:

□ Increase

□ Decrease

□ Remain the same

19. Based on the information provided in **question 18**, please indicate the level to which each of the following was responsible.	**Minor Reason**						**Major Reason**
Demand for new residential construction changed during this period	1	2	3	4	5	6	7
Low interest rates in the U.S	1	2	3	4	5	6	7
Consumer acceptance of factory-built home construction	1	2	3	4	5	6	7
Affordability of traditional site-built homes	1	2	3	4	5	6	7

20. How well does your product offer the following:	**Not Well**						**Very Well**
Quality of construction	1	2	3	4	5	6	7
Overall value (Quality for the Price)	1	2	3	4	5	6	7
Community quality	1	2	3	4	5	6	7
Look and feel of finished home	1	2	3	4	5	6	7
Resale value (Selling price)	1	2	3	4	5	6	7
Affordable purchase price	1	2	3	4	5	6	7
Ability to choose design features	1	2	3	4	5	6	7

21. Please rate the following products based on **QUALITY**	**Low**						**High**
Site-Built Home	1	2	3	4	5	6	7
Pre-Cut Home	1	2	3	4	5	6	7
Panelized Home	1	2	3	4	5	6	7
Modular Home	1	2	3	4	5	6	7
Manufactured Home	1	2	3	4	5	6	7

22. Please rate the following products based on **VALUE**	**Low**						**High**
Site-Built Home	1	2	3	4	5	6	7
Pre-Cut Home	1	2	3	4	5	6	7
Panelized Home	1	2	3	4	5	6	7
Modular Home	1	2	3	4	5	6	7
Manufactured Home	1	2	3	4	5	6	7

23. To what annual household income bracket (s) of potential buyers do you market your product: (Check one or more)

- □ < $25K
- □ $25K to less than $50K
- □ $50K to less than $75K
- □ $75K to less than 100K
- □ $100K +

24. In what category do you place your company: (Check one or more)

- □ Material supplier
- □ Manufacturer
- □ Assembler
- □ Distributor
- □ Installer

25. To what extent:	No Extent						Major Extent
Does your current supply-chain impact your overall performance?	1	2	3	4	5	6	7
Does your current supply-chain affect your ability to produce other types of factory-built homes?	1	2	3	4	5	6	7
Do your current technologies affect your ability to produce other types of factory-built homes?	1	2	3	4	5	6	7
Has the current U.S credit-tightening situation affected your business?	1	2	3	4	5	6	7

26. Is the factory-built housing industry an early adopter of innovation?

- □ Yes
- □ No

27. Given your best estimates, what percentages of end-users of your product declare their home unit as real estate?

- □ < 1%
- □ 1% to 4%
- □ 5% to 9%
- □ 10% to 14%
- □ 15% to 20%
- □ > 20%

28. How often does your business pursue relationships with:	Never						Often
Raw material suppliers	1	2	3	4	5	6	7
Sub-assembly providers	1	2	3	4	5	6	7
Component manufacturers	1	2	3	4	5	6	7
Distributors	1	2	3	4	5	6	7
Builders / Installers	1	2	3	4	5	6	7

29. Please provide any further information that you believe is important to this study:

THANK YOU!

Thank you. Please fold, tape, and return the completed questionnaire. The postage is prepaid. Also, please indicate if you would like to receive a summary of results.

___ Yes, please send results to the following email address: _____
___ No thank you, please do not send results.

62345

APPENDIX B: MAIL QUESTIONNAIRE COVER LETTER

VirginiaTech
College of Natural Resources

Wood Science and Forest Products
Wood Science & Forest Products
Brooks Center (0503), 1650 Ramble Road
Blacksburg, Virginia 24061
520-661-1928 Fax: 540-231-8868
E-mail: gvnwhrry@vt.edu
www.woodscience.vt.edu

October 31, 2009

«Company»
«Address_3»
«Address_1» «Address_2»
«City», «State» «Zip»

To Whom It May Concern:

The U.S residential construction industry is strongly influenced by the cyclical nature of the U.S economy and exhibits expansion and contraction periods in relation to a multitude of economic variables. With the state of the U.S residential construction industry in flux many homebuilders are readdressing their business strategies. The factory-built residential construction sector, while originating from manufactured homes, has seen emerging sub-sectors within the industry that promote the ability for producers to diversify to alternative products such as modular, panelized, and pre-cut homes. These alternative products provide opportunities to shift business strategies to maintain and gain market share.

Virginia Tech is in the process of conducting research to assimilate information from the factory-built home industry, including trends in the types of products offered, innovation being pursued, and government support that is currently offered to the factory-built home industry. With this information, Virginia Tech hopes to provide the factory-built home industry with valuable information as to diversification strategies and areas of future industry growth.

Your company, «Company», was selected from industry lists provided by the National Association of Home Builders (NAHB), Automated Builder Magazine, and the Manufactured Housing Institute (MHI). We are asking for your help in this project by completing and returning the enclosed questionnaire. The postage is prepaid. Since the number of participants is small, your response is vital for the success of this project.

We would like to thank you for your assistance in advance. Please be assured that your response will be treated with complete confidentiality. Your name and company will never be identified in the study results nor will your participation be disclosed to anyone. Only aggregated results will be reported. The questionnaire is numbered to ensure that your name and company are removed from the mailing list once I receive your response. This will prevent future mailings to your company.

Thank you very much for your time and assistance. Should you have any questions, please contact me by phone at 520-661-1928, (fax) 540-231-8868, or (email) gvnwhrry@vt.edu.

Sincerely,

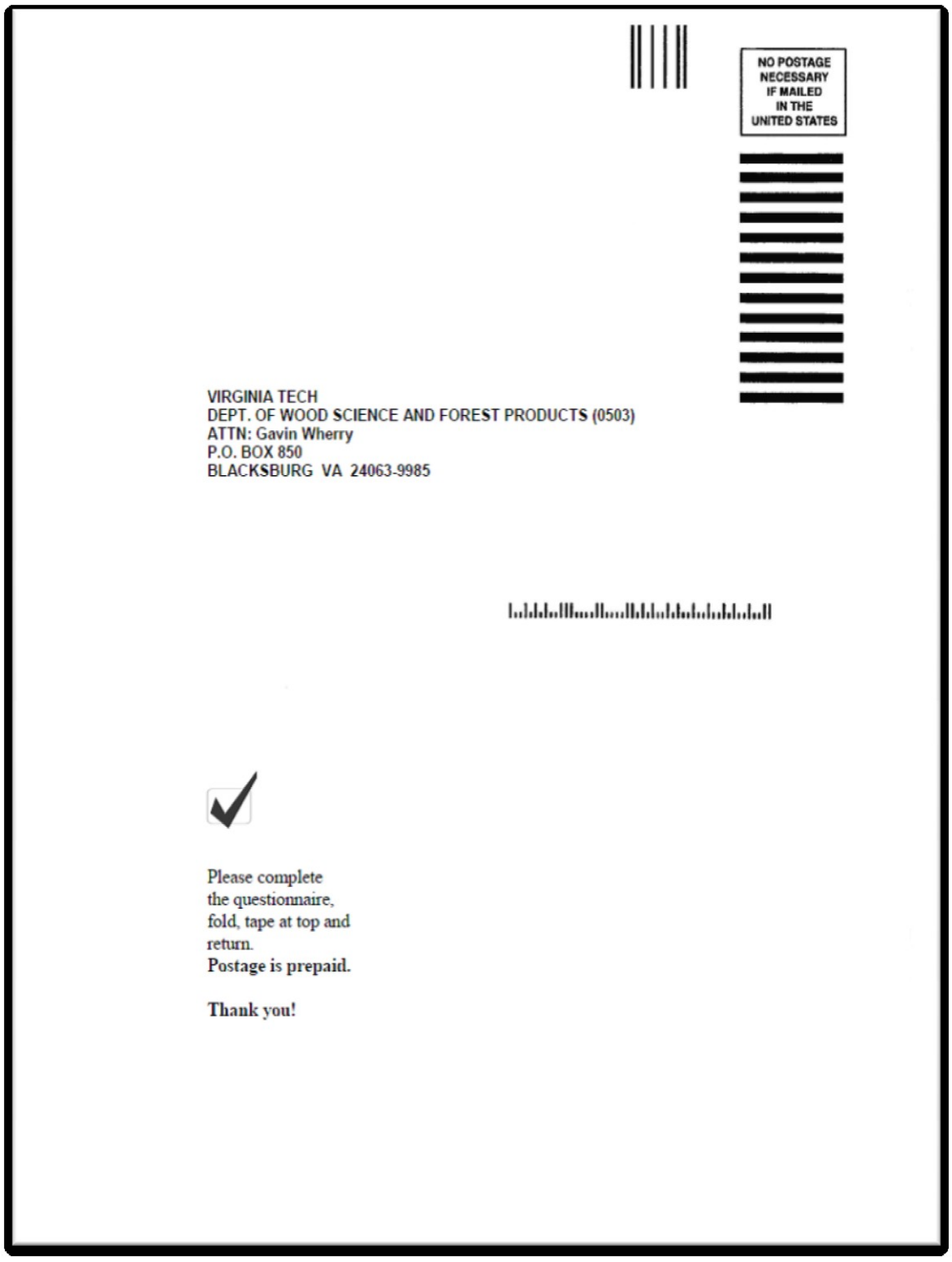
Gavin Wherry
Graduate Research Assistant

«Tracking_Number»

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

APPENDIX C: BUSINESS REPLY MAIL PAGE



APPENDIX D: FOLLOW-UP POSTCARD

VirginiaTech

College of Natural Resources

October 31, 2009

We need your help! Last week you were mailed a copy of a questionnaire regarding the factory-built home industry. I am contacting you to ask that you complete the questionnaire and return it, postage free, to the address listed on the back of this postcard. If you have already completed and returned it, please accept my sincere appreciation. The questionnaire is designed to gather valuable information regarding product trends, innovation and government support within the factory-built home industry.

Your name was chosen at random to participate in this questionnaire. However, your response is critical in providing accurate results to your industry. The information you provide will be kept **strictly confidential.** The number on the questionnaire allows us to remove your name from future mailings. If you have any questions, please contact me at 520-661-1928. Our fax number is 540-231-8868. Thank you in advance for your participation.

Sincerely,

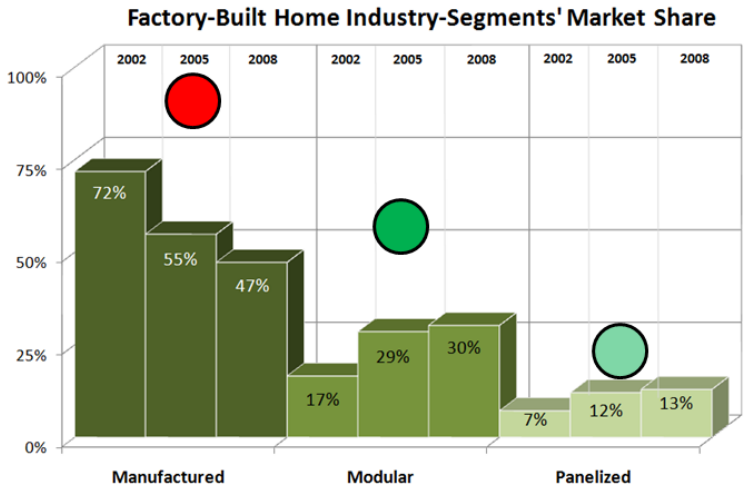
Gavin Wherry
Graduate Research Assistant
Department of Wood Science and Forest Products
Virginia Tech

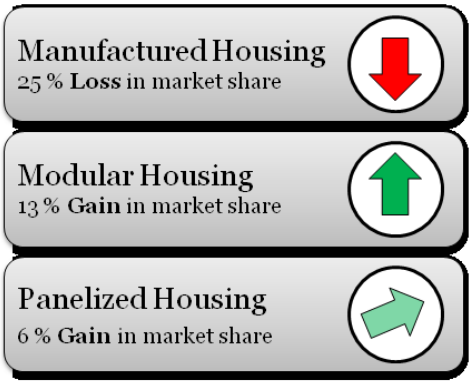
VIRGINIA TECH
WOOD SCIENCE AND FOREST PRODUCTS (0503)
ATTN: GAVIN WHERRY
P.O. BOX 850
BLACKSBURG, VA 24063-9985

62345

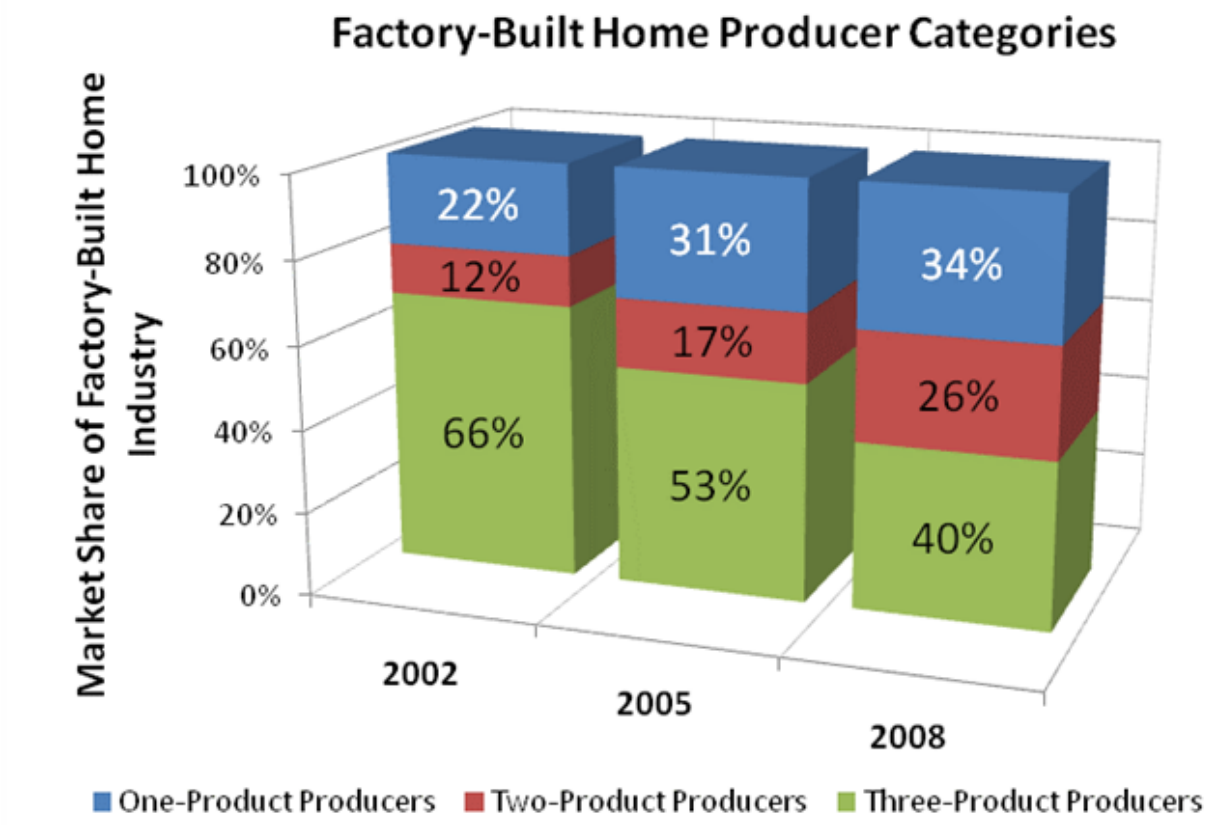
Company Name
Address Line 1
Address Line 2
City, State Zip Code

APPENDIX E: INDUSTRY SEGMENTS' MARKET SHARE

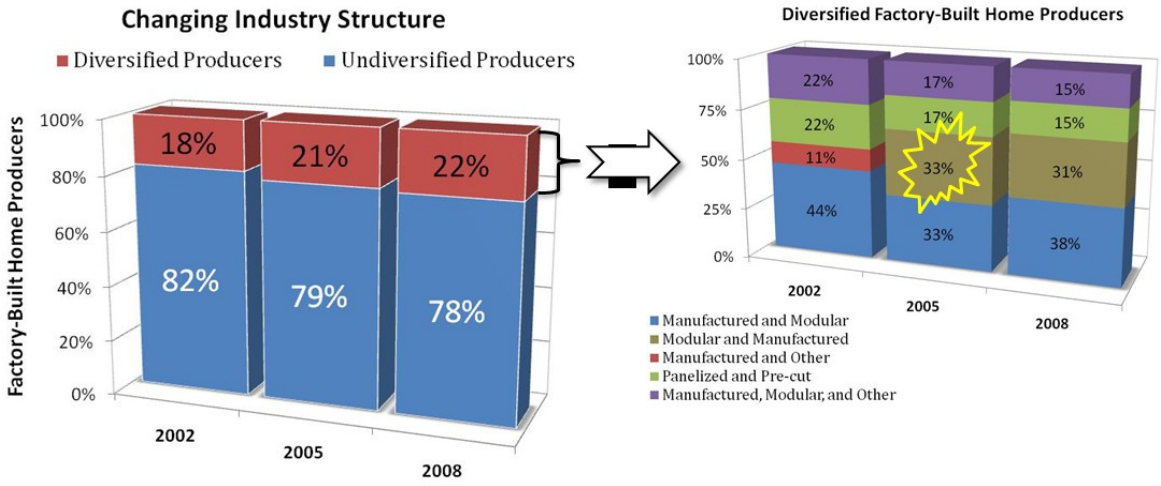




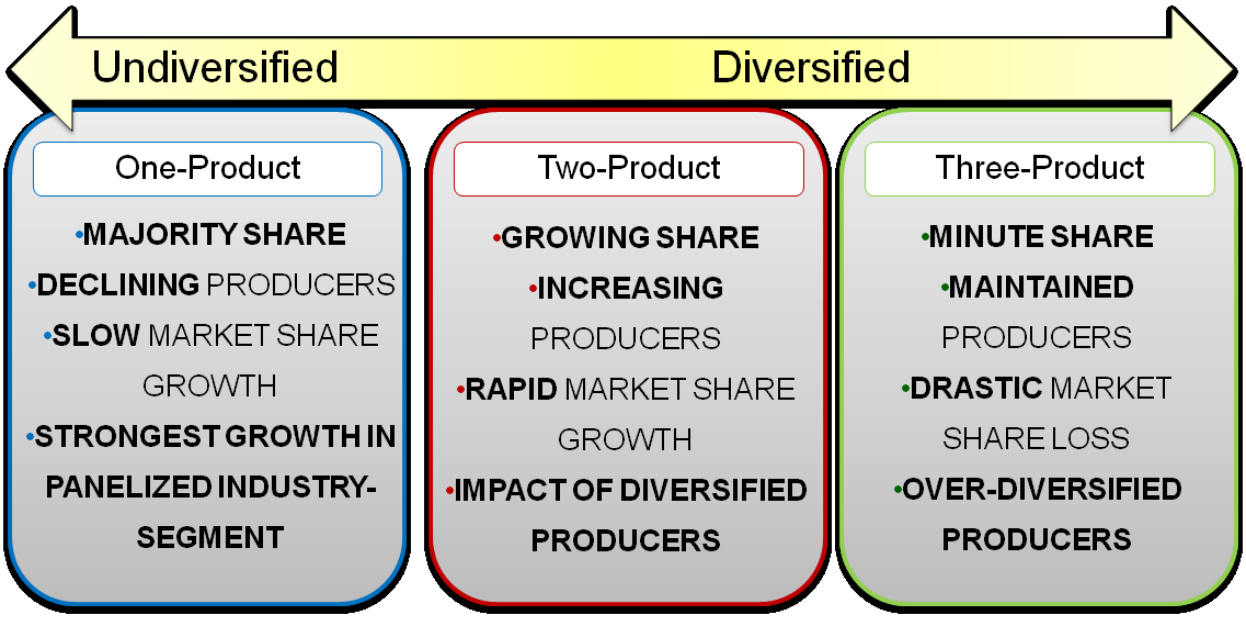
APPENDIX F: FACTORY-BUILT HOME PRODUCER CATEGORIES



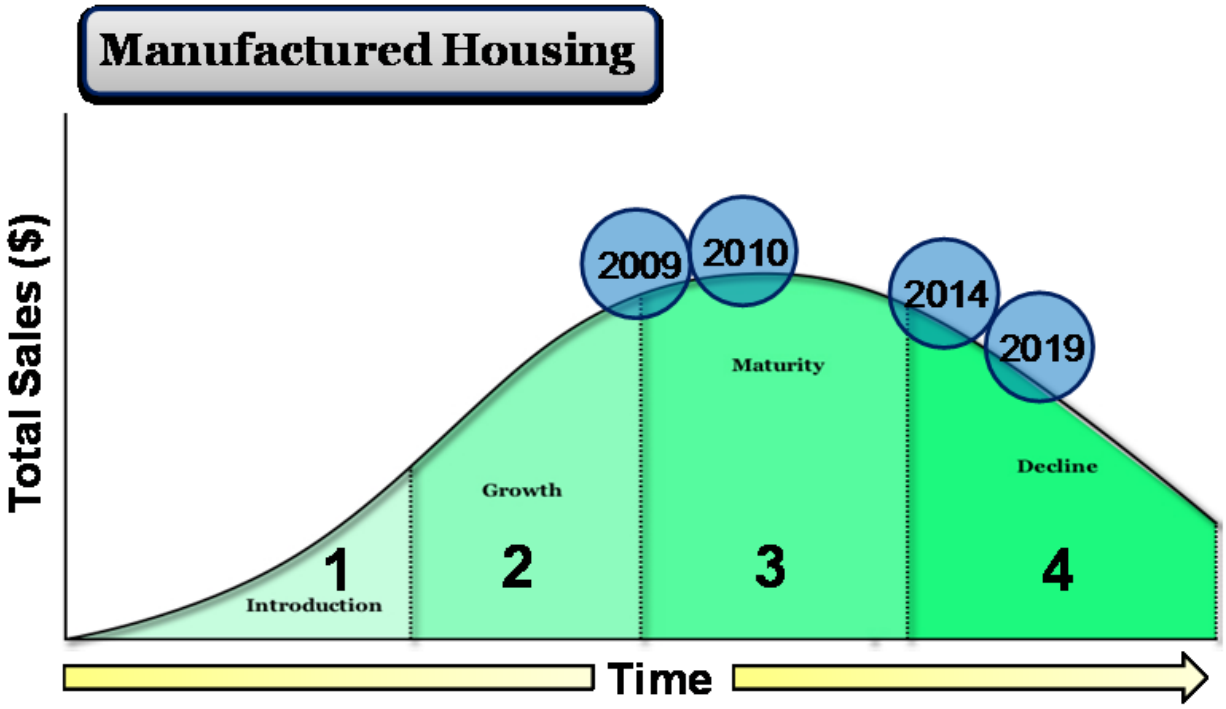
APPENDIX G: CHANGING FACTORY-BUILT HOME STRUCTURE



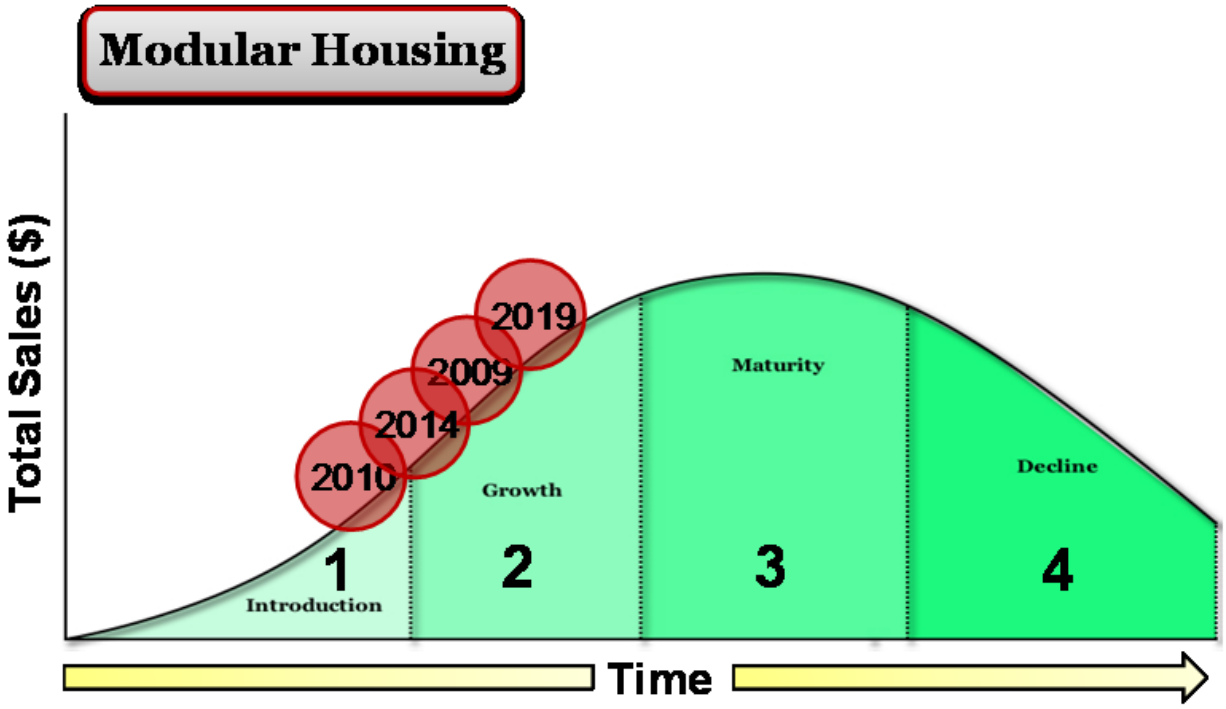
APPENDIX H: FACTORY-BUILT HOME INDUSTRY SPECTRUM



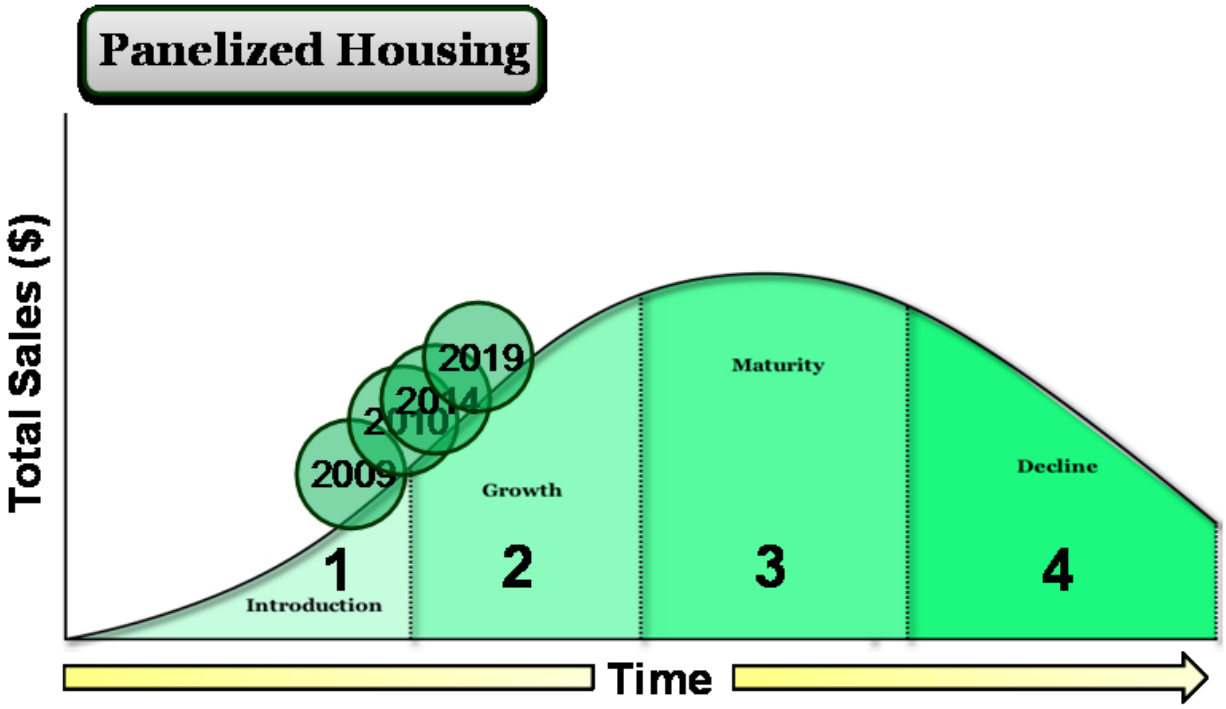
APPENDIX I: PRODUCT LIFE CYCLE FORECAST - MANUFACTURED HOMES



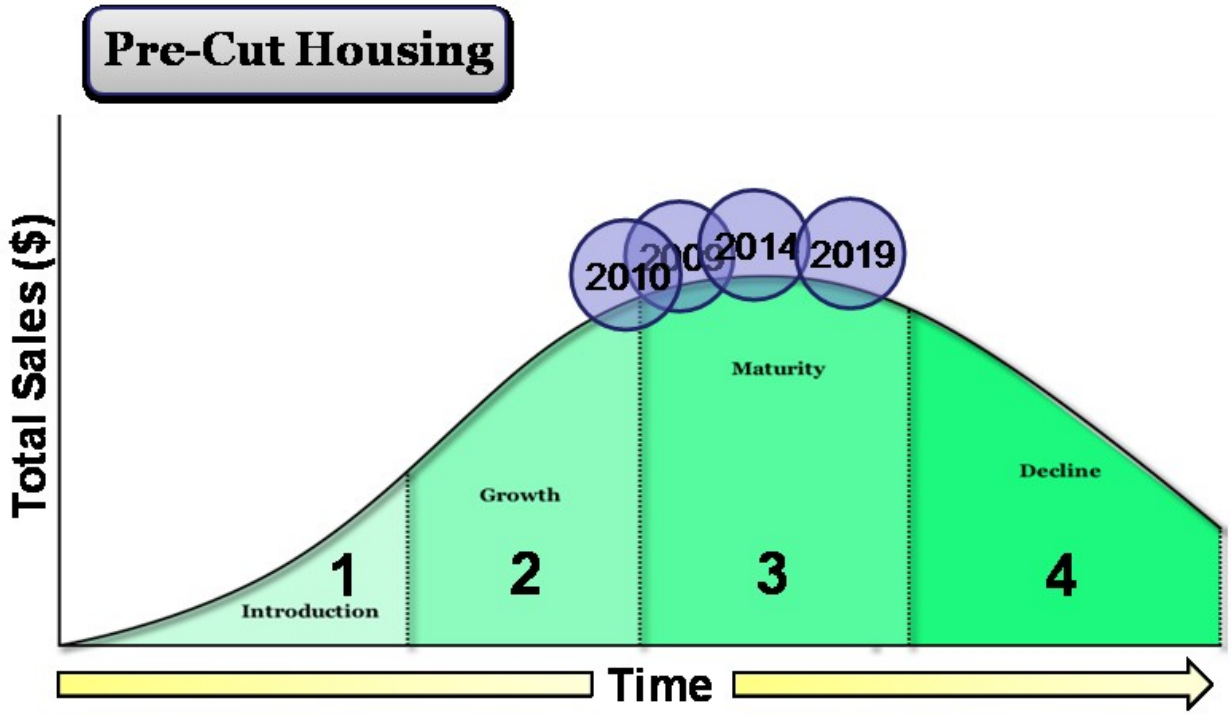
APPENDIX J: PRODUCT LIFE CYCLE FORECAST - MODULAR HOMES



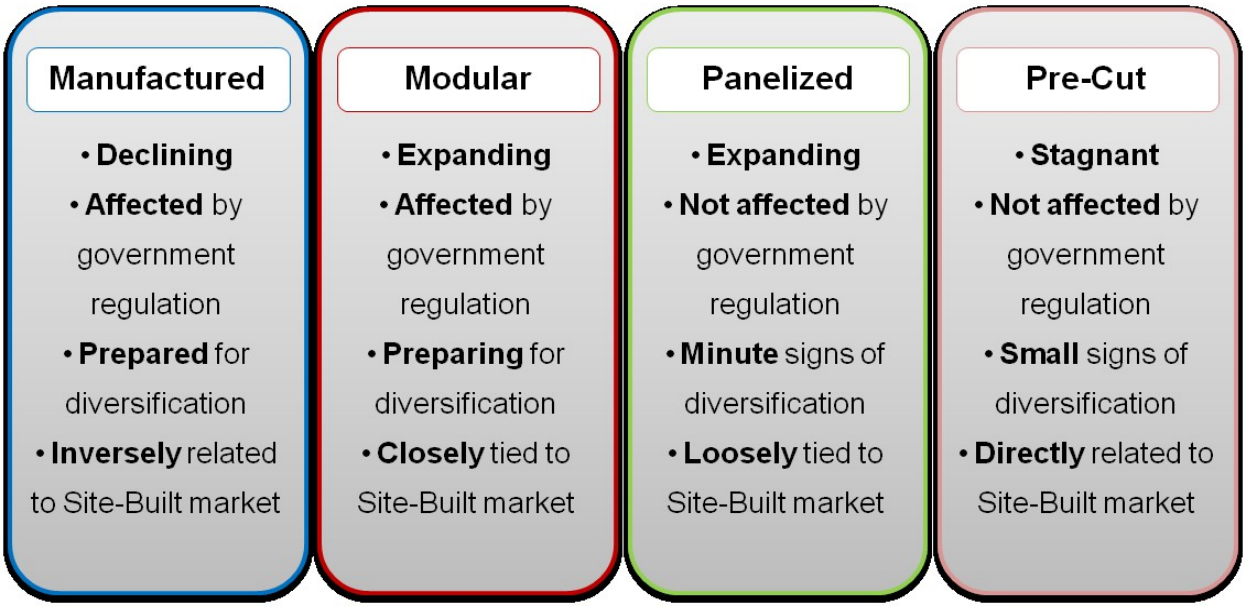
APPENDIX K: PRODUCT LIFE CYCLE FORECAST - PANELIZED HOMES



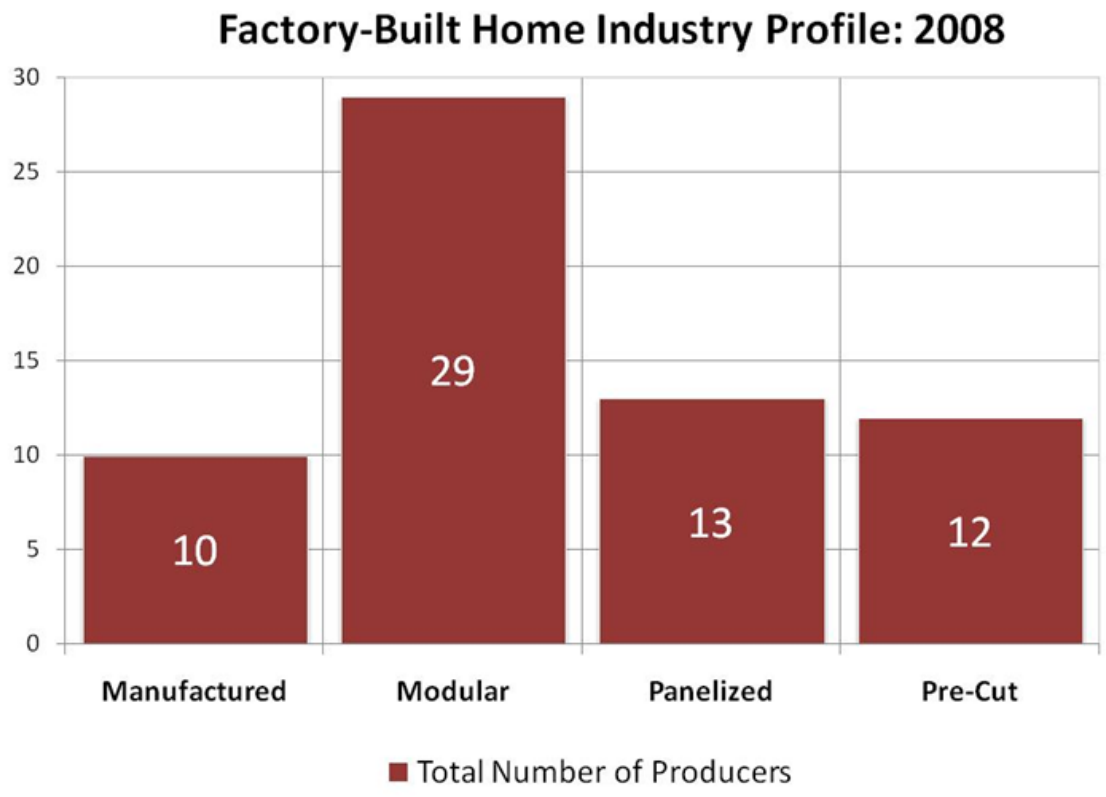
APPENDIX L: PRODUCT LIFE CYCLE FORECAST - PRE-CUT HOMES



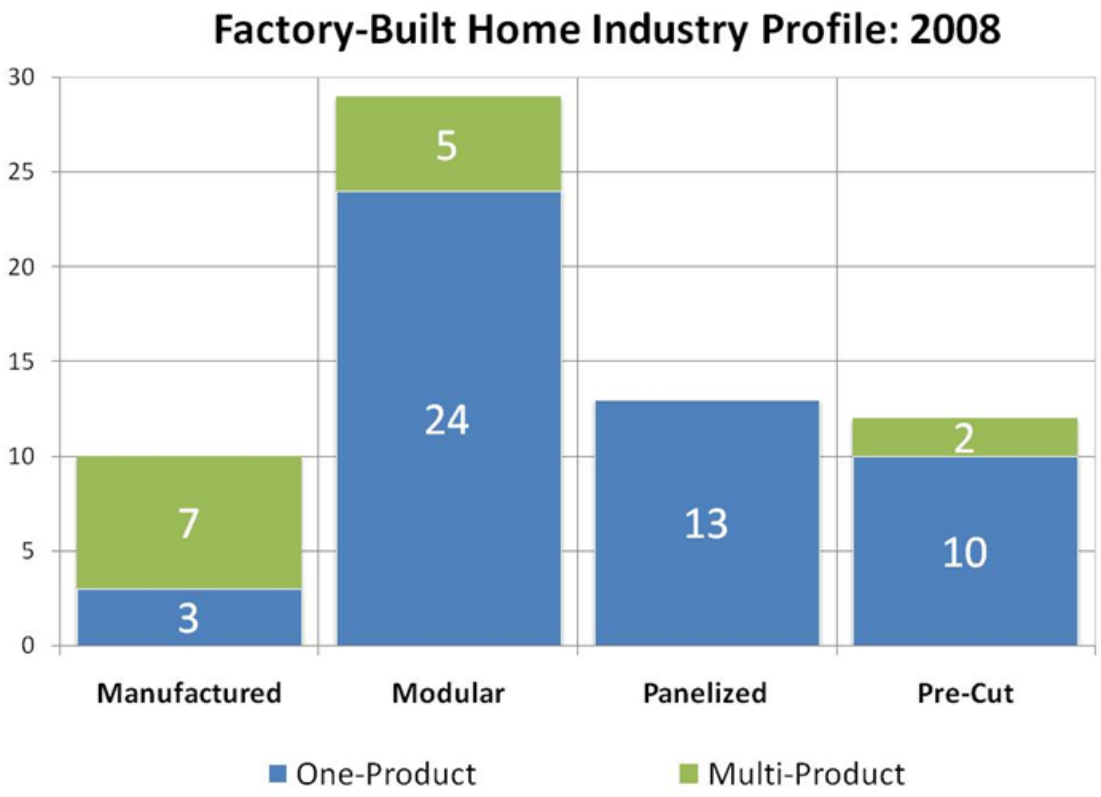
APPENDIX M: FUTURE OF DIVERSIFICATION IN FACTORY-BUILT HOUSING



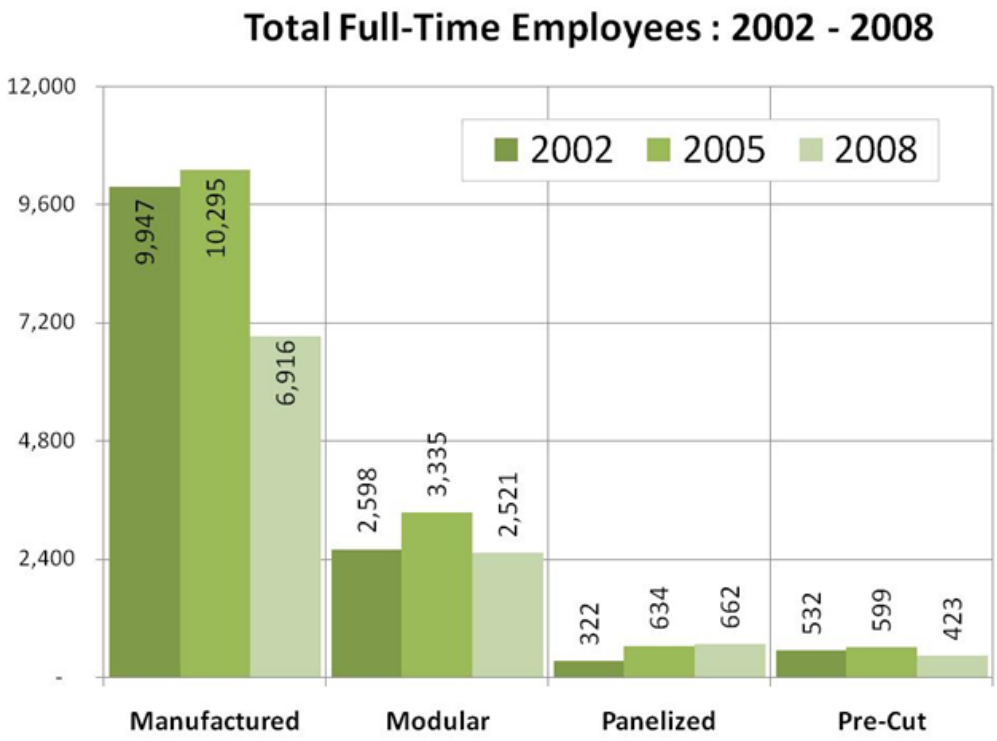
APPENDIX N: FACTORY-BUILT HOME INDUSTRY - PRODUCERS



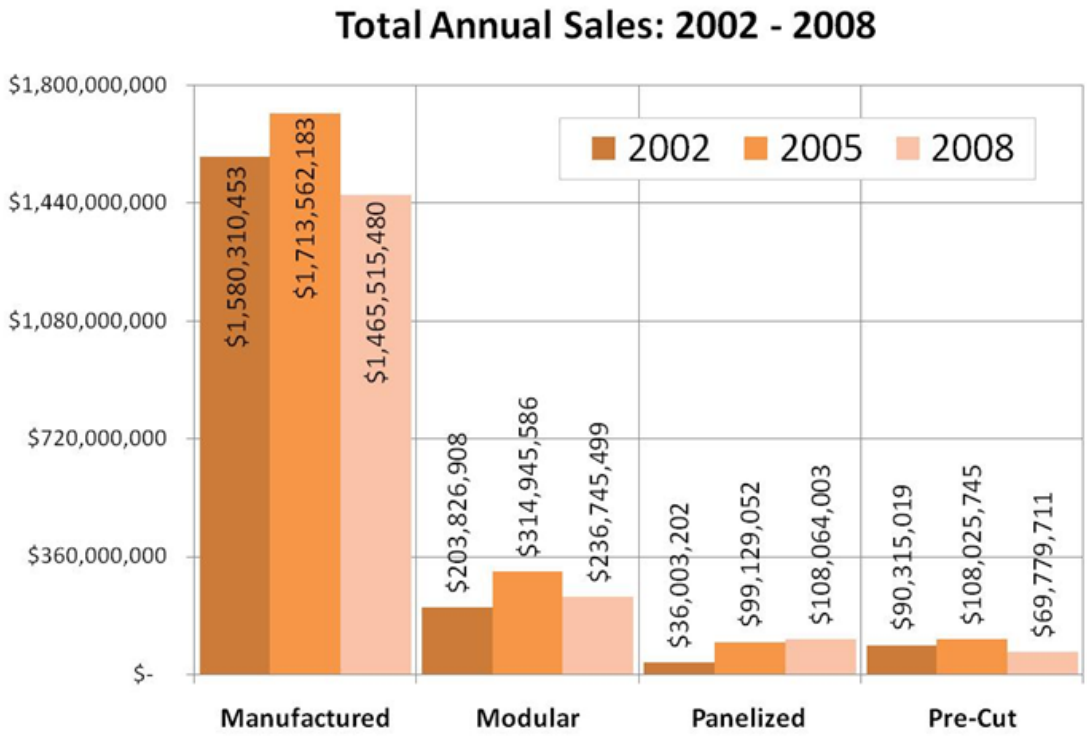
APPENDIX O: FACTORY-BUILT HOME INDUSTRY - CATEGORIES



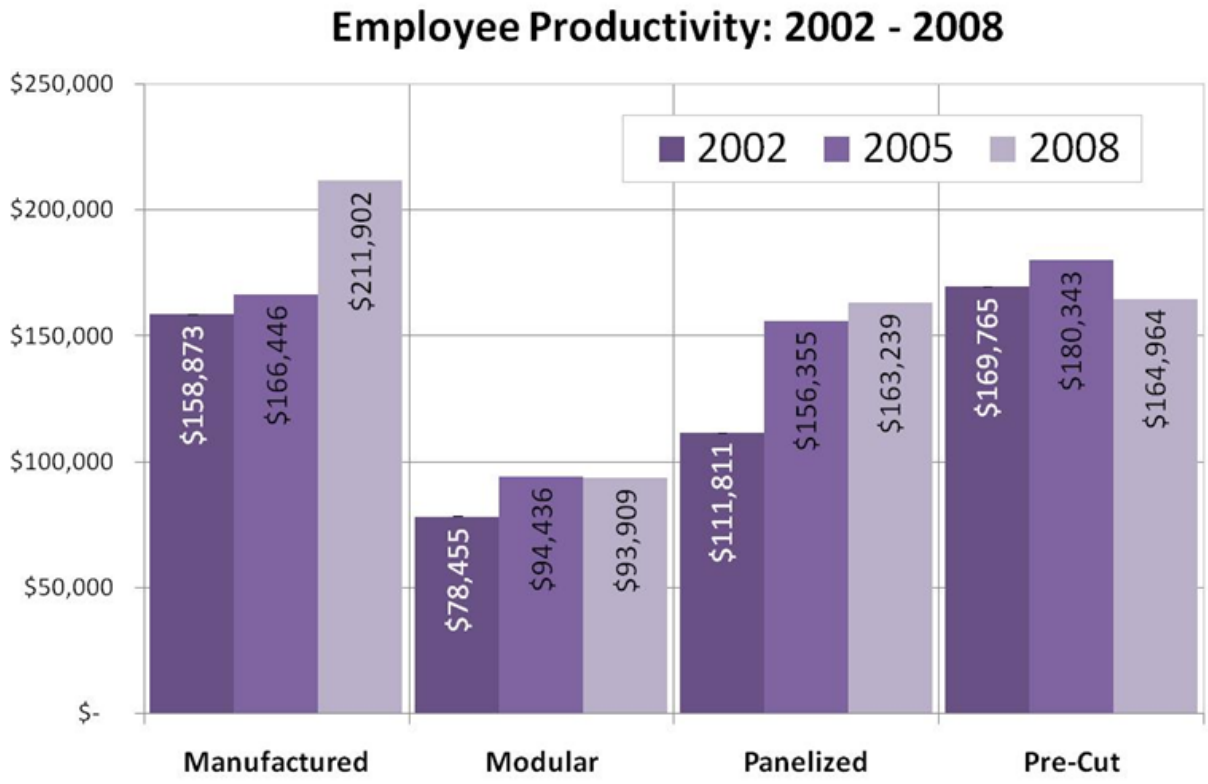
APPENDIX P: FACTORY-BUILT HOME INDUSTRY - EMPLOYEES



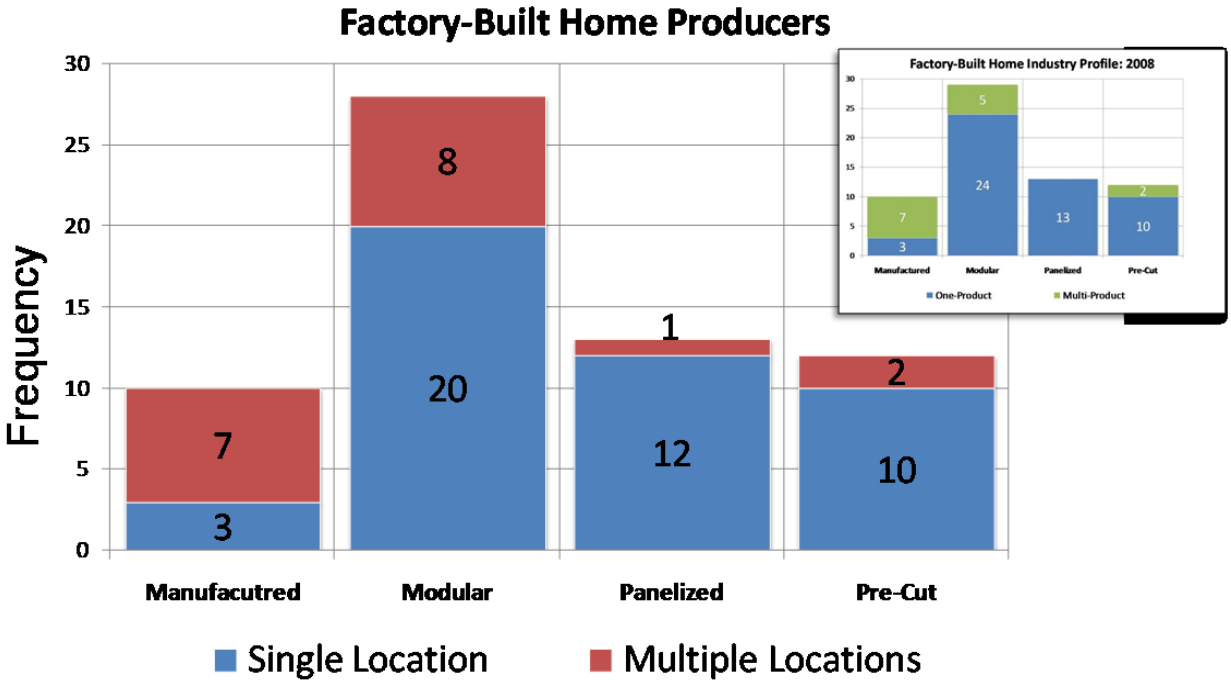
APPENDIX Q: FACTORY-BUILT HOME INDUSTRY - TOTAL ANNUAL SALES



APPENDIX R: FACTORY-BUILT HOME INDUSTRY - PRODUCTION

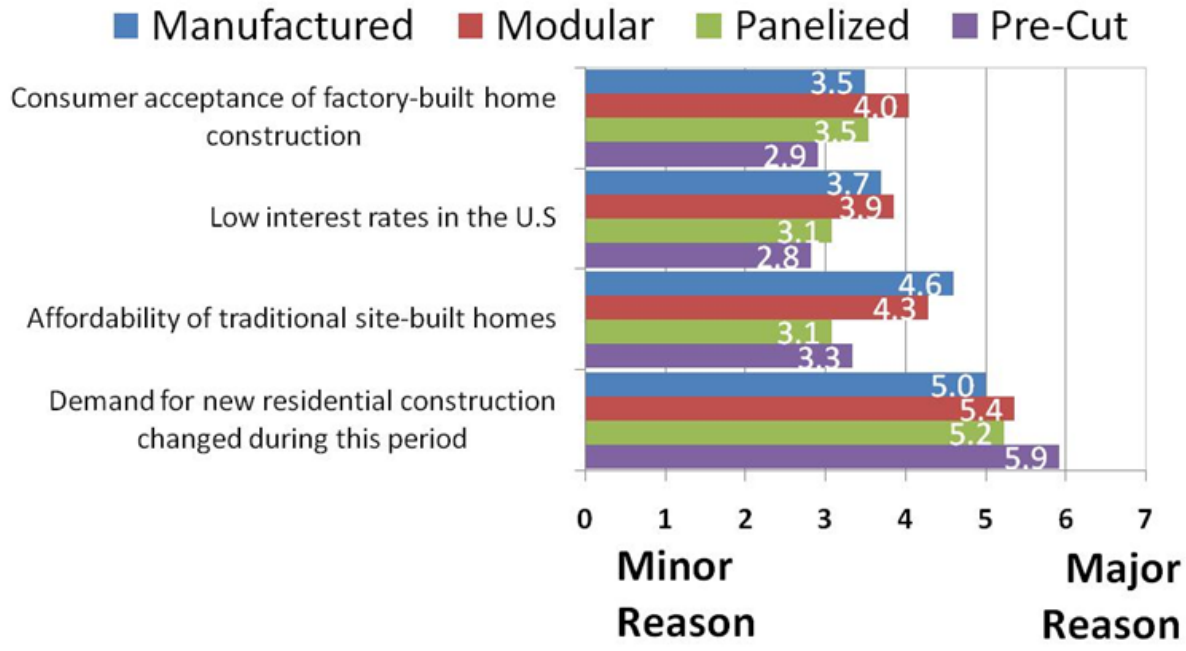


APPENDIX S: FACTORY-BUILT HOME PRODUCER - DEMOGRAPHICS



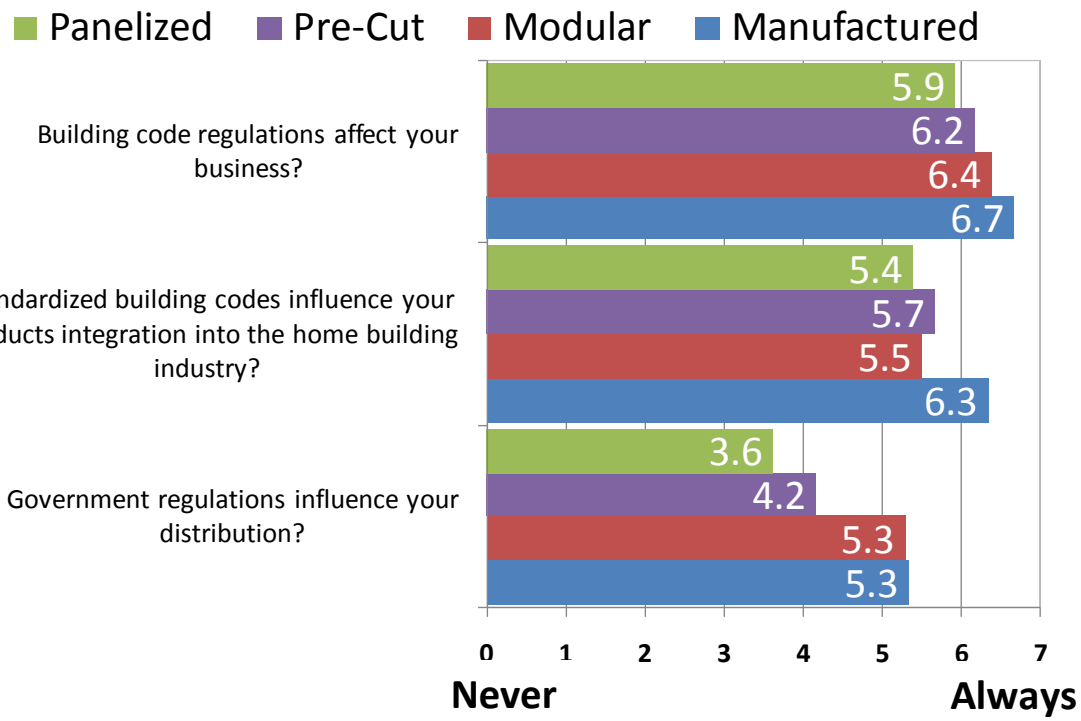
APPENDIX T: FACTORY-BUILT HOME INDUSTRY - ECONOMICS

Please indicate the level to which each of the following was responsible for changes seen in factory-built housing demand from 2002 to 2008:



APPENDIX U: FACTORY-BUILT HOME INDUSTRY - GOVERNMENT

To what extend do :



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APPENDIX V: FACTORY-BUILT HOME INDUSTRY - MARKETING

To what extent :