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Elena Falcettoni
Board of Governors of the Federal Reserve System

James A. Schmitz, Jr.
Federal Reserve Bank of Minneapolis

Mark L. J. Wright
Federal Reserve Bank of St. Louis

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

Elena Falcettoni[†]
James A. Schmitz, Jr[‡]
Mark L. J. Wright[§]

Abstract

We show that the first and only experiment of U.S. mass production of houses, in a factory-built home industry that became known as the Mobile Home industry (and today, as the Manufactured Home industry), was a tremendous success. Mobile Home prices–psf fell by two-thirds from 1955 to 1973, as productivity soared; home quality rose significantly, with Mobile Home building codes receiving ANSI certification in 1963 and National Fire Protection Association co-sponsorship in 1965; as production soared, Mobile Homes accounted for one-third of single-family homes produced in the early 1970s. These feats were achieved as industry leaders developed state-wide building codes for Mobile Homes. This dramatically increased the size of the market for them. Factories invested in specialized machinery to produce simple and standardized products, substituting machinery for labor. Given each factory produced under the same code, industry-induced productivity gains followed, including external effects and directed technical change. Lessons from this industry give insights into critical issues in today's residential construction industry. The poor productivity performance of today's residential construction industry is considered a puzzle. But this poor performance is not new. Our forebears before 1950 wrote extensively about the sector's poor performance, attributing it to the failure to adopt factory-built housing. Our analysis strongly supports this view – for their time and ours. It also supports their view, like that of Levitt & Sons, that factory production is the only way "to produce the homes and apartments needed to house our expanding population and our underprivileged citizens in a comfortable, dignified, decent way," (U.S. Senate 1969).

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

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[†]Board of Governors of the Federal Reserve System (email: elena.falcettoni@frb.gov)
[‡]Federal Reserve Bank of Minneapolis (email: jas@minneapolisfed.org)
[§]Federal Reserve Bank of St. Louis (email: mark.wright@stls.frb.org)

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 manufacturing process. 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 hundreds of years old.[1] However, housing has *always* faced a somewhat unique problem when trying to achieve mass production. When Henry Ford produced cars in one of his factories, there were no local producers of cars in that area. When a 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 faced significant opposition from stick-builders. None of the attempts at mass production succeeded.[2]

[1] For 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]."

[2] See, for example, Thurman Arnold (1947) for how resistance by incumbents in the stick-built sector

It was not until the late 1940s 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, lasting from roughly 1948 to 1973, yet it achieved what had been hoped for – factory-built homes greatly expanded home ownership for low and middle income households. From 1960 to the early 1970s, Mobile Home industry production rose from 100,000 to 600,000 units a year, and it was rising as fast as ever. Its share of single family housing production was one-third in the early 1970s, and rising; it exceeded 50 percent in 14 states.[4] Not only was this episode the first successful U.S. experiment in mass producing homes, it remains the only one.

The purpose of the paper is to seek to understand how the Mobile Home industry achieved mass production. We argue it was the industry's ability to develop state-wide building codes that led to its success.[5] Factory-built homes that predated Mobile Homes, homes that we discuss throughout the paper and break into two groups, "Modular Homes" and "panelized homes," were built to local building codes.[6] A home manufactured for one town's code could

sabotaged factory production of homes. Arnold, among many other accomplishments, ran the antitrust division at the Department of Justice under FDR from 1938-1943. He brought indictments against many groups that were sabotaging factory-built homes during his tenure. More below on the sabotage of factory-built homes.

[3]We have chosen to capitalize some words to avoid confusion. For example, the term "mobile home" is a generic term. As an Idaho judge explanied, 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.

[4]By "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).

[5]A building code is a list of standards that a building must satisfy. These standards are for various aspects of buildings, like fire safety and energy efficiency.

[6]The 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

be sold there, but not in other nearby towns with different codes. A major consequence of state-wide building codes for Mobile Homes was to increase the size of the market for them relative to other factory-built homes. With a state-wide code – that is, an identical building code for all locations within a state – a home manufactured for a given town could be sold at any location in the state.

This expansion of the market for Mobile Homes led to many sources of productivity gains, which we divide into *factory-induced* gains and *industry-induced* gains. It created incentives for a "factory" to invest in specialized machinery (and layout designs) to produce simple and standardized products.[7] These investments led to *factory-induced* productivity gains, as the factory increased its scale, and simultaneously replaced high skill workers with machinery and low skill workers.

While productivity gains followed from a *factory producing under the same code (or process)* for each of its houses, other productivity gains followed from *each factory in the industry producing under the same code.* These industry-induced gains included *external effects (or spillovers)* and *directed technical change* (i.e., the innovation of suppliers).[8]

homes that are not Mobile Homes. Mobile Homes were typically delivered to their housing sites by placing them on a chassis, fitted with axles and wheels. They were then towed by trucks. Modular Homes were typically delivered by placing them on flatbeds of trucks, using cranes and specialized labor. 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.

[7]Here is Paul Mazur (American Prosperity (1928)) on such machinery: "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. Here is Mazur again: "... take away the standardized product, and the machine has value only as junk."

[8]With a state-wide code, all factories must meet, or exceed, the same standard in the code for each aspect of the home. This does not guarantee that all factories will produce to the same standard (some may exceed a standard) or use the same process. But some coordination is expected. Moreover, the trade association in the industry worked on coordinating processes across factories (see Section 6 below).

There was another key factor that enabled the industry to achieve mass production.[9] As we said, factory-built homes have always been resisted, including those that predated Mobile Homes. But the opposition to Mobile Homes was far greater. Opponents in the stick-built industry successfully argued that Mobile Homes weren't homes at all. Mobile homes were consequently banned from traditional residential areas. Mobile Home manufacturers were forced to develop markets in areas where there was little local control over Mobile Homes. The mass production "experiment," then, consisted of an identical state-wide code, coupled with little local control over the homes.

While the mass production of Mobile Homes is the main focus of the paper, we've learned important lessons about other critical issues. Here are some questions we discuss: (1) Why did mass production of Mobile Homes end in 1973?; (2) Why haven't other factory-built home industries achieved mass production?; and (3) Why has the residential construction industry had such a poor productivity performance over the last several decades?

Our initial research on the Mobile Home industry was, in fact, directed at understanding why the industry collapsed after 1973. The research shows, in short, that the industry was sabotaged by those opposed to its success — groups of stick-builders, of course, but many others, like particular groups in the financial industry that financed Mobile Homes as cars (see Schmitz, Teixeira and Wright (2018), Schmitz (2020a) and Schmitz (2020b)). Further research over the last few years has found more evidence that the collapse was due

[9] Thus far we have implicitly defined mass production. More formally, we define mass production as a manufacturing process meeting a few criteria. First, it's a production process, one spurred by the development of highly specialized machinery, that manufactures simple and standardized products. Second, it's a process that achieves a large size – very large scale production at the "industry" level. Third, the factories in the industry benefit from external effects and directed technical change. This last requirement could be stated in terms of significant productivity growth that leads to very large price declines.

to such sabotage. We briefly discuss this research below. This research will be compiled in a companion paper. We decided to first explore the period of mass production, in this paper, before completing the companion paper.

In this introduction, we begin by describing the banning of Mobile Homes from traditional housing channels. This banning, paradoxically, set the spark that led leaders of the Mobile Home industry to develop state-wide codes.[10]

Banning of Mobile Homes. Factory-homes that pre-dated Mobile Homes, again, Modular Homes and panelized homes, were not banned from traditional housing channels. They were permitted in single-family residential districts. They were subject to the same building codes and zoning ordinances as traditionally built homes. But they faced significant opposition. Many methods were used to block them, but that these factory-homes were subject to the same "local" building codes as stick-built homes essentially shut off any chances of mass production. These "local" building codes typically 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, which is tied to repetitive production, thus reducing the incentive to invest in specialized machinery. When these factory-built homes were being introduced, local builders obviously strongly supported the continuation of local

[10] Very little has been written about the Mobile Home industry, not only in the economics literature but in general. Hence, we needed to construct a significant amount of the general history of the industry (and its institutions, etc.) as part of our research on mass production. We need to explain some of the history so as to explain our research on mass production. That's the reason (at least one of them) for why the introduction is lengthy.

codes (and opposed any attempt to develop more uniform codes).[11]

It's hard to imagine that the prospects of Mobile Homes were better than Modular Homes or panelized homes.[12] Many opponents of Mobile Homes wanted to ban them outright. To ban Mobile Homes, opponents argued they 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.[13] To create this fiction that Mobile Homes were Trailers, opponents argued that both were placed *on a chassis fitted with axles and wheels.*[14] For many local zoning boards, many of whose members were stick-builders or similar, this 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 the beginning of the industry, the chassis would often remain attached to the home. But as the industry developed, the chassis was removed, and the house often placed on a *permanent foundation.*

[11] A whole array of other local groups were strongly opposed to factory-built homes, in general, and they supported local building codes. Factory-home manufacturers faced a "perfect storm" of opposition. Some of these groups included local unions, who clashed with builder associations on many issues, but joined with these associations to support local codes. Local building inspectors supported local codes, fearing that homes with identical codes would be inspected in "far away" factories. Local materials suppliers, who made materials to the specifications of the local codes, supported them. Local banks supported them as well, fearing a loss of value of mortgages with the factory-built homes selling for vastly lower prices. With all these groups opposed, factory-home builders had little chance to introduce uniform codes. Modular Homes and panelized homes performed very poorly.

[12] 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, and so the zoning regulations would "bite" for Mobile Homes.

[13] As "trailer" is a generic term, we use the capitalized "Trailer" to refer to the primitive shelters opponents referred to. These shelters had no bathrooms and no kitchens – they were a place to carry belongings and rest one's head at night. Trailers had been banned from towns.

[14] Mobile Homes were delivered on a chassis because the alternative delivery method, using 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 hoseholds. 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.

Mobile Homes, then, were banned from residential areas.[15] Yet the industry developed markets in two types of areas where there was little local control over Mobile Homes. First, while many towns banned Mobile Homes entirely (i.e. from residential areas and all other areas), other towns permitted Mobile Homes in industrial areas and dumps, but then typically restricted them to Mobile Home parks.[16] When Mobile Homes were placed in these industrial areas, there were *no local building codes for houses.* Second, Mobile Homes were placed in towns that did not engage in "building regulation activities."[17] As reported in United States Congress (1969a, Table 2, p. 209) (the Paul Douglas report), of all towns in the United States, 46.7 percent had no zoning ordinances and 53.6 percent had *no local building codes* (see Manvel 1968).

Development of State-wide Building Codes. The leaders of the industry who formed a trade association, the Mobile Home Manufacturers Association (MHMA), recognized that if they developed a building code and they convinced states to make the code mandatory for all Mobile Home producers, then the industry would have an identical code at each location (where they were permitted) in the state. The MHMA accomplished this feat. The MHMA began developing codes in the early 1950s; by 1960, it had developed a code that it required members to follow. By 1963, the code was certified by the American Standards Association (later called ANSI, see below). In 1965, the National Fire Protection Association (NFPA) joined as a cosponsor of the code. In 1965, the MHMA began lobbying each state to make the code mandatory for all manufacturers – not just MHMA members. By 1973, 44 states

[15] They were blocked from traditional mortgage markets as well – they were financed as cars (see below).

[16] There were likely numerous reasons why towns permitted them in these undesirable areas and did not completely ban them. One reason is that some towns faced "constitutional" challenges to banning Mobile Homes. Allowing them in these industrial areas was a way to deflect the challenges.

[17] These governments were typically in rural areas and small towns.

had done so (see Cooke, et al, 1974).

Industry-Induced Productivity Gains. As we argued, these identical building codes enabled the industry to achieve many sources of productivity gains. Here, briefly consider industry-induced gains. Again, with many factories producing houses built to the same code and using a similar process, manufacturers benefited from *external effects*. An important source of these spillovers was the development of organizations that built industry infrastructure. This infrastructure was useful to existing firms (and firms considering entry) and it was free of charge. The MHMA was obviously one such organization, as it developed the state-wide building codes that were necessary if the industry had a chance to mass produce homes. It developed many other types of infrastructure, as described below.[18]

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.* The MHMA recognized this. In the MHMA's 1965 Annual Report, they wrote that " ... because of a concentrated, ready market, suppliers have been able to devote their research facilities to development of new products and applications which would not have been otherwise feasible." The MHMA not only recognized this, but was actively engaged in supporting directed technical change as described below.

Great Success of Mass Production. Mobile Home prices-per-square-foot (prices-psf) were, initially, 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

[18] Other organizations that built industry infrastructure included Agricultural Extension Services, both state and local, that wrote about Mobile Homes (see below).

made at small sizes.[19] In 1955, the price of a Mobile Home was $18 per square foot (in 1960 dollars), compared with $11 for a stick-build home. In 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.[20]

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. Mobile Home prices-psf were half traditional prices-psf by 1973, and this relative price was falling fast.[21]

In addition, over 1955-73, the quality of Mobile Homes was significantly increasing relative to 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,* just as traditional homes were. 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.[22]

Given significantly falling prices-psf and rapidly increasing quality, Mobile Home production soared. From 1960 to early 1970s, production increased from 100,000 to 600,000 units, and

[19] On this point, see the discussion below of James Price, CEO of National Homes.

[20] Why not build smaller stick-built houses? As a factual matter, the price-psf of traditionally built homes decreases with the size of the house, while Mobile Home prices-psf increase with the size of the house.

[21] The rapidly falling Mobile Home prices were driven by the industry's significantly increasing productivity over the period. From 1958 to 1972, TFP increased at an annual rate of 2.74 percent (see Bartelsman and Gray (1996) and discussion below).

[22] In many areas, there were no local building codes, so Mobile Homes were very likely of higher quality than most stick-built homes.

was taking a larger and larger share of the single family market from traditional builders. Not surprisingly, Mobile Homes were capturing the "lower-priced" end of the stick-built market, and were working their "way up" the price-ladder (see below).

Related Literature.[23] Our forebears wrote extensively about factory-built housing and its great potential during the first half of the 20th century (see below). But after 1950, our profession simply forgot about factory-built homes and their great potential. One exception were the economists at Morgan Guaranty Trust Company (MGTC) who wrote a series of articles on the potential of factory-built housing in the late 1960s and the early 1970s.[24] MGTC (1969) illustrated, for example, that over the period 1948-1968, residential construction costs rose roughly 100 percent, while prices of durable goods manufacturing (containing industries of similar nature to factory-built housing) rose only 22 percent.

Another exception were the economists writing about the Mobile Home industry during its era of mass production. Newman (1966) argued that Mobile Homes should play a significant role in U.S. housing production. Drury (1972) understood how the Mobile Home industry had been shunned from traditional housing channels yet was providing opportunities for low income households. Greenwald (1970) wrote about the success of the industry but emphasized how much more could be achieved if not for the resistance to the houses. And MGTC (1971) discussed how the factory-built housing industry was already achieving great success with the Mobile Home industry.[25]

[23] We briefly dicsuss a few pieces of related literature here. We will be discussing other related literature throughout the paper.

[24] For full disclosure, Schmitz worked at the research department of MGTC from 1979 to 1980. He says, "It was an impressive research group, so I'm not surprised they were aware of the importance of factory-built housing (as so many other economists were not and still are not) and had written well about it."

[25] One passage reads, "Among the growth industries of the Sixties, few were more dazzling than mobile homes."

As our profession has written next to nothing on factory-built housing, there is obviously very little on building codes for such houses. There is a literature, though small, on local building codes. Here the emphasis is on the extent to which building codes are "excessive," that they add unnecessary costs to building homes (see, e.g., Oster and Quigley (1977)).

A natural question here is: What would be the impact on the productivity of stick-built construction if local codes did not vary much over wide areas or, similarly, What would be the impact on their productivity if stick-builders could reach significant scale. There were such experiments in the 1940s and 1950s, such as that by Levitt and Sons on Long Island. As we argue in Section 6, these experiments were not mass production, as defined here, and as the Levitts acknowledged (see below, shortly), the methods did not solve the problem of meeting low-cost housing needs, as only factory-built housing could.

Other disciplines have written about building codes. A widely cited report published by the U.S. Advisory Commission on Intergovernmental Relations (1966) (which we label ACIR) discussed building codes for factory-built homes. They emphasized the role of uniform building codes in the Mobile Home industry's success. They pointed to its success to illustrate what uniform codes could accomplish in other factory-built home sectors.[26]

The rest of the paper proceeds as follows. Section 2 presents evidence on the zoning restrictions placed on Mobile Homes. Section 3 discusses how the Mobile Home industry developed

[26] This is from ACIR:" ...The impact and accomplishments of the mobile home industry — an often overlooked competitor of conventional housing — may indicate the feasibility of development of uniform standards by the residential construction industry and show the future of mass production techniques. Construction of mobile homes is, of course, not regulated by local governments, although local sanitary and land use regulations may be imposed by local officials. In 1964, production of mobile homes reached about 18 percent of private, one-family house starts. Yet, something close to 85 percent of the mobile homes are fixed in place as permanent dwellings. ..... the mobile home escapes local building restrictions, costly site construction, and craft organization of labor — all of which boost the cost of traditional housing." (p. 3)

state-wide building codes. Sections 4 (discussing prices and productivity) and Section 5 (discussing production) present the great success of the mass production of Mobile Homes. Section 6 argues the identical building codes led to 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.

Sections 8-10 address some of the questions listed above, with Section 8 discussing "Why date the end of mass production, really, the beginning of the end, in 1973?" The initial opposition to the Mobile Home industry involved local regulations, like zoning ordinances. As those regulations were failing to stop the industry's growth, stick built producers turned to the federal level for ways to sabotage the Mobile Home industry. Several major federal initiatives were undertaken against Mobile Homes in the late 1960s and early 1970s. The crushing blow was HUD-sponsored 1974-legislation that marked the beginning of the end for mass production of Mobile Homes — that is why we date mass production from 1948-1973.[27] This legislation established a national building code (i.e., the "HUD-code") for Mobile Homes that preempted the state-wide Mobile Home codes. The new code raised the costs of manufacturing the home while at the same time reducing its quality.[28]

[27] The National Mobile Homes Construction and Safety Standards Act of 1974, 42 U.S.C.

[28] One feature reducing its quality 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, reducing the desirability or quality of the home. Having 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.

This leads us to another lesson from the success of the Mobile Home industry: The importance of understanding what groups are writing the state-wide (or nation-wide) building code. In the state mobile home codes, it was the MHMA, who obviously wanted the industry to succeed, along with model-code groups, that wrote the codes. In the HUD-code, it was leaders of HUD (who were typically on leave from their stick-built companies) who wrote the code (often ignoring complaints from model-code groups that the codes were too onerous). This is a lesson Adam Smith taught us 250 years ago.[29]

Section 9 considers why no other factory-home sector (e.g., Modular) has reached mass production. We've already mentioned these sectors were subject to local building codes when introduced in the first half of 20th century. There was a push in the late 1960s to introduce state-wide codes for them. In 1969, HUD launched a major project, Operation Breakthrough, which had the goal of igniting mass production in factory homes (by which they meant Modular and panelized homes). A key part of the program was to develop a system of state-wide building codes for these homes. State-wide codes were developed that were poorly designed. They have failed to deliver any semblance of mass production. HUD completely ignored the Mobile Home industry in its Operation Breakthrough. This industry had, of course, already achieved what Operation Breakthrough had as its goals. We can see from the successful experience of Mobile Home codes why those designed during Breakthrough were doomed to fail.

[29] Here is Smith talking about monopolists (i.e. mercantalists), groups of this "order," proposing legislation. "The proposal of any new law or regulation of commerce which comes from this order ought always to be listened to with great precaution, and ought never to be adopted till after having been long and carefully examined, not only with the most scrupulous, but with the most suspicious attention. It comes from an order of men, whose interest is never exactly the same with that of the public, who have generally an interest to deceive and even to oppress the public, and who accordingly have, upon many occasions, both deceived and oppressed it."

Section 10 discusses the recent poor productivity in residential construction. Many consider it a puzzle. This sector's poor performance is not new. Our forebears in the first half of the 20th century wrote extensively about its poor performance. It was no puzzle for them. They concluded – with near unanimity – that it was the failure of the residential construction industry to adopt factory-built housing that led to the poor performance. Our analysis here strongly supports our forebears' view that the poor performance in their time was due to lack of factory-built home production. It supports the same conclusion for our time.

Slow productivity growth, or none, can lead to "affordable housing" issues. Our forebears, of course, connected the two — and that is why they called for factory-production of homes. Levitt & 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," (U.S. Senate 1969).

That the Mobile Home industry was making progress on affordable housing was widely recognized. Here is future president Gerald Ford, in a speech in 1973 to Mobile Home manufacturers: "You are entrepreneurs in the best tradition of the free enterprise system."[30] "Your industry fulfills a definite need. Statistics show that virtually all of the housing purchased by the $15,000-and-under income group is supplied by your industry."[31] and "...there is no

[30] By this he meant that Mobile Home producers were receiving no subsidies.

[31] Ford also discussed how quality was increasing. "You are to be congratulated for turning out a steadily improving product." ... "There is no question that the mobile home industry took a big step forward with the adoption of the American national Standards Institute A-119.1 standard and the National Fire Protection Associations standard 501.B."

question that the mobile home industry holds revolutionary potential for future advancement in the field of housing." The revolution, of course, was well underway when Ford spoke. It was very shortly to be crushed by HUD.

2 The Fiction: Mobile Homes Are Trailers

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

A. *Mobile Homes were not Trailers, were not vehicles, and were seldom moved.* Mobile Homes were not Trailers (as described above). Since opponents argued they were not homes, 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 feet 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 model. In 1962, the 12-foot-wide home was introduced, and it quickly replaced the 10-foot-wide one. A report on housing in California (California Governor's Advisory Commission on Housing Problems

1963) remarked on this "immobility" feature (and others) of Mobile Homes.[32] Because the homes were very difficult to move, the ACIR (1966) reported 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 (Maricopa County Planning and Zoning Dept. 1963) remarked on this feature (and others) of Mobile Homes.[33] On this same point, Levitt & Sons, in testimony before Congress, stated that "mobile homes, 90 percent of them, end up on a foundation and are not mobile at all" (U.S. Senate 1969).

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 conventionally built or prefab one-story dwelling."

Despite Mobile Homes reaching significant sizes, and despite them being taken off their

[32] The report notes, "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" (634).

[33] The 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*" (40).

chassis and put on permanent foundations (often with basements), they still faced significant zoning restrictions because of the fiction that they were 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, or retail), 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 ban 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.

There were two major efforts to summarize zoning regulations for Mobile Homes in the United States. Greenwald (1970) 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.[34] Some of the information from this census is presented in Figure 1.

The red areas in the figure are townships that completely banned Mobile Homes. There are large differences 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 –

[34] As Greenwald wrote, "To determine the role of mobile homes in New England, [we] contacted all 1,384 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".

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.[35]

Non-rural towns banned Mobile Homes more than rural areas did. 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 (unlike the rest of state) and the Portland area of Maine (unlike the rest of state).[36]

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 percent.[37] The (solid) 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.[38]

[35] Note that the black triangles in the figure represent Mobile Home parks. In many red areas, there are parks. This likely means that towns that had once permitted Mobile Homes in parks later banned them entirely. We thank Andrew Goodman-Bacon for asking about these parks in red areas.

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

[37] Again, 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 home share is $y/(x + y)$, and since $y > x$, mobile home share is greater than $y/(y + y) = 0.5$.

[38] It'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 colored either gold or white (no Mobile Homes placed), with one exception. The entire state of Connecticut has a similar pattern.

Bernhardt (1980) contacted state officials about the zoning regulations on Mobile Homes in their states.[39] Table 1 presents findings from this survey. Column 1 lists the state officials' estimates of the fraction of towns that completely banned mobile homes. The estimates for New England states are roughly like Greenwald's. 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 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 completely banned Mobile Homes. The percentage of towns 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 of them that confined Mobile Homes to parks.[40] The table shows that many states have very high percentages of these towns.

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.

[39] More specifically, Bernhardt says that "an appropriate official in each state government and state or regional trade association was contacted through correspondence and personal interviews and asked to provide any information available concerning the status of land-use controls relevant to mobile homes in each state".

[40] The other towns that allowed them to be in industrial areas have more "lenient" zoning, in that they can be placed on single lots as well as in parks.

While ordinances would restrict Mobile Homes, there was not a universally agreed-upon definition of what Mobile Homes were. 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 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 and the other Idaho. Each state receives "good marks" if we look at Bernhardt's statistics. In Tennessee, only 1 percent of towns completely banned Mobile Homes, while

of those towns that allowed them in non-residential areas, only 35 percent restricted them to parks. Idaho is one of the top states in "welcoming" Mobile Homes, with only 1 percent of towns completely banning them. While of those towns that allow Mobile Homes in non-residential areas, only 10 percent restricted 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 were greater costs of delivery on a flatbed. The potential benefit was placing the home in a residential area. Perhaps, some zoning clauses that mentioned Trailers, or made reference to a chassis, could have been bypassed. But de facto zoning might well have block the placement. If not, the Mobile Home would have faced the same zoning restrictions as Modular Homes. It would not likely

have met the zoning restrictions on minimum floor sizes. The Mobile Home would have also needed 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).[41] There are standards for many aspects of a house, such as fire safety, energy efficiency, plumbing, electricity, 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 each U.S. state. At the start of the 1950s, some 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 often referred to only a limited number of aspects of buildings. Rather than developing more comprehensive codes (of many standards), U.S. states gave wide latitude and authority to localities to develop their own building codes. The ACIR report on these codes starts with the following sentence: "Traditionally, building code preparation, administration, and enforcement has been delegated to local government by the State as an exercise of State police powers" (1966, 1).

[41] The codes can be performance codes or specification codes.

Localities developed building codes for residential areas and non-residential areas (such as industrial or retail areas). The residential building code applied equally to stick-built homes, 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.

Again, when Mobile Homes were introduced, they were shunted into industrial districts in which the only building codes were for industrialized buildings. As a result, these localities did not develop a residential building code for Mobile Homes. That is, these localities had banned Mobile Homes from residential areas for not being homes, which left them in no position to now claim they were homes. Manufacturers also looked to sell Mobile Homes in towns with no building regulations, so there would be no zoning regulations or building codes. Industry leaders soon set about developing sate-wide codes for these areas. 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. First, the MHMA started developing a code in-house, with experts from within the industry. It started with a few standards and added to them over time. Second, the MHMA then began to work with experts from outside the industry, so as to tap more expertise, and so that their codes received certification from national testing groups, giving more credibility to their project. Lastly, the MHMA then convinced states to pass legislation making these codes mandatory under the law.

The first stage began in the early 1950s, when MHMA, in conjunction with the Travel

Coaches Association (TCA), began developing standards for a code. These standards were developed by engineers from within the industry. The standards became titled the "MHMA-TCA Standard" (MHMA Annual Report 1963, 4). In March 1960, these standards for Mobile Homes became mandatory for MHMA members (10).

The second stage involved engaging with traditional code setting groups. The MHMA sought to publish their updated 1963 code under the auspices of the American National Standards Institute (ANSI), which at the time was known as the American Standards Association. The MHMA asked the ANSI to certify its code. Officially, the MHMA and the TCA would be "sponsors" of the MHMA-TCA Standard. ANSI then had a process for certifying the code. Committees were formed to review and potentially certify the code. [42] According to MHMA, "The committee included representatives of such organizations as the Underwriters' Laboratories, American Gas Association, National Electrical Manufacturers Association, American Society of Mechanical Engineers, and insurance and financing groups including the American Bankers Association" (Annual Report 1963, 4). The 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, 10).

During this second stage, more standards were added to the code. For example, construction standards were added to the three standards above (plumbing, heating, and electrical).

[42] As decsribed by ANSI, "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." See "Understanding Building Codes," National Institute of Standards and Technology, https://www.nist.gov/buildings-construction/understanding-building-codes.

Construction standards consist of requirements on the body, frame, chassis and running gear of the Mobile Home. The MHMA commissioned the Battelle Memorial Institute to develop standards for these features of the homes (MHMA Annual Report 1965, 30).[43]

Another major development during this stage was that in 1965, the National Fire Protection Association (NFPA) joined the MHMA and TCA as a cosponsor of American Standard A119 (Annual Report 1965, 30). So, as early as 1965, the building code for Mobile Homes had standards (including for fire safety) approved by the NFPA. The cosponsorship of the NFPA was only one important success of the year. "The high point of the past year occurred on February 16, 1965 when the Awards Committee of the American Standards Association which had previously unanimously approved presentation of the Howard Coonley Medal to the Mobile Homes Manufacturers Association Standards Committee Chairman, Earl W. Swett."[44]

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

The third stage, a crucial one, which began in 1964, was to convince states to make these codes mandatory under state law for all Mobile Home producers (not only MHMA members). As discussed in the 1964 Annual Report, "Legislatures in 47 states will meet in regular

[43] The MHMA understood well the concept of "directed tecnical change," so "The emphasis throughout this program is on performance rather than design based specifications, which may tend to discourage innovation and limit the use of new materials and techniques as they inevitably become available." Much more below on directed technical change.

[44] This is a description of the award, downloaded from the ANSI website on August 14, 2024: "The Howard Coonley Medal honors an executive who has rendered great service to the national economy through voluntary standardization and who has given outstanding support to standardization as a management tool. The selection of a recipient for this medal will be primarily based on that individual's service to the national economy through their work with, and support of, voluntary standards. Note: Only one Howard Coonley Medal may be awarded per year. If, in the judgment of the Awards Committee, no candidates meet the eligibility requirements, an award may not be given. The Awards Committee reserves the right to present a nominee with an award other than the one for which they were nominated."

session during 1965. A major goal of MHMA for the year is to have legislation introduced in as many as possible to bring about a requirement for all mobile homes and travel trailers to be constructed in accordance with the standards approved by the American Standards Association for electrical, plumbing, and heating installations. This major Association project, if effected, will bring safer and more efficient living to" buyers of Mobile Homes (22). This project was also successful. Table 2 shows that as of December 31, 1973, 44 states had enacted legislation for that Mobile Home codes mandatory for all producers.[45]

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 those of traditional homes during the period of mass production.

A. *Prices of Mobile Homes and traditional homes: Early 1950s to 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 dollars). From 1955 to 1973, Mobile Home prices fell from roughly $18 to $6, a drop of two-thirds.[46] The prices of traditional homes change little over the period. Prices for Mobile Homes, then, significantly fell relative to prices for traditional

[45]Note that if the state itself had a code for buildings, the Mobile Home producer would still face an identical code at each location.

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

homes. Figure 2B plots these prices with the normalization that 1973 prices equal 1.00.

Figure 3A makes the same plot, 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 to 1973, the CR prices increase a bit faster than the FHA prices. The conclusion that Mobile Home prices fell significantly relative to those of stick-built homes 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 to 1973.* The quality of Mobile Homes increased significantly faster than that 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.[47] Over the same period, the average size of traditional homes increased far slower. Another dimension of quality is the standards to which homes are built. As we discussed in the last section, the Mobile Home industry was adding many *standards to its building codes* over the period – and it was surely doing so at a faster rate than stick-builders. Lastly, Mobile Homes were being made to look like traditional homes. When arriving at their home site, they were *taken off their chassis and placed on permanent foundations*, being affixed to the ground like traditionally built homes.[48]

C. *Prices and quality after 1973.* As we said above, we focus on the period after 1973 in a

[47] The average size roughly tripled from 1955 to the late 1960s.

[48] Choices in styling were also increasing. MGTC noted, "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" (1971, 9).

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 follow-on regulations in 1976, and (ii) discuss the expected impact of the requirements on prices, quality and production.

The 1974 legislation contains the requirement of the permanent chassis. As we discussed above, this significantly reduced the desirability, or quality, of the house. 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.[49] This increase shifts the marginal cost curve up, leading to higher prices and further declining production.

The follow-on regulations in 1976 increased the costs of manufacturing the home. The regulations significantly increased some standards that Mobile Homes had to meet. For example, they 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 on fire safety: "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." HUD also developed an energy code that was very strict. In response to criticism, the HUD secretary argued that "energy conservation is a major national priority. As such, it was determined that none of the existing codes or standards was adequate for adoption as

[49] Among a few of the reasons was the increase in the cost of materials in making the home. Prior to the permanent chassis requirement, the chassis could be "reused" after the delivery of the home.

a Federal standard" (for a discussion and references, see Schmitz 2020, 189-191).

The increased fire and energy standards raised the cost of making the home, shifting the marginal cost curve up, leading to higher prices and lower output. While the increased standards raised the quality of the home, 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.

Summarizing, we expect the *direct impact* of the HUD code regulations to *decrease quality* (in a significant way), lead to *higher prices*, and *reduce industry output.* There are also important *indirect impacts* resulting from the drop in production. We argued above that increases in industry scale would increase productivity, leading to future price declines and increases in production. The same holds true in reverse: decreases in scale lead to increases in prices and decreases in production. These effects are stretched out over 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 been seen in Figures 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 (TFP) increased at very significant rates before 1973 and stopped afterwards (see NBER Manufacturing Industry database, Bartelsman and Gray

(1996)). Mobile Home industry TFP is estimated to have increased at the annual rate of 2.74 percent from 1958 to 1972.[50]

5 Mass Production Achieved: Soaring Output

We begin by showing that the production of Mobile Homes soared during the period of mass production, while the construction of traditional homes significantly declined.

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 60,000 to 120,500 units. They doubled again over 1959-1967 from 120,500 to 240,400, and once again over 1967-1971 from 240,400 to 491,700. They increased by 17 percent from 1971-1972 (491,700 to 575,900). As result of the severe 1973-1975 recession, shipments fell from 579,900 to 212,700, a drop of 63 percent.[51]

Figure 5 presents Mobile Home shipments and housing starts.[52] Housing starts fell from roughly 1,200,000 to 800,000 from 1959 to 1968. Housing starts are volatile, but it was fairly clear that the great increase in Mobile Home shipments was behind their precipitous drop in the 1960s, as the drop was centered in the lower-price end of the housing market. For

[50] During this period, the Mobile Home industry was grouped with the Travel Trailers and Campers industry in SIC 3791. It was not until 1972 that the Census created two separate SICs for these industries, Mobile Homes (SIC 2451) and Travel Trailers and Campers (SIC 3792). Bartelsman and Gray therefore had to make assumptions about how to "split" the SIC 3791 data into two parts in estimating Mobile Home TFP growth. We are currently considering alternative assumptions, as well as assessing what additional data we can bring to this estimation project.

[51] Shipments significantly fell in all other recessions too. From 1948 to 1949, they fell from 85,500 to 46,200, a drop of 46 percent.

[52] Housing starts are, again, construction of traditional homes plus production of Modular Homes and panelized homes. The traditional homes we consider are single-family, detached homes.

example, Miles and Robinson (see Table 2) present the distribution of sales prices for new single-family traditional homes over 1965-1968 (1973, 16). From 1965 to 1968, the sales of new traditional homes for under $15,000 fell from 21 to eight percent of total sales. For homes whose prices were $15,000 to $20,000, the share dropped from 29 to 22 percent.

It was clear the drop would continue if nothing was done. In response, HUD introduced subsidy programs for those buying traditional housing in the Housing and Urban Development Act of 1968. One such program was Section 235, a huge subsidy 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.[53] Subsidized single-family housing starts under Section 235 and a Department of Agriculture program (also for single-family homes) increased from 28,000 to 208,000 units from 1968 to 1971 (see Table 5 in Miles and Robinson 1973, 19). Yet Mobile Homes continued their capture of the lowest end of the housing market. After the sales of traditional homes selling for under $15,000 fell from 21 percent to 8 percent of total sales from 1965 to 1968, the sales continued to drop from 1968 to 1972, from 8 percent to 2 percent (see Table 2 in Miles and Robinson 1973, 16). In the next price-class, traditional homes selling for between $15,000 and $20,000, the share did significantly increase from 1968 to 1970, from 22 to 31 percent. But as the funds for Section 235 began to dry-up, the share quickly fell from 31 to 17 percent over 1970-1972.

B. *Mobile Home share of single family production 1947 to 1973.* Figure 6 presents the Mobile

[53]Here is how MGTC (1971) described the program: "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." Mobile Homes did not meet government construction standards because they were built to small sizes. See the discussion below by James Price, CEO of National Homes.

Home share of single family production. The share bounced around 5 percent in the early 1950s, before increasing to 10 percent in the years after 1955. It hovered just below 10 percent after that. There were two recessions in this period, which likely led to this stalled growth. Then, over the 1960s, the share increased from 10 percent to over one-third. The share decreased during the early 1970s recession, before bouncing back by 1973 to one-third.

As might be expected, given the significant differences across states in zoning regulations, the Mobile Home share by state varied widely.[54] Table 3 presents the three year average (1971-1973) of each state's Mobile Home share. In the Northeast, the shares in Connecticut, Massachusetts and New Jersey were in the five to six percent range. Contrast this to shares in some Southern states, like Alabama, Arkansas and Mississippi, whose shares were in the 58 to 60 percent range.

C. *Mobile Home shipments and share of single family production after 1973.* Here, we briefly discuss the post-1973 period. Our goal is to explain the national patterns in Mobile Home shipments and the Mobile Home share of single family production. Again, we explain this in more detail in a companion paper.[55]

We start by focusing on the Mobile Home share. We focus on the share over 1973-1989. As for the surge in shipments and the share in the 1990s, these resulted from a no-doc-type of lending boom in the 1990s.[56] We briefly discuss this lending-boom below.

We use an "abstract" figure of the Mobile Home share to help us describe its behavior over

[54] Housing starts are not available by state. To construct Mobile Home shares by state, we use building permit data. At the national level, the Mobile Home share constructed with building permits is very close to the share constructed with housing starts.

[55] Our discussion of the patterns is to show how they are consistent with the HUD-code having a major negative impact on the Mobile Home industry.

[56] See Berenson (2021).

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 steeply rising during the 1960s and early 1970s and showed no signs of slowing, we expect the share would have increased further, reaching a much higher "steady state" than its 1973 share.[57] Second, suppose there had been a recession (beginning at the first dotted-line in the figure) 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 in time series 1. For this scenario, we expect the path in time series 2.

Next, suppose there had been a recession and a HUD code (with requirements "biting" at the second dotted-line). Here we discuss two paths, time series 3 and time series 4, which differ in their 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 supposed 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 slows down. If the HUD code had not been very severe, then the share would have continued to rise but it would not have reached the levels it would have otherwise. This is time series 3. Had the HUD code been very harmful, then the share would have started to fall, as in time series 4.

The actual data look like path 4. If there is something perhaps not expected in the behavior of the national shipments and mobile home share is that their recoveries lasted until 1983-

[57] The curve in Figure 7 is drawn as concave, though the actual Mobile Home share was not concave through the 1960s and eraly 1970s.

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. The likely explanation for the extended recoveries is that some states resisted the HUD code for an extended period of time.[58]

We can see this by looking at the behavior of the state mobile home shares over time. While the *level* of the Mobile Home share varied widely across states in the early 1970s (as shown in Table 3), the share in each state *over the period 1973-1989* follows the same general pattern as the national average in Figure 6. That is, each state's share falls during the recession, then begins to recover after the recession. At some point, after starting its recovery, the share begins to fall significantly.[59] But state shares differ in the *size of their recovery* after the 1973-1975 recession and in *when the share begins to fall.* 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 these latter states resisting the HUD code.[60] Though this is explored in the companion paper, here we present time series for a few states to illustrate our points.

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.[61] Note also that in

[58] There was much resistance to the permanent chassis requirement, see below.

[59] The state shares do differ in response to the no-doc lending boom in 1990s. Some state regulators it seems "stopped" the boom.

[60] When we say states resisted the HUD-code, we mean state authorities were challenging the code. This meant some manufacturers were not following the HUD-code in the state.

[61] The state authorities in these states were encouraging manufacturers to follow the HUD-code from the start.

the early 1970s, Florida's share is twice California's share.[62]

Some of the states that resisted were located in the Midwest and the South. Mariano (1987) reports many of the states putting up the most resistance to the HUD-code were in the South. Figure 10 presents the shares in the Midwestern states of Illinois and Ohio. In contrast to the shares in California and Florida, the share in Illinois nearly recovers to its early 1970s level in a matter of a few years. Yet, its share begins to fall in the early 1980s, as did the shares in California and Florida. Ohio's share makes a sizable recovery and does not begin a significant fall until 1984.

Next are some Southern states. Figure 9 presents the shares in Alabama and Arkansas. Alabama's share reaches 60 percent in the early 1970s (with one year spiking to 70 percent), 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's 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. The bottom panel shows Oklahoma's share fell from a peak of 50 percent to 20 percent during the recession. But it fully recovered to 50 percent afterwards.[63]

After 1984, with most states following the code, state industry shipments and Mobile Home

[62] We don't have shipments data by states for 1987 and 1988.

[63] We have discussed one reason for the delayed fall in the national Mobile Home share – states resisting the HUD code. But there was another force at work too. Recall the very end of the last section, where we discussed the indirect impacts of the HUD code. By reducing industry scale, the code could have negative impacts on production that can be stretched through time.

share began to fall. Again, they would have kept falling if not for a no-doc type of lending boom in the 1990s.[64] This led to a surge in shipments and the Mobile Home share. The boom led to a significant increase in repossessions of Mobile Homes beginning in the late 1990s (even as the economy was growing). In January 2000, there were six Mobile Home repossessions per 1000 loans (see Hanson and Morgan 2005, using American Banker Association (ABA) data). This was higher than the highest rate of repossession reached during the severe 1973-1975 recession, which was 5.25 per 1000 loans (MHMA Annual Yearbook 1976, using the same ABA data). In the early 2000s, when the economy slipped into a recession, the repossessions surged to 12 per 1000 loans (Hanson and Morgan 2005). With the no-doc lending boom over in the late 1990s, Mobile Home shipments returned to their secular decline, falling to 100,000 by 2007. Shipments were then below 100,000 until 2021.

6 Identical Codes Drove Mass Production

A major consequence of identical codes was to increase the size of the market for Mobile Homes, leading to productivity gains from factory investments in specialized machinery, as well as industry-induced gains from the *industry achieving large scale* — a large numbers of factories, each at large scale, producing under a standardized production process. We consider these latter gains here. Subsection A considers gains from *inside* multi-plant firms, subsections B and C gains coming for *outside* the firm.

A. Gains from "inside" multi-plant firms. As the size of the market increases, the possibility

[64] See Berenson (2021).

of multi-plant firms increases. If a firm has more than one factory and it uses a standardized process across factories, then improvements in one plant can be shared across plants.

B. Gains from "outside" the firm: 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 that is both very useful to existing (and entering) firms and free of charge to them (or of little expense). Two organizations that did so were the MHMA and Agricultural Extension Services. We focus here on MHMA.[65] Here is a list of some of its activities building infrastructure.

1. *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. *MHMA helps creates (and initially fund) related trade associations.* MHMA helped the development of trade associations in very closely related industries to the manufacturing of Mobile Homes, such as the dealers of Mobile Homes and the owners of parks. "MHMA leans heavily on existing state and regional dealer-park operator associations in local cooperative efforts. The national Association has always been a strong supporter of these groups, working constantly through the years to help organize and strengthen them. In fact, MHMA organized the National Conference of State and Regional Associations nearly ten years ago, subsidizing it for two years until it was able to stand alone."

[65] Agricultural extension services have historically provided valuable information to agricultural industries and their communities. Griliches (1957) study of the diffusion of hybrid corn seed illustrates one case of these extension services providing valuable information to farmers. 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. Two reports from the Agricultural Extension Service of the University of Minnesota were "Costs of Owning a Mobile Home" and "Site Selection for your Mobile Home," both by William Angell.

3. *Financing survey.* The MHMA undertook significant efforts to improve the prospects for industry financing, both retail financing (for those buying Mobile Homes) and Mobile Home park financing (for those hoping to start parks). As for retail financing, there was significant prejudice against lending to Mobile Home buyers. 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, their experience with delinquencies, foreclosures and so on. As the MHMA had done in developing building codes, it commissioned an outside group to tabulate the surveys, giving greater credibility to the project. A significant fraction of lending institutions participated. Survey results showed that buyers of Mobile Homes paid off loans no differently than holders of mortgages on stick-built homes. The results of this survey were published each year in the MHMA's annual report and were an important part of the industry's "infrastructure."[66]

4. *How to develop and organize parks.* Having a uniform building code is not valuable if the industry is not able to market its homes widely. In towns with zoning ordinances that permitted Mobile Homes, which necessarily placed them in industrial areas, and typically in Mobile Home parks, the MHMA worked to improve the designs and layouts of the parks. In 1955, the MHMA commissioned a professor from the University of Chicago Business School, L.C. Michelon, to write a book about improving such parks: *How to Build and Operate a Mobile-Home Park* (Michelon 1955).[67] The MHMA continuously developed recommenda-

[66] As for Mobile Home park financing, the MHMA produced reports for each side of the transaction: those hoping to start a park,and those considering lending to them.

[67] Here is an excerpt from the MHMA's 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."

tions for improving the parks and their design.

5. *Finding other areas to sell homes.* The industry also found new areas to sell their homes: areas with no building regulations, and so no zoning. 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.[68] William Speck (1947), part of a team formed by Edward Levi at the University of Chicago to study affordable housing, emphasized this as well.[69]

6. *MHMA Annual Reports.* Annual Reports began in 1951, when they were a two-page stapled document. By the 1960s, they were glossy, well-produced and bound-documents that provided significant industry information across a wide-range of topics.[70]

C. Gains from "outside" the firm: 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.[71] The MHMA recognized their industry greatly

[68] National 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]."

[69] Speck said that "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]." (For a brief discussion of Edward Levi's team that studied affordable housing, see Schmitz 2020, 118-120)

[70] Annual reports typically listed reports that members could order from the MHMA for free or a minimal charge. For example, the Annual Report of 1961 offered a free kit to anyone considering opening a Mobile Home park (28).

[71] Schmookler (1962) produced studies showing the importance of such effects in railroads and other in-

benefited from directed technical change. They wrote that suppliers to the industry "find the industry a most attractive market. The opportunity for sales volume on a large scale to a comparatively small number of manufacturers lends itself to contract selling matched by few other industries .... " (Annual Report 1965, 31).[72]

D. MHMA supports direct technical change (*MHMA Suppliers Division.*). The MHMA not only recognized the importance of directed technical change, but also created institutions (industry infrastructure) directly supporting it. Here we focus on one such effort, the creation of the Mobile Homes Suppliers Division. In 1963, the MHMA formally created a division within the association (the "MHMA Suppliers Division"), which suppliers could join.[73] This division did much work to promote industry innovation. Here are two cases.

1. *MHMA and suppliers cooperate in standards development.* We mentioned how the MHMA helped the industry coordinate on the design and use of a building code. The MHMA discussed with suppliers on how new standards might be written so as not to disrupt suppliers manufacturing processes. "Industry emphasis on standards during the past year was nothing new to members of the MHMA's Suppliers Division. .... Suppliers Division members have long worked side by side on the various standards subcommittees with mobile home and travel trailer manufacturers" (Annual Report 1964, 28).

2. *Finance members (of suppliers division) update data collection methods.* Members of

dustries. See also Acemoglu et. al. (2012).

[72] They also wrote that " ... because of a concentrated, ready market, suppliers have been able to devote their research facilities to development of new products and applications which would not have been otherwise feasible." They praised suppliers for developing new products for their indsutry: "while providing an oversized sales outlet to many established industries, the mobile home field has brought about several unique industries catering only to the manufacturer of mobile homes .."

[73] As described in the MHMA Annual Report, "The MHMA Suppliers Division is organized within the structure of the Association. Its affairs are directed by a nine man Board of Governors, which in turn has representation on the MHMA Board of Directors and Executive Committee" (1963, 5).

the MHMA Suppliers Division not only included manufacturers. As the MHMA wrote: "... service type suppliers including banks, finance companies, and insurance groups also are great contributors to the industry growth. They pace the expanding market with terms and coverages to meet the changing budgetary needs of the purchaser. This year supplier members of the Finance Division aided in completely reorganizing the method of collecting information for the listing of used mobile home values" (Annual report 1963 p. 5).

E. Gains from mass production compared to Levitt-style production The Mobile Home industry was only one of many experiments introduced after WWII that attempted to bring low cost housing to returning veterans and more. The most famous experiment was by Levitt & Sons who pioneered new stick-built construction methods. They might build 100 homes at a single outdoor site. Houses were simple, standardized, and built to a standardized process. This on-site method was similar to an "assembly-line" system. In this system, however, houses would not move along the assembly line, workers would. Skilled workers, like electricians, would wire one house, then move next door, and so on.

Relative to building them one at a time, these methods significantly reduced the cost of producing homes.[74] But it was not mass production as we have 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 understood these drawbacks, of course, and ultimately concluded that factory methods were the only way to provide affordable housing, as their testimony cited in the introduction indicated.

[74]Note that the method was only of value when building hundreds of homes in an area. So, it was not of value in small towns and rural areas.

7 Success Could Have Been Much Greater

We've emphasized how the Mobile Home mass-production-experiment consisted of two key features: The development of a state-wide code that all producers had to adhere to, and, then, that local authorities had limited ability to block the homes from the markets the industry had created, in industrial areas and areas without housing regulation. But, of course, there was a third feature: Mobile Homes were subject to significant barriers. That Mobile Homes succeeded despite very significant barriers to them is a testament to the great power of mass production. Here, we discuss more about the barriers and how they limited the impact of Mobile Homes.

Financing. Mobile Homes were financed more like cars than conventional mortgages; the financing worked through personal loans at much higher interest rates and much shorter durations. Greenwald (1970) provides an overview of Mobile Home financing in New England in the late 1960s. For conventional mortgages, the average interest rate was 8 percent, with maturity of 30 years (Table 1). The financing terms for Mobile Homes were 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. As mentioned, 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."[75] The report goes on to say 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 did not just reduce the production of the industry. As Greenwald (1970) 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 often in the areas surrounding cities. Consequently, the poor were often "trapped" in cities.[76] Greenwald pointed out that "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

[75] By "do not meet government construction standards," the report is referring to the fact that Mobile Homes were considered too small to qualify.

[76] If a low income individual wanted to work in a city, the person could not live in an area contiguous to it, as Mobile Homes were banned there. The choice was to live "farther away" or in the city. Many chose to live in the city.

by the middle class cannot be allowed to condemn the less well-to-do to slum housing."[77]

Not only were Mobile Homes banned in areas surrounding cities, towns in rural areas also banned them or, more often, assigned Mobile Homes to industrial areas, limiting their desirability. This meant these areas could not improve. Greenwald noted, "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."[78]

8 End of Mass Production of Mobile Homes

As we said, when local zoning regulations and other obstacles placed in the way of Mobile Homes were failing to stop the rapid growth of the industry, stick-built producers turned to the federal level for new regulations. The crushing blow was the HUD-sponsored legislation from 1974, which marked the beginning of the end for mass production of Mobile Homes. This legislation established a national building code (i.e., the "HUD code") for Mobile Homes that preempted the state-wide Mobile Home codes. The new code contained many objectionable features that significantly damaged the industry. We have already discussed some of these.

[77] See Glaeser et al. (2008) who argue that cheaper transportation in cities explains why the poor live in cities.

[78] Another major obstacle to the homes was the prejudice they have been subject to since they have been introduced. This was, of course, both encouraged and engineered by opponents to the homes.

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

Second, HUD dramatically changed its *definition* of Mobile Homes. HUD gave this definition in 1968: "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."[79] HUD's definition in the 1974 legislation included the "*permanent chassis*": 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]

This term *"permanent chassis"* was a radical break from past practice. As mentioned, under the law, a buyer of a Mobile Home was not permitted to remove the chassis from the home after delivery, greatly reducing the desirability or quality of the home. This term had *never before been used in reference to Mobile Homes* – it was a creation of HUD in its attempt to

[79] From: U.S. Department of Housing and Urban Development, "Housing Surveys Parts 1 and 2: (1) Occupants of New Housing Units and (2) Mobile Homes and the Housing Supply," p.73.
https://www.huduser.gov/portal/sites/default/files/pdf/Housing-Surveys-Parts-1-and-2-Occupants.pdf

sabotage Mobile Homes.

The HUD code was immediately challenged by the industry.[80] 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][81] (United States Senate, 1977).

9 Why Never Mass Production of Modular Homes?

Modular and panelized homes have never been mass produced. When introduced in the first half of 20th century, they were subject to local building codes, and so there was no chance of them reaching mass production. As we mentioned, in 1969 HUD launched a major project, Operation Breakthrough, which had the goal of igniting mass production in factory homes (by which they meant Modular and panelized homes). A key part of the program was to develop a system of state-wide building codes for these homes. Mass production was not

[80] For example, many states challenged the law's 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.

[81] In "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.

ignited (barely any production came from Breakthrough and its aftermath). Breakthrough was very early declared an utter failure (see, e.g., McLaughlin (1974)).

Here we describe how the state-wide codes were very poorly designed, and that mass production under the codes was not possible. There were other mistakes, that we briefly discuss, which doomed the project as well. None of these lessons about Breakthrough's failure has been learned.[82] These mistakes have recently been repeated by startups to manufacture Modular Homes, and they have failed as a result.[83]

An important reason to study Breakthrough, and these recent failures of startups, is because they have *"spoiled the water."* Breakthrough's failure and the recent failures have led some to argue that factory-built housing is not much more productive than stick-built construction. This is, obviously, false on its face. The experience of Mobile Homes during their period of mass production attests to that. Yet the view is widely expressed. Here is Erlich (2023) "For all the clamor about disruption and innovation [from Modular Home manufacturing startups], transformative business models have experienced as much failure as success and are, in any case, restricted to a small segment of the industry. The barriers to industrial building — the decentralized nature of the industry and the limited number of employers in a position to make long-term investments, the complications of transportation, and the uncertainty about demand for the product — ensure that modular building will remain a stable but relatively small percentage of total construction spending."

A. *Productivity, Prices and Production Before Breakthrough.* We first briefly discuss the

[82] As we said above, but maybe should have emphasized more, we have learned lessons about Breakthrough from our study of mass production in Mobile Homes.

[83] McLaughlin (1974) offered an early review of the disaster, closing with this question: Why study a disaster? He gave a good answer: So it doesn't happen again.

history of the industry before Breakthrough. In official U.S. statistics, the industry is called "prefabricated wood buildings."[84]

1. *Productivity of prefabricated wood building.* Available evidence shows that the industry's productivity (TFP) increased very little over the 1958-1972 period. TFP was U-shaped: It fell from 1958-1970, then turned around from 1970-1972 (see, NBER Manufacturing Industry database, Bartelsman and Gray (1996)). Industry TFP is estimated to have increased seven percent from 1958-1972, compared to 46 percent for Mobile Homes.[85]

2. *Prices.* There is little evidence on prices for these homes. Available evidence suggests that these homes had a price-psf that was not much lower than traditional stick-built homes. McGraw Hill (1969) estimates that the price-psf for these homes was seven percent lower than stick-built ones.

3. *Production.* Here the issue of how "factory-built homes" are defined takes on importance. Statistical agencies typically say a house is factory-built if the value added off-site, including transport and manufacturing, is greater than some percent of total value added. Mobile Homes have the greatest share of off-site value-added, with Modular Homes next. Given both types are fully formed modules, with little assembly on-site (in particular for Mobile Homes), both are considered factory-built by value-added measures.

The case of panelized homes is less clear, since much more assembly takes place on-site.

[84] The industry consists of Modular Homes and panelized homes made from wood. There was a very small amount of such homes made from steel and concrete. They are in different SICs.

[85] During this period, "prefabricated wood buildings" was grouped with another industry, "other prebabricated wood buildings" in SIC 2433. It was not until 1972 that the Census created two separate SICs for these industries, "prebabricated wood buildings" (SIC 2452) and "other prefabricated wood buildings" (SIC 2439). Bartelsman and Gray therefore had to make assumptions about how to "split" the SIC 2433 data into two parts in estimating TFP for "prebabricated wood buildings." We are currently considering alternative assumptions, as well as assessing what additional data we can bring to this estimation project.

There is also a wide variation among these homes in on-site assembly. Trade associations have published production data (in terms of units) for the sum of Modular Homes and panelized homes. Field and Rifkin (1975, p. 21) publish National Association of Home Manufacturers data (NAHM) for single-family homes. Value-added methods are not used to produce the totals. Rather, "manufactured homes are housing packages consisting of at least the structural shell."[86] The structural shell alone is most likely only a small share of the value-added in the house.

The level of production in NAHM data, and its growth during the 1960s, looks very similar to that of Mobile Homes. In 1967, NAHM reports Modular Homes and panelized homes production equaled 225K units.[87] The U.S. Census Bureau, which used vale-added methods, reported 71K units produced in 1967.[88] The Census Bureau has much smaller production – about one-third. Moreover, the Census numbers include not only single-family housing, but many other categories, like multi-family homes.

B. *Operation Breakthrough*: *Why it Failed.* We briefly describe three lessons from Breakthrough's failure: What technology is being used?; Who is writing the state-wide codes?; and the design of the state codes.

1. *No need for latest technology.* Those running Breakthrough emphasized bringing the best and latest technology to the program. They appointed a specialist in rockets rather than

[86] This method is reported in note to Table 2-2. Also, Field and Rifkin call "Modular and panelized homes" by the name manufactured homes, as in the first column of Table 2-2. This was common practice before 1980.

[87] Most of this production was panelized homes, Modular Homes accounting for about 25 percent.

[88] The Census has presented *units produced* for "Modular plus panelized homes" production in 1967 and 1972, and then for each separately, on an annual basis, from 1993 on. The 1967 numbers appear in the 1972 Census of Manufactures.

housing to run Breakthrough. In particular, Harold Finger, who had been the head of the Office of Space Flight Programs for NASA, was in charge of Breakthrough.

Breakthrough's goal was to build homes for the low income. Affordable homes. There is no logic for why the latest technology is needed. There is logic for the opposite – for using simple technology. The newest technology is the most expensive. It typically suffers the most delays and bugs.

In addition, scholars of prefabrication had emphasized that using the *latest technology was not crucial* to the success of factory-built housing. Bruce and Sandbank (1944): "Technological considerations are, in the last analysis, subsidiary to these more important questions."[89]

There was also experience. The success of the Mobile Home industry, which was using "simple" technologies, was showing the best and latest technology were not needed. The industry had already achieved what Breakthrough was hoping for.

This lesson was not learned. Startups today still tout the new technologies that they bring to the task of achieving mass production in housing.

2. *Who is writing the law*? Many states introduced state-wide building codes for factory-built homes (again, Modular and panelized homes) in the early 1970s. A key question, one we've already seen the importance of, and one taught to us by Adam Smith, was "Who was

[89] "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)

writing the law?" Lots of groups opposed to Modular Homes were writing the laws (see Field and Rifkin, pp. 103-110). These groups didn't want the law to succeed. Not surprisingly, perhaps, the laws were poorly designed.

3. *State wide codes for factory-built homes were badly designed.* Falk (1976) argues that many of the state-wide building codes for factory-built homes were based on the design of California's law. We discuss California's law shortly. Though the aim of this law was to build factory-homes to a single code, they were built to many codes. And though the law was suppose to limit local control, local authorities had significant leverage over the factory-builders.

While many states have state-wide building codes for factory-homes, there is significant local control. In fact, when building codes for factory-built homes are characterized by different groups, it is often described that factory-built homes are subject to *local building codes*. Here is the characterization of the Congressional Research Service (2023, p. 29): "Modular and other types of factory-built homes are subject to the same local building codes as site-built homes." And from a HUD information flyer: "Unlike HUD Code manufactured homes, factory-built homes must comply with local building codes."[90]

C. *California's Early Experience with State-Wide Codes for factory-built homes.* California passed its "Factory-Built Housing Law" in 1971 (see Columbia Law Journal (1972) and Palumbo (1971) referenced sometimes as Stanford Law Journal (1971)). Again, the aim of this law was to build factory-homes to a single code, and to limit local control over the factory-built homes. The law has failed to deliver mass production. Here we describe some

[90] https://www.huduser.gov/portal/sites/default/files/pdf/Info-Brief-SingleFamilyHomeowners.pdf

of its problems.

1. Modular Homes Built To Many Codes. While the law's stated purpose was to lead to mass produced homes built to a single-code, nothing like this happened. Under the law, a manufacturer hoping to place a factory-built home at a location had three options:

a). Submit a plan to the Department of Housing and Community Development (HCD) that adhered to the state-wide code. However, "The approval process may consume a number of weeks, and its length may depend on the manufacturer's care in drawing up the plans. Alterations and corrections are frequently required." (Columbia Law, p. 474). Note a significant difference to the state-wide Mobile Home codes: a manufacturer *submits a plan*, meaning an expense and time delay. Note two reasons why the law would lead to factory-homes built to *different specifications*. The manufacturer submits its own plan, which likely differs from other plans. Also, HCD can ask for alterations. We call such possible changes from a uniform code to be *"slippages"* from production under a uniform code.[91]

b). Submit a plan to HCD different from the current code, seeking HCD approval. This involves additional slippage.

c). Bypass HCD altogether, and manufacture the house to the local code at that location. "If the manufacturer feels that submission to the Department's process of plan checking is not in its best interest, and that dealing directly with the locality could result in a faster completion of the approval process or local regulation more favorable to its product proposal than the state codes, the statute provides an alternative. It allows the manufacturer to go

[91] In addition, a plan could be rejected which met the code but which HCD decided did not meet the "general welfare" requirement.

directly to the local building official with his plans, in which case the statute and regulations are superseded by the local building codes." (Columbia Law, p. 475).

This option had the potential to add significant slippage. In practice, HCD reported that about 50 percent of those submitting plans to build factory-built homes chose option (c), building to local codes (see below).

So, while the California law may have sounded impressive, in practice it seems there was very little coordination around a single-code. There were no external effects, no directed technical change.

2. Law Gives Local Authorities "Significant" Control. The law was meant to significantly limit the power of local authorities to block mass production. There are many reasons this might fail in practice. Laws may contain provisions that are not recognized as problems. More likely, these laws were being written by groups who did not want mass production, so they were written in ways that gave significant local control (perhaps in deceptive ways). And beyond De Jure reasons, there are always De Facto reasons.

Under the law, the power to "*inspect the manufactured units"* was given to HCD. The statute reserved to the localities the power to *inspect the installation* of factory-built housing, to *issue permits for utility hookups and landscaping*, and to regulate "*architectural and aesthetic requirements*." (Columbia Law, p. 486) As a result, "Evidently, a substantial amount of discretion remains with the local building official, although the statutory objective was to remove such power." Moreover, "there are indications that some manufacturers are 'encouraged' to elect subjection to local building codes by warnings that local regulations will

otherwise be strictly enforced against them. Indeed, the Department has recently criticized the local officials for intimidation of manufacturers." (Columbia Law, pp. 486-487).

3. Local authorities can use other means to block Factory-built Homes. Other types of local control can be used to frustrate factory-built homes. Local zoning can undo the law. While Modular Homes are usually allowed in residential areas, other changes in zoning, like increases in minimum house size, disadvantage factory-built homes.[92] So, as expressed in Columbia Law: "The objective of the California legislature in enacting the Factory Built Housing Law was to facilitate the use of industrialized construction methods which, it was believed, would increase the amount of low-cost housing within the State. It was hoped that the poor would then be able to move from the cities to the suburbs, where the cost of housing had been prohibitive. However, this barrier against the movement of poor people to the suburbs which might be obviated by the statute can be easily resurrected through the use of the local zoning power, an especially effective exclusionary device. The California law goes so far as to specifically reserve this tool to the localities, producing the irony of a law designed to extend greater opportunity to the disadvantaged while allowing others to deny them that opportunity." (p 486). This discussion is reminiscent of Greenwald's analysis of the harms of zoning against Mobile Homes.

D. *California's recent Experience with State-Wide Codes for Factory-Houses.* These failings of the California law persist to this day.[93] Here we briefly describe some of the problems facing modular producers of multi-family homes in California, as described in the WSP

[92] See a discussion of such issues in Columbia Law, p. 486, including footnote 129.

[93] Again, these are failings from the perspective of bringing mass produciton to Modular and panelized homes. For some groups, that oppose factory-built homes, the law is succeeding.

(2018) report "Modular construction for multifamily affordable housing."

The report describes how the state has control over the modules (boxes) produced by the manufacturers: "... unlike conventional site-built housing, the California Department of Housing and Community Development (HCD) administers the construction and remodeling of FBH [Factory Built Housing] in California. Consequently, HCD has jurisdiction over all modules, both in the factory and on-site." (p. 19) This sounds good.

But there is still local control: "... on the other hand, all site-built work – the foundation, the podium, the roof, stairs, and the exterior building skin – fall outside of state jurisdiction and are approved by local agencies." (p 19). Certainly, local control seems extensive, in that it extends to parts of the modules over which the state was suppose to have control, including the roof and exterior skin.

Again, we have these conflicting parts of the law: The state has control over the boxes, yet local authorities have control over parts of the boxes. In practice, not surprisingly, this conflict leads to significant problems for the factory-home producers. At the start of the report, some of the big challenges facing factory-home producers were discussed. This included "... lack of consistency in local jurisdictions' approach to code review and compliance. Some local agencies prefer to examine the modules again after the state examines them, and are particularly concerned with fire proofing and plumbing." (p 5). Local authorities were engaging in procedures not in their power under the law.[94]

E. *Failure of Recent Startups and a New Attempt (Onx Homes).* There have been a series

[94]It's interesting to note *the list of advantages* of factory-built housing that are trumpeted by the report. These are: time savings, reduced waste, quality control, employee safety, .." (pp 11-14.) No mention, of course, of external effects, or directed technical change.

of recent startups [of Modular Home producers] that aimed to bring mass production to the U.S. housing industry — and to bring great cost reductions to housing. Many have failed. By "failed," we mean they no longer operate. All have failed to bring mass production and significant price declines.

Much has been written about these failures, in particular, Katerra. This was a massively funded startup, which was involved in building factory-housing across many locations, but had a big presence in California, in multi-family housing (and was thanked in the WSP report above). Many reasons were given for its failure. It grew too fast. It went too far in vertical integration. It had too few experts in housing, too many in other fields.[95] But none of these analyses have written about the problem of building codes that Katerra faced. If Katerra had "not grown too fast, if it had not become too vertically integrated, if it had hired more housing experts, ..." it may have not failed (that is, ceased operations), but it certainly would have *failed to deliver significant price declines* given the building code environment it faced in California.

There is a potential bright spot on the horizon, though. Some of the founders of Katerra seem to have learned some of the lessons about building codes and mass production. They've begun a new startup in Florida — Onx Homes — that is manufacturing factory-built homes according to the Miami-Dade building codes and selling them throughout the state. The logic is that if it meets Miami's code, then it meets all codes in the state.[96]

[95] See, for example, Daniel Davis, "Katerra's $2Billion Legacy," Architect Magazine, June 18, 2021; and Konrad Putzier and Eliot Brown, "How a SoftBank-Backed Construction Startup Burned Through $3Billion," Wall Street Journal, June 29, 2021.

[96] See Joshua Andino, "This Factory Represents a Homebuilders Bet on the Future of Housing," CoStar News, April 9, 2024. As he reports: "Houses made by Onx Homes are designed to exceed Miami-Dade County building codes, some of the strictest in the nation. The region, known for its hurricanes, often gets

If Onx-homes have a "competitive advantage" over stick-built homes constructed to Miami's code, so that they can be produced at, say, x% of the cost, that advantage will decrease (and disappear in some places?) when compared to locations where the local code is less strict than Miami's code. But such disadvantages can in principle be calculated and evaluated. But the analysis here suggests a few potential concerns. There are De Jure concerns. Some localities may have standards for some house features that Miami's code doesn't have (or they can add additional features). These features may not be "crucial" features for safety and the like, but still ones that need to be met, again frustrating mass production. And there are always De Facto concerns, with local officials going beyond the written law in judging the homes.

10 Today's Low Productivity? Forebears Had Answer

A series of papers have documented the recent poor productivity performance of the U.S. residential construction industry (see, e.g., Garcia and Molloy (2023) and Goolsbee and Syverson (2023)). The performance is left as a puzzle.

Gordon and Sayed (2019) show that construction sector productivity has lagged other sectors' productivity in the United States since 1950. They show that the annual rate of labor productivity growth in commodities (the combined sectors of agriculture, mining, manufacturing, utilities and construction), for the periods 1950-72, 1972-95, 1995-2005, and 2005-

strong winds, rain and flooding even outside hurricane season. If Onx Homes can build a strong, sturdy and desirable product in South Florida, the logic is that they can duplicate it in other markets."

2015, exceeded that in construction by 1.5, 2.89, 4.62 and 2.19 percent.[97] This sector's relative performance has also deteriorated over time. Its productivity growth was actually negative in the last three sub-periods.[98]

This sector's poor performance, then, is not new, going back to at least 1950. It goes back further. Our forebears in the first half of the 20th century wrote extensively about the poor performance of the sector. The poor performance was no puzzle for them. They concluded – with near unanimity – that it was the failure of the residential construction industry to adopt new technologies, in particular, factory-built housing, that led to the poor performance.

Our forebears' ideas about the poor productivity performance of residential construction were ignored after 1950. Our analysis here strongly supports our forebears' view that the poor performance in their time was due to lack of factory-built home production. It supports the same conclusion for our time. First, the share of factory production in residential construction in the United States is very small today (as it was in their time). Crucially, we've shown this is due to the vast set of regulations that greatly hamper its development (as they did in their time). Second, our analysis of Mobile Homes shows that factory production can achieve extraordinary productivity growth.[99]

It's extraordinary, really, that when we consider reasons for the slow productivity growth in residential construction, that the failure of innovation and technology would not be a

[97] For the same periods, annual labor productivity growth in manufacturing exceeded that in construction by 1.52, 3.87, 6.55 and 2.82 by percent.

[98] Note that Gordon and Sayed's statistics are for the entire construction industry, not the residential construction industry by itself. Statistics for the residential construction industry are only available, as far as we know, for these later periods, in which its productivity growth is typically negative. It would be nice to know if it was negative in the first sub-period.

[99] Note that Gordon and Sayed's statistcis on construction do not include Mobile Home statistics (and other factory-home statistics), as they are part of the manufacturing sector in the U.S. Census.

suspect, and the key suspect. When economists typically discuss productivity, we consider innovation and technology to be paramount. But not today, not when discussing construction productivity. In discussions ninety years ago, they were.

We next present a few studies by our forebears on the failure of the industry to adopt factory-built housing (and the role of monopolies in blocking the homes).

1. In the early 1920s, Judge Kenesaw Mountain Landis wrote an arbitration decision dealing with warring monopolies in the Chicago construction sector. At that time, the only construction materials that could be used in Chicago were those manufactured there. "Imports" were blocked. As a result of the arbitration decision, firms from Iowa sought to ship factory-built homes into the city. Figure 12 is an advertisement in the Chicago Tribune, from an Iowa firm that manufactured factory-built homes, placed the day after Landis' arbitration decision. The firm was offering to deliver factory-built homes to Chicago.[100]

2. Blocking of factory-built homes was widespread. The DOJ antitrust division, under Thurman Arnold, sought to stop the practice. Corwin Edwards (1941, p. 339), Arnold's chief economist, discussed one such effort:

"A first step in the protection of the prefabricator was taken in September 1940 by an indictment which charges a conspiracy to prevent the sale of prefabricated houses in Belleville, Illinois. Local building materials dealers, contractors, officials of the carpenters' and building laborers' union, and the chief of police are charged with a series of efforts to prevent the erection of a prefabricated house by concerted refusals to perform the work and by violence to prevent others from performing

[100] See Schmitz (2020a) for extended discussion of Landis' study of the Chicago construction industry.

it. Before the indictment there had been repeated riots at the construction site; thereafter the work proceeded without further violence."

3. When Arnold left the DOJ, he did not stop challenging monopolies in traditional construction and protecting producers of factory-built homes. In "Why We Have a Housing Mess," Arnold (1947) began with a picture of a homeless Pacific War veteran, with his wife and five children, sitting on the street with their belongings (see Figure 13). The caption stated: "This Pacific War veteran and his family are homeless because we have let rackets, chiseling and labor feather-bedding block the production of low-cost houses." Arnold began his text this way:

"Why can't we have houses like Fords [i.e., automobiles]? For a long time, we have been hearing about mass production of marvelously efficient postwar dream houses, all manufactured in one place and distributed like Fords. Yet nothing is happening. The low-cost mass production house has bogged down. Why? The answer is this: When Henry Ford went into the automobile business, he had only one organization to fight [an organization with a patent] . . . But when a Henry Ford of housing tries to get into the market with a dream house for the future, he doesn't find just one organization blocking him. Lined up against him are a staggering series of restraints and private protective tariffs."

11 Conclusion

As we said above, with slow productivity growth, or negative growth, "affordable housing" becomes a large issue. Again, our forebears, of course, connected the two — and that is why

they called for factory-production of homes. We've already presented the opinion of Levitt and Sons, that factory production was the only way to produce affordable homes.

Here are some earlier housing experts expressing the same sentiment. Here is reporting in the New York Times ("Mass Production of Housing Needed," July 9, 1938) on a lecture by Harvey Corbett:

"The hope of eliminating economic difficulties besetting America's rehousing program lies in factory mass production of houses on their sites, Harvey Wiley Corbett, architect of Radio City, declared yesterday in a public lecture at Columbia University. .....The differential between the cost of rehousing and the rent that former occupants of slum dwellings must pay, which must be made up with subsidies, is caused by the high labor cost in building."

In the 1950s, British architectural critic John Betjeman (1952) wrote:

"Architects have been too wrapped up in "style," in bricks and foundations and what not, to devote their attention to the only solution of the housing problem—the production of decent and convenient mass-produced houses. These houses should be pre-fabricated, as was the Crystal Palace, they should be and could be well planned, as sound and weather-proof as the best brick-built house."[101]

Our analysis strongly supports those who have argued since the 1930s (at least) that *the only chance* of building homes that are "affordable" is in a factory. Our analysis shows that there is not only a chance, but that it's possible. It's been done. We studied the mass production of Mobile Homes over the period 1948-1973. Mass production of these houses achieved what had long been hoped for – housing prices, in the low to middle end of the

[101] In the 1990s, British architect Colin Davies called the Mobile Home "the house of the century."

market, were falling fast, making home ownership a possibility for lower income segments of our population. Importantly, we identified the key ingredients that led to its success: state-wide building codes, with local authorities having little power to squash the homes. By identifying the ingredients, we have shown that the success can be repeated. Moreover, these lessons can be "transferred" to other factory-built sectors.

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

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

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**	*none*		
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**	*unknown*	Jan-74	Yes
CO	*unknown*	Jul-71	Yes	**NC**	*unknown*	Jul-69	Yes
CT	*unknown*	Oct-70	Yes	**ND**	Mar-71	Jul-71	Yes
DE	Mar-74	Jul-74	Yes	**OH**	*unknown*	Jul-74	
FL	Jun-71	Jul-71	Yes	**OK**	*none*		
GA	Mar-68	Sep-68	Yes	**OR**	*unknown*	Jan-62	Yes
HI	*none*			**PA**	May-72	May-72	Yes
ID	Mar-71	Jan-73	Yes	**RI**	Mar-73	May-75	
IL	*unknown*	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	*none*			**VT**	*none*		
ME	Jun-71	Oct-71	Yes	**VA**	Apr-70	Jul-71	Yes
MD	May-71	Jul-71	Yes	**WA**	*unknown*	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**	*none*		
MS	*unknown*	Jul-70	No	**DC**	*none*		
MO	*unknown*	Jan-74	Yes	**PR**	*none*		
MT	Jun-69	Sep-74	Yes	**VI**	*none*		
NE	May-69	Dec-69	Yes				

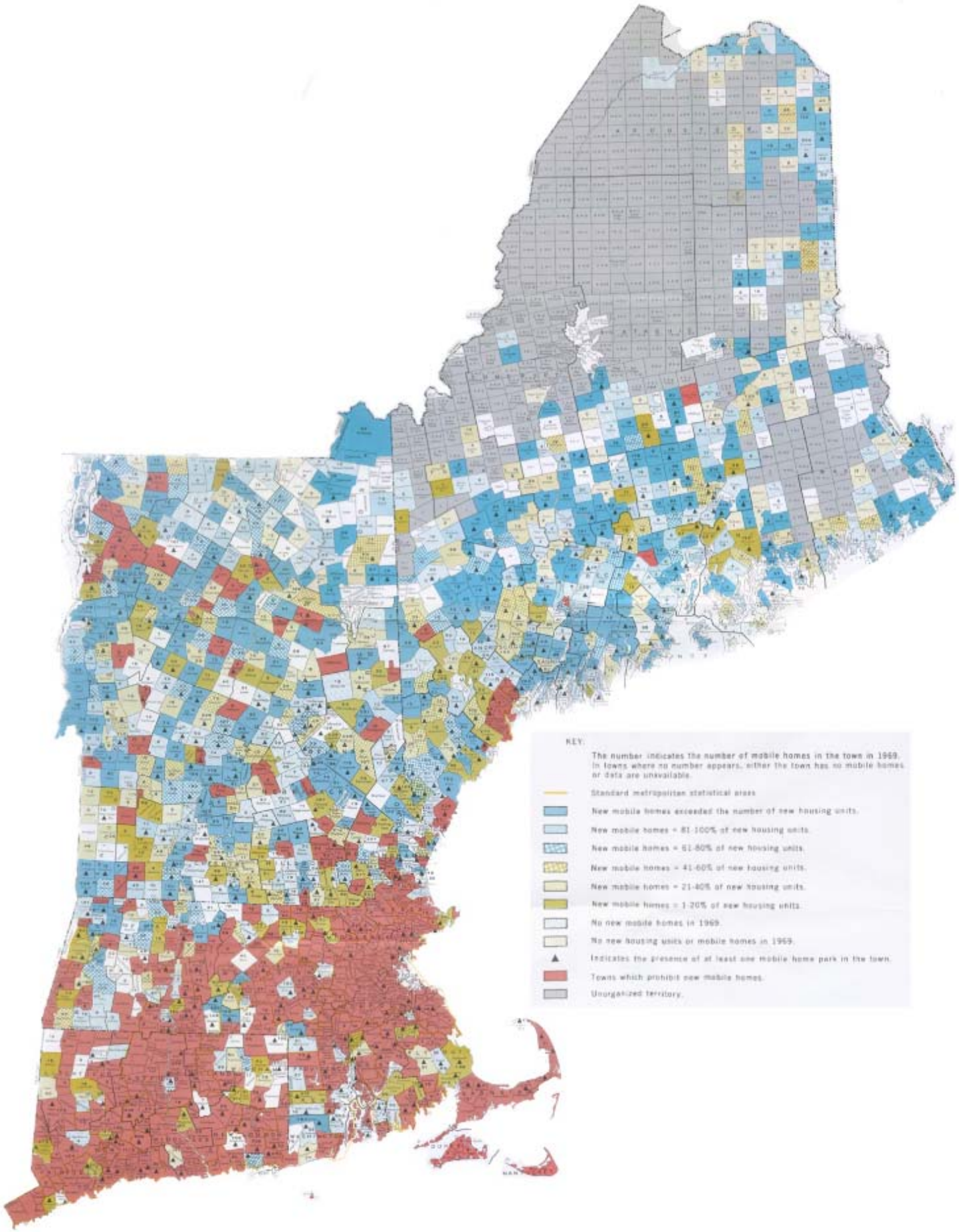
Source: Cooke, Patrick W. *State Building Regulatory Programs for Mobile Homes and Manufactured Buildings: A Summary.* Vol. 853. US Department of Commerce, National Bureau of Standards, 1974: Table 1.0.

Table 3: Mobile Home Share of Single-Family Housing Production (%), by State

State	Average 1971-1973	State	Average 1971-1973	State	Average 1971-1973	State	Average 1971-1973
West Virginia	82.46	**Oregon**	50.76	**Arizona**	39.07	**Wisconsin**	28.14
Montana	74.80	**Maine**	48.04	**Vermont**	38.21	**Nevada**	27.96
South Dakota	63.44	**South Carolina**	47.79	**Delaware**	37.40	**New York**	26.78
Alabama	60.39	**Alaska**	46.21	**Iowa**	35.42	**Illinois**	26.31
Arkansas	58.38	**Kansas**	46.12	**Nebraska**	35.31	**Virginia**	21.37
Mississippi	57.91	**Louisiana**	44.77	**Michigan**	34.62	**California**	21.37
Wyoming	57.67	**Georgia**	44.08	**New Hampshire**	33.03	**Maryland**	9.63
North Dakota	57.13	**Florida**	43.38	**Ohio**	32.85	**Rhode Island**	7.91
North Carolina	56.56	**Texas**	42.74	**Washington**	31.88	**New Jersey**	6.24
Kentucky	55.79	**Missouri**	42.15	***National Average***	31.45	**Massachusetts**	6.20
Idaho	52.54	**Oklahoma**	42.04	**Utah**	29.48	**Connecticut**	5.59
New Mexico	51.80	**Indiana**	41.54	**Minnesota**	29.08	**Hawaii**	0.61
Tennessee	51.01	**Pennsylvania**	39.99	**Colorado**	28.99		

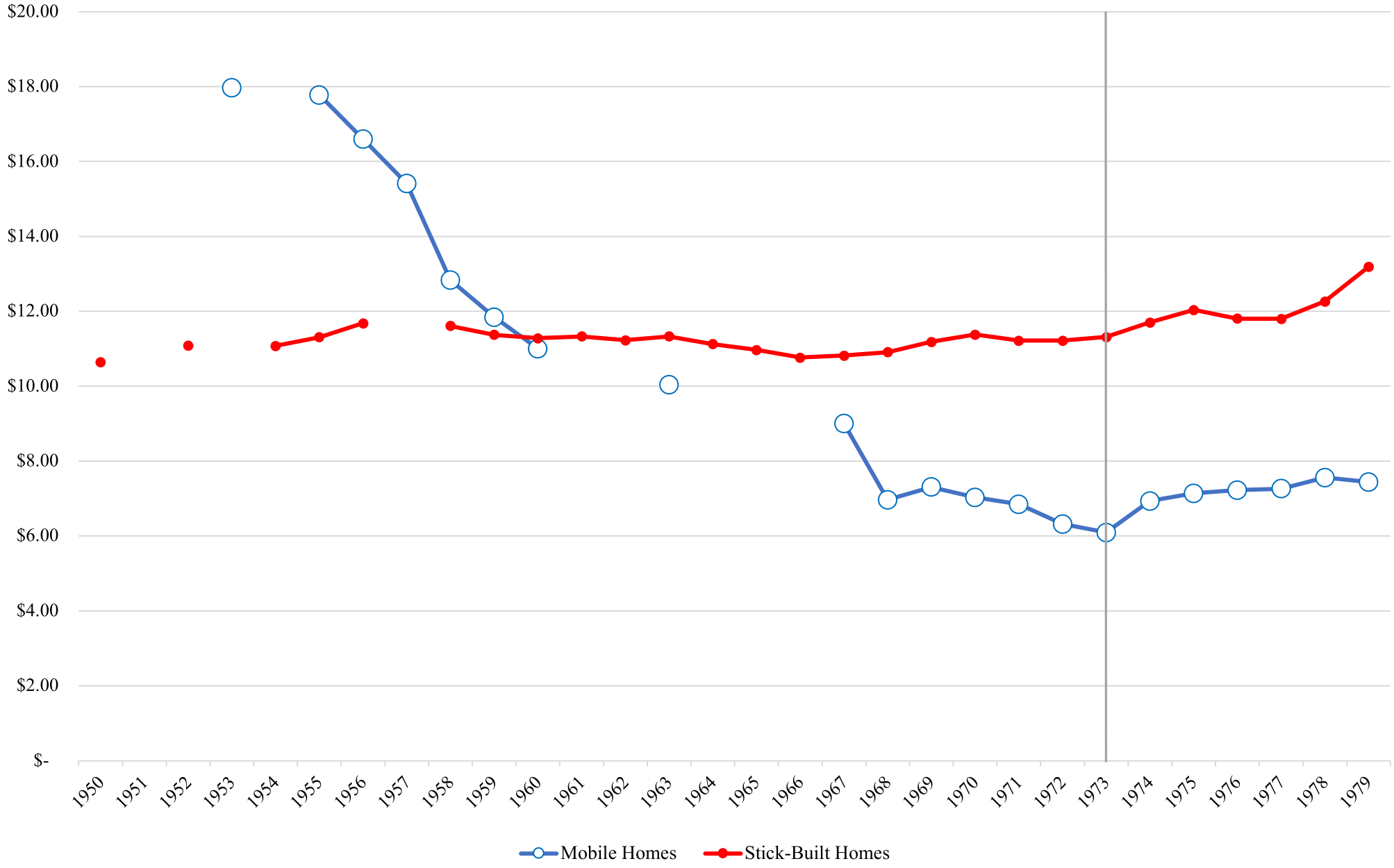
Sources: State shipment data available from MHMA annual reports, building permits data available from the United States Census Bureau.

Figure 1



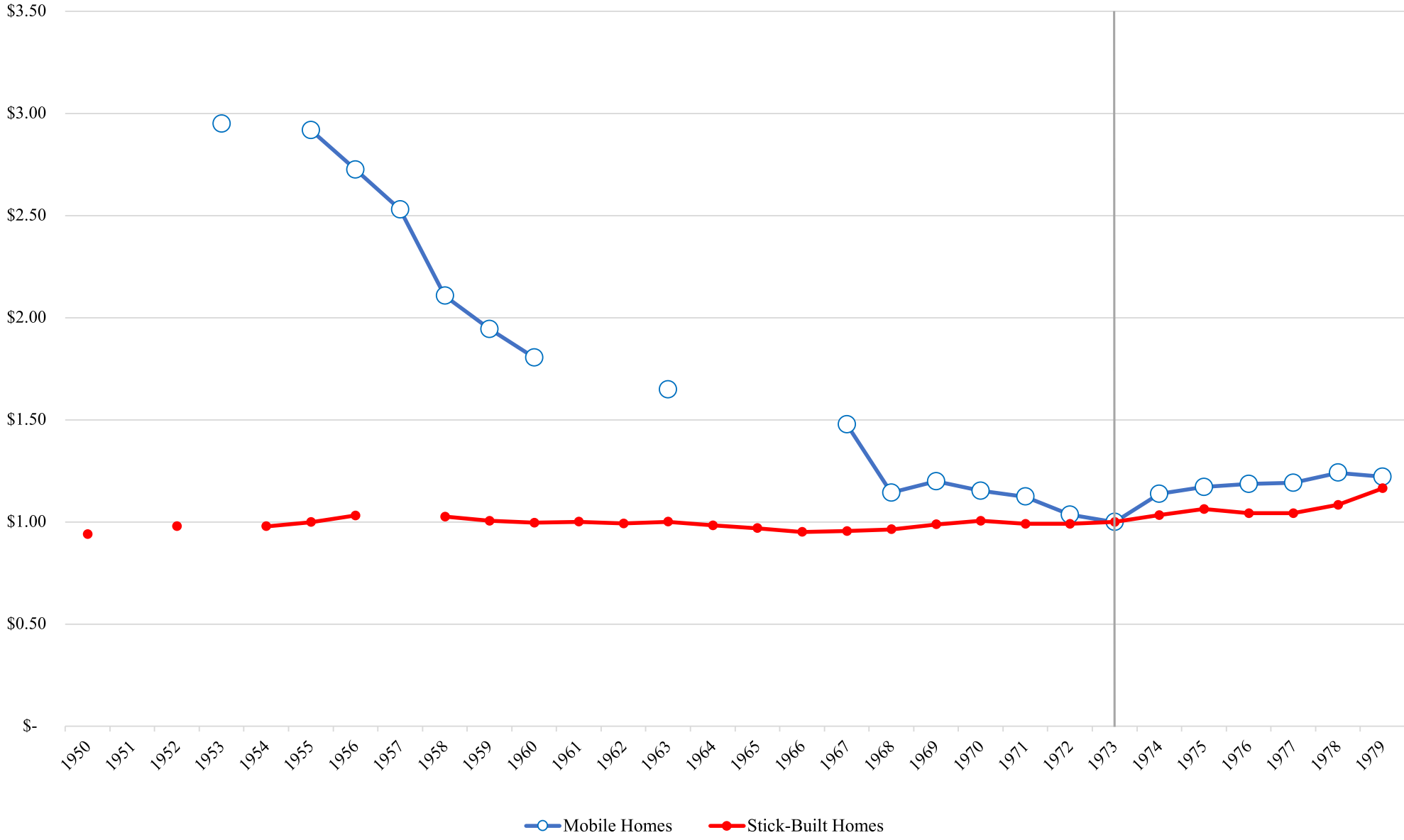
Source: Greenwald, Carol S. "Mobile Homes in New England," New England Economic Review (June 1970): 2–27.

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



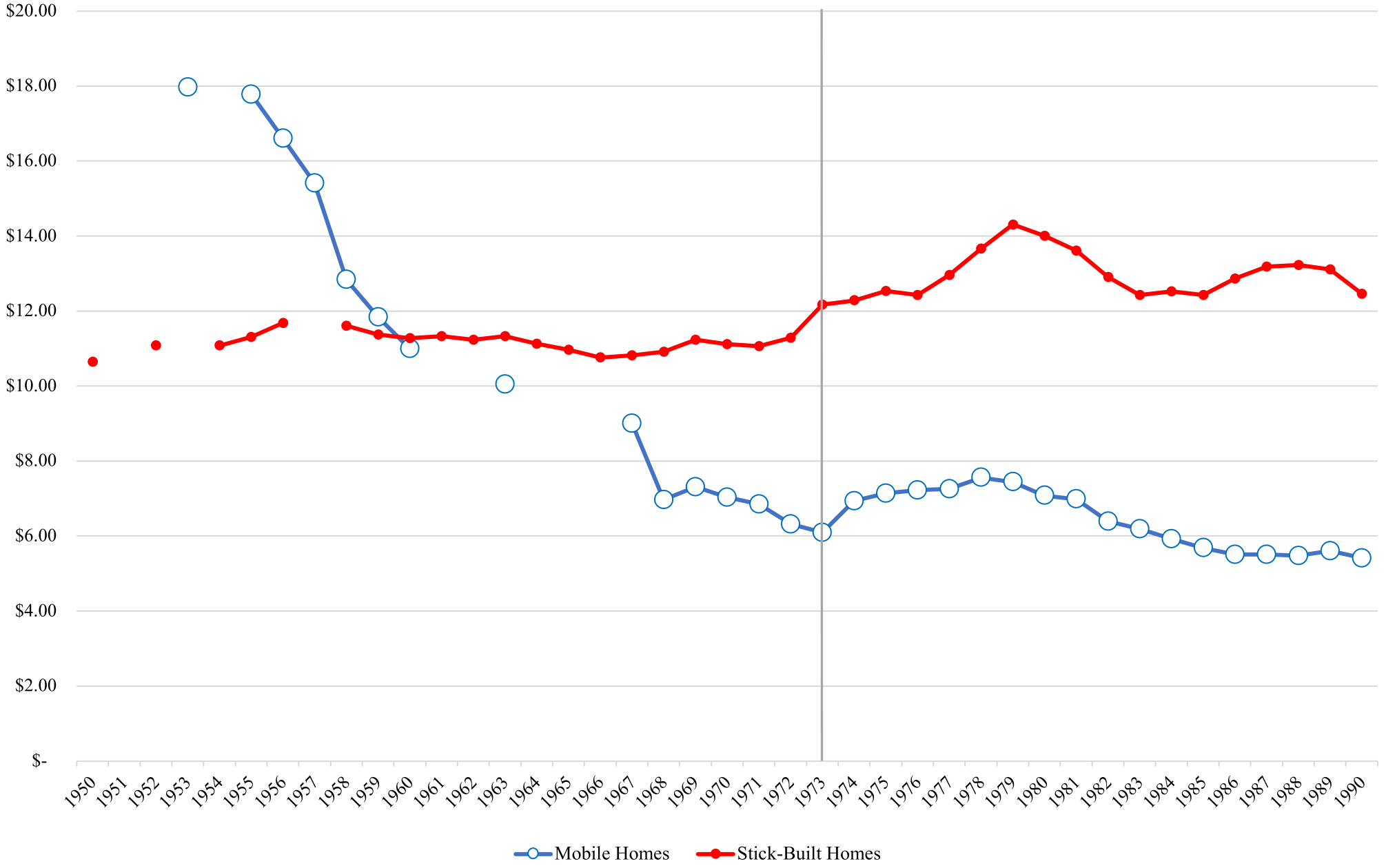
Prices for stick-built homes are for homes that qualified for FHA Section 203(b) loans.

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



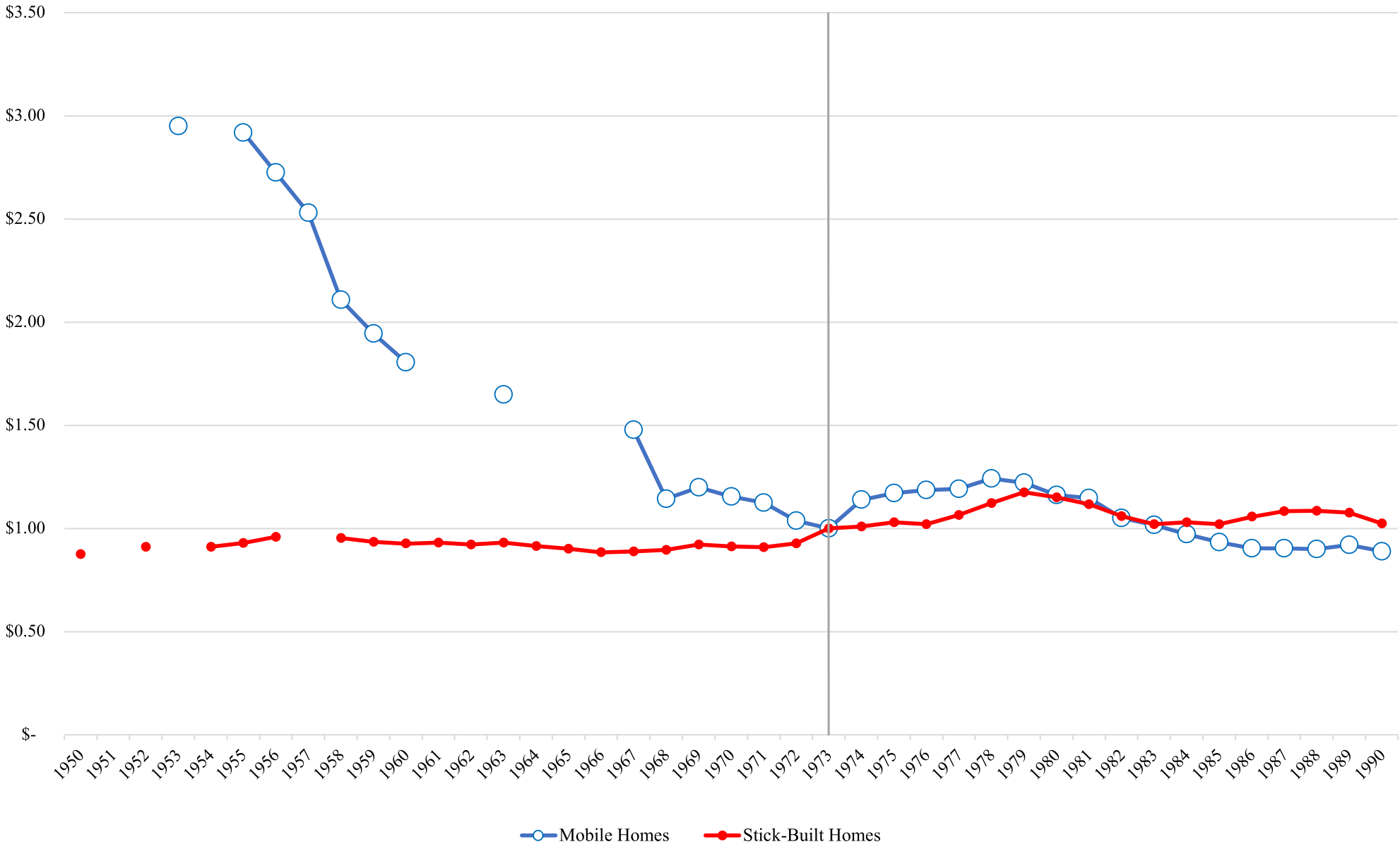
Prices for stick-built homes are for homes that qualified for FHA Section 203(b) loans.

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)

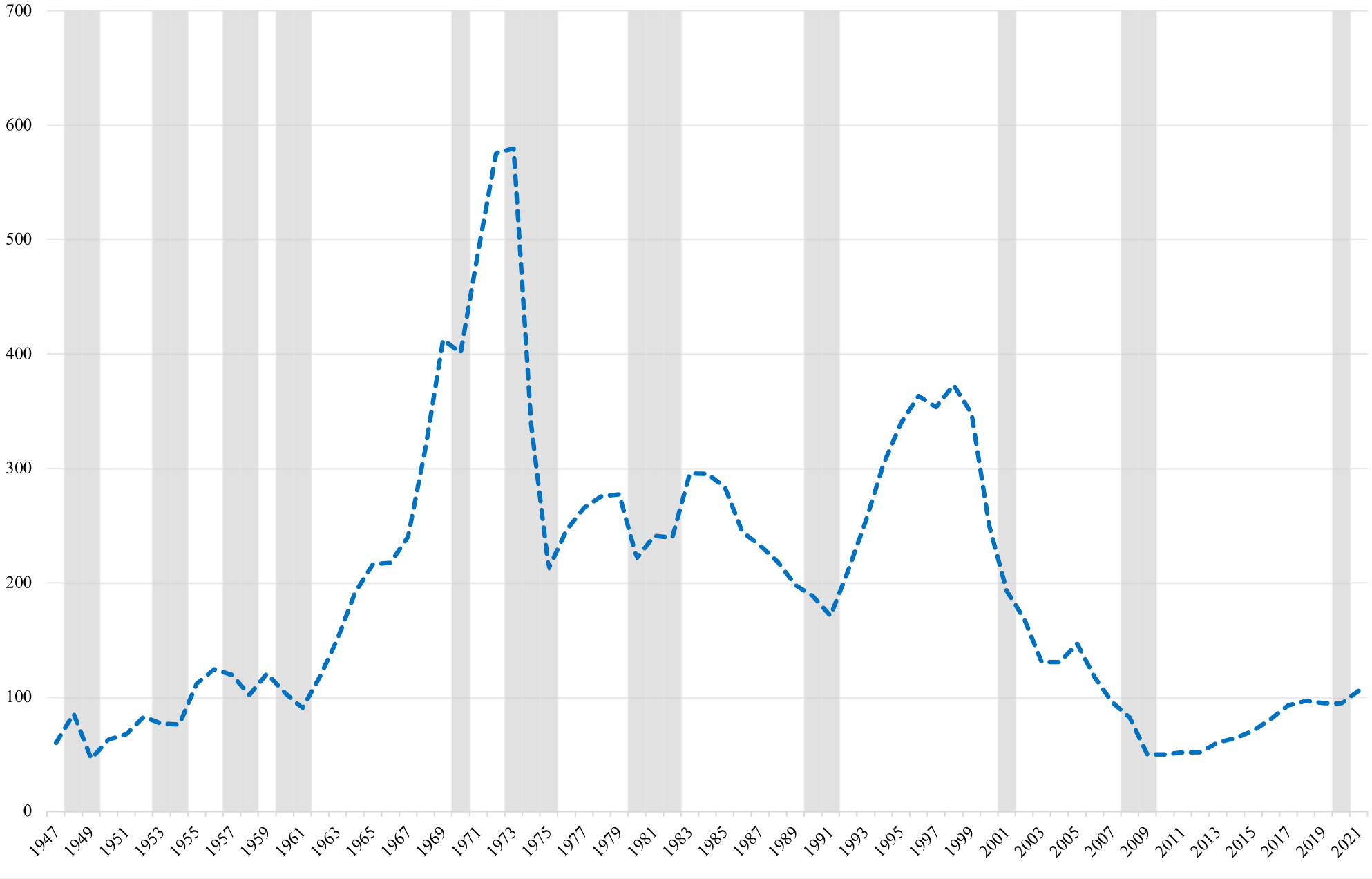


Figure 5: Shipments of Mobile Homes and Housing Starts (Units, 000s)

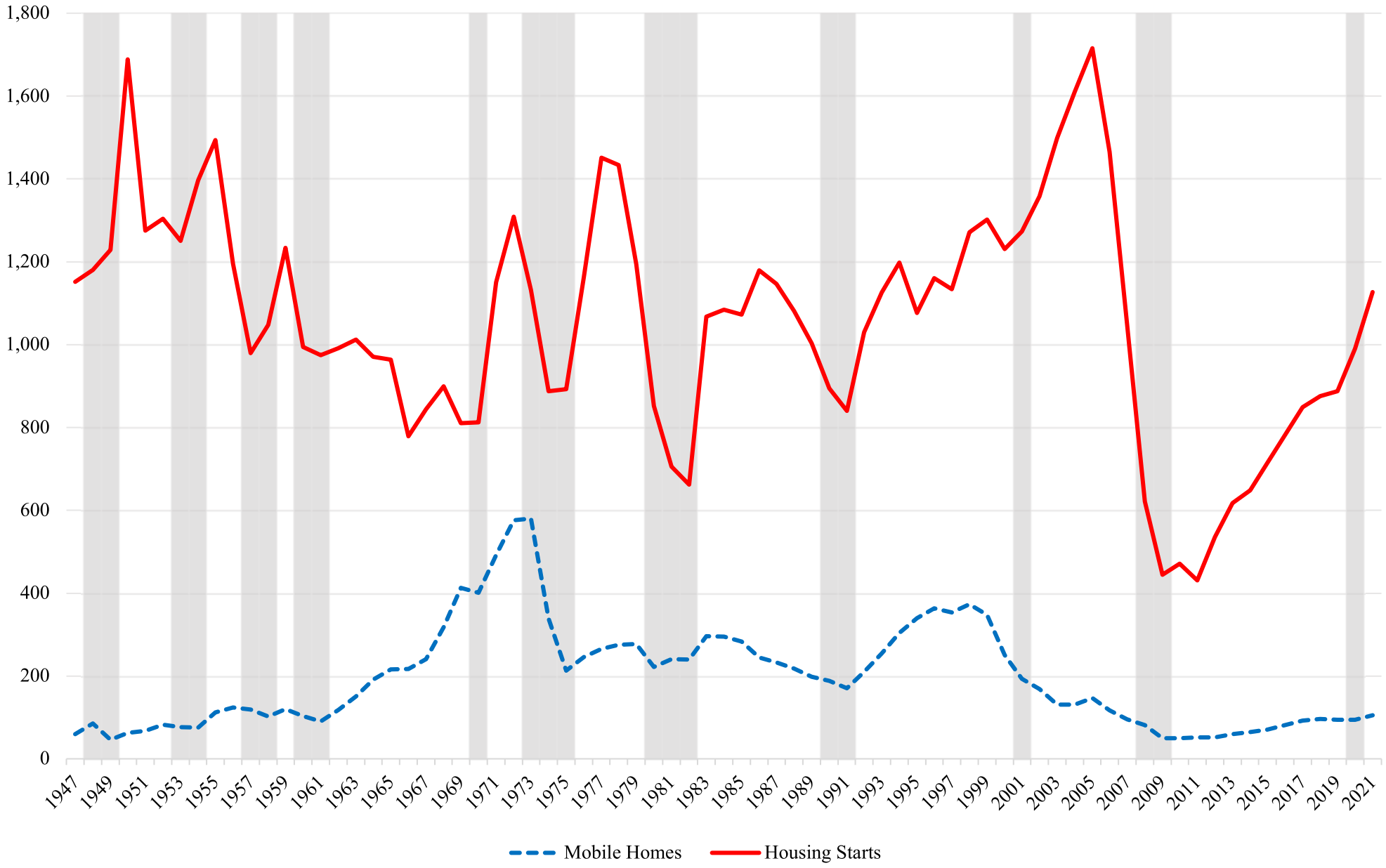
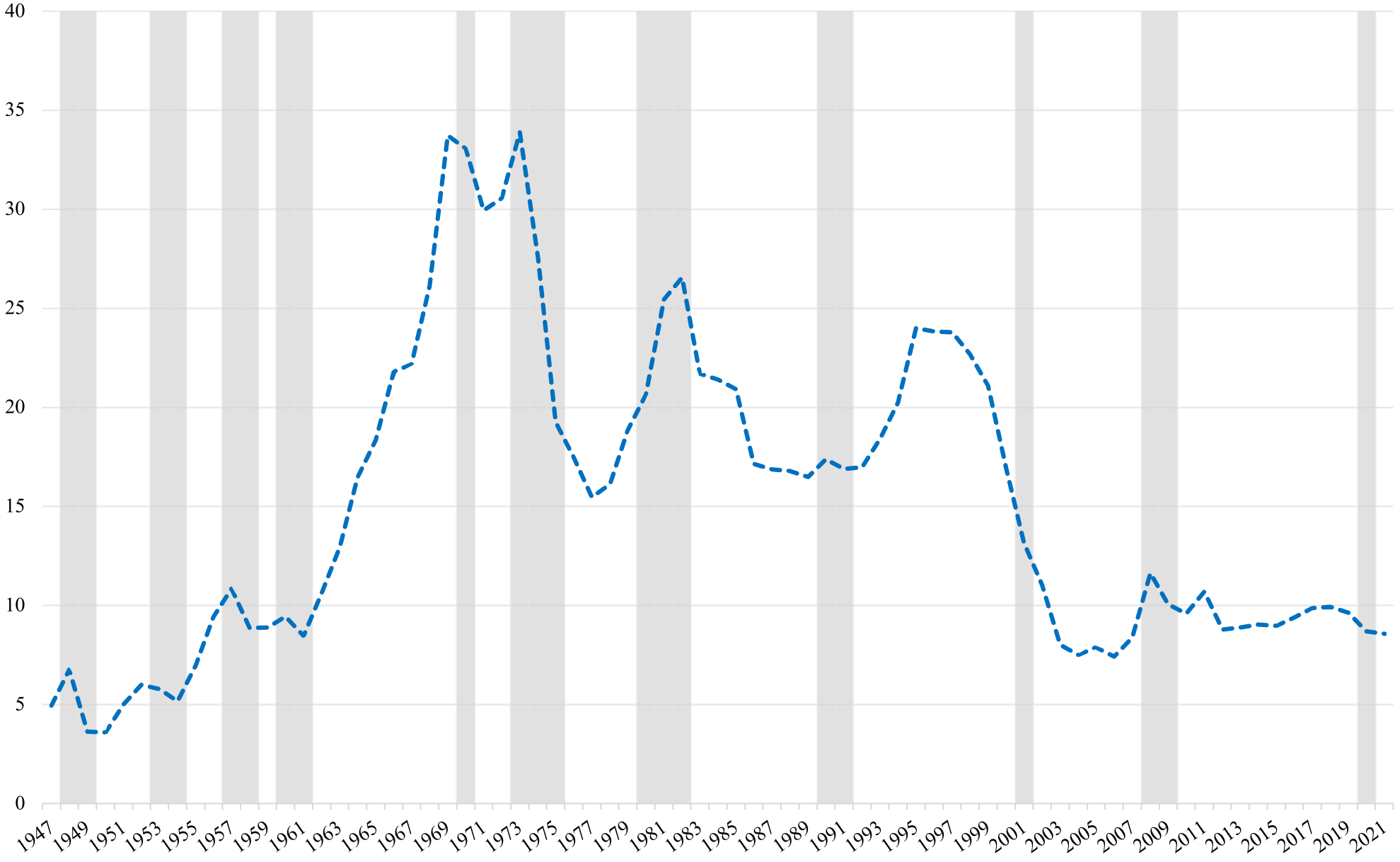


Figure 6: Mobile Home Shipments as % of Total Single Family Production



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

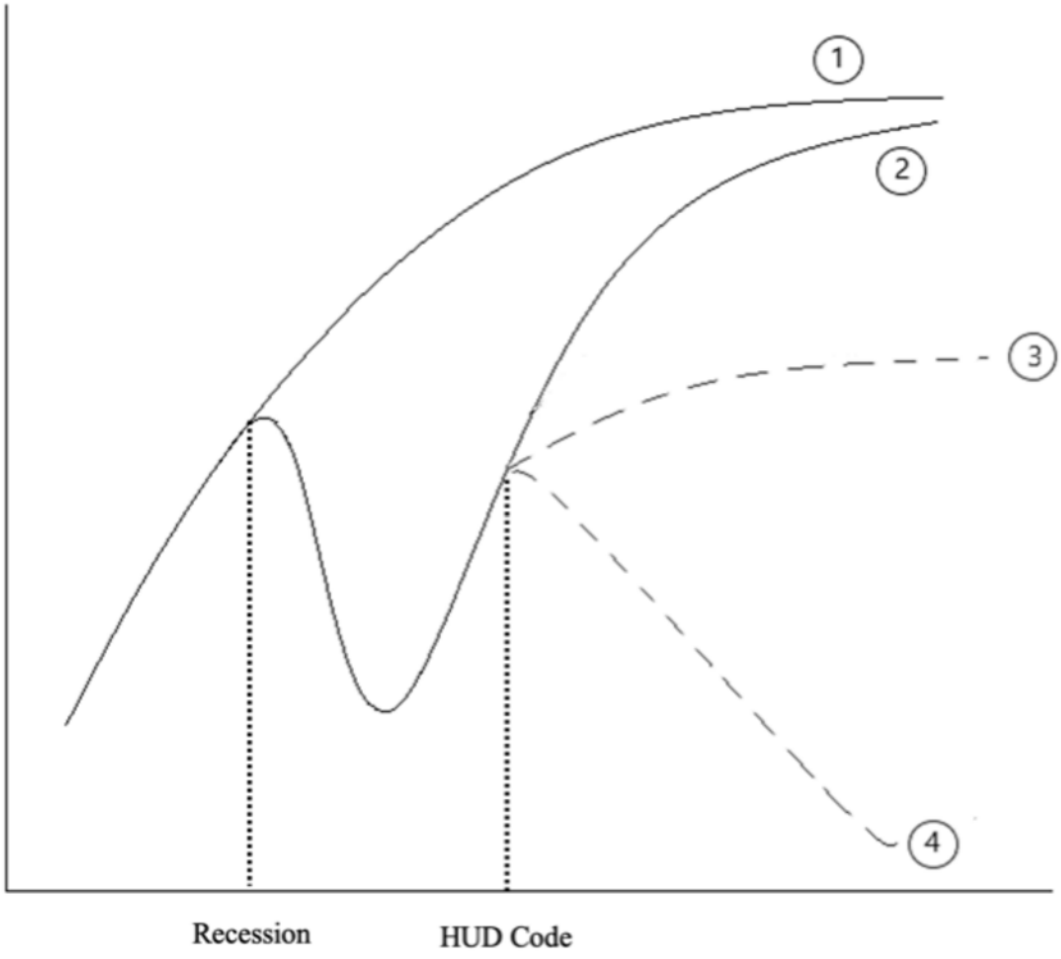
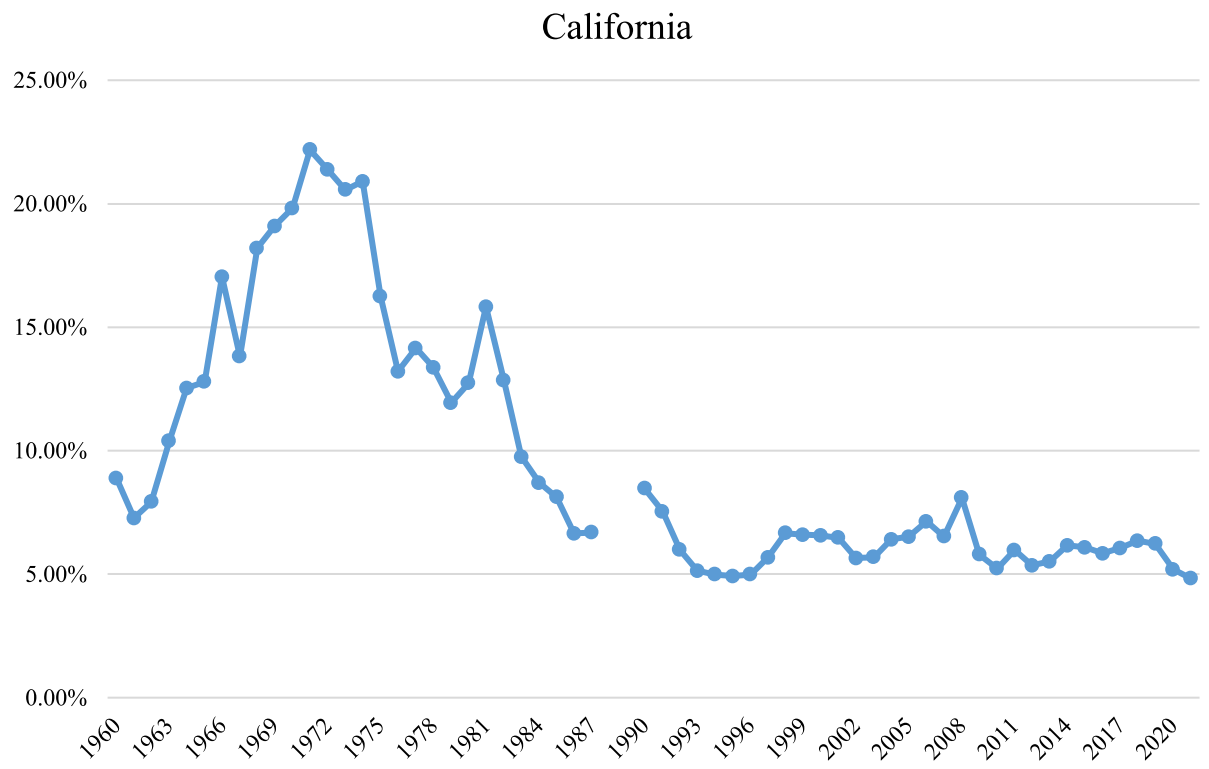


Figure 8: Mobile Home Share of Single Family Housing Production



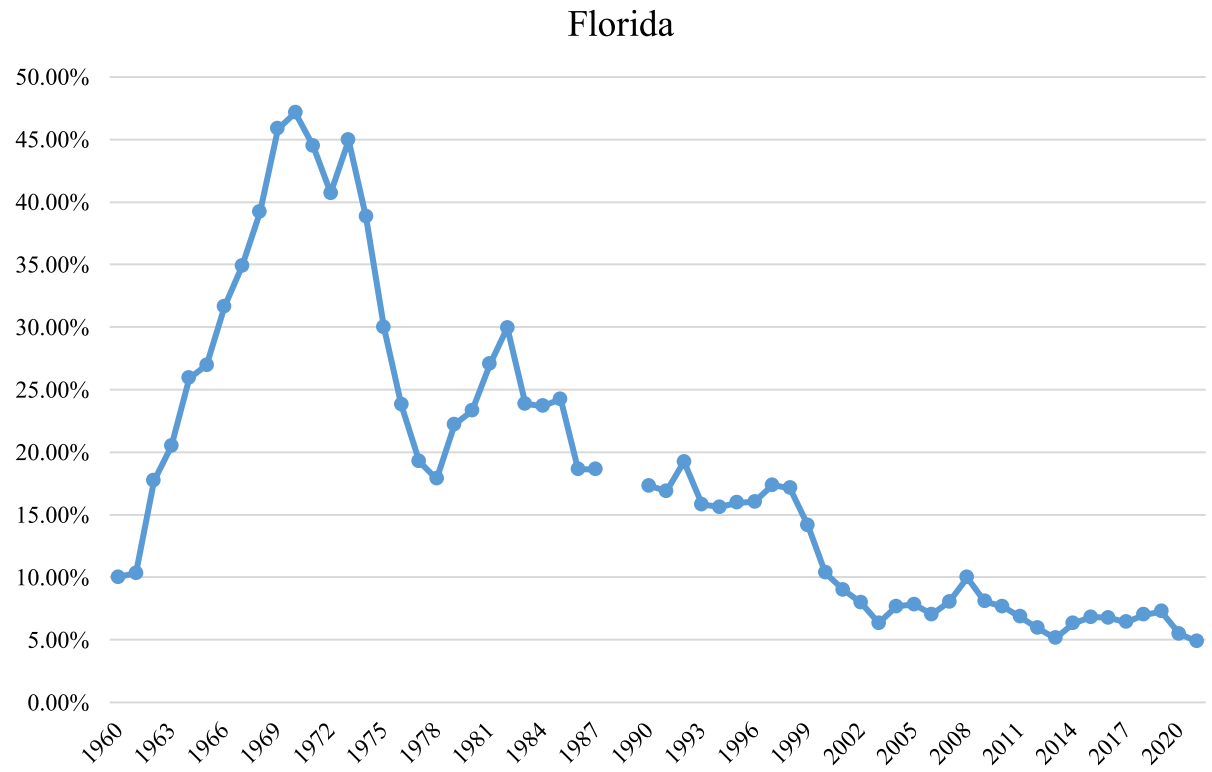


Figure 9: Mobile Home Share of Single Family Housing Production

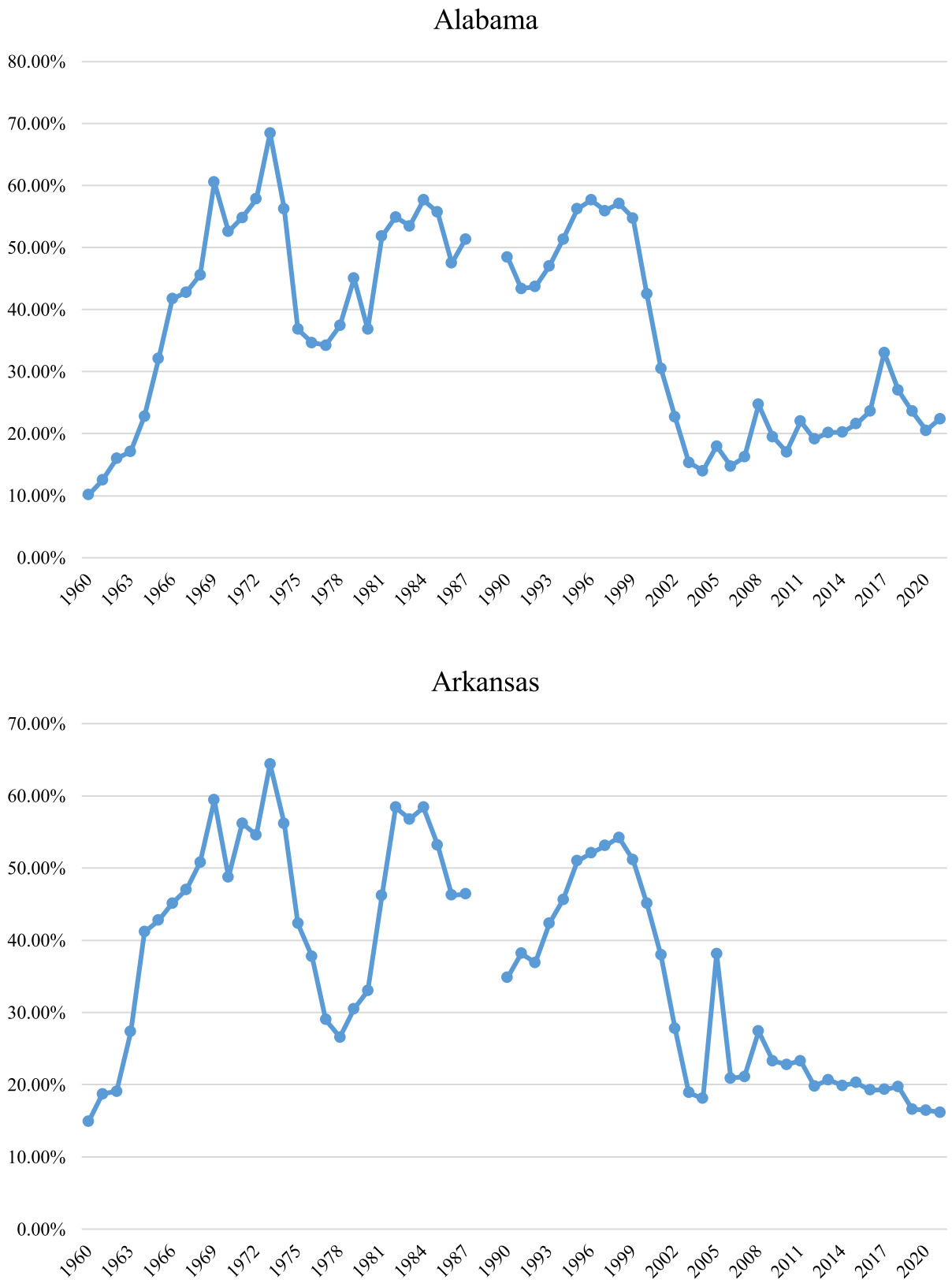
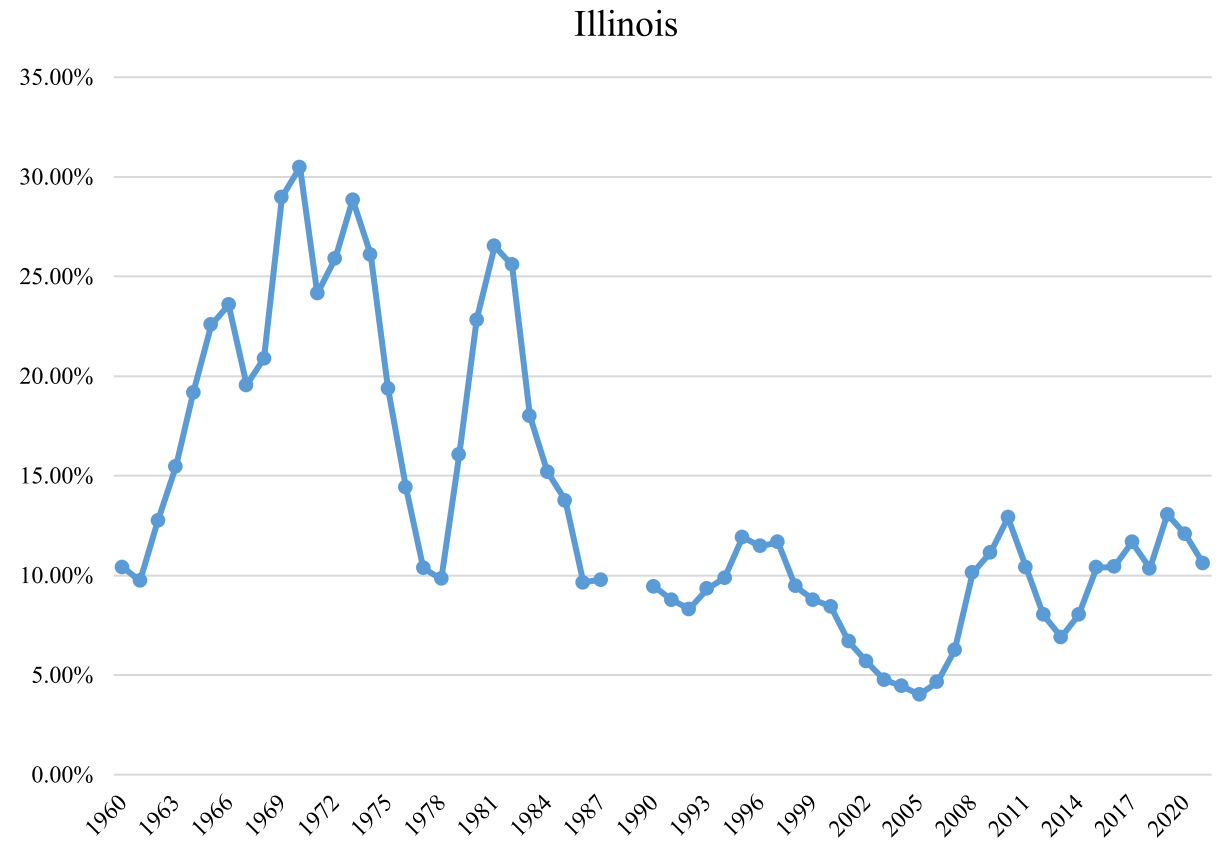


Figure 10: Mobile Home Share of Single Family Housing Production



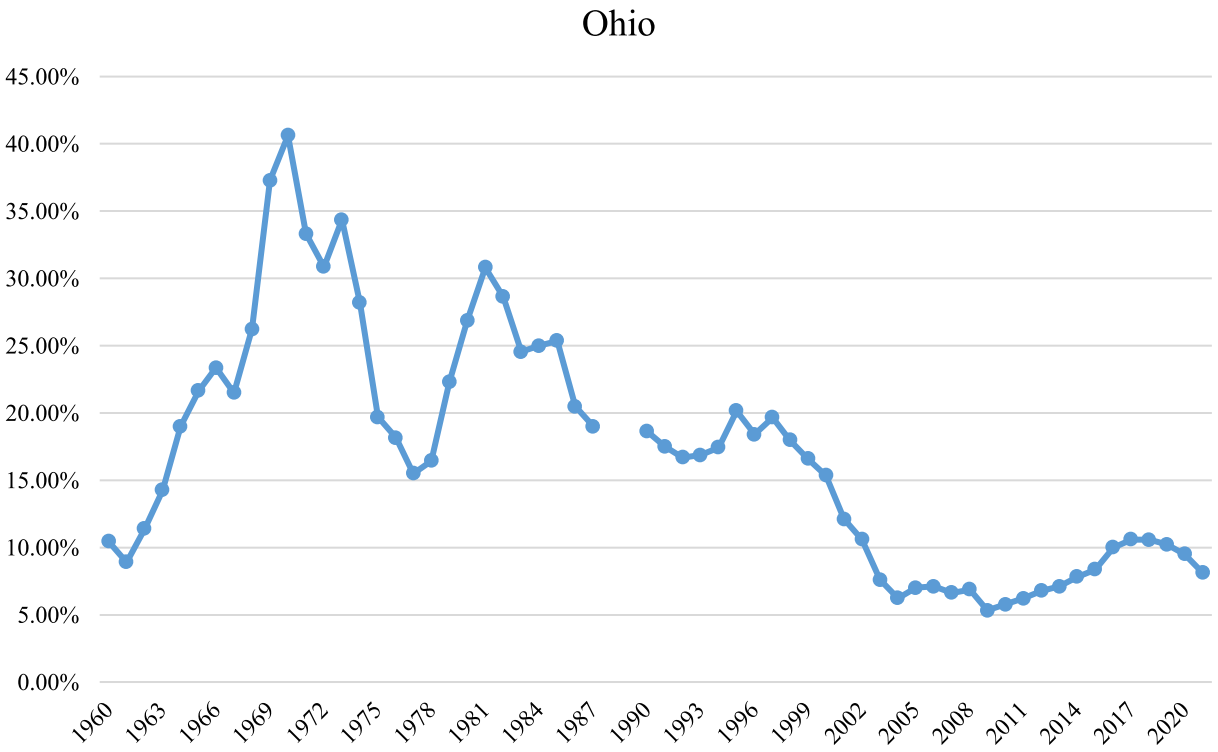
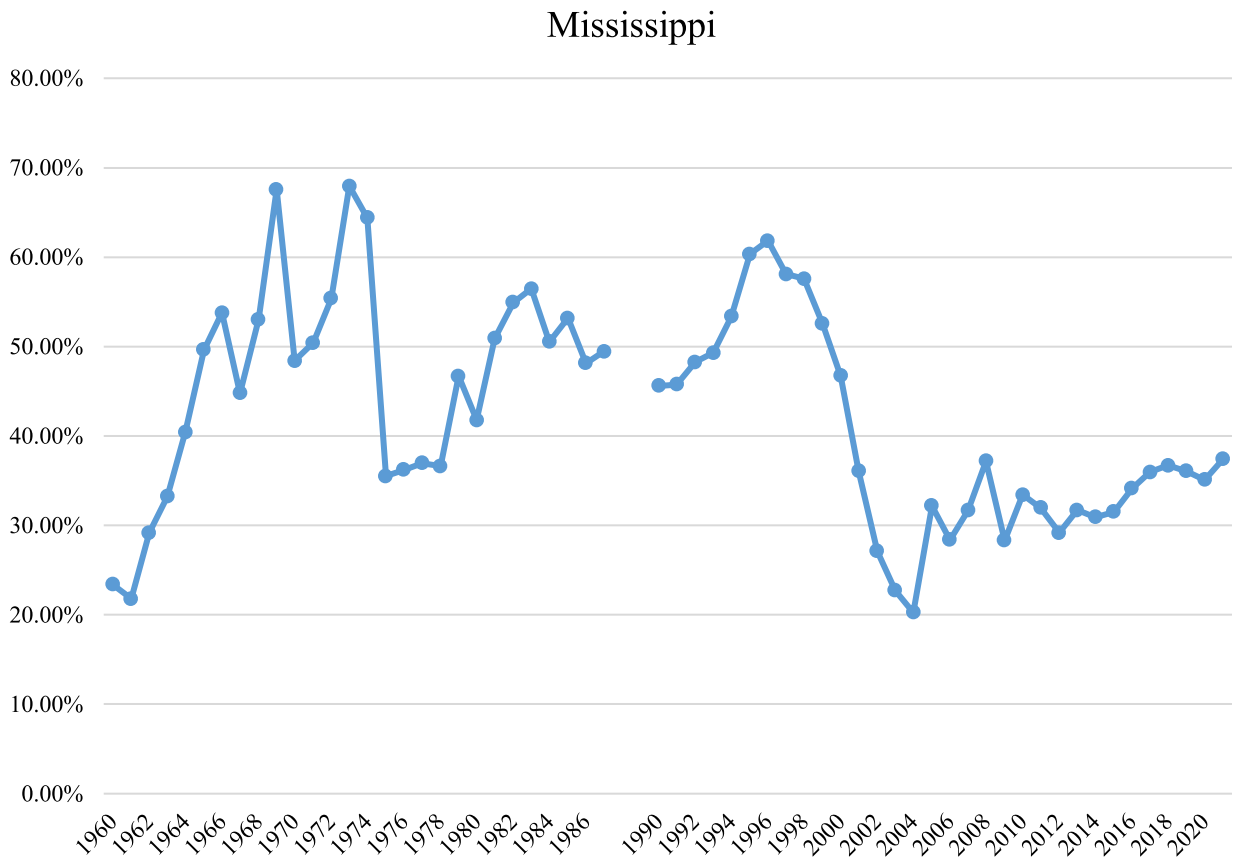


Figure 11: Mobile Home Share of Single Family Housing Production



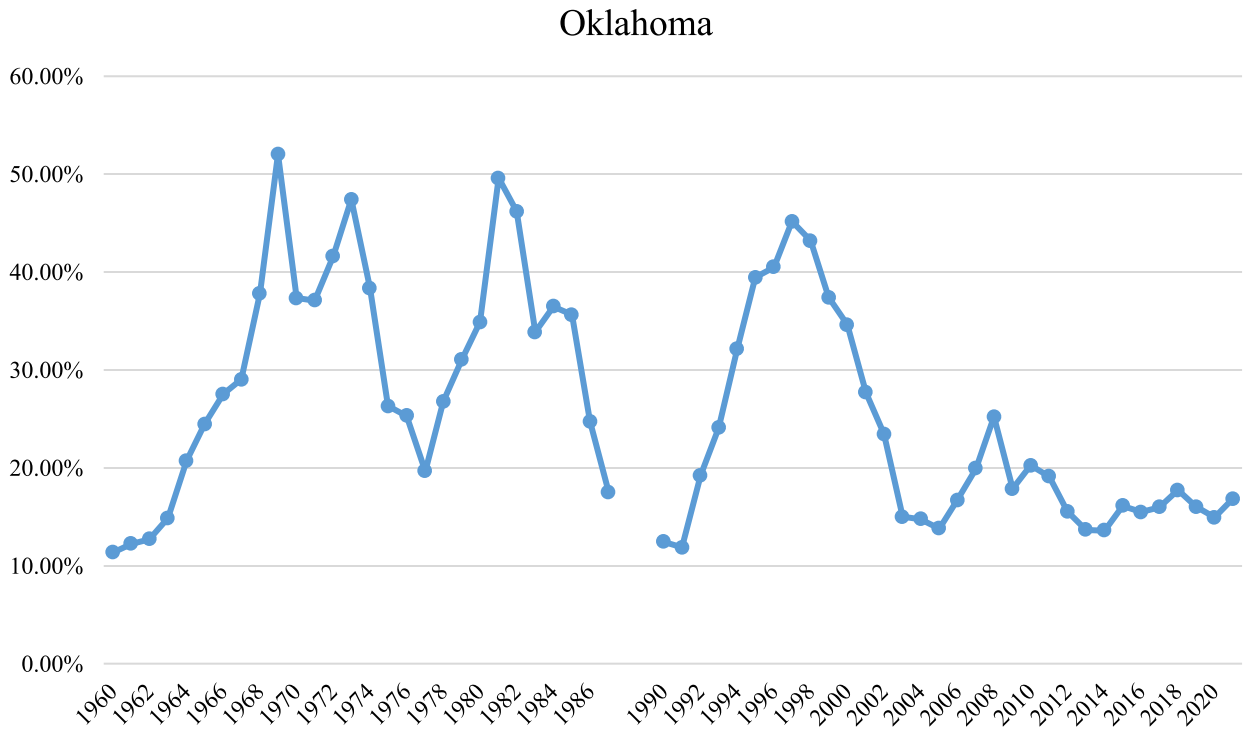


Figure 12



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**The Chicago Tribune* (Sep. 6, 1921): p. 6.

Figure 13



*_Look_ (April 1, 1947): p. 21.