

Mass Production of Houses in Factories in the United States: The First and Only “Experiment” Was a Tremendous Success*

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Abstract

We study the first and only experiment of mass production of factory-built homes in the United States. The experiment was “run” in a sector of the factory-built home industry introduced shortly after WW2—Mobile Homes (now called Manufactured Homes). We argue it was the industry’s ability to develop a state-wide building code (for each state) that led to its success. Factory-built homes had always been manufactured to meet local building codes. Since these codes varied widely from town to town, a home manufactured for a given town could be sold in that town but not elsewhere. With a state-wide code, that is, an identical building code at all locations, a manufacturer could sell the home at any location in the state. This created incentives for factories to invest in specialized machinery to produce simple and standardized houses—to mass produce—leading to factory-level productivity gains. As industry-level output soared, further productivity gains were won (“industry-level” sources of gains), including those from external effects and directed technical change. Over the period of mass production (1948-1973), industry TFP grew at annual average rate of 2.74%. From 1955 to 1973, Mobile Home prices (per square foot) fell two-thirds, while the homes also significantly increased in size and other dimensions of quality. At the same time, traditional house prices (per square foot) increased. It’s not surprising, then, that Mobile Home production soared, deeply cutting into sales of craft-producers to low and middle income houses. Over the 1960s, the mobile home share of single family production increased from 10 to 33 percent. By the early 1970s, the share exceeded 50 percent in 14 states.

Keywords: factory-built homes, mobile homes, affordable housing, building code, mass production.

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1 Introduction

Mass production in factories ushered in dramatic price declines in a wide range of goods — automobiles, bicycles, clothing and more. It did so by developing simple versions (“no bells and whistles”) and standardized versions (products with “uniform” features) of craft-produced goods, and by using highly specialized machinery and a standardized process, in making them. Mass production greatly expanded consumption opportunities for low and middle income families.

Housing was an obvious candidate for mass production, as it accounted for large shares of low and middle income household budgets. Moreover, the construction methods used by craft producers during the first half of the 20th century, sometimes called “stick-built” methods, were 100s of years old.¹ While housing was an obvious candidate for mass production, it has *always* faced a somewhat unique problem when trying to achieve it. When Henry Ford produced cars in one of his factories, there were no local producers of cars in that area. When a factory-producer manufactured a home in a factory, there were always local craft-builders of homes in the area — and typically they fiercely resisted the factory-built homes.

So, while many groups attempted to mass produce housing during first half of 20th century, hoping to accomplish for housing what had been achieved for other goods, they each faced significant opposition from stick-builders. None succeeded.² It was not until the late 1940s

¹For example, A.C. Shire (1937), who was the chief engineer of the Federal Housing Administration, wrote: “in an age of large-scale financing, power, and mass production, we have the anachronism that the oldest and one of the largest of our industries, concerned with the production of one of the three essentials of life follows practices developed in the days of handwork [and] is unable to benefit by advancing productive techniques in other fields.” He continued “Unlike other widely used commodities, *shelter is not made in a factory or plant organized for its production.....*” [our emphasis]

²See, for example, Thurman Arnold (Look, 1949) for how resistance by incumbents in the stick-built sector sabotaged factory production of homes. More below.

that a successful effort was launched — in a new sector of the factory-built-home industry, which came to be known as the Mobile Home industry (now called the Manufactured Home industry).³ The experiment was brief, roughly 1948-1973, yet it achieved what had been hoped for – factory-built homes were greatly expanding home ownership for low and middle income households. By the early 1970s, the industry was producing 600k units a year. Its share of single family housing production was one-third; it exceeded 50 percent in 14 states.⁴

The purpose of the paper is to understand how the Mobile Home industry achieved mass production. We argue it was the industry’s ability to develop a state-wide building code (for each state) that led to its success. While this is the main focus of the paper, we also discuss other lessons we learn along the way. We discuss why mass production of Mobile Homes ended (the focus of a companion paper). We discuss why mass production has never been achieved in other factory-built sectors. We briefly discuss the “paradox” of extremely low productivity growth in residential construction. In the Mobile Home industry, during its period of mass production, TFP grew at an average annual rate of 2.74 percent.

By mass production, we mean a production process, one spurred by the development of highly specialized machinery, which made it possible to profitably manufacture simple and standardized products. Though the prices for such standardized goods were typically signi-

³We have chosen to capitalize some words to avoid confusion. For example, the term “mobile home” is a generic term. As an Idaho judge explained, all factory homes “are, of course, necessarily mobile until they arrive at their destination.” (See judge’s remarks below). So, we use “Mobile Home” for the type of factory-built home that is the focus of this study. The term “manufactured home” is also a generic term, one that refers to a home made in a factory. So, we use “Manufactured Home” to refer to the name given to Mobile Homes in the early 1980s.

⁴By total single family production, we mean housing starts plus Mobile Home shipments. Housing starts, in turn, are the sum of traditional construction and “other-factory-built” homes (these latter homes are introduced shortly). While the U.S. Mobile Home share reached one-third in the early 1970s, it could easily have been much higher, as huge subsidies were given to buyers of traditional homes beginning in 1968 (see below).

ificantly lower than the prices of craft produced goods they competed with, the specialized machinery meant the simple products could be produced in very large quantities, making profits possible. The great volume at which they were produced meant productivity growth was very significant and the rate of price declines very large.⁵ On these counts, the Mobile Home industry was mass producing homes over 1948-1973.

For the Mobile Home industry, a state-wide code, that is, an identical building code at all locations, meant a manufacturer could sell a home meeting this code at any location in the state. This created incentives for a “factory” to invest in specialized machinery (and layout designs) to produce standardized products.⁶ These investments led to productivity gains, as the factory could increase its scale, and simultaneously replace high skill workers with low skill. With these codes, the industry also achieved high volumes of production – that is, many factories, each at large scale, and each producing similar goods, using similar processes. This led to further productivity gains, perhaps more important ones. I call these *industry-level sources of gains*, which included *external effects (or spillovers)* and gains from the innovation of suppliers (i.e., *directed technical change*).

In this introduction, we first summarize how the industry developed this identical building code. We then briefly present the great successes of mass production, describing the industry’s soaring productivity and production, and its declining prices. Lastly, we briefly discuss the many different sources of productivity gains achieved under the codes – that is,

⁵Here is Paul Mazur (American Prosperity (1928)): “With well-developed machine equipment in existence, mass production therefore became the Great America Art. Automatically there was thus created the need for standardized production, and the genii summoned by those two magic words brought to the American people quantity production at extremely low production costs, in spite of high wages.” pp 12-13.

⁶Again, Paul Mazur, on investing in specialized machines “A machine is both costly and inflexible. Its cost of creation is borne by the factory which uses it. Unlike labor, it is made for a highly specialized purpose, and ordinarily it is useful only within the most limited sphere of activity. But it can produce quantities.”

we argue it was the identical codes that set the stage for mass production.

We begin by discussing the history of *how* the industry achieved its uniform code. We can explain the identical codes, and the sources of productivity gains they engendered, without this history, but this history illustrates how the industry has faced stiff resistance from incumbents in the stick-built industry from the industry’s inception.⁷ When Mobile Homes were introduced, there were two broad types of factory-built homes in existence, which we call “Modular Homes” and “panelized homes.”⁸ These factory-homes were placed in traditional residential areas, side-by-side with traditional homes. They, too, faced significant opposition by stick builders. These factory homes met very little success. Their share of single-family production was very small. One way Modular Homes and panelized homes were resisted was through building codes. These factory-homes (and stick-built homes) were subject to local building codes. Since these codes varied widely from town to town, a home manufactured for a given town could be sold in that town but not elsewhere. To sell to another town, with its own building code, would require a different manufacturing procedure, meaning the specialized machines would need to be adjusted. This, of course, defeats the whole purpose of factory production, reducing the incentive to invest in specialized machinery, which is tied to repetitive production.⁹

⁷It’s important to understand that factory-built homes have been resisted by incumbents in the stick-built industry for the last 100 years. While this is not the main focus of the paper, we’d be remiss not to discuss this fact in the paper. The history we discuss below shows the Mobile Home industry was able to develop a identical building code only because of inadvertant mistakes made by opponents when trying to sabotage the industry.

⁸The term “modular home” is a generic term for homes leaving the factory in fully-formed 3D modules. Mobile Homes are, of course, modular homes. We use the capitalized term “Modular Home” for modular homes that are not Mobile Homes. Modular Homes were typically significantly larger than Mobile Homes. They were also typically delivered by placing them on flatbeds of trucks. Mobile Homes were delivered differently (see below). We use the term “panelized home” as a catch-all for factory-homes that were not modular, that left the factory in many more pieces, “2D pieces.” These homes had many names, like kit-homes.

⁹In the extreme case, Paul Mazur again: “take away the standardized product, and the machine has value

The local codes were promoted by local builders, and their trade associations, who also blocked any attempts to move toward more uniform codes. A whole array of other local groups supported local building codes. Local unions, who clashed with builder associations on many issues, joined with them to support local codes. Local building inspectors supported them, fearing that with identical codes homes would be inspected in “far away” factories. Local materials suppliers, who made materials to specification of the local codes, supported them. Local banks supported them as well, fearing the loss of value of mortgages with factory-built homes selling for vastly lower prices.¹⁰

It’s hard to imagine that the prospects of Mobile Homes were better than Modular Homes or panelized homes. And they weren’t – they were worse. As one important example, zoning regulations in traditional residential areas typically required homes to be greater than some minimum size. As Mobile Homes were being manufactured for low and middle income families, they were built to much smaller sizes than other factory-built homes – the zoning regulations would “bite” for Mobile Homes. Yet opponents of Mobile Homes wanted to ban them outright. So, they argued Mobile Homes were not homes at all — that they were “Trailers,” by which they meant the primitive forms of shelter that families had towed behind their cars searching for work during the Great Depression.¹¹ These shelters had no bathrooms, no kitchens – they were a place to carry belongings and rest one’s head at night.

Trailers had been banned from towns.

only as junk.”

¹⁰Factory-home manufacturers faced a “perfect storm.” As we said in footnote 2, that it was this opposition that ultimately caused the failures to achieve mass production before 1950 was well understood and documented by academics, policy makers, antitrust authorities and more. There was an extensive literature on this that we discuss at the end of the paper.

¹¹As “trailer” is a generic term, we use the capitalized “Trailer” to refer to the primitive shelters opponents referred to.

To create this fiction that Mobile Homes were Trailers, opponents argued both were placed *on a chassis fitted with axles and wheels*.¹² For local zoning boards, many of whose members were stick builders or related, this similarity was enough to establish the fiction. Of course, the axles and wheels were never removed from the chassis of a Trailer – they were moved daily. After the delivery of a Mobile Home, the axel and wheels were always removed from the chassis. At beginning of the industry, the chassis would likely remain attached to the home. But as the industry developed, the chassis was removed, and the house often placed on a *permanent foundation* (just as traditionally built homes were).

Many towns, then, banned Mobile Homes outright. In some towns, they were banned from residential areas, but permitted in industrial areas, though typically restricted to Mobile Home parks. In these industrial areas, there were *no building codes for houses*.¹³ The leaders of MHMA recognized that if they developed a building code, and required all members of MHMA to abide by this code, the industry would have an identical code at each location in the state. They accomplished this and more. MHMA began developing codes in the early 1950s – by 1960, it had developed a code it required members to follow. By 1963, the code was certified by ANSI. In 1965, the National Fire Protection Association (NFPA) joined as a cosponsor of the code. MHMA also lobbied each state to make the code mandatory for all manufacturers – not just MHMA members. By 1973, 44 states had done so. These were great accomplishments.

¹²Mobile Homes were delivered on a chassis because the alternative delivery method, on the flatbed of a truck, was significantly more expensive, requiring additional capital (cranes) and skilled labor. Mobile Homes were designed for low and middle income households. They were the most economical way (for a given quality of materials) to produce a house. Mobile Homes squeezed the greatest amount of skilled labor out of the process of manufacturing, delivering and assembling a home.

¹³There were areas of the country, rural areas and small towns, with no administrative bodies setting zoning ordinances. Mobile Homes were also being placed in these locations. They typically had no local building codes as well. More on these areas below.

We next briefly describe the great success of the industry, its falling prices, soaring productivity and surging output. At the outset of the industry, Mobile Home prices were significantly higher than traditional home prices. This seemingly incongruous state of affairs highlights a great advantage of all factory-built homes – they can economically be made of small sizes. But over the next 20 years or so, Mobile Home prices fell by two-thirds. By 1973, their prices were one-half traditional home prices.

In 1955, the prices of Mobile Homes and stick built homes were \$18 vs \$11 (per square foot, in 1960\$), respectively.¹⁴ As gains from mass production accumulated over 1955 to 1973, Mobile Home prices (psf) fell from \$18 to \$6. Over the same period, prices (psf) for traditional stick homes (again in 1960 dollars) increased from roughly \$11 to \$12. These rapidly falling prices were driven by significantly increasing productivity over the period. From 1958-1972, TFP increased at an annual rate of 2.74% (NBER data). In addition, over 1955-1973, the quality of Mobile Homes was significantly increasing relative to the quality of traditional homes. First, as we mentioned, when Mobile Homes were delivered to their housing site, it became common practice to remove their chassis and place them on a *permanent foundation, often with a basement*. The homes looked like traditional homes. Second, the average size of Mobile Homes was increasing much faster than those of traditionally built homes. And third, the development of the state-wide Mobile Home codes meant that the standards of these homes were increasing much faster than traditional houses.

Given significantly falling prices (psf) and rapidly increasing quality, Mobile Home produc-

¹⁴In 1955, most Mobile Homes were 320 square feet, with a total cost of \$5,760. Stick-built homes were on average roughly 1,100 square feet, with a total cost of \$12,100. At \$5,760, a Mobile Home was an option for low and middle income households. Why not build smaller stick-built houses? As a factual matter, the price (per square foot) of traditionally built homes decreases with the size of the house, while Mobile Home prices increase with the size of the house.

tion soared. From 1960 to early 1970s, production increased from 100k to 600k units, and was taking a larger and larger share of the single family market from traditional builders.

Lastly, we argue it was the identical building codes that enabled the industry to achieve many sources of productivity gains, leading to price declines, and mass production. We've discussed how identical codes increased the incentives for a factory to invest in specialized machinery, and how they also led to industry-sources of productivity gains. Consider the latter. With many factories producing houses built to the same code, and using a similar process, manufacturers benefited from "*external effects*." That is, organizations developed that "built industry infrastructure" and "produced industry information" that were both very useful to existing firms (and firms considering entry) and were free of charge. The trade association, the Mobile Home Manufacturers Association (MHMA), was obviously one such organization, as it developed the identical building code, as well as surveys of financial institutions that gave significant information to lenders of Mobile Home buyers.¹⁵ Also, as the number of factories using a similar production process increased, the gains to suppliers of the industry in developing innovations grew as well. That is, the industry benefited from "*directed technical change*."

We next discuss why we date the end of mass production (or the beginning of the end) in 1974. But before that we briefly discuss a HUD-sponsored program — Operation Breakthrough — to develop housing for low income households. This program, begun in 1969, was to develop technology – in particular, factory-built housing — to solve the housing problems of the low income. The program also emphasized the development of state-wide building codes

¹⁵Other organizations included agricultural extension services, state and local, that wrote about mobile homes.

for factory-built homes as an important ingredient to success. The Mobile Home industry, of course, had already achieved what Breakthrough had as its goals. But by factory-built homes, HUD only meant Modular Homes and panelized homes. HUD essentially acted as if Mobile Homes did not exist.

It's hard to believe HUD did not know Mobile Homes existed. HUD, of course, did know about them (as we show shortly), but did not want to promote the industry, as it threatened stick-builders in a way Modulares did not. When we say "HUD," we mean more. The political appointees at HUD, in the key positions of leadership at HUD, were composed of individuals from the stick-built industry, often leaders from the National Association of Home Builders (NAHB). Groups like NAHB played large roles in setting policy at HUD.

During Breakthrough, as HUD poured many millions into developing a Modular Home industry, it was devising means to sabotage the Mobile Home industry. It succeeded. HUD-sponsored 1974-legislation, the National Mobile Homes Construction and Safety Standards Act of 1974, 42 U.S.C. (and follow-on regulations in 1976), marked the beginning of the end for mass production of Mobile Homes — that is why we date mass production from 1948-1973.

HUD-developed a national building code (HUD-code) for Mobile Homes that preempted the state-wide Mobile Home codes developed by the industry and model code groups. The HUD-code was a complete break from precedent in developing codes. It developed many of its standards "in-house," ignoring complaints from model-code groups, like NFPA, that its standards were too onerous. The new code contained many objectionable features that significantly damaged the industry. One such feature was the *permanent chassis requirement*.

Under the law, a buyer of a Mobile Home was not permitted to remove the chassis from the home after delivery. This increased the cost of manufacturing, but its greatest harm was reducing the desirability or quality of the home.¹⁶ We discuss the role of the HUD-code in the industry’s decline in a companion paper, though we briefly discuss it at various points below.

Breakthrough was an utter failure (Abrahamson (2015)). Nothing came of it except the lessons for why it failed – but these were never learned. Here are two. First, those running the program emphasized bringing the best and latest technology to the program. That certainly was not a necessary ingredient, as the experience of the Mobile Home industry was showing. And that the latest technology was not crucial to the success of factory-built housing had been argued even before the Mobile Home industry emerged: “Technological considerations are, in the last analysis, subsidiary to these more important questions.”¹⁷

A second lesson is that the state-wide codes that HUD promoted were a failure. They never achieved what the Mobile Home codes had, that a home built for one town could be sold in any town. This subject, “Why the failure of the Modular state-wide codes?” is a vast

¹⁶Having a Mobile Home where the chassis cannot be removed is much less desirable than one where you can. Most families prior to 1974 were putting the homes on a permanent foundation, often with a basement. After 1974, doing this would incur additional, significant costs, as the home had a chassis attached to it. Foundations and basements would have to be dug deeper to accommodate the chassis. Even then the chassis would be lying exposed in the basement. To “hide” the chassis, “false” ceilings would be installed. For a brief discussion of these issues, see Washington Post Opinion “Want affordable housing? Take the chassis off manufactured houses. And don’t call them mobile homes.” By Lee E. Ohanian and James A. Schmitz, May 21, 2024. Schmitz thanks Nancy Szogan for great editorial assistance on this piece.

¹⁷“Thus any attempt to evaluate the present status of prefabrication must begin with recognition of the fact that the most important factors in such an evaluation are still not established [...]. Widespread application of prefabrication for ... housing will depend primarily upon the development of superior sales methods and a more saleable product, [...]. Technological considerations are, in the last analysis, subsidiary to these more important questions. Even a house which represented no important structural advances (such as the conventional “readycut”), if available on a standardized basis for quick delivery at a fixed price, would be a bigger step towards house manufacture than a more advanced system of construction minus a practicable merchandising plan.” (Bruce and Sandbank, 1944)

one, and we are still early in its research. But their failure has been briefly discussed in the literature already. Consider California. Palumbo (1971) forecasted that the state-wide factory built-home law (for Modulares) would fail as written. Columbia Journal of Law (1972) presented an analysis of the laws early experiences, showing in detail why it was not working. Almost 50 years later, WSP (2108) discussed significant problems faced by the law, and how the state-wide code was not succeeding. Some of the reasons are De Jure reasons (how the law is written. But some are also De Facto reasons (there will always be local opposition to factory-built homes, the question of great importance is “to what extent”).

Section 2 presents evidence on zoning restrictions placed on Mobile Homes given the fiction they were Trailers. Section 3 discusses how the Mobile Home industry developed state-wide building codes. Sections 4 (prices and productivity) and 5 (production) discuss the great success of mass production of Mobile Homes. Section 6 argues the identical building codes led many different sources of productivity gains which set the stage for mass production. Section 7 shows the mass production experiment could have been much more successful if not for the great obstacles placed in the way of the industry. Section 8 discusses how the HUD-code was the beginning of the end for mass production.

Affordable housing and homelessness are a major problem today, in the United States and around the world. In the United States, at least, this problem has been discussed for 100 years. When considering possibilities of producing any type of good, economists consider the inputs and technologies that are available to produce the goods. The long term prospects for the prices and quantities of goods are almost uniformly thought to depend on technology. Paradoxically, the recent literature on housing does not follow this model. Technology is

assumed to be fixed.

This was not the case 100 years ago. That is, for the first half of the 20th century, when economists talked about housing crisis, they laid the problem at the failure of the construction industry to adopt new technologies, in particular, factory-built housing. Not only economists understood this problem. Levitt and Sons, innovators in stick built housing, said this in Congressional testimony in 1969: “The labor time in a factory-built dwelling unit is only a fraction of what is required to construct a similar unit on-site. That’s why we must look at factory-built housing. That’s why factory-built housing must succeed, or we will never be able to produce the homes and apartments needed to house our expanding population and our underprivileged citizens in a comfortable, dignified, decent way.”

2 The Fiction: Mobile Homes Are Trailers

When Mobile Homes were introduced, opponents created fictions that they were not homes but Trailers, that they were vehicles or could be easily moved. Because of these fictions, opponents succeeded in imposing severe zoning restrictions on them. Here we present statistics on the zoning regulations, but not before briefly dispelling the fictions created by opponents.

A. Mobile Homes were not Trailers, were not vehicles, were seldom moved. Mobile Homes were, of course, not Trailers. They were titled as personal property and these titles were often issued by Departments of Motor Vehicles — but they weren’t vehicles.

Mobile Homes were also seldom moved. At the early stages of the industry, when Mobile Homes were 8-foot wide (and typically 320 square feet), they were relatively easy to move,

and were likely moved with some frequency. But that soon changed. First, much larger homes were soon introduced that were more costly to move. In 1955, the 10-foot wide home was introduced. By 1960, it had completely displaced the 8-foot wide. In 1962, the 12-foot wide home was introduced, and it quickly replaced the 10-foot wide. A report on housing in California (1963) remarked on this “immobility” feature (and others) of Mobile Homes.¹⁸ Because the homes were very difficult to move, ACIR (1966, pg x) reports that in 1964 “Manufacturers [of Mobile Homes] actually sell a prefabricated, delivered-to-the-site house that has an added advantage in that it can be easily relocated.”

It was not only their growing size that meant Mobile Homes were seldom moved. The homes were also being *taken off their chassis and placed on permanent foundations*. A report on housing in Arizona (1963) remarked on this feature (and others) of Mobile Homes.¹⁹ On this same point, Levitt and Sons (1969), in testimony before Congress, stated that “Mobile homes, 90 percent of them, end up on a foundation and are not mobile at all.”

Some homes were being put on *foundations with basements*. Bair (1967, 287) describes how “The doublewide unit (a type of Mobile Home) is a stranger to wheels except during its journey from factory to site. Two 12-foot wide sections are ‘slid’ onto an already prepared foundation, with or without basement, and permanently joined. The result is a house 24 feet wide, up to 56 or more feet in length, and in most respects indistinguishable from the

¹⁸“In considering this type of housing [Mobile Homes], it should be noted that in recent years the mobile home industry has made great progress and today’s mobile homes and the parks are quite different from the past. The mobile homes are *seldom moved* and are not used for travelling. With expansion, they may contain up to 750 square feet in floor space, and the careful arrangement of the built-in facilities means that they are quite efficient.” (p. 634)

¹⁹The report mentioned that Mobile Home subdivisions were being developed: “Mobile-Home Subdivisions are developments similar to conventional housing subdivisions where the land is subdivided into individual lots for individual ownership. Streets and alleys are dedicated to the general public and domestic water and sewage connections are normally made to public systems. Mobile-home subdivisions are a permanent type of development where units are *seldom moved* and usually located on *permanent foundations*.” (p40)

conventionally built or prefab one-story dwelling.”

Despite Mobile Homes reaching significant sizes, despite them being taking off their chassis and put on permanent foundations (often with basements), they still faced significant zoning restrictions for being Trailers and vehicles.

B. *Some evidence on zoning against Mobile Homes (De Jure)*. Zoning regulations are predominantly set by local governments. They divide townships into several zoning districts (e.g., residential–single family, industrial, retail and more), setting regulations for each district. Before 1950, residential zoning regulations permitted stick-built homes, Modular Homes and panelized homes. They banned Trailers. When Mobile Homes were introduced, localities used existing ordinances for Trailers to restrict them. They also introduced new ordinances that, through direct definition of a Mobile Home, or by reference to Trailers, restricted them.

The banning of Mobile Homes from residential areas was seemingly universal. Some townships completely banned them. Some towns permitted them outside residential areas – in industrial and manufacturing areas. It was for Mobile Homes sold in these townships, in industrial areas, that the industry sought to develop an identical code.

There were two major efforts to summarize zoning regulations for mobile homes in the United States, Greenwald (1970) and Bernhardt (1980). Greenwald directed a census of zoning regulations and housing production (both stick-built and mobile homes) by township in New England states while at the Federal Reserve Bank of Boston. The census was conducted through mailing and phoning local officials.²⁰ Some of the information from this census is

²⁰As Greenwald wrote: “To determine the role of mobile homes in New England, [we] contacted all 1,384

presented in Figure 1.

The red areas in the figure are townships that completely banned Mobile Homes. There are large differences, across New England states and also across rural areas and non-rural areas, in the extent to which townships completely banned Mobile Homes. A much larger fraction of towns in Southern New England states, Connecticut, Massachusetts and Rhode Island, completely banned them than did towns in Northern New England states, Maine, New Hampshire and Vermont. In Connecticut, the red areas nearly cover the state. A large share of townships in Massachusetts and Rhode Island banned them.²¹

Non-rural towns banned Mobile Homes more than rural areas. Towns in the (mostly non-rural) eastern half of Massachusetts banned them far more than towns in the (mostly rural) western half, as did towns in the capital area of Vermont (vs rest of state) and the Portland area of Maine (vs rest of state).²²

The other colors in Greenwald's map provide information, again for townships, on how the number of new Mobile Homes put in place in 1969 compared to housing starts in 1969. The dark blue townships are those where Mobile Homes exceeded housing starts. Hence, the share of Mobile Homes in total single family production is greater than 50%.²³ The (solid)

towns in the 6 New England states. Through mail and telephone contacts with town officials, this Bank tried to determine the number of mobile homes in each town, how many new ones had come into the town during the period 1967 through 1969 and how this compared with the number of conventional housing units started in those years. In addition, the survey asked questions about zoning restrictions ..."

²¹Note that the black triangles in the figure represent Mobile Home parks. In many red areas, there are parks. This means that towns that had once allowed Mobile Homes in industrial areas in parks later completely banned them. We thank Andrew Goodman-Bacon for pointing this out.

²²This non-rural and rural divide tells us that, in New England states, the percentage of population in towns that completely ban Mobile Homes exceeds the percentage of towns that completely ban them. There is other evidence indicating this geographical difference holds throughout the United States.

²³Again, total single-family production equals housing starts plus Mobile Home shipments. (Housing starts are the sum of stick-built construction plus the manufacture of Modular Homes and panelized homes). Let x denote housing starts and y Mobile Homes placed, so that $x + y$ is total single family production. Mobile

light blue townships are those where new Mobile Homes put in place were 80 to 100 percent of housing starts – so the Mobile Home share lies between 44 and 50 percent. On the other extreme are townships where few Mobile Homes were placed. The very light blue (with dots) townships had none. The gold townships are those where new Mobile Homes put in place were 1 to 20 percent of housing starts.²⁴

The second major effort was by Bernhardt (1980). He contacted state officials about the zoning regulations toward Mobile Homes in their states.²⁵ Table 1 presents findings from this survey. Column 1 are the state-officials' estimates of the fraction of towns that completely banned mobile homes. The estimates for New England states are roughly what we expect from Greenwald. Southern New England states have a much higher percentage of localities that completely ban Mobile Homes than do Northern New England states. In the Middle Atlantic states, each state has a very high percentage of localities that completely banned mobile homes. Presumably if we had maps for New York and Pennsylvania like those prepared by Greenwald, downstate New York would be much more red than upstate, and in Pennsylvania, the east would be much more red than the west. There are only a few states outside of New England and the Middle Atlantic states that have a very high fraction of towns that completely ban Mobile Homes (though California has a fairly high percentage).

The statistics in Column 1 show that in most states only a small percentage of towns com-
home share is $y/(x + y)$, and since $y > x$, mobile home share is greater than $y/(y + y) = 0.5$.

²⁴It's reasonable to conjecture that these other colors, the non-red colors, provide some information about the overall stance of zoning in towns. It's likely that the towns near large cities, like Portland, Maine, have restrictive zoning ordinances for Mobile Homes. And we see the fraction of townships close to Portland, Maine that are colored "gold" is higher than the fraction in the state overall. In Eastern Massachusetts, of the towns that are not colored red, all are either colored gold or white (no mobile homes placed), with one exception. The entire state of Connecticut has a similar pattern.

²⁵"An appropriate official in each state government and state or regional trade association was contacted through correspondence and personal interview and asked to provide any information available concerning the status of land-use controls relevant to mobile homes in each state."

pletely banned Mobile Homes. The percentage that allowed them in industrial areas was large (the percentage being equal to 100 minus the number in Column 1). Among towns allowing them in industrial areas, Column 2 gives the percentage that restricts them to be in parks.²⁶ The table shows that many states have very high percentages of these towns that restrict Mobile Homes to be in parks.

C. Zoning against mobile homes (De Facto). Mobile Homes also faced “De Facto” zoning restrictions, as courts took positions against them that extended beyond the written ordinances. While ordinances would restrict Mobile Homes, there was not a definitive definition of them. Manufacturers could try to place them in single lots in industrial areas, or even a residential area, arguing that the home met zoning regulations. But these attempts, no matter their merit, typically lost in the courts.

According to Bartke and Gage (1970, 501-502), “The most extreme position excluding mobile homes from single-family districts seems to have been taken by the Massachusetts courts. Their attitude can best be summarized as either ‘once a trailer, always a trailer’ or ‘a trailer is a trailer is a trailer.’ The fact that the mobile homes were purchased without wheels to be brought in on flatbeds, or that the wheels were to be removed and the structures were to be permanently attached to foundations, landscaped, and in every other respect made to comply with the applicable zoning ordinances did not make an impression on the Massachusetts judges.”

Here is an excerpt from the ruling of a judge in Massachusetts upholding the blocking of mobile homes in a town: “In ordinary parlance the unit shown in the exhibits will be spoken

²⁶The other towns that allow them to be in industrial areas have more “lenient” zoning, in that they can be placed on single lots as well as in parks.

of as a trailer or a mobile home, even if it has not been sold with wheels or its wheels have been taken away, and even if it has been axed to the land. It looks like a trailer, has the qualities of a trailer superstructure, and has been built as a trailer.” (Town of Manchester v. Phillips 1962; cited in Bartke and Gage 1970, 501).

“De Facto zoning” occurred across the country, not only in New England, where we would expect it. Here we give two cases of “De Facto zoning” blocking mobile homes, one in Tennessee, the other Idaho. Each state receives “good marks” if we look at Bernhardt’s statistics. In Tennessee, only one percent of towns completely ban mobile homes, while of those towns that allow them in non-residential areas, only 35 percent restrict them to parks. Idaho is one of the top states in “welcoming” mobile homes, with only one percent of towns completely banning mobile homes, while of those towns that allow them in non-residential areas, only 10 percent restrict them to parks.

Here is a judge in Tennessee, dissenting from a ruling blocking Mobile Homes: “The structure in the present case is resting on a foundation and in order for it to be moved must be cut in half and have axles and wheels installed. I find it difficult, if not impossible, to hold that such a structure under the restriction in question is a mobile home.” (Albert v. Orwige, Tennessee Court of Appeals; cited in Milligan 1987, 558)

In Idaho, a dissenting judge wrote: “It is undoubtedly an easy matter for the nation’s elite to decide for the less affluent that they simply should not live in mobile homes. . . . The elite see no appreciable difference between the trailer house of yesteryear and the prefabricated homes of today which are, of course, necessarily mobile until they arrive at their destination. Although times have changed, and “mobile homes” can no longer be equated with trailer

houses, the elite do not change” (Berry 1985, 157).

D. *Why not break the connection with the chassis?* The chassis on which Mobile Homes were delivered to their housing site was used against the industry to claim they were Trailers. Why not deliver the house on the flatbed of a truck? There are greater costs of delivery on a flatbed. The potential benefit is placing the home in a residential area. Perhaps some zoning clauses which mention Trailer, or make reference to a chassis, can be bypassed. But De Facto zoning might well block the placement. If not, the Mobile Home would face the same zoning restrictions as Modular Homes. It would not likely meet the zoning restrictions on minimum floor sizes. The Mobile Home would also need to meet the local building code.

3 Given fictions, industry develops uniform codes

Here we describe how the Mobile Home industry developed state-wide building codes.

A. *Designated as Vehicles, Mobile Homes Faced No Local Building Code.* A building code is a list of standards that a building should satisfy (or exceed).²⁷ There are standards for many aspects of a house, such as fire safety, energy efficiency, plumbing, electrical and so on. These standards are typically developed by non-profit national (or regional) testing organizations, like the National Fire Protection Association.

The authority to set building codes belongs to U.S. States. At the start of the 1950s, some U.S. states had building codes, though far from all. They typically contained standards that applied to all buildings, such as residential, industrial, retail and so on. They typically

²⁷The codes can be performance codes or specification codes.

referred to only a few aspects of buildings. Rather than developing more encompassing codes (of many standards), U.S. states gave wide latitude and authority to localities to develop their own building codes. The ACIR (1966, p. 1) report starts: “Traditionally, building code preparation, administration, and enforcement has been delegated to local government by the State as an exercise of State police powers.”²⁸

A locality developed building codes for each of its zoning districts, for residential areas and non-residential areas (such as industrial, retail,). The residential building code applied equally to stick-built, Modular Homes and panelized housing. The residential code typically contained standards for many aspects of the house. The non-residential building code had standards for various buildings, including industrial, commercial and retail buildings.

When Mobile Homes were introduced, some towns, again, completely banned them — so there was no issue of what building code applied to them. In towns that banned them from residential areas, but allowed them in industrial areas, the only building codes were for industrialized buildings. These towns did not then develop a residential building code for Mobile Homes. They had banned them from residential areas for not being homes, leaving them in no position to now claim they were homes. Mobile homes, then, faced no local building code. Industry leaders soon set about developing a building code that would have the same standards throughout the state. We call these “State-Mobile-Home-codes.”

B. *State mobile home codes and Model-code groups.* Industry leaders, working through the industry trade association, The Mobile Home Manufacturers Association (MHMA), developed the building codes in three stages: (1) The MHMA started developing a code in-house, with

²⁸See also Paul Douglas’s report and discussion below.

experts from within the industry. It started with a few standards and added to them over time; (2) The MHMA then began to work with experts from outside the industry, so that their codes could receive certification from national testing groups; and (3) The MHMA then convinced states to pass legislation making these codes mandatory under the law.

The first stage began in the early 1950s, when the MHMA, in conjunction with the Travel Coaches Association (TCA), began developing standards for a building code. These standards were developed by engineers from within the industry. The standards became titled the “MHMA-TCA Standard.” (Annual report, 1963, p. 4.) In March 1960, these standards for Mobile Homes became mandatory for MHMA members (Annual report, 1963, p. 10.).

The second stage involved engaging with traditional code setting groups. MHMA wanted to publish their updated 1963-code under the auspices of the American Standards Association (later renamed American National Standards Institute (ANSI)) — asking ANSI to certify their code. Officially, MHMA and TCA would be “sponsors” of the “MHMA-TCA Standard.” ANSI then had a process for certifying the code. Committees would be formed to review and potentially certify the code. The process called for “balanced committee representation among interested parties — builders, manufacturers, building officials, researchers and others — so that one group does not dominate the process.”²⁹ MHMA and TCA were successful: “In March 1963 due to actions by the American Standards Association, the Mobile Home Manufacturers Association and the Trailer Coach Association Standards for the Installation of Plumbing, Heating and Electrical Systems in Mobile Homes became American Standard A119.1–1963.” (Annual Report, 1963, p. 10)

²⁹See “Understanding Building Codes,” National Institute of Standards and Technology. <https://www.nist.gov/buildings-construction/understanding-building-codes>

During this second stage, more standards were added to the code. For example, Construction Standards were added to the previous three standards above (plumbing, heating, electrical). Construction standards consist of requirements on the body, frame, chassis and running gear of the mobile home. MHMA commissioned the Battelle Memorial Institute to develop standards for these features of the homes. (Annual Report, 1965, p. 30).

Another major development during this stage was that in 1965, the National Fire Protection Association (NFPA) joined MHMA and TCA as a cosponsor of American Standard A119 (Annual Report, 1965, p. 30). So, as early as 1965, the building code for Mobile Homes had standards for fire safety approved by NAFB.

C. Industry convinces states to make state-wide mobile home codes mandatory.

The third stage, a crucial one, was to convince states to make these codes mandatory under state law for Mobile Home producers. Table 2 shows that as of December 31, 1973, 44 states had enacted legislation for mandatory Mobile Home codes. With a state-wide code, that is, an identical building code at all locations, a manufacturer could sell a home at any location in the state. Note that if the state itself had a code for buildings, the Mobile Home producer would still face an identical code at each location.

4 Mass Production Achieved: Declining Prices

We begin by showing that the prices of Mobile Homes significantly declined (and their quality significantly increased) relative to traditional homes during the period of mass production.

A. *Prices of Mobile Homes and traditional homes: Early 1950s – 1973.* Figure 2A plots the prices (psf) of Mobile Homes and traditional stick-built homes. The price series for traditional homes is from the Federal Housing Administration(FHA). The series ends in 1979. The Mobile Home prices are from a few sources (described in a separate appendix). Prices are deflated (using the CPI, 1960\$). From 1955 to 1973, mobile home prices fall from roughly \$18 to \$6, a drop of two-thirds.³⁰ The prices of traditional homes change little over the period. Prices for Mobile Homes, then, significantly fall relative to prices for traditional homes, the craft-produced good — one of the conditions in our definition of mass production. Figure 2B plots these prices with the normalization that 1973 prices equal 1.00.

Figure 3A makes the same plots, but uses prices for traditional homes from 1950 to 1969 from the FHA, then uses prices from Construction Reports (CR) from 1969 to 1990. The prices from the two sources are nearly identical in 1969. From 1970-1973, the CR prices increase a bit faster than the FHA prices. The conclusion that Mobile Home prices are significantly falling relative to traditional prices doesn't change. Figure 3B plots these prices with the normalization that 1973 prices equal 1.00.

B. *Quality of Mobile Homes and Traditional Homes: Early 1950s – 1973.* The quality of Mobile Homes increased significantly faster than those of traditional homes. House-size is an important dimension of house-quality. The average size of Mobile Homes significantly increased over the period of mass production.³¹ Over the same period, the average size of traditional homes increased far slower. Another dimension of quality is the standards to

³⁰Note that the rate of price decline does not slow during the late 1960s and early 1970s, as the data are not in logs.

³¹The median-widths of the homes increased from 8-feet to 10-feet. Double-wide homes were becoming common — for example, two 12-foot wide homes would be placed back to back (after delivery), creating a 24-foot wide home. Lengths were increasing.

which homes are built. As we discussed in the last section, the industry was adding many *standards to its building codes* over the period – faster than, almost surely, traditional homes. Lastly, the homes were being made to look like traditional homes. When arriving at their home-site, they were being *taken off their chassis and placed on permanent foundations*, being axed to the ground in the manner of traditionally built homes. The choices in styling were also increasing.³²

C. Prices and quality after 1973. As we said above, we focus on the period after 1973 in a companion paper. Here we briefly discuss the period. Before doing so, we briefly: (i) Present a few of the regulatory requirements of the HUD-code, from the 1974 legislation and from the follow-on regulations in the 1976 federal register; (ii) Discuss the expected impact of the requirements on prices, quality and production; and (iii) Discuss when the requirements were suppose to be met (i.e., the expected *timing of impact*).

The June 1974 legislation contains the requirement of the permanent chassis. This significantly reduced the desirability, or quality, of the house.³³ Reduced desirability would shift the demand curve back, and assuming a constant marginal cost, lead to less production and no change in price. The requirement also increased the cost of manufacturing the home.³⁴ This

³²From MGTC (1971): “Contrary to the name, most mobile homes are not very mobile. Four out of five mobile homes are placed on land sites and are not moved. Such mobile homes often are hard to distinguish from standard housing. Units come adorned with wood shingles, cathedral ceilings, and sliding glass doors. ... Standard equipment ... includes central heating, furniture, basic appliances ... Buyers have a choice of decor — Early American, ...Mediterranean, Contemporary ...” p 9

³³The requirement greatly reduces the quality (or desirability) of these homes. Having a Manufactured Home where the chassis cannot be removed is much less desirable than one where you can. Most families prior to 1974 were putting the homes on a permanent foundation, often with a basement. After 1974, doing this would incur additional, significant costs, as the home had a chassis attached to it. Foundations and basements would have to be dug deeper to accommodate the chassis. Even then the chassis would be lying exposed in the basement. To “hide” the chassis, “false” ceilings would be installed.

³⁴Costs increased for two reasons. First, before the requirement, the chassis could be removed. It could be reused or the materials used in its construction recycled. Second, HUD argued that the home, since it was suppose to be “mobile” at any time, not only in its original delivery, but say in 20 years time, required

increase in costs shifts up the marginal cost, leading to higher prices and further declining production. The requirement was suppose to be implemented within 18 months.

The follow-on regulations published in the federal register, in June 1976, called for standards on fire safety and energy efficiency beyond those recommended by model-code groups. These model-code groups wrote to HUD, objecting to the higher standards that it was imposing on Mobile Homes. Here is a HUD official: “The Secretary [of HUD] was formally requested by the National Fire Protection Association and the National Council of States and Building Codes and Standards to incorporate the Standard for Mobile Homes, NFPA 501B, by reference in the Federal Standards. This request was rejected.” (see Schmitz (2020) pp. 189-191, for a discussion and references).

These regulations on fire safety and energy efficiency increased the quality of the home. But the impacts were certainly far smaller than the decrease in quality due to the permanent chassis requirement. On net, the combined requirements significantly reduced quality.

The increased fire and energy standards standards raised the cost of making the home, shifting the marginal cost curve up, leading to higher prices, and lower output. These requirements were to be met in 18 months.

Summarizing, we expect the *direct impact* of the HUD-code regulations to decrease quality, in a significant way. They also should have led to higher costs, and prices. Both the higher prices and decreased desirability would lead to decreased production. There were also *indirect impacts*. As the regulations reduced industry output, the advantages accruing

the chassis to be built to stricter standards than it before the code, requiring more steel and so on.

to mass production would fall. Productivity growth would lessen. The harm could persist, even accumulate, through time.

Turning to actual prices after 1973, we see the prices (psf) of Mobile Homes begin to increase. Moreover, their path does not differ much from prices of traditional homes. The prices of Mobile Homes are no longer significantly falling relative to traditional home prices. This can be seen in Figure 2B and 3B. As for quality, the situation after 1973 was the complete opposite of that before 1973: Mobile Homes were now significantly decreasing in quality relative to traditional homes.

D. Productivity of Mobile Home industry before and after 1973. Available evidence shows that the industry's productivity increased at very significant rates prior to 1973 and stopped afterwards. Such evidence is presented in the NBER Manufacturing Industry database, which was developed by Bartelsman and Gray (1996). This data shows Mobile Home industry TFP increased at the annual rate of 2.74% from 1958-1972.³⁵

5 Mass Production Achieved: Soaring Output

We begin by showing that the production of Mobile Homes soared during the period of mass production. The construction of traditional homes significantly declined from 1959 to 1969 (when a subsidy program was introduced for those buying these homes).

³⁵In future work, we plan to investigate the statistics in this database, as we may have data that enables us to improve on these estimates. In particular, from 1947 until 1972, Mobile Homes homes and “trailer coaches and campers” were part of the same 4 digit SIC. In 1972, the Census created two separate SICs, Mobile Homes 2451 and travel trailer and camper manufacturing 3792. When Bartelsman and Gray constructed their data set, they used a method to break the pre-1972 industry data into two “parts,” into SIC 2451 and 3792. In this way, they created productivity measures for these two industries from 1958 onwards.

A. *Mobile Home Shipments and Housing Starts 1947 to 1973*. Figure 4 presents U.S. shipments of Mobile Homes from 1947 to 2021. Shipments of Mobile Homes grew significantly after their introduction, doubling over 1947-1959, from 60K to 120.5K units. They doubled again over 1959-1967, from 120.5K to 240.4K, and once again over 1967-1971, from 240.4K to 491.7K. They increased 17 percent from 1971-1972 (491.7K to 575.9K). As result of the severe 1973-1975 recession, shipments fell from 579.9K to 212.7K, a drop of 63 percent.³⁶

Figure 5 presents Mobile Home shipments and housing starts.³⁷ Housing starts fall from roughly 1,200k to 800k from 1959 to 1968. Housing starts are volatile, but it was fairly clear that the great increase in Mobile Home shipments were behind the precipitous drop in the 1960s. And it was clear the drop would continue if nothing was done. HUD-sponsored subsidy programs for traditional housing were introduced in the Housing Act of 1968. One such program was “Section 235,” a massive subsidy program for *low-income* buyers of stick built homes. MGTC (1971) described the great generosity of the program, noting it might bring the end to growth in Mobile Home shipments.³⁸ During the subsidy period, housing starts jumped from 1969 to 1973, from 800k to 1200k, to 1959 levels.³⁹ The increase was seemingly, in good part, due to the subsidies.⁴⁰ Yet Mobile Home shipments continued to

³⁶Shipments significantly fell in all other recessions too. From 1948-49, they fell from 85.5k to 46.2k, a drop of 46 percent.

³⁷Housing starts are, again, construction of traditional homes plus production of Modular Homes and prefabricated homes. There are estimates available for production of Modular Homes and prefabricated homes during the period 1948-1973, but their quality is not very good. We show this below. So, here we focus on housing starts. In addition, we focus on detached single family traditional homes.

³⁸Here is the program, as described in MGTC (1971): “Section 235 of the Housing Act of 1968 permits low-income homebuyers to make a tiny down payment and sets up a system of subsidies under which the government pays all but 1% of the mortgage interest on a loan that can run 30 years. Mobile homes, where interest rates can run 13% a year and the loan term is held to eight to ten years, cannot qualify under the Section 235 program because they do not meet government construction standards.” [cite the phrase, staying alive with 235]

³⁹The Section 235 program was suspended in 1973 given the great burden on Federal budget.

⁴⁰The increase in housing starts was solely driven by those of traditional homes of small sizes.

rise, from 400k to 600k. If not for this program, and others, Mobile Home shipments may have come close to equalling housing starts by 1972.

Figure 6 presents the Mobile Home share of single family production. The share bounced around five percent in the early 1950s, before increasing from five to ten in the few years after 1955. It again hovered around a new level, just below 10%, for the next few years. There were two recessions in this period, likely leading to this stalled growth in share. Then, over the 1960s, the share increased from 10% to over one-third. The share decreased during the early 1970s recession, before bouncing back by 1973 to one-third.

B. Mobile Home Shipments and share of single family production after 1973. Here we briefly discuss the post-1973 period though, again, this is the focus of a companion paper. Our goal is to “explain” the national patterns in Mobile Home shipments and the Mobile Home share of single family production. We start by focusing on the Mobile Home share.

We use an “abstract” figure of the Mobile Home share to help us describe its behavior over 1973-1989. We consider the path of the share under four different assumptions – as shown in Figure 7. First, suppose there had been no recession and no HUD code. We expect the path would be as in time-series-1. As the share was rising steeply during the 1960s and early 1970s, and the “curve” had not become concave, we expect the share would have increased further, to a higher “steady-state.” Second, suppose there had been a recession, but no HUD code. The share would have dropped, as it did in every previous recession. But it would have begun a recovery in say 1976, and begun converging to the same steady-state as in time-series-1. We expect the path in time-series-2.

Next, suppose there was a recession and a HUD-code. Here we discuss two paths, time-series-3 and time-series-4, depending on our assumptions about the severity of harm caused by the HUD-code. The paths follow each other during the recession, and during the early recovery, before the requirements of the HUD-code come into play. (The permanent chassis requirement was suppose to be met by early 1976, and the follow-on regulations by early 1978). When the code requirements become “binding,” the recovery in the share would “slow” down. Under the assumption that the HUD-code was not very severe, the share would continue to rise, but would not reach levels it would have. This is time-series-3. Under the assumption that the HUD-code was very harmful, the share would start to fall, as in time-series-4.

The actual data looks like path-4. If there is something perhaps not expected, it’s that the recoveries (in shipments and share) lasted until 1983-1984. Shipments did fall in the 1981-1982 recession, though they began to recover afterwards. The share did not drop during the recession, the only recession where it did not fall. One important reason for the “extended” recovery is that some states protested against, and ignored, provisions of the HUD-code, like the permanent chassis requirement. This resistance lasted into the mid 1980s.

If we examine individual-state Mobile Home shares, we see that every state has a general pattern like the national average in Figure 6. States shares differ in the size of the share recovery after the 1973-1975 recession, and then when the share begins to fall (and how quickly). While the shares in many states begin to fall around 1980 or so, there are some states whose share does not decline until a few years later. Again, this delay is likely the result of some states resisting the HUD code. Though this is explored in the companion

paper, here we present time-series for a few states.

Figure 8 presents the Mobile Home share of single family production in California and Florida. The share in each state begins a weak recovery from the 1973-1975 recession, then begins to fall in the early 1980s, with the shares falling fairly quickly. Note also that Florida's share is twice California's share in the early 1970s.⁴¹ Figure 9 presents the shares in Illinois and Ohio. The share in Illinois nearly recovers to its early 1970 level in a matter of a few years – much different than California and Florida. Yet its share begins to fall in the early 1980s, similar to those two states. Ohio's share recovers a significant amount, but does not begin a significant fall until 1984.

Figure 10 presents the shares in Alabama and Arkansas. Alabama's share reaches 60% in the early 1970s (with one year spiking to 70%), falling to 35 percent during the recession. But it recovered to 60 percent afterwards. Its share doesn't begin to fall until 1984, and then not by much. Arkansas' share fell from a peak of 65 percent to below 30 percent during the recession. But it recovered to 60 percent afterwards. Its share also remains high through 1984. Figure 11 shows Mississippi's share fell from a peak of 70 percent to under 40 percent during the recession. But its recovery approached 60 percent afterwards. Oklahoma's share fell from a peak of 50 percent to 20 percent during the recession. But it fully recovered to 50 percent afterwards.⁴²

⁴¹We don't have shipments data by states for 1987 and 1988.

⁴²We have discussed one reason for the delayed fall in the national Mobile Home share – states resisting the HUD code. There is another possible reason – complimentary to the first. The shipments (and production) of Mobile Homes from say 1974-1984 was very much lower than in the early 1970s. This was due to the recession and the HUD code. The gains from mass production, which are tied to the level of production, would be falling during this period (see next section for evidence). These falling gains could lead to lower productivity growth, and then falling output.

The surge in shipments and the share in the 1990s was the result of a no-doc lending boom.⁴³ After 1984, most states were following the code, and industry shipments began to fall. They would have kept falling if not for the no-doc lending boom. Shipments plunge in the late 1990s, falling to 100k by 2007. Shipments are then below 100k until 2021.

6 Identical Codes drove Mass Production

A major consequence of identical codes was to increase the size of the market. Adam Smith (1776), of course, discussed how increases in the “extent of the market” changed the incentives for “how to produce,” that is, it led to specialization of tasks. With larger markets, it was possible for labor to work on narrow tasks, so that they would repeat these tasks more frequently, leading to higher productivity.

The development of specialized machinery after Smith added a new dimension. As labor can specialize, so can machinery be specialized. But here’s an important difference. Labor is flexible. As labor specializes, there is nothing to presume the narrow tasks would be simple, as specialization spreads to occupations like academics, where tasks may be complex. Machinery is inflexible, so the tasks must be simple, and they must be the same task each time. This leads to a situation where manufacturers produce simple and uniform products, using a standardized production process.

A. Many Sources of Productivity Gains From Identical Codes

⁴³See Berenso (2021).

Above we discussed how productivity gains from a larger market can come from the factory level, as well as the industry level. We've discussed the gains at the factory level: With a state-wide code, that is, an identical building code at all locations, a manufacturer could sell a home at any location in the state. This made it possible for a manufacturer to achieve high volumes of production with a simple and standardized product. This created the incentive to invest in specialized machines and the like at the factory.

We focus in this section on the gains coming at the industry level, from the *industry achieving large scale* — a large numbers of factories, each at large scale, producing under a standardized production process. The next three sections will discuss these sources of productivity gains for the Mobile Home industry (with extensive evidence in the last two sections).

B. Gains from inside multi-plant firm. A factory will “discover” simple changes to production processes that improve productivity. If a firm has more than one factory, and uses a standardized process across factories, then improvements can be shared across plants.

The next two sections consider productivity gains for the firm coming from “outside” the firm: external effects and directed technical change.

C. Gains from Outside the firm – #1: External Effects (spillovers). When an industry grows to a large scale, and is producing a standardized product, using standardized production processes, organizations may emerge that “build industry infrastructure” and “produce industry information” that are both very useful to existing firms (and future firms considering entry) and are free of charge to them (or little expense). Here we discuss two organizations that did so: The Trade Association (the Mobile Home Manufacturers Association (MHMA)) and

Agricultural Extension Services.

Trade Association (MHMA)

1. *Developing Infrastructure — State Building Codes.* It was the MHMA, with the help of model-code groups, that developed the industry’s identical code, making mass production a possibility.

2. *Developing Infrastructure — Financing Survey.* MHMA undertook significant efforts to improve the prospects for industry financing, both retail financing and financing of Mobile Home parks. As for retail financing, there was significant prejudice against lending to those buying Mobile Homes. To alleviate this situation, the MHMA developed a survey of lenders regarding their experience lending to buyers of Mobile Homes. Information was collected from financial institutions on lending volume, its experience with delinquencies, and so on. Again, MHMA commissioned an outside group to tabulate the surveys. A significant fraction of lending institutions participated. Survey results showed that buyers of Mobile Homes had paid off loans no differently than holders of mortgages on stick-built homes. The results of this survey were published each year in MHMA’s annual report — these results were an important part of the industry’s “infrastructure.”⁴⁴

3. *Developing Information — How to Develop and Organize Parks.* Having a uniform building code is not valuable if the industry was not able to market its homes widely. In towns with zoning ordinances that permitted Mobile Homes, which would be in industrial areas, and typically in Mobile Home parks, one way to build markets was to improve the designs

⁴⁴As for mobile home park financing, MHMA produced reports for each side of the transaction: those hoping to start a park, those considering financing a park.

and layouts of the parks. In 1955, MHMA commissioned a Professor from the University of Chicago Business School, L.C. Michelon (1955), to write a book about improving such parks: *How to build and operate a mobile-home park*.⁴⁵ MHMA continuously developed recommendations and advice for the improving of parks and their design. This information appeared in annual reports.⁴⁶

4. *Developing Information — Finding other areas to sell homes.* The industry also found new areas to sell their homes, areas with no administrative bodies, so there was no zoning.⁴⁷ These areas, in fact, played an important role in the Mobile Homes industry's growth. Industry leaders, and scholars, tell us this. James Price, the CEO of National Homes, the largest producer of factory-built homes in the United States, explained this in Congressional testimony in 1970.⁴⁸ William Speck, part of a team formed by Edward Levi at the University of Chicago to study affordable housing, emphasized this as well.⁴⁹

Government Agricultural Extension Services

⁴⁵Here is text, written by MHMA, from the Preface to the book: "Professor Michelon, who had spent several periods in Florida studying mobile-home park development and its relation to retirement programs, came to the conclusion that there was a definite need for a text on the construction of such a park. The Mobile Homes Manufacturers Association, which with its Park Division had spearheaded the planning of such parks, readily joined with his cause The Manufacturers Association takes pride in the publication of this text, the first complete volume covering the construction of a mobile-home park."

⁴⁶The annual report of 1961 offered a free kit to anyone considering opening a park, p. 28.

⁴⁷In fact, a stratified sample done for Paul Douglass' study of housing (by the Census Bureau) found that only 53 percent had zoning regulations. They were the smaller townships. (see Marvel).

⁴⁸National Homes had a capacity of 100,000 factory-built housing units in 1970. National Homes had almost exclusively produced modular homes and panelized homes before the 1960s, but quickly added capacity for mobile homes in the middle 1960s. Here is Price in his testimony: "I want to deal with mobile homes. I think it has to be mentioned at this time because insofar as the consumer is concerned, 65 percent of the people have to either look to a mobile home or low rent apartment for shelter. The spectacular rise in the mobile home industry is because mobile homes are placed primarily in an area beyond where code and zoning requirements are exercised. *Their construction techniques allow far less space* than the accepted housing standards for the Federal Government. ... " [our emphasis]

⁴⁹"The combination in house building of perhaps the most complete and widespread local government regulation, restraint-of-trade minded builders and material dealers, and some of the strongest, most conservative labor unions in the country has proved in many localities an insurmountable obstacle to the use of new methods. *Prefabricated builders have simply confined themselves to those areas where restraints are not serious.*" [our emphasis]

Extension services provide valuable information to agricultural industries and their communities.⁵⁰ Low-cost housing has been a perennial concern for these communities. Extension programs, in their capacity to provide information for communities, wrote extensively about the option of mobile homes for these rural areas.⁵¹

D. Gains From Outside the firm – #2: Directed technological change. Once an industry reaches a large scale, using a (relatively) standardized production process, the return to making an innovation on such a process grows large.⁵² These effects were at work in this industry. Annual reports describe how the MHMA had members that were suppliers to the industry, making up a “Suppliers Division.” (More on this later)

E. Gains from mass production compared to Levitt-style production The Mobile Home industry was only one of many experiments introduced after WW2 attempting to bring low cost housing to returning veterans and many more. The most famous experiment was by Levitt and Sons, that produced homes on Long Island. The Levitts and a few other groups pioneered new stick-built construction methods. They might build 100 homes at a single, outdoors site. Houses were simple, standardized, and built to a standardized process. It has sometimes been described an “assembly-line-like” system on-site. In this system, houses would not move along an assembly line, workers would. Skilled workers would move along the “assembly line,” that is, from house to house. Electricians would wire one house, then move next door. And so on.

⁵⁰Griliches study of the diffusion of hybrid corn seed illustrates one case of these extension services providing valuable information to farmers.

⁵¹We discuss these writings in detail in the next version.

https://conservancy.umn.edu/bitstream/handle/11299/205102/287_1973_31951D01928569K.pdf?sequence=1

https://conservancy.umn.edu/bitstream/handle/11299/205076/265_1972_31951D019285416.pdf?sequence=1

⁵²Schmookler produced studies showing the importance of such effects in railroads and other industries. More later.

These methods significantly reduced the cost of producing homes relative to building them one at a time.⁵³ Yet it had drawbacks. It's of value only when building 100s of homes in an area. Most importantly, it was not mass production as we've defined it. These methods did not make extensive use of specialized machinery. Given this, the method did not greatly reduce the fraction of skilled labor, or the total use of labor. The Levitts understand these drawbacks, of course, and ultimately concluded that factory methods were the only way to provide "affordable housing." In Congressional testimony in 1969, the Levitts stated: "The labor time in a factory-built dwelling unit is only a fraction of what is required to construct a similar unit on-site. That's why we must look at factory-built housing. That's why factory-built housing must succeed, or we will never be able to produce the homes and apartments needed to house our expanding population and our underprivileged citizens in a comfortable, dignified, decent way."

7 Success could have been much Greater

Mass production of Mobile Homes succeeded despite very significant barriers to them. Here we discuss more about the barriers, and how they limited the impact of Mobile Homes.

Financing. Mobile Homes were financed as cars, with personal loans, at much higher interest rates and much shorter durations, than conventional mortgages. Greenwald (19xx) provides a good overview of Mobile Home financing in New England in the late 1960s. For conventional mortgages, the average interest rate was eight percent, with maturity of 30 years (Table 1, p.

⁵³One sizable gain was buying materials in large quantities.

4). The financing terms for Mobile Homes in New England was very different. The average interest rate was 12.2 percent. The fraction of loans with a maturity of less than 60 months was 47.1 percent.

Subsidies. To stop the Mobile Home industry, opponents lobbied for and received massive subsidies for those buying stick-built homes. In discussing the future of Mobile Homes, MGTC (1971) wrote: “What future for mobile homes? A key element in the outlook is the role of federal housing aids for conventional structures.” As we mentioned above, large subsidies were contained in Section 235 of the Housing Act of 1968. Here is the program, as described in MGTC (1971): “Section 235 of the Housing Act of 1968 permits low-income homebuyers to make a tiny down payment and sets up a system of subsidies under which the government pays all but 1% of the mortgage interest on a loan that can run 30 years. Mobile homes, where interest rates can run 13% a year and the loan term is held to eight to ten years, cannot qualify under the Section 235 program because they do not meet government construction standards.”⁵⁴ MGTC (1971) reported that “Many housing experts expect growing demand for [traditional] homes under the 235 program — and a consequent easing in demand for mobile homes. If they are right, the peak in mobile home production may have been passed.”

Zoning. Zoning regulations were, obviously, a major impediment to the growth of Mobile Homes. The regulations not only reduced the production of the industry. As Greenwald () argued, they had big impacts on the spatial distribution of the population – perhaps surprising ones. As we saw in New England, Mobile Homes were banned in most cities and,

⁵⁴By these construction standards, they mean the houses were too small.

then, often in the areas surrounding cities. Consequently, the poor were often “trapped” in cities.⁵⁵ Here is Greenwald: “It is becoming obvious that our urban problems cannot be solved if the central cities are forced to harbor all of the poor. The Federal Government and many states are increasingly realizing that they cannot permit local governments to foreclose housing opportunities for moderate-income households. ... Apartments and mobile home parks do have a place in the suburbs. The quest for quality residential environments by the middle class cannot be allowed to condemn the less well-to-do to slum housing.”

Not only were Mobile Homes banned in areas surrounding cities, towns in rural areas banned them, or more often assigned them to industrial areas, limiting their desirability. This meant these areas could not improve. Again, Greenwald: “Rather than simply tolerating mobile homes, the states might explore how they can be used in the development of depressed areas. In areas with much substandard housing, the states could encourage mobile homes as the quickest and least expensive way of upgrading the housing stock. Certainly, towns with much substandard housing should not be allowed to foreclose a means of better housing for their poorer residents. States must not let local governments prevent this opportunity from being realized.”

8 End of Mass Production of Mobile Homes

We date the end of mass production, or really the beginning of the end, to 1974 legislation leading to the HUD-code. It was a national code, preempting all other codes, including the

⁵⁵If a low income individual wanted to work in a city, the person could not live in an area contiguous to it. The individual would need to live “further” away. Many then choose to live in the city.

Mobile Home codes developed by the industry and model-code groups. This building-code was a complete break from past practice – it was a radical change. First, it was a sharp break from how building codes had been *developed* in the past. Typically codes were developed in conjunction with national testing bodies and model code groups. HUD developed many of the standards in its code “in-house” – without reference to major standard setting bodies. Recall that the National Fire Protection Association (NFPA) wrote to HUD arguing its in-house standards were too strict. Also recall how the Mobile Home industry developed their state-wide codes. They sought certification through ANSI, as well as sought cosponsors for the codes, including the NFPA. Working with these bodies gave their codes credibility.

Second, HUD dramatically changed its *definition* of Mobile Homes. Here is a 1968 definition from HUD: “A mobile home is a movable or portable dwelling constructed to be towed on its own chassis, connected to utilities, and designed with a permanent foundation for year-round living”⁵⁶ And here is the definition in the 1974-legislation: A Mobile Home is “... a structure, transportable in one or more sections, which is eight body feet or more in width and is thirty-two body feet or more in length, and which is built on a *permanent chassis* and designed to be used as a dwelling with or without a permanent foundation” 42 U.S.C. § 5402(6). [emphasis added]

The term “*permanent chassis*” was a radical break from past practice. It had never before been used in defining Mobile Homes.

⁵⁶From: Housing Surveys Parts 1 and 2: (1) Occupants of New Housing Units and (2) Mobile Homes and the Housing Supply, p.73. This text accompanying this definition also included: “Mobile homes are towed to their sites by trucks whose movements are controlled by state highway regulations or they are shipped on railroad flat cars.”

The HUD-code was immediately challenged by the industry.⁵⁷ In 1977-testimony, a mobile home trade association argued that the law should be amended stating: “Several states have refused to recognize the preemptive effect of the Mobile Home Act, standards and regulations. This may be partly because there is still much confusion among the states regarding precisely what the states are preempted from doing as a result of the Mobile Home Act and implementing regulations. *But the basic problem is HUD’s failure to get the states to obey the law.*” [emphasis in original]⁵⁸

⁵⁷Challenges to the new HUD-code emerged soon after its introduction. Many states challenged its validity, and passed legislation attempting to override it. The permanent chassis requirement was a particular objection of the states and the industry. As late as 1987, some states were fighting the permanent chassis requirement. So, the impact of the legislation is seen in some states much earlier than in other states. So, the experiment of mass production ended, for practical purposes, in 1974. It faced a slow death, which dragged on for a decade or so.

⁵⁸In “Impact of the cost of regulation on small business homebuilders joint hearing before the Select Committee on Small Business and the Subcommittee on Small Business of the Committee on Banking, Housing, and Urban Affairs and the Subcommittee on Housing and Insurance of the Committee on Veteran’s Affairs, United States Senate, Ninety-fifth Congress, first session Atlanta, Ga., February 16, 1977 United States. Washington : U.S. Govt. Print. Off., 1977.

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Table 1: Summary Statistics on Zoning Regulations of Localities, by U.S. State

<i>Region</i> State	Mobile Home Ban % of localities	Restriction of Mobile Homes to Parks % of localities out of those without ban	<i>Region</i> State	Mobile Home Ban % of localities	Restriction of Mobile Homes to Parks % of localities out of those without ban
<i>New England</i>					
Maine	18	5	Delaware	29	49
New Hampshire	2	3	Maryland	20	100
Vermont	2	12	Virginia	11	62
Massachusetts	65	80	West Virginia	40	100
Rhode Island	51	27	South Carolina	1	61
Connecticut	87	92	North Carolina	25	100
<i>Middle Atlantic</i>					
New York	50	22	Georgia	1	30
New Jersey	95	80	Florida	5	79
Pennsylvania	60	75	<i>West South Central</i>		
<i>East North Central</i>					
Ohio	50	80	Arkansas	0	5
Indiana	10	28	Louisiana	0	25
Illinois	3	39	Oklahoma	1	51
Michigan	15	47	Texas	1	10
Wisconsin	10	56	<i>Mountain</i>		
<i>West North Central</i>					
Minnesota	15	100	Montana	5	5
Iowa	2	82	Idaho	1	10
Missouri	1	10	Wyoming	1	10
North Dakota	1	51	Colorado	1	40
South Dakota	1	33	New Mexico	4	10
Nebraska	1	15	Arizona	1	66
Kansas	5		Utah	1	64
<i>East South Central</i>					
Kentucky	10	33	Nevada	1	25
Tennessee	1	35	<i>Pacific</i>		
Alabama	5	11	Washington	10	83
Mississippi	5	14	Oregon	25	67
<i>West South Central</i>					
<i>California</i>					
<i>Alaska</i>					
<i>Hawaii</i>					

Source: Bernhardt, Arthur D. *Building Tomorrow: The Mobile/Manufactured Housing Industry*. (1980).

Table 2: State Mobile Home Building Codes

State	Legislation enacted	Effective date	Preempts local law	State	Legislation enacted	Effective date	Preempts local law
AL	Sep-71	Mar-72	Yes	NV	1967	Jan-69	Yes
AK	May-71	Sep-71	No	NH	<i>none</i>		
AZ	May-72	Sep-72	Yes	NJ	Sep-72	Dec-72	Yes
AR	Feb-73	Feb-73	Yes	NM	Feb-67	Jul-67	Yes
CA	Sep-57	Sep-58	Yes	NY	<i>unknown</i>	Jan-74	Yes
CO	<i>unknown</i>	Jul-71	Yes	NC	<i>unknown</i>	Jul-69	Yes
CT	<i>unknown</i>	Oct-70	Yes	ND	Mar-71	Jul-71	Yes
DE	Mar-74	Jul-74	Yes	OH	<i>unknown</i>	Jul-74	
FL	Jun-71	Jul-71	Yes	OK	<i>none</i>		
GA	Mar-68	Sep-68	Yes	OR	<i>unknown</i>	Jan-62	Yes
HI	<i>none</i>			PA	May-72	May-72	Yes
ID	Mar-71	Jan-73	Yes	RI	Mar-73	May-75	
IL	<i>unknown</i>	Jul-74	No	SC	Jun-72	Jul-72	Yes
IN	Apr-71	Jan-72	Yes	SD	Mar-73	Jul-73	Yes
IA	Jul-72	Feb-73	Yes	TN	Apr-72	Jan-73	Yes
KS	Jul-72	Jan-73	Yes	TX	Jun-69	Dec-69	Yes
KY	Mar-74	Jul-74	No	UT	Sep-69	May-71	Yes
LA	<i>none</i>			VT	<i>none</i>		
ME	Jun-71	Oct-71	Yes	VA	Apr-70	Jul-71	Yes
MD	May-71	Jul-71	Yes	WA	<i>unknown</i>	Jan-68	Yes
MA	Jul-72	Jan-75	Yes	WV	Mar-74	Jan-75	Yes
MI	Jul-72	Jul-74	Yes	WI	1973	Jan-74	Yes
MN	May-71	Jul-72	Yes	WY	<i>none</i>		
MS	<i>unknown</i>	Jul-70	No	DC	<i>none</i>		
MO	<i>unknown</i>	Jan-74	Yes	PR	<i>none</i>		
MT	Jun-69	Sep-74	Yes	VI	<i>none</i>		
NE	May-69	Dec-69	Yes				

Source: Cooke, Patrick W. *State Building Regulatory Programs for Mobile Homes and Manufactured Buildings: A Summary*. Vol. 853. US Department of Commerce, National Bureau of Standards, 1974.

Figure 1

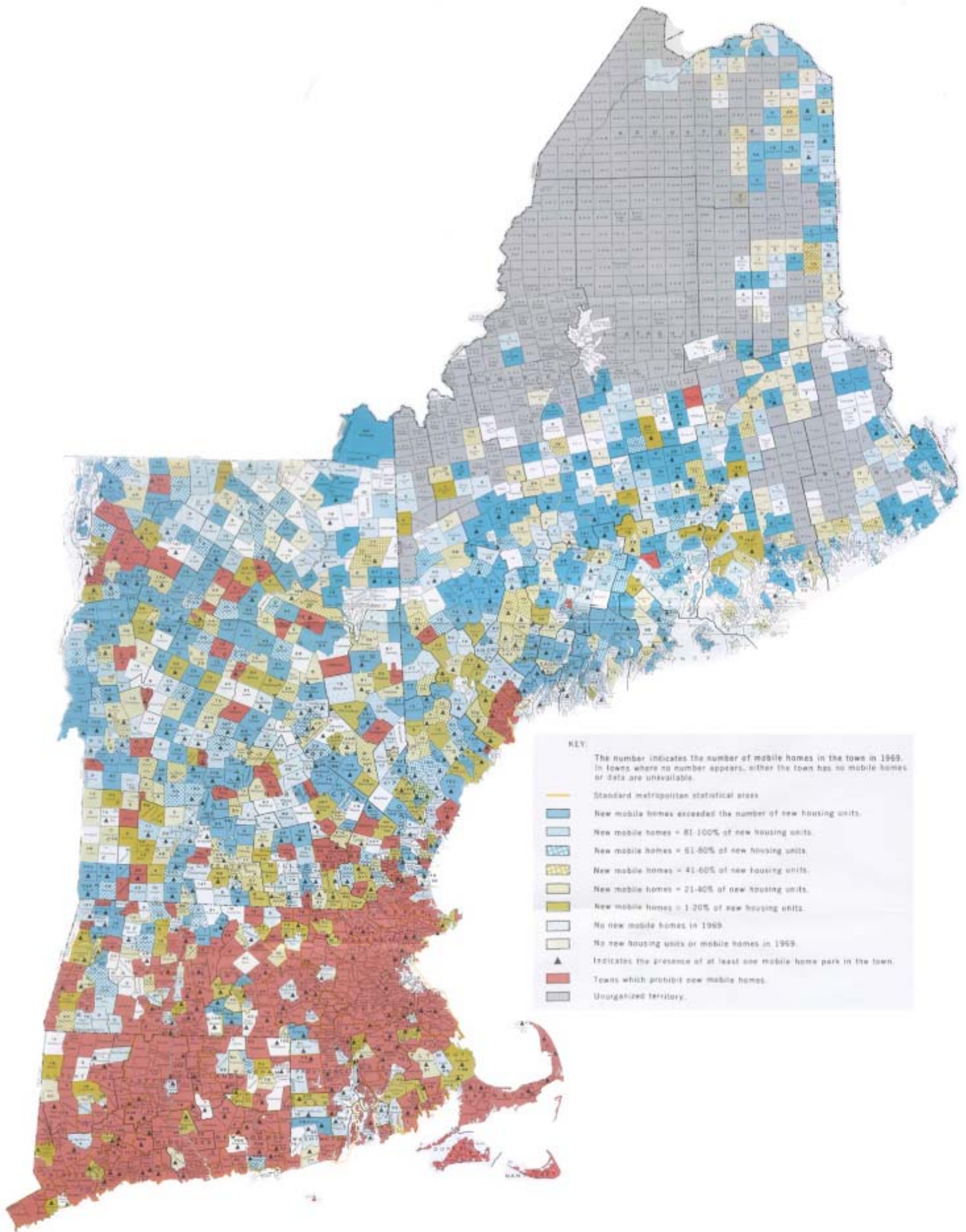
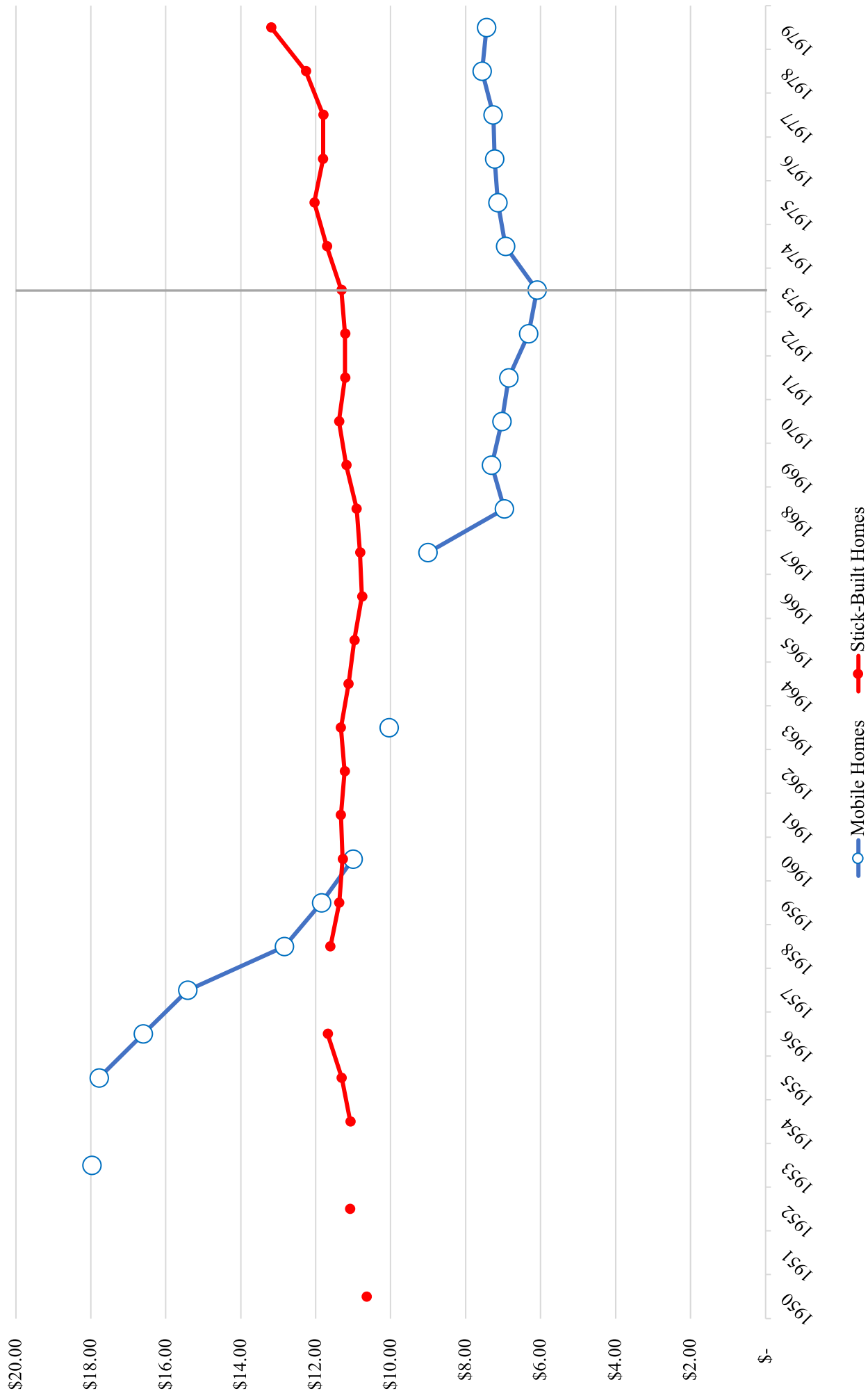
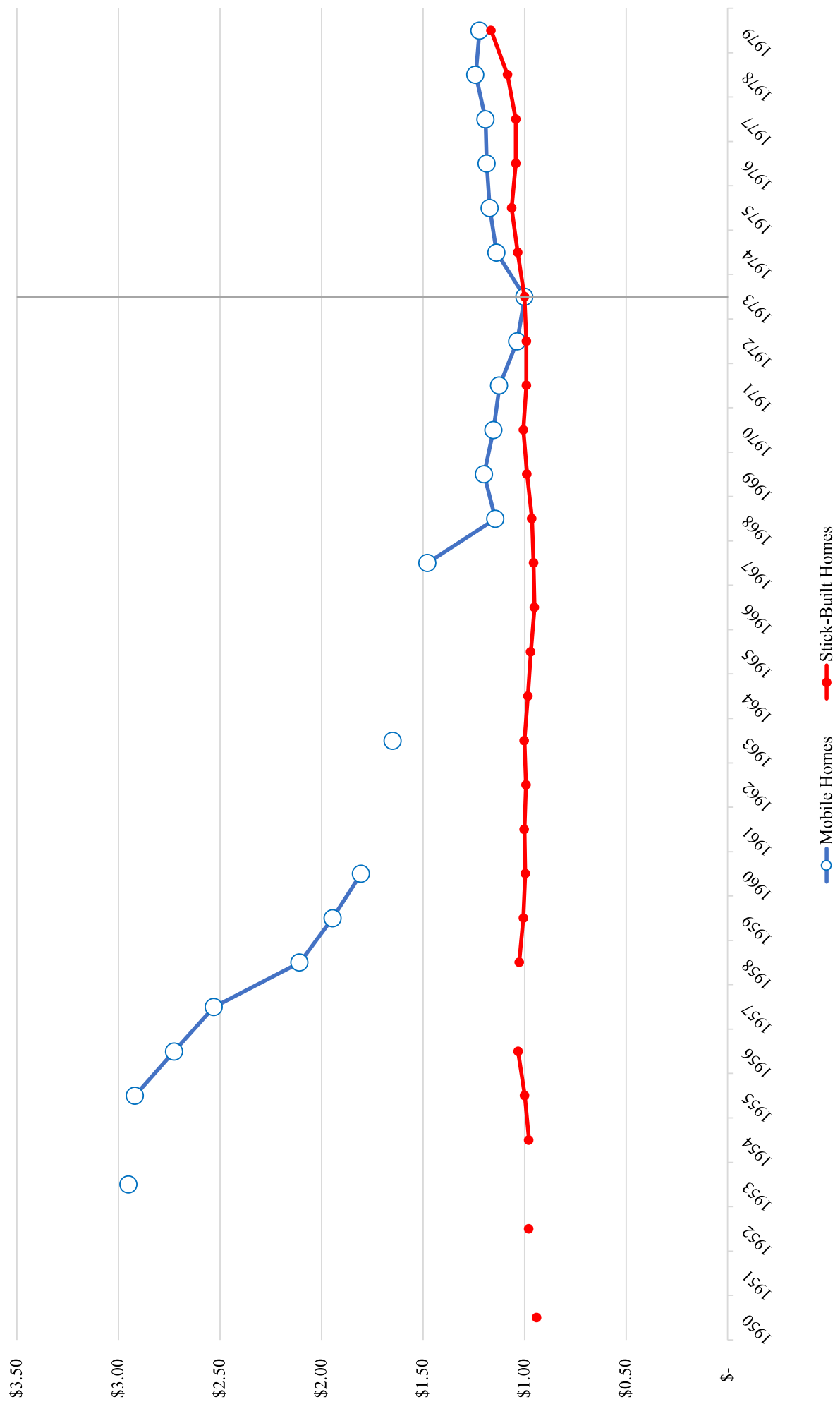


Figure 2A: Mobile Homes vs. Stick-Built Homes: Cost per Square Foot, Deflated (1960\$)



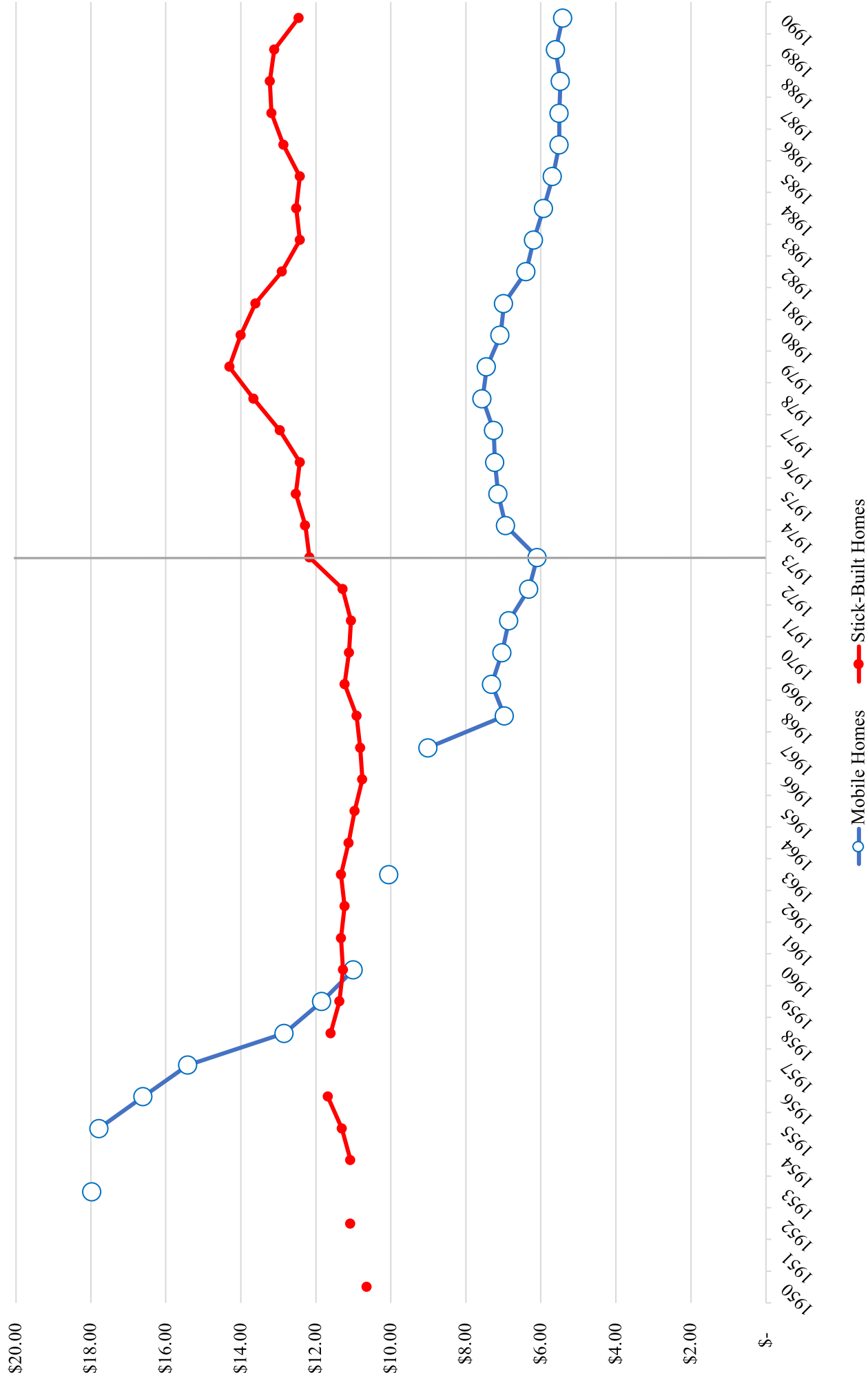
Prices for stick-built homes are for homes that qualified for FHA Section 203(b) loans.

Figure 2B: Mobile Homes vs. Stick-Built Homes: Cost per Square Foot, Deflated (1960\$), 1973=1



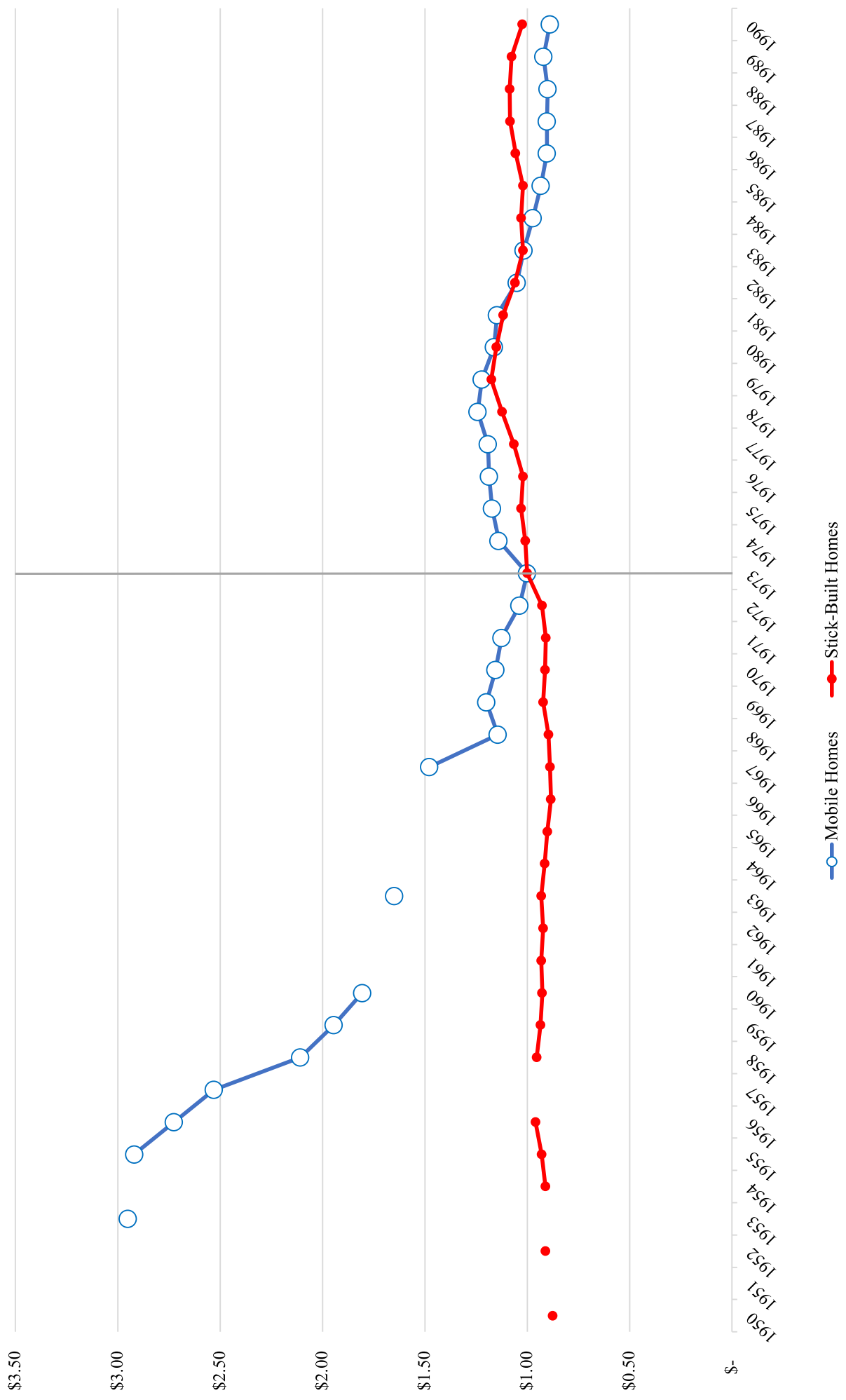
Prices for stick-built homes are for homes that qualified for FHA Section 203(b) loans.

Figure 3A: Mobile Homes vs. Stick-Built Homes: Cost per Square Foot, Deflated (1960\$)



Prices for stick-built homes until 1968 are for homes that qualified for FHA Section 203(b) loans; from 1969 onward, values are sourced from the U.S. Bureau of the Census, Construction Report C25 Series.

Figure 3B: Mobile Homes vs. Stick-Built Homes: Cost per Square Foot, Deflated (1960\$), 1973=1



Prices for stick-built homes until 1968 are for homes that qualified for FHA Section 203(b) loans; from 1969 onward, values are sourced from the U.S. Bureau of the Census, Construction Report C25 Series.

Figure 4: Shipments of Mobile Homes (Units, 000s)

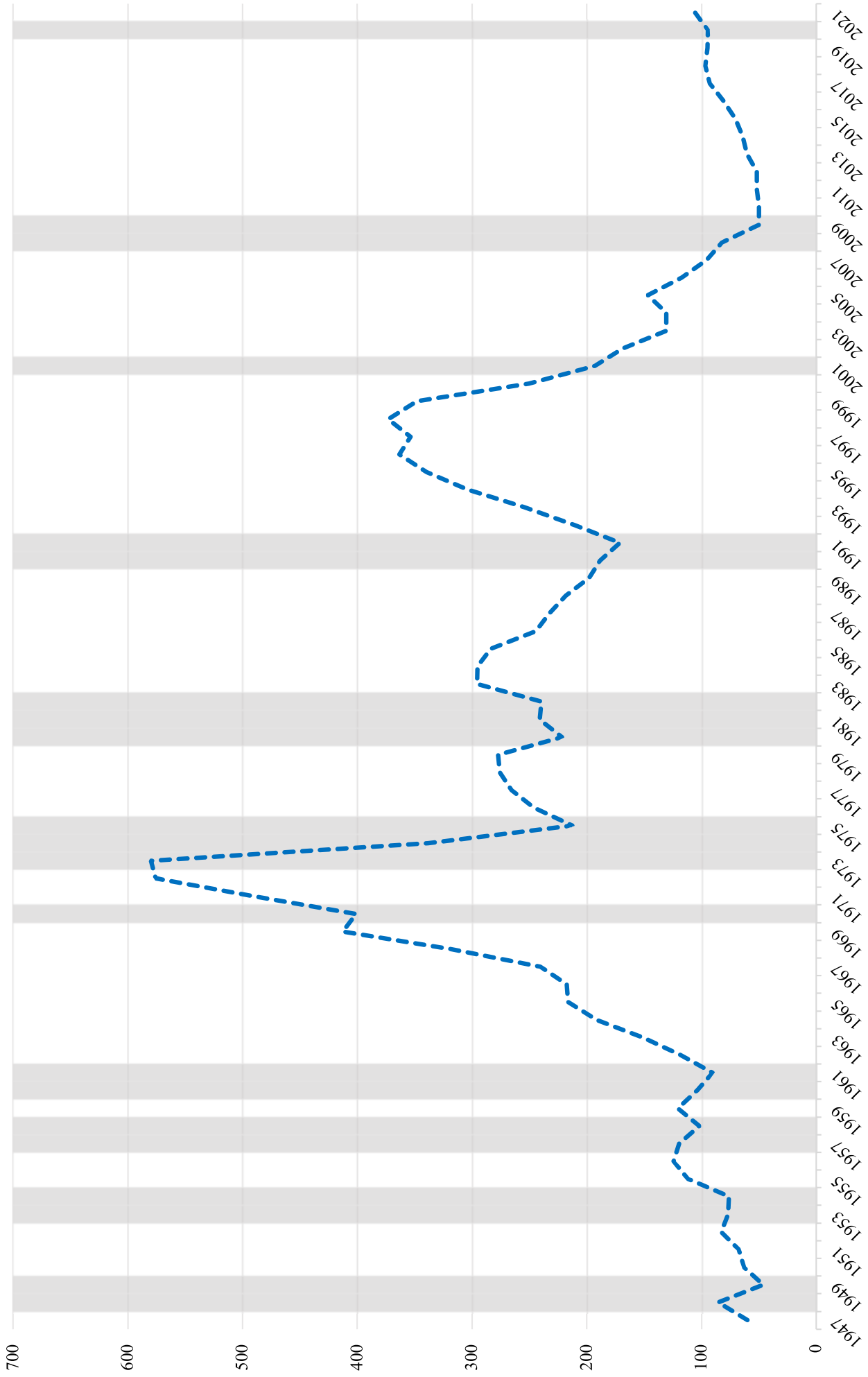


Figure 5: Shipments of Mobile Homes and Housing Starts (Units, 000s)

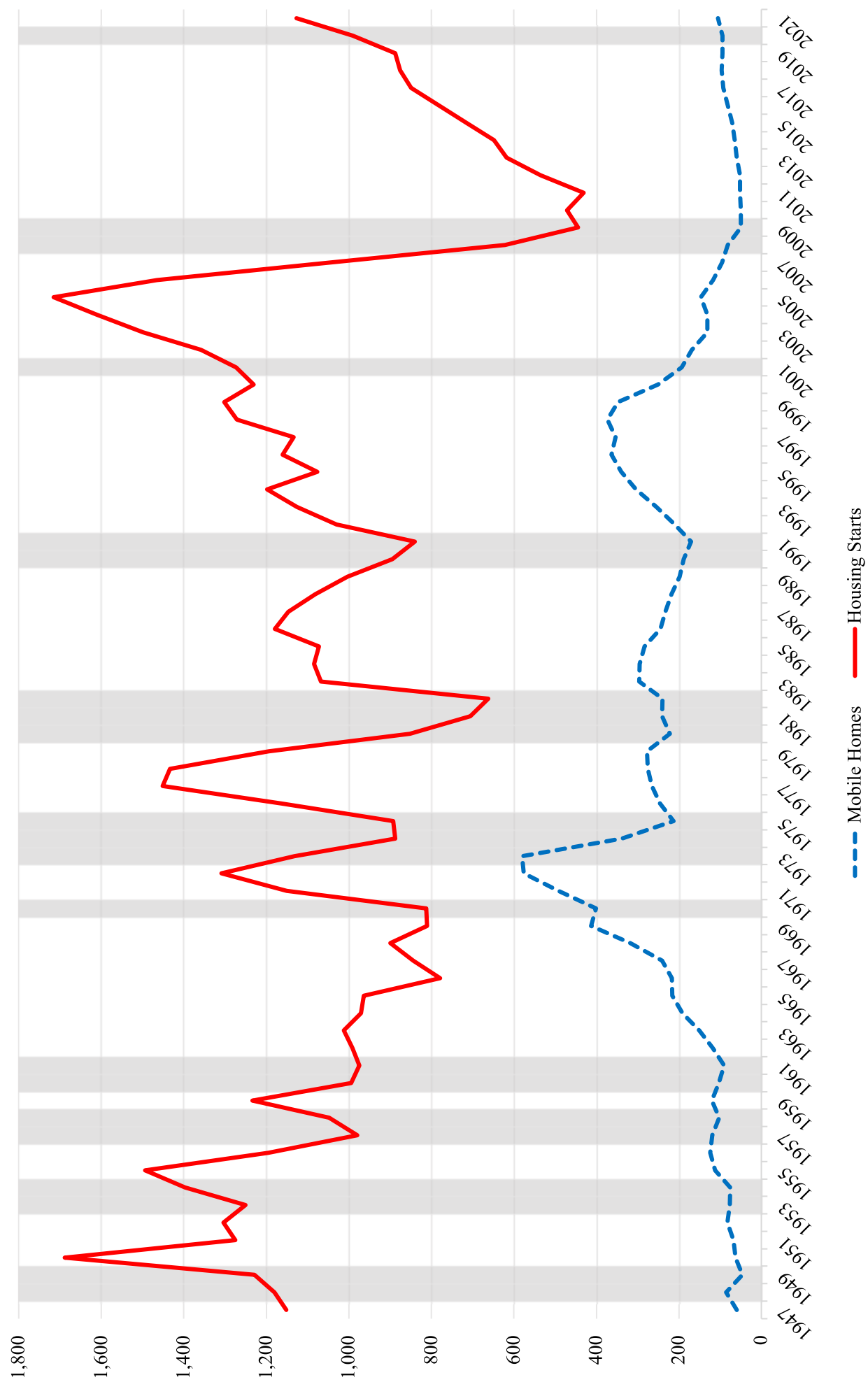
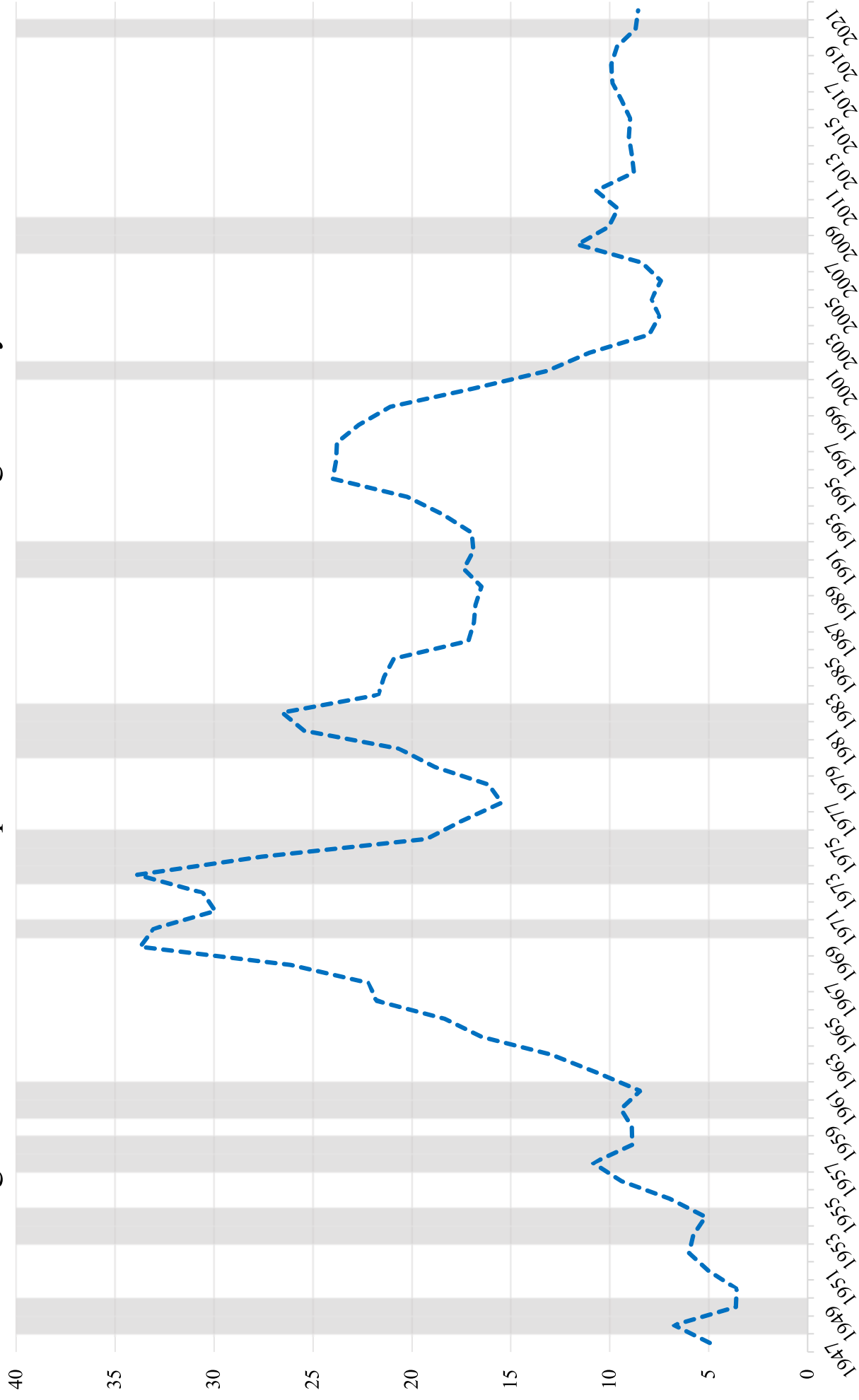


Figure 6: Mobile Home Shipments as % of Total Single Family Production



Note: Total single family production in any given year is defined as the sum of one-family housing starts and mobile home shipments.

Figure 7

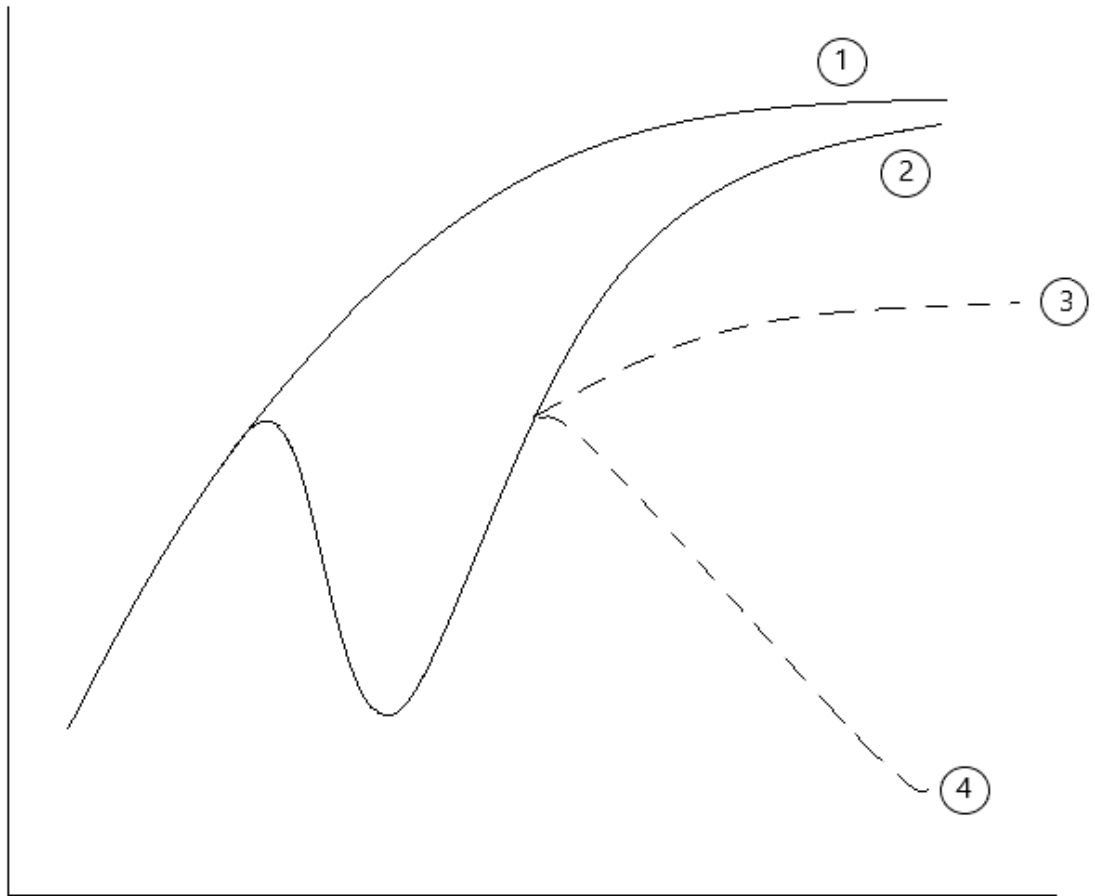
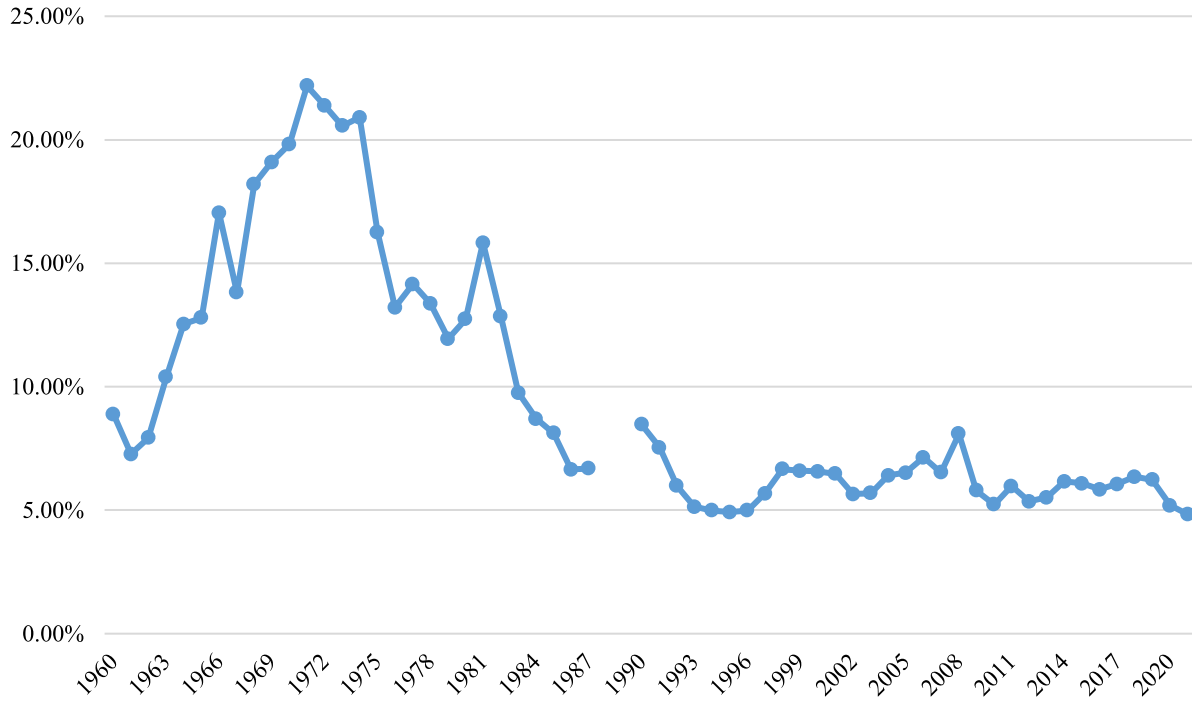


Figure 8: Mobile Home Share of Single Family Housing Production

California



Florida

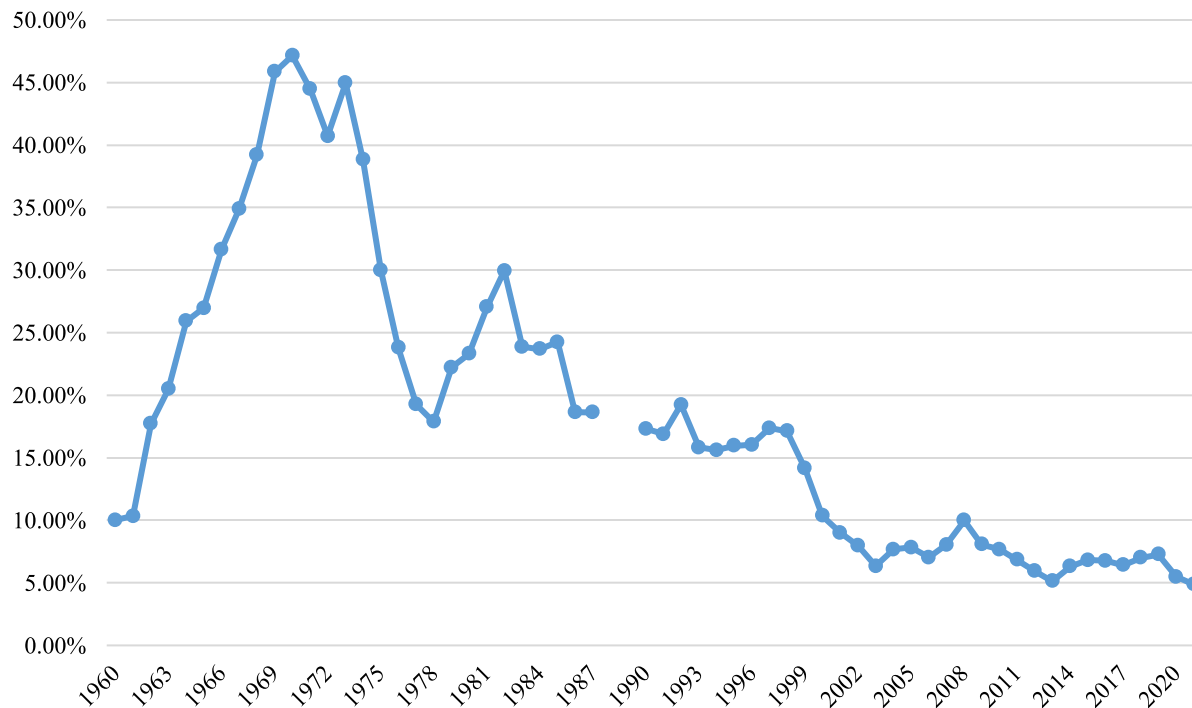
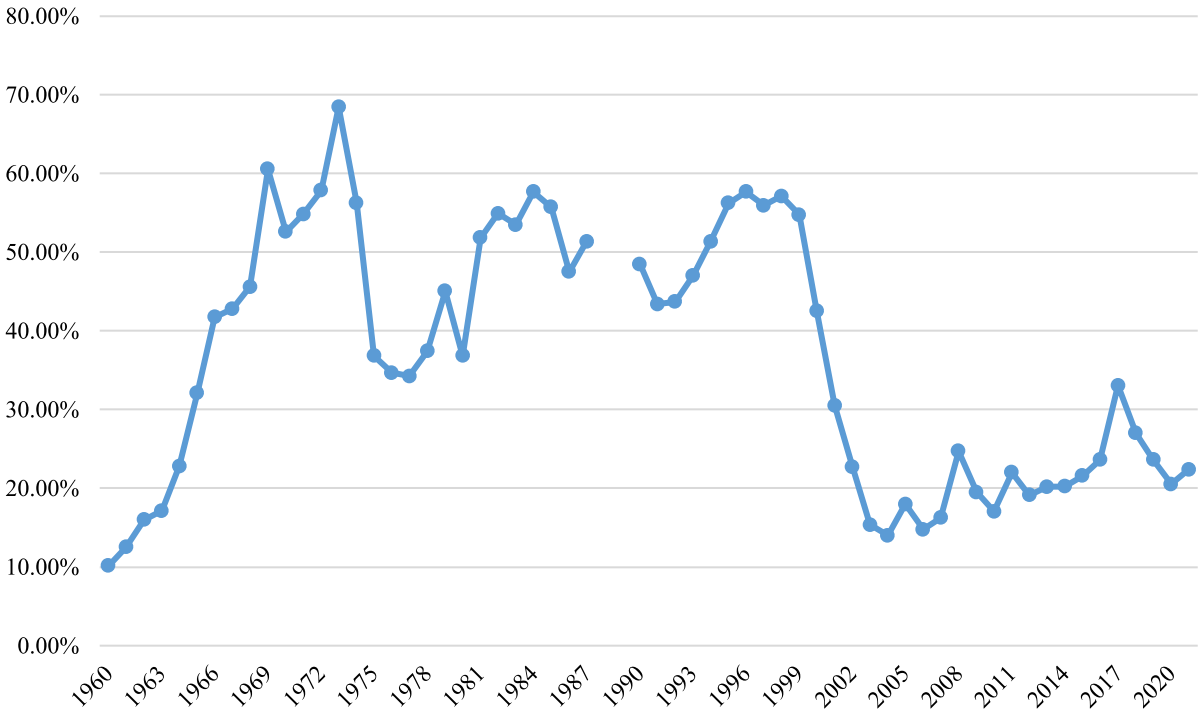


Figure 9: Mobile Home Share of Single Family Housing Production

Alabama



Arkansas

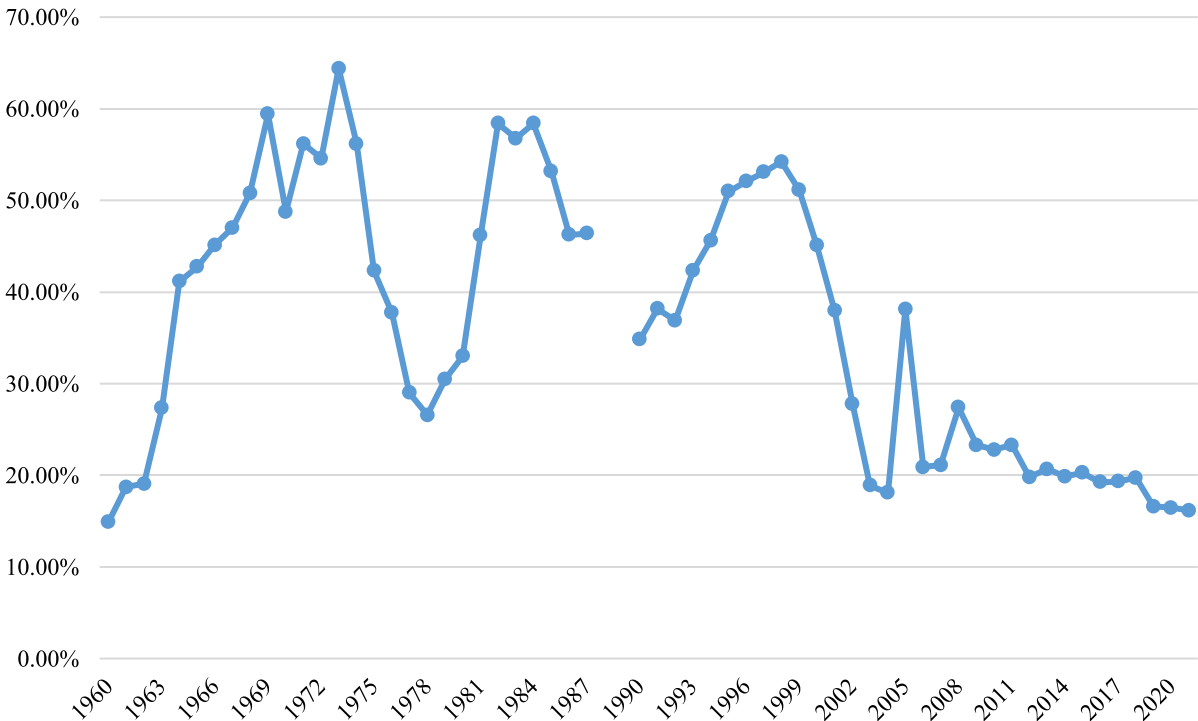
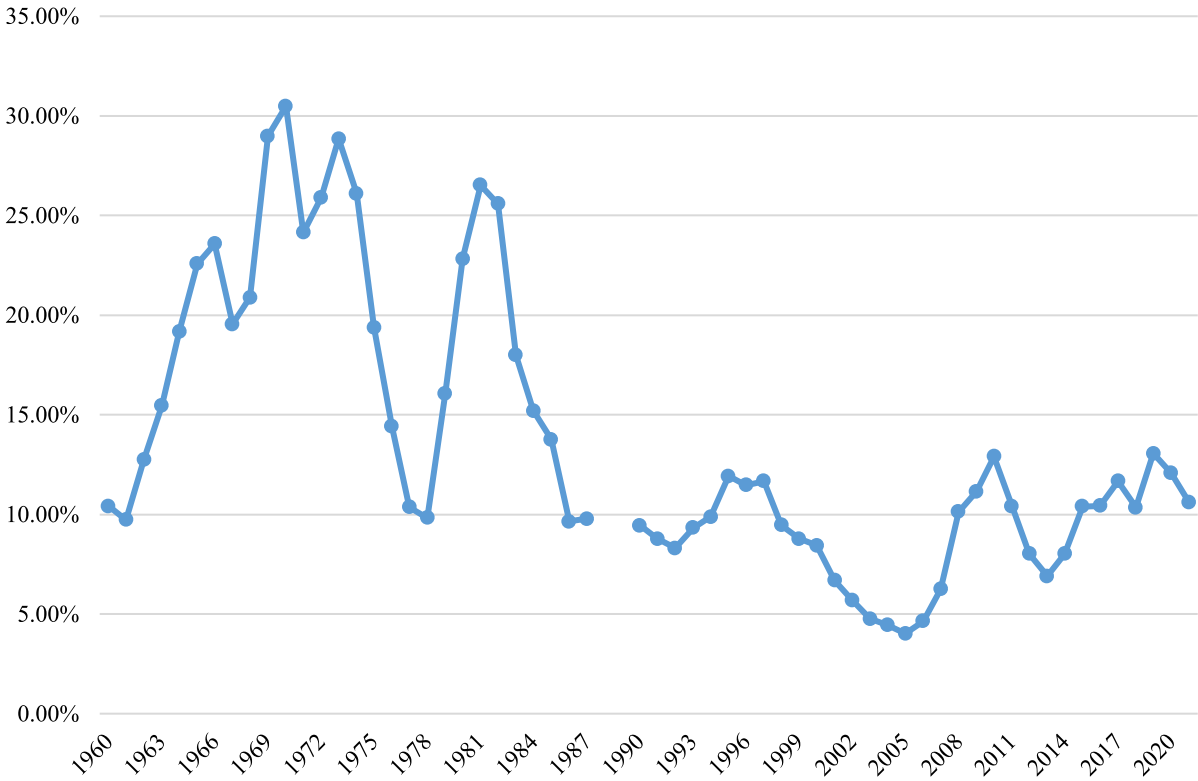


Figure 10: Mobile Home Share of Single Family Housing Production

Illinois



Ohio

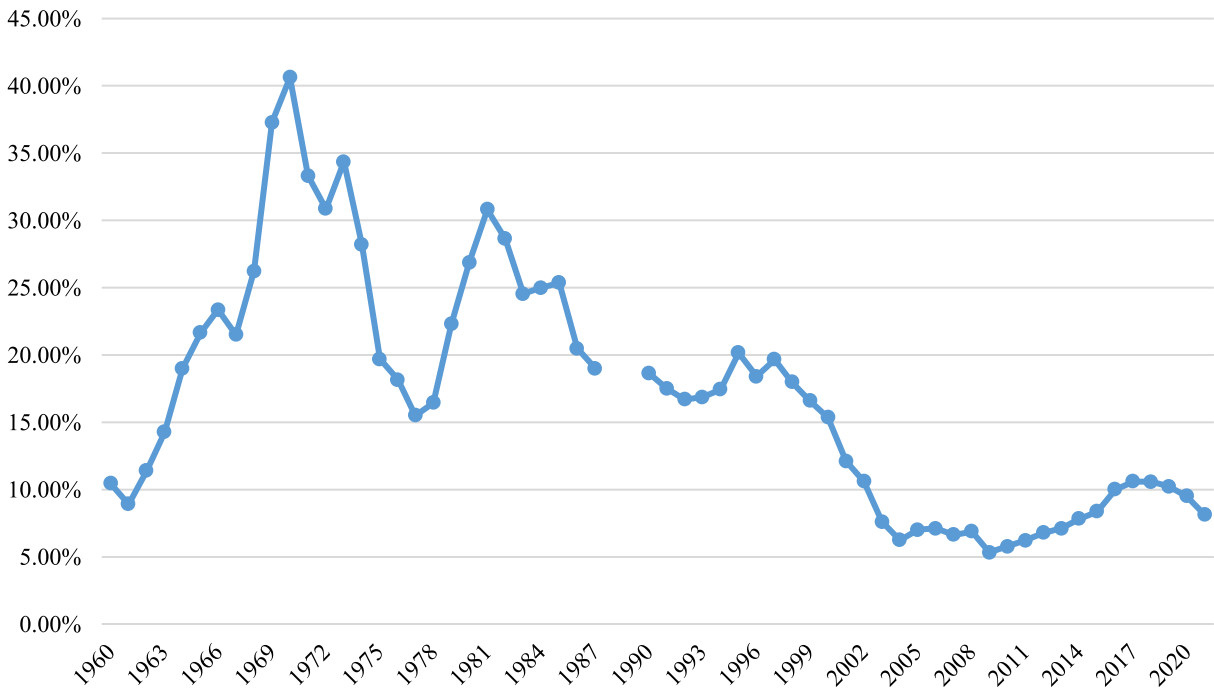
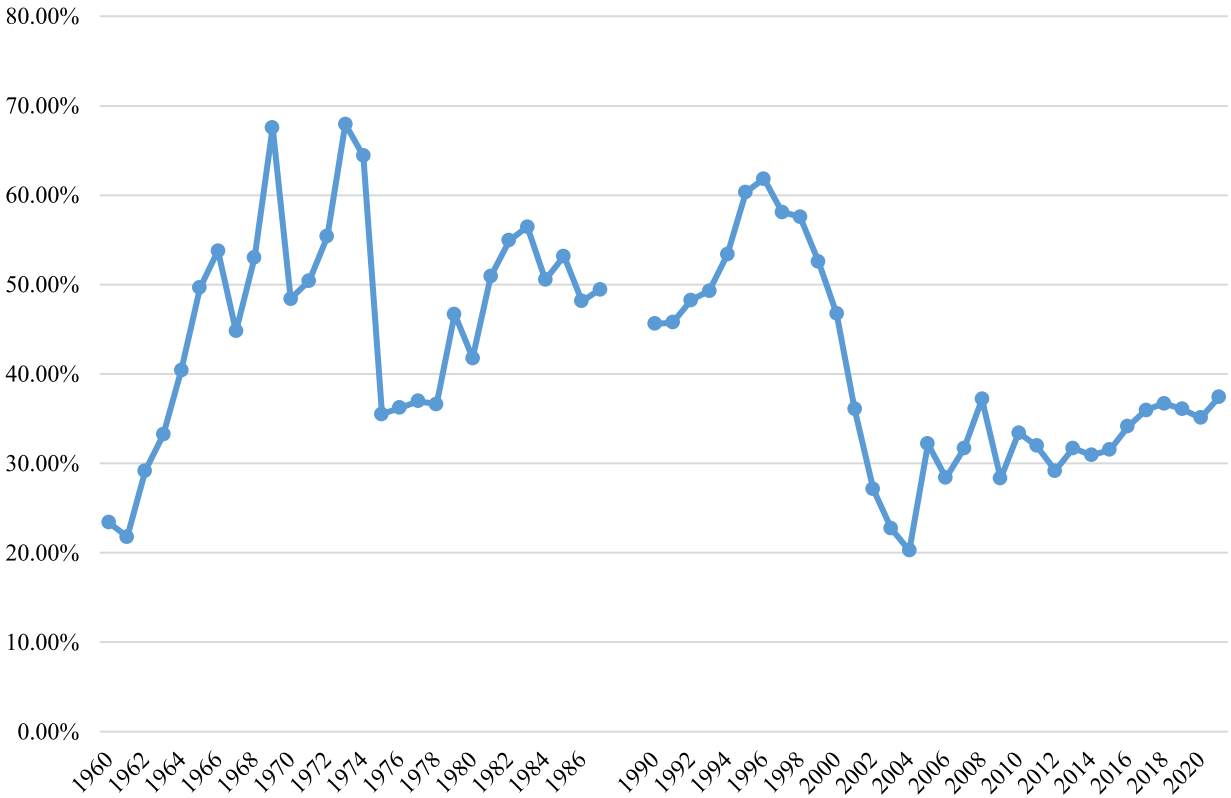


Figure 11: Mobile Home Share of Single Family Housing Production

Mississippi



Oklahoma

