

Trailer Park Economics

Caitlin Sona Gorback

Professor Charles Becker, Faculty Advisor

Abstract

In this paper, we explore the various reasons behind the development of the American institution of trailer parks. The first two models arise in equilibrium, the last two respond to housing shocks. Models include “Bad Tenants” in which tenants and landowners contract to protect against bad neighbors, a basic “Capital Constraints model in which tenants and landowners share the burden of capital costs, “Uncertain Growth” in which landowners respond to boom and bust economic growth, and “Long vs. Short Run Growth” in which landowners must decide how to invest on their land given rates of land appreciation.

Keywords: Trailer Parks, Manufactured Housing, Urban Growth, Rural Growth, Housing
Economics

JEL codes: R21, R23, R31

*Honors Thesis submitted in partial fulfillment of the requirements for Graduation with
Distinction in
Economics in Trinity College of Duke University.*

Duke University
Durham, North Carolina
2011

Acknowledgements

First and foremost, I would like to thank my Faculty Advisor, Dr. Charles Becker. He has worked with me for the past year and a half on this novel project, pushing me to model new theory, explore different types of existing housing and related literature, and even to venture out and take a look at trailer parks myself. I am so grateful for all of the first hand knowledge and experience I have gained in working with him, and look forward to our collaborative work in the future. Secondly, I would like to thank my family. From the first time they heard about my project idea (after their initial disbelief), they were enthusiastic about offering help, guidance, and support. A special thanks to my father, for pointing out foreign mobile home concepts existing at the border between sharecropping and trailer parks. Next, I would like to thank the many friends and associates who have asked me thought provoking questions about my work, assisted me in writing Stata code, understanding econometric theory, and even the most basic grammatical corrections.

I could not have achieved this thesis without the support and curiosity of those of you mentioned above. I extend my most heartfelt thanks, once more, to all of you.



1 Introduction

Trailers, mobile homes, manufactured housing, or whatever else one would like to label prefabricated housing units with origins in mobility, have been an integral part of the United States housing sector since their first introduction back in the 1920's. With the affordability and popularity of the Ford Model T came the associated American dream of exploring the nation. The first few trailers were little more than wooden tents on wheels meant to make moving from camp ground to camp ground more efficient. People towed their trailers behind their Model T, stopping on the sides of roads, in empty parking lots, or minor streets in the evenings. Soon enough, roadside property owners got frustrated with the transient campers, who would leave garbage behind, pick bouquets from private gardens, and forage in private orchards for a bite of fruit; these travelers had to be accommodated somewhere (Hurley, 2001)! City governments responded by designating plots of unused land as travel trailer parks. The move towards trailer parks thus began with the advent of free, municipal trailer camps, which provided amenities such as restrooms, potable water, and lighted streets. Soon enough, private landowners caught on to the fact that, for a small fee, travelers would flock to camps offering better amenities, such as electrical hookups and playgrounds.

With the Great Depression came a large expansion in trailer parks, and a move towards using trailers as permanent housing. With a mobile population in many ways reminiscent of the Joad family from *The Grapes of Wrath*, many desperate job seekers abandoned their permanent residences in favor of a mobile home they could take with them as jobs became available (Hurley, 2001). The privately owned trailer parks meant for vacationers soon saw large populations of job-seekers settling down more or less

permanently as jobs proved scarce and alternative housing grew exceedingly expensive, due to the Depression and the general housing shortage in the 1930's.

With the beginnings of World War II, hundreds of thousands of workers flocked to defense jobs located in formerly small towns such as Pascagoula, Mississippi, Ypsilanti, Michigan, and Orange, Texas, as well as fast growing cities such as Detroit, Philadelphia, St. Louis, and San Diego (Hurley, 2001). None of these towns had sufficient housing to meet the military's immediate and large demand, and so the government began buying trailers in 1940. By 1942, the National Housing Agency acknowledged government purchases of more than 35,000 trailers (Hart, Rhodes, Morgan, 2002). Although the government got out of the trailer park operation as soon as the war ended, selling the land back to the original owners, and selling trailers to private buyers, World War II had forever legitimized trailers as a means of permanent, immobile housing (Hart et al., 2002).

This legitimacy proved invaluable in the extreme housing shortages following the war. Because of the materials rationing during the war, most industry being put towards the war effort, and the housing stagnation during the depression, millions of Americans had difficulty finding suitable housing in postwar America. This was only exacerbated by the number of veterans returning home expecting to start families and purchase middle-class housing cheaply under the power of the GI Bill of Rights (Hurley, 2001). Because housing was in such short supply, manufactured housing and trailer parks once again became a necessary component to the housing stock. Many lower middle-class Americans turned to trailer parks as "temporary housing", as an intermediary while they waited for affordable Levittown type suburbs to be built. As Levitt towns began cropping up, the cost of a stick built suburban home still proved too expensive for most working-class families.

Additionally, the federal government either offered low mortgages to those settling in nice, new suburban plans like Levittown, or subsidized very low-income inner-city developments. A large section of America's working-class, those who could still not afford the mortgages offered through the Federal Housing Administration, yet did not qualify for publicly subsidized housing, was left without any government housing advantages. These people had little option but to remain permanently in the trailer parks previously viewed as transition homes (Hurley, 2001).

As the 1950's and 1960's progressed, a stable trailer park population emerged. Homes grew larger and less mobile as trailer parks became more established, and parks themselves began to regulate more strictly the relationships between renters and park owners. Park owners implemented regulations meant to maintain the standard of the park, putting limitations on pets, children, and even days when the laundry could be hung out (Hurley, 2001). The result was a movement towards a more strictly defined characterization of what a decent trailer park community should look like in order to attract more tenants. Indeed, trailer park owners tried many ways to improve the status of their parks, but they had to face a litany of obstacles set up by both the FHA and municipal zoning laws. The Mobile Home Research Foundation attempted to mitigate these obstacles by providing the handbook, *Local Regulation of Mobile Home Parks, Travel Trailer Parks, and Related Facilities* (1965), as a guide for municipalities on how to set up favorable zoning laws which distinguished travel trailers meant for transient stay in parks from mobile homes, which permanently resided in a park. The author argued that mobile home communities should be allowed only in residential areas, as they could not in all cases reach a size large enough to buffer the negative residential externalities in an industrial or commercial area. On the other hand, travel trailer

parks should be allowed in any commercial area in which a motel would be placed, attracting tourism to commercial centers (Bair, 1965). It would seem from the stigma arising in the 1960's, that Mr. Bair's advice was not taken into consideration by many zoning committees or the FHA. Slurs of "white trash" and "trailer trash" cropped up as working-class America decided to distance itself from economically similar, but socially and residentially insular trailer park residents (Hurley, 2001). If these stigmas were to ever be overturned, coordinated action by both the federal government and municipal governments would need to be taken, but for a range of such policy to take place, an overhaul in the perception of trailer parks would be necessary.

Consistent in their indifference towards this lower lower-class, the FHA did not recognize trailer parks as having fixed homes, but rather insisted on considering these trailers as "mobile homes." These mobile homes paid no property taxes (the landowner was responsible for those) and were considered personal property, not real property. As such, it was not until 1971 that the FHA extended mortgage insurance to the consumers of mobile homes, but by that point, there had already developed a stigma surrounding trailer parks as unsavory, and low value locations (Hurley, 2001). Municipalities operated under these stigmas, shunning trailer parks to the very fringes of city limits, often limiting parks to floodplains and other undesirable land tracts with the reason that the housing units were "mobile", when in fact it is highly costly to move a trailer. Continually shunning trailer parks to blighted areas perpetuated the stigmas in a vicious cycle (McCarty, 2010).

In combination with the 1971 FHA expansion of mortgage opportunities came two important federal actions in the 1970's meant to ameliorate the stigmas surrounding trailer parks and afford trailer park tenants more economic freedoms. First, in 1970 President

Richard Nixon acknowledged that mobile homes were a viable form of housing (McCarty, 2010). Second, the Mobile Home Construction and Safety Standards Act of 1974 helped turn around the public perception of trailer parks. In ensuring that these mobile homes were up to government safety standards, consumers could more easily find manufacturers and secure loans and mortgages with rates closer to traditional mortgages (Hart et al., 2002). Another step forward for trailer parks came after the Mobile Home Manufacturers Association rebranded itself the Manufactured Housing Institute, and then lobbied congress to change the wording in all federal law from “mobile home” to “manufactured housing” (Hart, et al. 2002). This switch in terminology reflected the fact that by the 1970s, residents of trailer parks moved residential addresses less often than the average American, showing themselves to be, in fact, less mobile than those in stick built housing. This immobility arose due to many factors: the lack of appreciation of trailers, the prohibitive transportation costs, and the inability of those in trailer parks to accumulate savings. Trailers are very poor long term investments; they depreciate over the course of 20-35 years (most optimistic, and for high end trailers) rather than 100 years for a stick built home and have much shorter mortgages (7-12 years) at much higher rates than conventional mortgages (Hart et al., 2002). Additionally, with utilities, park fees, rental rates, and high interest on mortgages, many trailer tenants end up saddled with higher monthly payments than many residents of stick-built houses, all because they could not afford the initial purchasing costs. This leaves trailer owners subsisting month to month, unable to build capital with which to move towards higher-income housing, or to another park.

Moving through the 1980's and 1990's, regardless of the government's steps forward in housing regulation in the 1970's, municipalities stuck with their original trailer park

stigmas developed in the 1950's and 1960's. Even today, zoning commissions rarely make provisions for trailer parks, not wanting them located in urban areas that could potentially lower urban property values city officials hope will rise, and allocating much fringe land to agriculture instead of utilitarian housing tracts (Hart et al., 2002). This means that many potential park developers have been shut out of the market, restricting supply of trailer parks sharply. This places many people desirous of living in a trailer park on long waiting lists, and leaves current and future tenants up to the whims of the park owner, who owns the property and is free to do almost anything he can imagine to extract rents from his tenants. The shortage of trailer park spots combined with the immobility of current manufactured homes further weakens the status of tenants, leaving them open to abuses such as month-to-month rents, hidden fees, and forced to abide by tie-ins. Tie-ins are agreements between manufactured housing producers and trailer park owners in which owners get kick backs from the producers if they sell a producer's product to a new tenant. As such, tenants often are not allowed to bring used trailers to new parks, and must buy a new trailer from the park owner. In the event that a tenant could find a park in which to settle his used trailer, he still must pay thousands of dollars in transportation costs as well as risk permanent damage from relocation, further lowering mobility (Hart et al, 2002). To make matters worse for tenants, because the property is at the sole discretion of the landowner, the landowner can choose to end the trailer park in order to convert his land into a more lucrative opportunity or sell the appreciated land.

With all of the social stigmas surrounding trailer parks, the abuses suffered by tenants, and the government's general indifference towards manufactured housing (excepting in times of natural disaster like Hurricane Katrina, which further lowered the nation's opinion

of trailer parks), why do people still choose to live in these institutions? We have mentioned that many live in trailer parks due to capital constraints, due to large booms in economic growth such as war, and that park owners may use the institution to extract temporary rents, but what about the nature of the individuals? There is also a case to be made for the strong communities that often develop in trailer parks. By no means are trailer parks uniform; they range from the most utilitarian and destitute gathering of abused single-wides, to elaborate retirement communities with palm-tree lined private roads. Sociologists have found that many trailer parks, while on aggregate very heterogeneous, have very homogenous tenants reflecting elderly communities, family style parks, parks for singles, parks that allow pets, and parks with strict or lax regulations (Kusenbach, 2009). Within these homogenous societies, studies have shown that very vibrant and supportive social communities have developed in the rather insular institution of trailer parks, though this is more prevalent in “high end” trailer parks (even “high end” trailer parks are considered low income housing). This means that the abuses levied by landlords do not necessarily define the relationship between tenants and their trailer park. In fact, tenants may have much to gain from a trailer park system as opposed to traditional low-income housing options.

Beyond the history and arguments for and against trailer parks, in order to grasp the magnitude of general trailer park ignorance, it is worthwhile to note the prevalence of trailer parks in America. During the late 1990’s and early 2000’s, during and immediately after President Clinton’s push for affordable single-family housing (Manufactured Housing Improvement Act 2000), the amount of manufactured home sales peaked at 373,800/1,616,900 single-family housing starts in 1998 (US Commerce Department, 2009).

Table 1

Percentage of Housing Starts as Manufactured Homes By Region					
Year	% total of housing starts that are MH	% housing starts are MH in Northeast	% housing starts are MH in Midwest	% housing starts are MH in South	% housing starts are MH in West
1980	18.1	9.8	14.8	21.8	15.9
1981	21.1	10.2	18.2	25.6	18.2
1982	22.0	10.6	17.2	27.3	17.0
1983	16.3	9.7	15.7	19.9	10.8
1984	16.5	9.7	14.5	22.3	9.0
1985	16.3	8.0	16.1	24.0	7.9
1986	14.2	7.2	12.6	22.1	7.3
1987	14.8	8.8	13.4	23.0	7.2
1988	15.1	9.7	14.3	22.7	7.9
1989	14.7	11.3	14.7	21.0	7.7
1990	16.4	14.3	14.9	22.6	9.3
1991	17.2	12.7	15.2	23.6	10.6
1992	17.7	11.9	14.7	25.0	10.5
1993	18.8	12.2	14.9	26.1	11.9
1994	20.0	11.8	16.2	27.8	12.4
1995	23.6	12.7	19.8	33.0	13.2
1996	20.9	12.3	18.3	33.0	12.3
1997	22.8	10.5	18.2	32.7	13.0
1998	23.1	9.9	17.6	33.7	12.8
1999	20.6	9.1	15.4	30.5	11.1
2000	17.9	9.6	15.3	25.0	10.1
2001	12.2	8.2	11.4	15.9	7.7
2002	10.2	7.5	9.8	12.9	6.5
2003	7.6	6.9	6.7	9.2	5.5
2004	6.4	6.3	5.8	7.4	4.9
2005	5.9	4.8	4.8	6.8	5.4
2006	6.2	4.7	5.2	7.3	5.4
2007	7.0	4.9	5.1	8.7	5.5
2008	8.8	4.1	6.1	11.7	6.7

More recently, in 2008 new placements of manufactured homes accounted for 8.76 % of new single-family housing starts. As of 2011, it is estimated that about 18 million Americans live in roughly 50,000 trailer parks throughout the country, meaning that about 6% of our nation's population resides in a manufactured home within a park (Berlin, 2011). The seeming

discrepancies between manufactured home placement and trailer park residents reflects the fact that many manufactured homes are placed on private property as a means of cheap housing.

Closer to home, in the 1990's, North Carolina alone accounted for 15% of the nation's new manufactured housing placements (Eckstein, 2010). With approximately 5,200 block groups, North Carolina as of 2009, has a housing stock of 3,523,944 housing units, 577,323 of which are manufactured homes. This means that the North Carolina housing stock is a little over 16% manufactured housing. Of these 5,200 block groups, a quarter of the block groups (1266 housing blocks) have 30% or more of their housing stock as manufactured homes. Let's do some basic math: this means that 1,300 bloc groups have 30% of their housing as manufactured, with approximately 2,000 people per bloc group, a rough estimate shows there to be around 780,000 North Carolinians living in manufactured homes, and likely, at least half of those in trailer parks.

Moving back to a broader picture, the South in total has comprised between 53.2% and 67.2% of the new manufactured housing placements (U.S. Commerce Department, 2009). The table below details the manufactured home placements by region, in thousands, in the US from 1980-2008.

Table 2

United States Manufactured Home Placements by Region, in thousands of units					
Year	United States Total Placement	Northeast Placement	Midwest Placement	South Placement	West Placement
1980	233.7	12.3	32.3	140.3	48.7
1981	229.2	12.0	30.1	143.5	43.6
1982	234.1	12.4	25.6	161.1	35.0
1983	278.1	16.3	34.3	186.0	41.4
1984	287.9	19.8	35.2	193.4	39.4

1985	283.4	20.2	38.6	187.6	36.9
1986	256.1	21.2	37.2	162.3	35.4
1987	239.2	23.6	40.0	145.5	30.1
1988	224.3	22.7	39.1	130.7	31.8
1989	202.8	20.2	39.1	112.8	30.6
1990	195.4	18.8	37.7	108.4	30.6
1991	174.3	14.3	35.4	97.6	27.0
1992	212.0	15.0	42.2	124.4	30.4
1993	242.5	15.4	44.5	146.7	35.9
1994	290.9	16.3	53.3	177.7	43.6
1995	319.4	15.2	57.5	203.2	43.7
1996	337.7	16.2	58.8	218.2	44.4
1997	336.3	14.3	55.3	219.4	47.3
1998	373.7	14.7	58.3	250.3	50.4
1999	338.3	14.1	53.6	227.2	43.5
2000	280.9	14.9	48.7	178.7	38.6
2001	196.2	12.2	37.6	116.4	30.0
2002	174.3	11.8	34.2	101.0	27.2
2003	139.8	11.2	25.2	77.2	26.1
2004	124.4	11.0	20.6	67.4	25.5
2005	122.9	9.2	17.1	68.1	28.5
2006	112.4	7.9	14.5	66.1	23.9
2007	94.8	7.0	10.8	59.4	17.7
2008	79.3	5.0	8.2	53.0	13.1

Additionally, below is a list of total housing starts in the US from the same period (U.S. Census Bureau, 2010).

Table 3

New Privately Owned Housing Units Started Annually (Number of housing units in thousands)												
Year	Total	Structure Size			Region							
		1 unit	2-4 units	>4 units	Northeast		Midwest		South		West	
					Total	1 unit	Total	1 unit	Total	1 unit	Total	1 unit
1980	1292.2	852.2	109.5	330.5	125.4	87.1	218.1	141.5	642.7	428	306	195.6
1981	1084.2	705.4	91.2	287.7	117.3	84	165.2	19.08	561.6	363.2	240	148.4
1982	1062.2	662.6	80.1	319.6	116.7	79.3	149.1	98.8	591.6	357.4	205.4	127.1
1983	1703	1067.6	113.5	522	176.6	122.8	217.9	153.3	935.2	557.2	382.3	234.3
1984	1749.5	1084.2	121.4	543.9	204.1	158.3	243.3	167.2	866	528.4	436.1	230.2

1985	1741.8	1072.4	93.5	576	251.6	181.7	239.6	148.1	782.4	504	468.2	238.7
1986	1805.4	1179.4	84	542	293.5	227.6	295.8	187.5	733.1	503.6	483	260.7
1987	1620.5	1146.4	65.1	408.7	269	204.2	297.9	202.8	633.9	484.7	419.8	254.7
1988	1488.1	1081.3	58.7	348	235.3	11.3	274	193.6	574.9	442.8	403.9	263.6
1989	1376.1	1003.3	55.3	317.6	178.5	131.5	265.8	190.2	536.2	409.3	395.7	272.2
1990	1192.7	894.8	37.6	260.4	131.3	104.3	253.2	193.2	479.3	371.1	328.9	226.3
1991	1013.9	840.4	35.6	137.9	112.9	99.3	233	191.3	414.1	352.6	254	197.3
1992	1199.7	1029.9	30.9	139	126.7	111.8	287.8	236	496.9	438.5	288.3	243.6
1993	1287.7	1125.7	29.4	132.6	126.5	115.7	297.7	250.8	561.8	498.4	301.7	260.9
1994	1457	1198.4	35.2	223.5	138.2	122.5	328.9	268.3	639.1	521.7	350.8	285.8
1995	1354.1	1076.2	33.8	244.1	117.7	101.9	290.1	233.6	615	485	331.3	255.8
1996	1476.8	1160.9	45.3	270.8	132.1	111.7	321.5	254	661.9	523.9	361.4	271.3
1997	1474	1133.7	44.5	295.8	136.8	111.2	303.6	238	670.3	506.7	363.3	277.7
1998	1616.9	1271.4	42.6	302.9	148.5	122.2	330.5	272.6	743	573.7	394.9	302.8
1999	1640.9	1302.4	31.9	306.6	155.7	126.4	347.3	288.7	746	579.5	391.9	307.7
2000	1568.7	1230.9	38.7	299.1	154.5	118.3	317.5	260.4	713.6	555.6	383.1	296.5
2001	1602.7	1273.3	36.6	292.8	149.2	110.8	330.4	269.3	732	590.3	391.1	303
2002	1704.9	1358.6	38.5	307.9	158.4	117.8	349.6	276.7	781.5	628.2	415.5	335.8
2003	1847.7	1499	33.5	315.2	162.6	115.9	374.1	309	838.7	686.3	472.3	387.8
2004	1955.8	1610.5	42.3	303	175.4	127.7	355.7	306.4	908.5	743.4	516.2	433.1
2005	2068.3	1715.8	41.1	311.4	189.7	137.5	357.4	305.7	996.1	831.2	525.1	441.4
2006	1800.9	1465.4	42.7	292.8	167.2	118	279.5	235.3	910.3	756.5	443.8	355.6
2007	1355	1046	31.7	277.3	142.9	93	210.1	171.1	681.1	539.5	320.9	242.4
2008	905.5	622	17.5	266	121	62.7	134.9	102.3	453.4	323.7	196.2	133.3
2009	554	445.1	11.6	97.3	61.8	44.1	97.1	76.3	278.2	232	116.8	92.8

What one should note from the graph are the housing trends associated with 1) the single-family housing push spearheaded by President Clinton and Chairman Greenspan in the mid 1990's, which extended easy credit to people who had never qualified for mortgages before, and 2) the subprime mortgage crisis beginning in 2007. We see manufactured housing peak in 1998, with the expansion of easy credit, and consumers begin to move away from manufactured housing towards cheap stick-built housing. Stick built housing then peaks in

2005 before the subprime crisis, and once the crisis hits in 2007, both stick built housing and manufactured housing contract through the most recent data. It will be interesting to note the housing shift as the recession ends and the housing market begins once more to grow. With the tightening access to credit among low-income households, we wait to see whether manufactured housing placement and trailer parks, once more become a preferred housing option.

What makes manufactured housing so interesting to economists? While many manufactured homes are placed directly on privately owned land, manufactured homes have also given rise to the institution of trailer parks. A trailer park is a community of tenants who provide their own manufactured homes and rent lots of land from a park owner. The owner manages utilities, provides roads, power, and water supplies, and sometimes a system of governance similar to a neighborhood organization. The tenants purchase their own homes, which may be double or singlewide units, are responsible for maintaining their lot and home, and are subject to the rules of the park instated by the owner and/or a governing body of tenants. The trailer park straddles two traditional forms of housing: privately owned stick-built housing, and apartment rental systems. How did such a unique form of mixed ownership and rental evolve?

2 Literature Review

As one turns to the existing literature, expecting a plethora of papers on such a unique and interesting housing institution, one is immediately left grasping for any straw that may offer insight into the development of a trailer park. Indeed, the current literature is largely silent on what makes up a large percentage of the US housing stock. The minimal research

relating to trailer parks has been divided into two main categories: rent control in trailer parks, and econometric analysis comparing owner satisfaction in trailers to those in rental apartments and stick-built housing.

The literature on rent-controlled trailer parks generally comes to the same unsurprising conclusion found in much rent-control literature in other forms of housing: that rent controls in trailer parks promote housing shortages in the parks. Zheng, Deng, Gordon, and Dale-Johnson (2007) from USC find that imposing rent controls leads to accelerated growth in resale prices, or that the future value of lower rents is capitalized into the present selling price. Carl Mason and John M. Quigley (2006) from the University of California at Berkeley present a study on three rent-controlled trailer parks in southern California. They, too, found that rent-controlled trailer park pads result in a shortage of pads available, and the capitalization of future savings in the selling cost. All benefits of rent control are lost in the initial purchase of the pad and trailer. This is different from apartments in that the benefits from rent are included in the price of the capital (the mobile home pad), thus negating any positive welfare gains from a controlled rent for the tenant.

The econometric literature is largely in its early stages. Marshall and Marsh (2007), from Purdue University and Washington State University, respectively, used econometric modeling to look at the differences in price elasticity of demand for consumers and investors in manufactured housing. The results indicated that investors are very price elastic, and thus respond largely to small changes in prices in the manufactured housing sector. This shows that investors have many building options when considering start up costs. On the other hand, consumers' demand is not so elastic, and is less responsive to changes in the price of manufactured housing. This is most likely due to the few low-cost options for families of

low- to moderate-income levels. Boehm and Schlottmann (2008), from the University of Tennessee and the University of Nevada, Las Vegas, respectfully, attempt a holistic explanation as to why people of low to moderate income decide to purchase manufactured homes. They find that manufactured housing is a comparable low-cost housing option for low to moderate income families, and in fact, that renters tend to be happier in manufactured housing parks than those in rented housing, such as apartment complexes. It is also to be pointed out, that many of the negative measures of traditional rented apartments have analogues in trailer parks, as many are tied to lower income. Unfortunately, the study incorporates over fifty variables within its data, and does not offer an explanation as to the development of trailer parks, merely offering a comparison of satisfaction with manufactured homes vs. rented apartments. None of the above articles tackle the question as to the existence of trailer parks, choosing instead to try and explain anomalies within the system, before questioning the origins of the system. It seems to us, that without knowing what leads to the rise of trailer parks and rigorously defining them, one cannot successfully identify anomalies; it is premature.

Thankfully, the institution of trailer parks is not without an analogue: sharecropping. Sharecropping is a long-established method of farming which incorporates a mixed capital-rental system, the agricultural answer to the trailer park system. A landowner provides a tenant with a home and a plot of land in return for a share of the tenant's agricultural profits. There are many variants of sharecropping dependent on the levels of capital provided by the tenant and the owner at the initial contract, but the gist is still a mixed ownership-rental system. Fortunately, sharecropping literature is much more developed than trailer park literature, most likely due to its longer, culturally diverse, and widespread history.

The sharecropping literature has shed much light on the idea of risk sharing by tenant and owner, as well as on the effects of liquidity constraints. The concept of risk sharing between farmers and landowners is similar to the relationship between renters and trailer park owners; park owners embark on a risky business venture, but in requiring tenants to provide their own housing, their investment is smaller and risk is spread. Additionally, the idea of liquidity constraints provides a convincing argument for the creation of trailer parks. On the owner's side, lack of access to credit would mean fewer funds for capital. In this way, perhaps land can be purchased, but the owner lacks money to construct buildings. On the renter's side, a manufactured dwelling is cheaper than site-built housing, and it comes without the necessity of a mortgage or owning land, both of which require access to large amounts of credit.

3 Theoretical models with housing market in equilibrium

Trailer parks provide an interesting case of a housing system using a mixed ownership-method. Taking lessons from the sharecropping literature, we consider agents, both tenants and owners, which are sensitive to negative externalities, have capital constraints, and are risk averse in their investments. In an attempt to shed light on the development of such a mixed system, we look to four models of low-income housing developments, divided into equilibrium and disequilibrium models. Equilibrium models include 1) Bad Renters, 2) Capital Constraints on both Investors and Occupants, while disequilibrium models include 3) Risk-Sharing and Uncertain Growth, and 4) Short vs. Long Term Urban Growth. In all of the following models, "renters" and "tenants" will apply to the same group of people, but will

vary based on the rental or ownership behavior. The “owner” will always be the main landowner, who would manage the trailer park in the event that a trailer park arises from the model. In the equilibrium models, we assume renters and owners start in a housing market in equilibrium, and rationally move towards a contracting agreement in which both parties benefit from movement towards a trailer park system and away from more traditional forms of housing. In the disequilibrium models, due to unexpected or uncertain economic growth, the housing market is thrown out of equilibrium and trailer parks arise as responses to shocks. Trailer parks are incorporated as a movement towards equilibrium, in the third case by solving a short-term housing crunch and subsequent uncertainty, in the fourth case by providing a housing developer with a transitory form of housing investment.

3.1 Equilibrium, Case 1: Bad Renters

In the first case of “Bad Renters” we start with a pure rental system, in which an investor owns all land and all manufactured home units, then rents packages of land and units to occupants. We hypothesize that occupant-owned capital structures arises when rented capital maintenance costs become too high, both due to depreciation from bad tenants misusing property and due to the externalities created by unruly tenants. We show that profit for the owner is maximized when occupants own the capital. Utility is maximized on the side of the tenants when a strict owner has the ability to evict unruly neighbors that impose negative externalities on the rest of the community.

On the other side of the story, we start with a case in which the occupant owns both the manufactured unit as well as the parcel of land upon which the unit is placed. In this case, we look to the negative externalities created by unruly tenants and their effects on the

park. We show that these externalities are minimized when the land is not owned, but rented, in effect creating a government to control unruly tenants. In this way, an unruly tenant can be easily evicted, whereas if he owns his land, he cannot be, devaluing the entire park.

Thus, combining the two experiences, that in which the park owner prefers occupants to provide their own housing, and that in which other occupants prefer a rented lot system, we explain the rise of a mixed-housing system prevalent in trailer parks.

3.1.1 Case 1.1: Full Rental System

As stated previously, an investor, hereafter named the “owner”, owns a large tract of land, and parcels it into lots, upon which he places rental units. The owner’s goal is to maximize his profits, π , by renting out land and unit packages to renters at a flat rental rate, r . Unfortunately, at the time of contracting, the owner cannot observe whether the renter is responsible, the “good renter”, or destructive, the “bad renter.” We will hereafter label renters as m^i , where $i \in [g, b]$, with g for “good renter” and b for “bad renter”. Thus, revenues can be written as $r(m^g + m^b)$, or rent charged for the total renters, be they good or bad. We have left out the revenue from security deposits, as those are considered sunk costs and should not effect the owner’s optimizing behavior. We assume that at the end of the contract’s term, the owner will have to renovate the rental units in order to contract again with a new renter in the next time period. The owner thus pays costs associated with each renter, c^i , where $c^b < c^g$. The owner also pays the cost of general park upkeep, G . The costs for the owner will depend on the type of renter he contracts with. Good renters occur with probability $P(m^g)$, and bad renters occur with probability $(1 - P(m^g))$. Additionally, after

finding out the tenant is unruly, the owner can evict the tenant at a cost of C^e . We can then write the owner's costs as

$$\left[P(m^g)c^g + (1 - P(m^g))(c^b + C^e) \right] - G \quad (1)$$

or the probability of the renter being bad multiplied by the cost of a bad renter, added to the probability of a good renter multiplied by the cost of a good renter, and then finally, the cost of upkeep is added. Additionally, from the perspective of the trailer park owner, he views both types of tenants' demand for rented housing to be declining functions of the probability of renting to bad renters; both good renters and bad renters get disutility from large numbers of bad renters. Thus, we combine the revenues and costs to find our objective function, which is to maximize owner's profit.

$$\max_{m^b, m^g} \pi = r(m^b(b) + m^g(b)) - \left[P(m^g)c^g + (1 - P(m^g))(c^b + C^e) \right] - G \quad (2)$$

π is clearly maximized when there is no "bad renter", so the owner opts to homogenize renters, but how can he accomplish this task? Assuming it is much more difficult to destroy a piece of land than a manufactured housing unit, the owner can require the tenant to purchase his own housing unit to place on the land. In this way, the owner no longer assumes responsibility for maintenance of housing units across differing types of tenants. It should also be noted that by "homogenizing" renters, the owner will in effect lower C^e and increase r . This will happen because people who are sensitive to their neighbors will tend to clump together, further enhancing the owner's attempt to homogenize the population. Then, because the owner has successfully removed a negative externality, he can then charge higher rents to the remaining tenants. In the end, we should see parks which have uniform populations, and eviction rates across types of parks should not vary, as those sensitive to their neighbors will

have moved towards parks with like-minded neighbors, and those who do not care about an unruly neighbor, will have moved into parks that are suited to that behavior.

3.1.2 Case 1.2: Full Ownership

In this case, each tenant owns both their own land and their own units. In the event that a tenant is “bad”, he will create negative externalities for the entire community. These externalities include but are not limited to, poor upkeep and facilities appearance, crime, disruptive noise, and communal property damage. All of these externalities result in a decline in property value, and thus resale prices. Occupants will wish to maximize their utility subject to a budget constraint which includes the cost of evicting an unruly occupant. The cost of eviction is clearly lower in the case where land is rented, as the occupant community will not have to buy out or incentivize the unruly tenant in order to force them out of the community. In effect, in renting land and buying homes, the occupants are paying for government regulation by the park owner in order to minimize negative externalities.

We begin formal discussion of the model with a two-player collective action game, without any form of third party intervention. In this case, there are two tenants, and they are to undertake a joint project, in our case, maintaining a neighborhood with high property values. In order to achieve this, each tenant must exert effort e^i , $i \in \{1,2\}$, and they will garner utility $U^i - e^i$ for participating, and being a “good tenant”. In the event that one tenant shirks his duties, and becomes a “bad tenant”, he then gains utility $U^i > U^i - e^i$. This negatively affects the bad tenant’s neighbor, especially if he tries to maintain his home and property value. The good neighbor will then lose additional utility due to the negative externality, ne^i , of having a bad neighbor, but the bad neighbor benefits by having a good

neighbor, and he feels no negative externalities. In the case where both shirk, they both earn utility U^i , but the combined lack of maintenance leads to both feeling the effects of the negative externalities, and $ne^i < e^i$. The Nash Equilibrium of this game will then be (Bad Tenant, Bad Tenant). The reader recognizes that this is the basic Prisoner's Dilemma problem, wherein both parties strategize and end up with a less than optimal solution, whereas with cooperation, they could have achieved a much higher outcome.

Figure 1

Player (1, 2)	Good Tenant	Bad Tenant
Good Tenant	$(U^1 - e^1, U^2 - e^2)$	$(U^1 - e^1 - ne^1, U^2)$
Bad Tenant	$(U^1, U^2 - e^2 - ne^2)$	$(U^1 - ne^1, U^2 - ne^2)$

In the case where we allow a third party actor to regulate the neighbors, we can achieve a more desirable social outcome. Specifically, we allow a third party actor to forcibly evict bad tenants, thus any bad tenant will incur the cost of losing housing and searching for new housing, C^e , or the cost of eviction, on top of the loss in property value, ne_i . We assume the cost of eviction to be larger than the maintenance effort, $C^e > e^i$, otherwise, every agent would opt to be evicted and move to another park or neighborhood with lower effort costs. Based on this assumption, the resultant Nash Equilibrium is (Good Tenant, Good Tenant), which yields the maximum social utility as well as the maximal individual utilities.

Figure 2

Player 1,2	Good Tenant	Bad Tenant
Good Tenant	$(U^1 - e^1, U^2 - e^2)$	$(U^1 - e^1 - ne^1, U^2 - C^e)$
Bad Tenant	$(U^1 - C^e, U^2 - e^2 - ne^2)$	$(U^1 - ne^1 - C^e, U^2 - ne^2 - C^e)$

The next step towards analyzing the incentives for tenants to hire a third party to regulate and monitor bad tenants is to generalize the two party general action game to allow for N tenants. In this case, all payoffs are dependent on the number of participants, n . In this way, we can show how the benefits and costs from n participants may be enough that the next participant may not harm the group by shirking his duties, the idea being that in a group project, benefits and costs are no longer individual, but dependent on all actors' decisions. We follow the method laid out in Chapter 11 of Dixit and Skeath's book (1999), and define good tenant payoff to be $G(n) = b(n) - c(n)$, or payoff equals the difference between the benefits and costs, dependent on the entire group of participants. The bad tenant has payoff $B(n) = b(n)$, or payoffs equal to the payoff dependent on group participation, and he incurs no cost, at least not until we insert our third party actor. We can then observe that in order for the $n+1$ person to participate, $G(n+1) > B(n)$, and the reverse will be true for a bad tenant.

We can now define the societal total payoff from being good or bad tenants:

$$T(n) = nG(n) + (N - n)B(n) = NB(n) - n[B(n) - G(n)] \quad (3)$$

We can assume that both forms of payoff are increasing with respect to n , or that payoffs increase the more people participate in the project, regardless of what the $n+1$ person does. This means that the distinction between the system without a third party regulator and with one depends on the gap between $G(n)$ and $B(n)$. Furthermore, notice that $[B(n) - G(n)] = c(n)$. In the case of a large gap between $B(n)$ and $G(n)$, the cost to participating (the value of the effort, and any surplus you gain from the results of your effort) put into maintaining your manufactured home, is very high. This game and its Nash Equilibrium are characterized by the Prisoner's Dilemma, and all parties will shirk their duties. In the case that the gap is small, when additional costs are imposed on $B(n)$, the game transforms to the Multi-person

Assurance game, where one shirks when one's neighbor shirks, and works when one's neighbor works (Dixit, Skeath, 1999).

We can now differentiate between the total societal payoff in the cases with, and without, a third party regulator.

$$\text{Without regulation: } T(n) = NU^n - n[U^n - (U^n - e)] = NU^n - n(e) \quad (4)$$

$$\text{With regulation: } T(n) = N(U^n - C^e) - n[(U^n - C^e) - (U^n - e)] = N(U^n - C^e) - n(e - C^e) \quad (5)$$

By maximizing $T(n)$ with respect to n , we can find out the optimal number of good tenants in each case. For simplicity we assume $U^n = n^\alpha h^{1-\alpha}$, where h stands for housing value, and $0 \leq \alpha \leq 1$. This is a general Cobb-Douglas function and has the necessary first and second order conditions, namely, decreasing marginal returns to housing value, assuming additive separability in all other goods. The resulting optimal numbers of participants are shown below for each case:

$$n^* = \left(\frac{\alpha N h^{1-\alpha}}{e} \right)^{\frac{1}{1-\alpha}} \quad (6)$$

$$n^* = \left(\frac{\alpha N h^{1-\alpha}}{e - C^e} \right)^{\frac{1}{1-\alpha}} \quad (7)$$

When $|e - C^e| < e$, we find that n^* is larger with a third party regulator. Additionally, we impose the constraint that C^e is bounded, otherwise the owner could evict the entire park, leaving him without revenues. Upon repetition of this game, across a number of years, for example, tenants will realize that it is in their best interest (they gain highest utility most often) by inviting a third party to moderate the park.

Now we have shown that for certain values of C^e , it is optimal for the tenants to hire a third party regulator to kick out bad tenants, and ensure that social utility is maximized and negative externalities are minimized. Taking a step outside the mathematical and theoretical, what does this mean for trailer parks? Consider a general neighborhood for a moment, and think of playing the role of a property owner. As a property owner, you own a piece of land and build a house upon it. So does your neighbor. When it comes time to sell your property, the value of yours is dependent on the value of your neighbor's as well, and if they maintain their property poorly, this will be reflected in your appraisal. What kind of negative externalities can actually occur on the part of your bad neighbor? There are three basic possibilities: the yard is overgrown and poorly maintained, the house has fallen into disrepair, or both. The negative externalities imposed by a poorly maintained house are usually considered to be higher than those from an overgrown lawn, as remedying a decrepit house is much more expensive than mowing a lawn and trimming some hedges. How can homeowners minimize these externalities?

In upscale communities there are homeowner's associations or other agreements by which neighbors keep tabs on each other to maintain a certain standard within the neighborhood. New middle-class neighborhoods are often characterized by "cookie-cutter" homes, or similar homes that in kind, attract similar, homogenous owners. While these two methods solve the negative externality problems in upper- and middle-class neighborhoods, how do poor communities, and those with high turnover control for these externalities? A likely option is to invite a more permanent resident to have power to enforce standards.

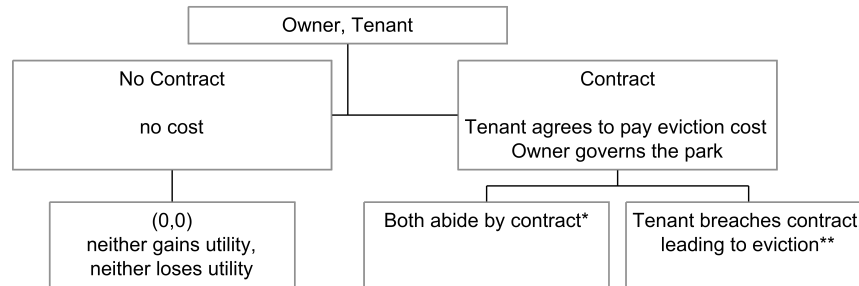
Consider the fact that negative externalities from manufactured homes are smaller than those on stick built homes. In the case of a trailer park, when one tenant decides not to

maintain his home, this affects the value of the neighbor's home to a lesser extent because manufactured homes are, in theory at least, moveable and easily replaceable. Moreover, with the addition of a third party actor to regulate evictions, instead of buying out your bad neighbor, and his property, the park owner can more easily evict the bad tenant. This provides the key insight needed to show why a system in which a third party owns the land, and controls who rents it, could result in higher utility for the tenants.

3.1.3 Case 1.3: Mixed Rental and Ownership System

As discussed in the previous sections, landowners would prefer to rent only land, and tenants would prefer to have a system of governance in which a third party owns land, but how does this system realize itself? We take a look at a basic contracting game, and by using backwards induction, we can show that the contract holds when the landowner rents land, and the tenants abide by the contract and have good behavior. In the event that both abide by the contract, we have $(U(r_i l), U^i - e)^*$. In the event of a breach in contract by the tenant, we have $(P(U(r_i l - r_i l^i), P(U^i - C^e))^*$. This equation means that, with probability P , the owner loses utility from tenant i 's eviction, and tenant I must pay the cost of eviction. We still assume that $C^e > e_i$, and by backwards induction, it is clear that when the Tenant agrees to incur eviction costs when they are detected as behaving poorly, that the contract results in good tenants.

Figure 3



3.1.4 Case 1: Summary

As we have shown above, it is in the land owner's best interest to require tenants to purchase their own housing units, and it is in the tenant community's best interest to push the burden of eviction costs onto the owner, incentivizing a land-rental system. This correctly predicts the mixed ownership-rental system seen in modern trailer parks.

3.1.5 Case 1: Empirical Methods

In considering how to go about collecting data to measure the above model, one immediately recognizes the need to compare different types of trailer parks. The ratio of trailer parks in which the stereotypical mixed rental-ownership system is in place should be contrasted with the ratio of full-ownership and full-rental systems. Another method by which we could test whether this model is the correct reason behind the mixed system is to measure the correlation between tenant complaints about neighbors and the movement toward a trailer-park government, or third party enforcer. This will hopefully reveal a selection bias in which tenants group with like-minded neighbors, but unfortunately data are not likely to be easily available outside of the EASI Quality of Living indices. Finally, we should see trailer parks hosting homogenous populations. While these data may be difficult to find, we believe

this should also correspond with levels of crime, as crime rates should correlate with quality of tenants and trailer park governing system. Specifically, variance in crime rates across trailer parks in a single metropolitan area should be high.

3.2 Equilibrium, Case 2: Capital Constraints

In this case, both occupants and park owners are capital constrained. We compare a pure rental, pure ownership, and mixed system and show that profit is maximized when the owner rents land and the occupants buy their own housing.

In the pure rental example, the owner has purchased both the housing units and the land, meaning that the number of rental packages (unit + land) is less than the number of land parcels alone he could have rented out if he faces a capital or borrowing constraint. In the pure ownership case, the owner purchases a large tract of land and sells parcels to buyers. Since this rules out future earning on rents, the entire future earnings are capitalized into the present value of the land parcel. Thus, the price of these units is prohibitively high to low-income buyers, resulting in low demand. Due to the low demand, price for the units will fall and the landowner will not maximize profits in this manner. We show that the mixed system, in which the owner rents land, but not units, results in the highest profit for landowners.

On the side of the tenants, we compare the utility maximization results across the pure rental, pure ownership, and mixed systems in order to show that utility is indeed maximized when the tenants is only responsible for owning the housing unit.

3.2.1 Case 2.1: Pure Rental System

Consider first a pure rental system in which the owner rents out units, k , and land, l , to tenants. The rent for a housing unit is r^k , and the rent for a parcel of land is r^l . Since this is a rental contract, at the end of the contract, the owner knows he must pay maintenance costs on the unit, c^k , and on the land, c^l , in order to contract with a new tenant. He must also pay for the initial purchase of manufactured housing units, M_0 , and for the initial land purchase, L_0 . The owner's objective is then:

$$\max \pi = r^k k + r^l l - c^k k - c^l l - L_0 - M_0 \quad (8)$$

He will be maximizing with respect to k and l . The owner will also face capital constraints, such that the total expenditures on L_0 , M_0 , $c^k k$, and $c^l l$ are less than some startup capital, k_0 . Additionally, he cannot rent out land without renting out the units, or vice versa, as that would move away from a pure rental system. Thus, k must equal l . We have the following constraints:

$$\text{s.t. } L_0 + M_0 + c^k k + c^l l \leq k_0 \quad (9a)$$

$$\text{s.t. } k = l \quad (9b)$$

We can maximize profit by substituting the constraints to the objective.

$$\max \pi = l \left[(r^k + r^l) - (c^k + c^l) \right] - L_0 - M_0 \quad (10)$$

$$\text{s.t. } l \leq \left(\frac{k_0 - L_0 - M_0}{c^k + c^l} \right)$$

Then the profit is maximized when

$$\pi = (k_0 - L_0 - M_0) \left(\frac{r^k + r^l}{c^k + c^l} \right) - k_0 \quad (11)$$

On the side of the renters, we assume basic Cobb-Douglas preferences, and renters gain utility from housing, which is achieved by renting land, l , and manufactured housing units, k .

As per usual, $0 \leq \alpha \leq 1$. Renters are constrained by their startup capital, k_0 , and they cannot rent more units and land than they can afford. The renter's objective function and constraint are

then:

$$\max U(h(k,l)) = l^\alpha k^{1-\alpha} \quad (12)$$

$$\text{s.t. } r^l l + r^k k \leq k_0$$

Utility is maximized when

$$k^* = \frac{k_0(1-\alpha)}{r^k} \text{ and } l^* = \frac{\alpha k_0}{r^l} \quad (13)$$

3.2.2 Case 2.2: Pure Ownership System

In the case of pure ownership, the owner buys a large tract of land and then sells parcels of land to tenants at price p_l . Because any future rents on the sold land will be lost, they are capitalized into the selling price, raising it so that the present value captures all possible future earnings. Any land that is not sold in the first period can still be rented out, at price r_l . Because both renters and the owner are capital constrained, it can be shown that p_l is a very high price, dependent on the interest rate, R , and is exclusionary to much of the demand for trailer lots. With the fall in demand, the price lowers such that the owner no longer maximizes his profit and chooses to do other ventures with his land. As for constraints, the owner's purchase of land and maintenance of unsold land cannot exceed his startup capital, and the value of the initial purchase must be less than or equal to the price of lots sold multiplied by the number of lots sold, in order to make a profit on the land purchase. The owner's objective is then:

$$\max \pi = p^l l + (r^l - c^l)(l_0 - l) \quad (14)$$

$$\text{s.t. } c^l(l_0 - l) + l_0 \leq k_0$$

$$\text{s.t. } l_0 \leq p^l l$$

where

$$p^l = \sum_1^{\infty} \left(\frac{1}{1+R} \right)^i r^l \quad (15)$$

On the renter's side, we are maximizing the same utility as in the pure rental case, but now the constraints have changed. Once the renter has purchased a plot of land and a housing unit, he has purchased an asset that may appreciate or depreciate. Thus, the amount he spends purchasing land and unit cannot exceed the initial startup capital and the expected value of returns on the land and unit. We will assume that land appreciates and that manufactured homes depreciate. Because the value of manufactured housing strictly depreciates, as soon as it has been placed on the lot the value has dropped, so we represent that future value of the housing in the next period by a round bracket; it can never be as valuable as in the first period. Further, manufactured housing cannot be of negative value (purely a cost to the owner), as it would be instead be discarded and replaced with something which has nonnegative value to the owner. There is no bound, upper or lower, with the value of land, and we allow it to appreciate, or be fully a burden (negative value) as determined by the market value and land characteristics (for example, well-maintained vs. torn up by hurricane). Furthermore, the interest rate, R , is increasing in the amount of debt collected by the individual. We then have the renter's objective function:

$$\max U(h(k,l)) = l^\alpha k^{1-\alpha} \quad (16)$$

$$\text{s.t. } p^l l + p^k k \leq k_0 + \frac{1}{1+R(d)} E(k^1 + l^1)$$

Where:

$$k^1 \in [0, k^1) \text{ and } l^1 \in (-\infty, \infty)$$

Utility is maximized when

$$l^* = \frac{\alpha \left[k_0 + \left(\frac{1}{1+R} \right) E(k^l) \right]}{p^l} \quad (17a)$$

$$k^* = \frac{(1-\alpha) \left[k_0 + \left(\frac{1}{1+R} \right) E(k^l) \right]}{p^k} \quad (17b)$$

Because p^l is very high, the tenant is left with a very low amount of l^* compared to the full rental model, especially since k_0 and $E(k^l)$ are constrained.

3.2.3 Case 2.3: Mixed Rental and Ownership System

In the mixed case, the owner rents land to tenants and tenants provide their own housing units to be placed on the land.

$$\max \pi = r^l l - c^l l - L_0 \quad (18)$$

$$\text{s.t. } L_0 + c^l l \leq k_0$$

We can again maximize profit by using the budget constraint and see that profit is maximized when

$$\pi = \frac{(r^l - c^l)k_0 - r^l L_0}{c^l} \quad (19)$$

On the side of the tenants, they maximize the same utility function as in the prior cases, but their constraint has changed to rental expenditures on land and purchase of a housing unit, which must be less than the startup capital plus the future value of the housing asset.

$$\max U(h(k,l)) = l^\alpha k^{1-\alpha} \quad (20)$$

$$\text{s.t. } r^l l + p^k k \leq k_0 + E(k^l)$$

We find:

$$k^* = \frac{(1 - \alpha)(k_0 + E(k^1))}{p^k} \quad (21a)$$

$$l^* = \frac{\alpha(k_0 + E(k^1))}{r^l} \quad (21b)$$

3.2.4 Case 2: Summary

We can see then, that in the capially constrained scenarios, it is in the best interest of the landowners to only rent plots of land, and allow tenants to be responsible for securing their own homes. On the other side, it is optimal for tenants to purchase only their housing structure and leave land ownership and maintenance to the landowner.

Taking this outside of the theoretical, why is this a realistic model for explaining the existence of trailer parks? Trailer parks generally occur in low-income areas, often near factory towns, or outside of traditional city limits due to restrictive zoning laws (Hart et al., 2002). These areas are not attractive to developers with deep pockets, like those who would develop expensive condominium skyscrapers. Indeed, much low-income housing is in fact formerly middle-class housing that has been allowed to age and depreciate. The lack of existing structures and deep pockets allows for the capially constrained owner scenario to be quite the convincing case for trailer parks. On the side of the tenant, low-income families do not have many options when it comes to low-income housing. As stated before, it is a rare case that urban, high rise, low cost apartment buildings are newly built, and their supply is short. On the other hand, outside of traditional urban areas, or in newly developing factory towns, cheap land is widely available, and manufactured homes can be delivered within a week due to the vast network of manufacturers and transporters (Wallis, 1991). Again, the

capital constraint model provides a convincing argument for explaining the prevalence of low-income trailer parks and their appeal to low-income families.

3.2.5 Case 2: Empirical Methods

In order to prove whether this model is the basis for the existence of trailer parks, data on income levels of both owners and tenants need to be collected, as well as prices for manufactured homes, and startup costs for trailer parks. We will need to compare the startup costs and capital constraints for trailer park startups to other forms of low-income housing developments. In this way, we can see whether or not investing in a trailer park is in fact cheaper than other low-income housing projects. On the side of the tenant, we do not envision a large distinction between those who live in trailer parks and those who live in more traditional low-income housing, rather, we look to see that they are, in fact, capitally constrained. We can observe this by looking at credit ratings, savings behaviors and the like, to ensure that tenants truly could not afford a more expensive option, as purchasing their own home or condominium.

4 Theoretical models with housing market responding to shocks

4.1 Disequilibrium, Case 3: Risk Sharing and Uncertain Growth

In this case, we assume that the investor/landowner is risk averse and gets less utility from profits than he does disutility from losses, i.e. he fears losses more than he enjoys profits. This will be modeled using a common Cobb-Douglas utility function, which has risk-averse properties, namely, that the associated indirect utility function shows decreasing

marginal utility in wealth. Because the owner faces an uncertain future, he will hope to minimize his future costs. He cannot minimize future costs by scaling back the entire venture; the variability can still result in high losses when tenants follow work to another city. Thus it is the owner's best choice to share some of the burden of risk with the tenants, whom he views as flight risks. We then show that the risk is minimized when the owner rents land to the tenants.

This also relates to the "uncertain growth" problem, especially as pertains to factory towns. In towns with newly built factories, there is a high demand for new housing immediately. Manufactured housing is a low-cost and expedient way to provide housing to blue-collar factory workers. On the side of the developer, however, is the worry that the factory will close, leaving the new housing developments empty. Again, it is most profitable for the landowner to rent parcels of land, but not to invest in the housing units, instead having renters provide their own units which they can tow away in the event that growth halts.

4.1.1 Case 3.1: Uncertain Growth and Risk Sharing

Owners: maximize utility $U(\pi)$ where preferences are Cobb-Douglas, satisfying the necessary risk aversion specifications. Thus, $U(\pi) = \sqrt{\pi}$, and there is no loss of generality as long as risk averse behavior occurs. We will define π as in case 2, but simplify it only to include per unit costs, and show that this is maximized over two time periods when the owner owns only the land and the renters own the housing units. Following case 2,

$$\pi = r^k k + r^l l - c^k k - c^l l.$$

Over two time periods, the owner will maximize his expected utility. We assume the owner has information about the growth and urban climate in the first time period, but is

uncertain about growth in the second period. We represent the probability of growth, and the case wherein the landowner successfully rents out units and land, as P , with $0 < P < 1$. The case in which the growth is negative and renters move away occurs with probability $(1-P)$. In either case, he must maintain the housing units and land over both periods, so cost of maintenance is unaffected by probability of growth, P . Furthermore, utility from future profits is diminished by a factor of β , showing that next period's profits are not as valuable to the owner in the current period. The current period is represented by the subscript "0", and future period by the subscript "1". Thus,

$$\max U(\pi) = \sqrt{(r^k - c^k)k_0 + (r^l - c^l)l_0} + \beta\sqrt{P(r^k k_1 + r^l l_1) - (c^k k_1 + c^l l_1)} \quad (22)$$

The owner maximizes profit with respect to k and l . As probability of growth goes to zero, we note that the landowner must absorb all costs associated with maintaining both land and capital structures, without reaping any profit. The owner realizes in cases of uncertainty about growth, he can maximize this profit function only by cutting out k , or by not providing housing units for rent, in effect minimizing the losses in the second period. He cannot maximize by cutting out land, as he already owns the land and has decided to hold it for the second period. Thus, the only mechanism by which he can realistically reduce costs is to require tenants to provide their own housing unit.

Considering our last example in the real world, and taking a pause from the theoretical, we see much historical precedent for this model. During World War II, the US Navy commissioned over 18,000 prefabricated houses from 1940-1941 alone to support the war effort in key Naval areas (Wallis, 1991). Southwest Kansas is another prime example of a factory town encouraging the growth of trailer parks. Since 1960, the area has become one of the US's main beef-producers, and Garden City, Kansas, for example, increased its

population by nearly 50% between 1980 and 1990, with much of the new population moving to trailer parks supported and partly financed by the meat-processing plants. Trailer parks in the area range in size from 244 lots to over 2,200 (Hart et al., 2002). The case for uncertain growth then provides key insight into the reasons behind trailer parks in factory towns. The main concern with this type of model is that many trailer parks have sprung up in areas with constant growth.

4.1.2 Case 3: Empirical Methods

For this case, it is imperative to observe the correlation between industrial growth rates and trailer park startups. In this way, we can observe whether the prevalence of trailer parks is contingent on urban growth. As an extension to this correlation, it would be useful to also look at population growth of low-income families. Lastly, we need to compile a list of recent factory towns and check to see how many formed contracts with trailer park developers, as in the case of the US Navy mentioned above.

4.2 Disequilibrium, Case 4: Short Run vs. Long Run Urban Growth

In this case, we posit that in areas that will grow in the near future, trailer parks will arise instead of stick-built housing. The rationale behind this is that with property values predicted to rise in the future, any housing development that is built will eventually be bulldozed in order to capitalize on increased property values and the land will be sold to developers. In the event that the property value is set to increase quickly, we should see trailer parks placed on the land because stick-built housing will not have depreciated adequately to justify their destruction. Stick-built housing will appear where growth is

expected to happen over a longer period; this allows the housing to more fully depreciate, incurring fewer losses when the housing development is destroyed in favor of selling the land. An additional constraint is added such that the rents collected from trailer parks must exceed rents from other options such as pasture, agriculture, or even hunting license. This case only looks to the side of the owner, as this is purely driven by investment, and not by renter preferences. Furthermore, as noted in the introduction, trailer park spots are often in short supply, meaning that any supply created by the landowner opening up a trailer park in a growing area would be equated by demand.

We begin with direct profit maximization, and consider two cases, one in which urban growth rates are high, another in which growth rates are low. In the case with low growth, the landowner will keep his land purchase and extract profits from it, while in the event of high growth, he can decide to sell early in the future. This selling decision is represented by $S(g)$, where $g \in \{0,1\}$, with 0 representing low growth, and 1 representing high growth. We let $S(g=0)=0$ as the owner decides to keep his land in the event of low growth. The landowner now maximizes profit after determining whether to buy or sell his land soon, to simplify the model we consider profit maximization over two periods.

Low Growth Case: The landowner will profit from rents earned on both land and capital and we allow for economies of scale so rents are a decreasing function of capital, $r(k)$. Future rents are discounted at a rate of β , so profit from rents is $r(k)(1+\beta)(l+k)$. The owner faces depreciation costs in period two, Rk with R as interest rate, as well as the initial cost of building the development, $I(k)$, which is increasing in k .

$$\max \pi = r(k)(1 + \beta)(l + k) - Rk - I(k) \quad (23)$$

Taking the first order condition,

$$\frac{\partial \pi}{\partial k} = r'(k)(1 + \beta)(l + k) + r(k)(1 + \beta) - R - I'(k) \quad (24)$$

where the apostrophes now denote partial derivatives with respect to capital. By setting $I'(k)$ equal to the other terms, we can derive the owner's supply and demand function for capital. We assume that $I'(k)$ to be constant returns to scale, so in the price-capital space, $I'(k)$ will be constant at the low growth initial cost level, $I'(k)_{LG}$. The other terms, $r'(k)(1 + \beta)(l + k) + r(k)(1 + \beta) - R$, represent revenues to the landowner. Because $r'(k)$ and R are negative, we assume the first and third terms dominate the second term, $r(k)(1 + \beta)$, yielding a downward sloping demand curve for capital. This market is shown in figure 4.

High growth case: In this case, the landowner decides to sell his land in period 2, giving him profits $\beta S(g=1)$. Profits in period 1 are $r(k)(l+k)$. Costs are depreciation, Rk , tear down costs (which decreases with depreciation of capital), $\frac{T(k)}{1+R}$, and initial cost of development, $I(k)$. The landowner then maximizes profit:

$$\max \pi = \beta S(g=1) + r(k)(l+k) - Rk - \frac{T(k)}{1+R} - I(k) \quad (25)$$

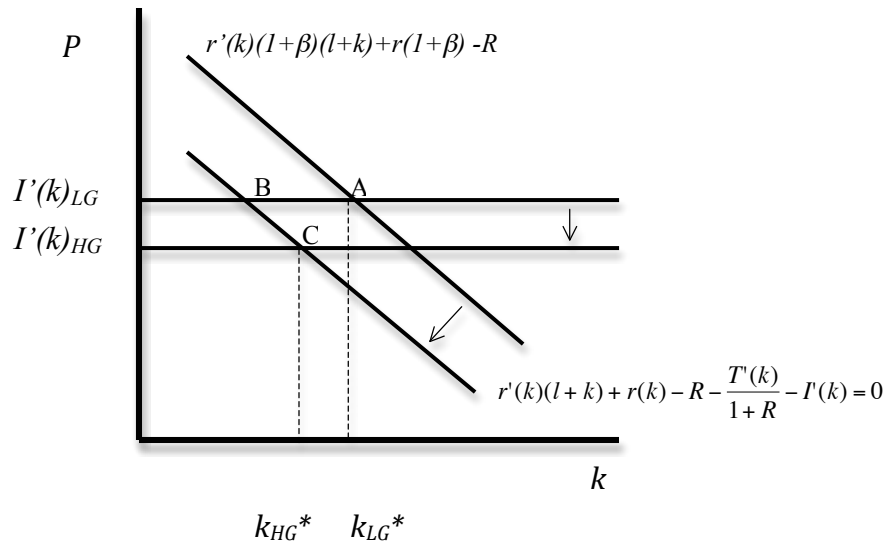
Taking the first order conditions,

$$r'(k)(l+k) + r(k) - R - \frac{T'(k)}{1+R} - I'(k) = 0 \quad (26)$$

We can now compare the two cases in figure 4. Under high growth the owner's revenue curve has shifted in because each unit of capital now pays less on the margin, because he is taking a lump-sum profit when he sells his land, but extract less rent from each unit of capital placed on the land. This means the equilibrium falls from point A to point B. Because the landowner has noted his marginal revenues fall, and also knows he is selling his land in the next period, he will lower the quality of his infrastructure (it does not have time to

depreciate), lowering $I'(k)$ to the high growth initial costs, $I'(k)_{HG}$. This moves the equilibrium to point C. By lowering the quality of infrastructure, the landowner can lower his marginal initial costs enabling him to provide more capital, though not as much as in the low growth case. The final results are shown in figure 4.

Figure 4
Landowner's Market for Capital Structures



It is further important to note that at the limit, as the interest approaches zero, $R \rightarrow 0$, housing will move towards trailer parks, as low interest rates are indicators of favorable investment environments, a requirement for high growth rates. Similarly, as $I \rightarrow 0$ housing will move towards trailer parks, as this shows that landowners are putting less and less into the startup costs, something only possible when making substitutes such as septic systems instead of sewage, generators instead of power lines, and gravel roads instead of roads kept up by municipalities, all characteristics of trailer parks, not stick build development communities. Lastly, in cases of very high growth, in which the landowner expects to sell land in a few years, manufactured homes have an advantage over stick-built housing because

new manufactured homes can be moved to another location (this only applies to new homes, as many depreciated homes are not accepted in trailer parks).

Additional assumptions can be applied to the rental rate functions, specifically, that trailer parks offer the chance to achieve increasing returns to scale, whereas stick built homes at best offer constant returns to scale, the assumption we used above for both long run and short run growth. The logic behind this differentiation is that once a trailer park has utilities established, normally a septic system and generators for electricity, adding one more unit requires little extra space or connection costs, whereas stick built homes must be connected to the electrical grid and sewage system, not to mention the space requirements far exceed that of a trailer park. Thus, once these returns to scale are defined, there is a rental threshold, at which additional rents can no longer cover initial costs, teardown costs, and depreciation of stick-built homes, where an owner moves towards the increasing returns offered by a trailer park. This threshold is also contingent on the timing of the costs compared to the rents, specifically; whether the capital placed on the land has been given time to fully depreciate. In the equation above, the depreciation costs go to zero as time increases, and manufactured homes depreciate much quicker than stick-built homes, so we would expect instances in which growth happens quickly to favor trailer parks. This would add additional rotation in the $I'(k)_{HG}$ curve, showing it to be downward sloping, meaning the equilibrium would be at an even lower P and higher k than at point C.

4.2.1 Case 4: Empirical Methods

In this case, econometric models will observe the relation between urban growth rates and the number of trailer parks over the main growth years. Urban growth rates and number

of trailer parks will be approximated using census bloc group level data. Ideally, we could work property values into the empirical methods as well.

5 Theoretical Conclusions

In sum, at this point in our manufactured home research, the models proposed are all derived from realistic housing scenarios, and very few generalizations or assumptions have been made. We hope that by keeping these models simple, and still yielding the expected results, that we successfully show that this housing phenomenon is not an implausible, minor sector of the housing market that violates traditional housing principles, but is in fact and unsurprising result of the low-income housing climate. All four cases employ commonly used utility functions and profit maximization strategies to theoretically model the existence of trailer parks. It should be stressed that these models are in no way designed to be mutually exclusive; in fact, we expect them to overlap depending on the geographic sample taken. In isolating each model, we hope to see how much of a contribution each trailer park characteristic (capital, crime, risk, growth, etc.) is to the formation of a trailer park.

In our first model, we discuss the possibility of good and bad tenants. From the landowner's point of view, he would like to homogenize his tenants, and can only do so when the tenants are responsible for owning their own housing units. The tenants, on the other hand, worry about the externalities posed by bad neighbors. Because a tenant cannot force his neighbor off his or her own land, the tenants move to support a third party actor who will own the land, rent it to the tenants, and have the power to evict unruly tenants who pose risks to the property value of the park.

In our second model, we envision a scenario in which both the landowners and the tenants are capital constrained. We show that profit for the landowner is maximized when he must only bear the cost of purchasing and maintaining land, while the tenants are required to provide their own housing units. Similarly, on the tenants' side, utility is maximized when they are able to purchase larger amounts of housing, analogous to living space, and need only rent land, instead of set aside more funds to purchase a plot of land.

The third model discusses the implications that uncertain growth will have on starting up a housing development. When a developer wishes to create a housing project, he must take into consideration the future payoffs to his investment. In the case that the future is uncertain, a developer will be hesitant to invest great sums in the project, thus explaining the move from stick built housing to manufactured housing. Additionally, in order that the tenants do not skip out on rent or leave too easily, the landowner requires that they provide their own housing unit. In this way, risk is shared between the landowner and the tenants.

The fourth model is a question of investment timing and returns. Given that a city is growing, a landowner must decide if the revenues from stick-built or manufactured houses can maximize his profits when facing costs and depreciation. Since stick built houses depreciate slower and require expensive and permanent utilities, neighborhoods of rented stick-built homes should only crop up in areas with slow expected urban growth. Due to the transient nature of manufactured homes, their inexpensive utilities, and little impact on land, it is easy to quickly resell land on which a trailer park has been placed, and we should see trailer parks grow and die near quickly growing urban areas.

Moving forward with this project, we look to the empirical methods needed to corroborate all or some of the above models as true explanations of the rise of trailer parks.

Data on manufactured housing starts, their location, startup costs, and contracting with large firms all needs to be collected. Looking at tenants, we must collect data on savings rates, credit ratings, and their relationships with neighbors and/or trailer park governments. Hopefully, the empirical models we will derive will support at least one of the above models, or even interactions between multiple models, and we can move forward in explaining one of the most unique systems of low-income housing.

6 Housing Demand in Equilibrium Models

In order to move towards an empirical model for trailer parks, one must first define a general model of supply and demand for trailer parks and their lots. The suppliers of trailer parks will be the landowners, and those demanders of trailer park plots are the tenants, thus this housing demand model only applies to models 1 and 2. At first glance, one may be tempted to argue that the suppliers of manufactured homes should be modeled as suppliers, however the authors feel that these merely supply one characteristic inherent in the trailer park market problem. In this theme, we look to a hedonic model of revealed preferences for trailer park supply and demand, noting that the actual manufactured home is only one facet of the demand for trailer parks.

On the demand side, tenants will decide on optimal price ranges by considering many facets of housing, namely the capital structure, land, and community traits. We define this price by

$$p_i^d = \alpha + \beta_{in}k_{in} + \beta_{im}l_{im} + \beta_{ij}c_{ij} + \varepsilon_i \quad (27)$$

where $\beta_{in}k_{in}$ is the vector of n housing unit characteristics (characteristics of the manufactured home itself) over i individual observations, $\beta_{im}l_{im}$ is the vector of m land

characteristics over i individuals, $\beta_{ij}c_{ij}$ is the vector of j community characteristics over i individuals, and ε_i characterizes an independent and identically distributed error term with mean 0 and variance σ_ε^2 . Variables describing housing include square footage, whether the housing structure is stand-alone or within a larger structure, access to utilities, number of rooms and the like. Land characteristics include lot size, number of neighbors, and access to roads. Community characteristics are described by education levels, mean and median income, population density, population density, property values, and crime levels. Together, the consumers of trailer park plots, the tenants, consider these three housing facets (capital structure, land, community) and their respective qualities when purchasing a home.

On the supply side, the landowner also has a hedonic housing model when pricing his product, whether it is land parcels for sale, land and capital structure for rent, or only land plots for rent. We define

$$P_i^s = +\phi_{in}k_{in} + \phi_{im}l_{im} + \phi_{ij}c_{ij} + \varepsilon_i \quad (28)$$

where $\phi_{in}k_{in}$ is a vector over capital structures with n characteristics over i individuals, $\phi_{im}l_{im}$ is a vector of m land characteristics over i individual observations, and $\phi_{ij}c_{ij}$ is a vector of j community characteristics over i individual observations. Capital structures, on the side of the landowner, will be defined by their rates of return on investment, the initial build cost, the depreciation costs, the tear-down costs, and the rent charged on the structure alone. The land is characterized by rates of return on investment, initial purchasing costs, rents charged for land alone, and rents charged for substitutable activities for housing developments (agriculture, for example). The community vector includes population growth rate, industrial growth rate, and property values. Together, these variables describe three main aspects of consideration when a landowner undertakes neighborhood development. The various

restraints on the variables will define prices for pure rental, land rental, and land sale systems.

Combining the supply and demand sides, we now have an empirical method by which we can measure the impacts of the two equilibrium models. Cases 1 and 2 allow us to impose empirical constraints on the general model and find out when equilibrium is reached. We predict that under the constraints we impose through the various models, equilibrium prices will only be reached in the mixed rental-ownership system, rather than a pure rental, or pure ownership system.

7 Data Collection and Empirical Models

There is no national registry for trailer parks, so data collection is dependent on both official and non-official sources. Government databases such as US Census Data and the American Housing Survey are quintessential parts of the raw data. Both provide geographic, racial, and income data alongside indicators for manufactured housing. We glean the official data from SimplyMap, a database that compiles data from various governmental and institutional surveys and provides over 70,000 variables for demographic, market, health, and business data from 1980-present. The non-official collection has been largely exploring state and local websites claiming to have compiled lists of trailer parks in their respective areas or regions.

We construct datasets for each model individually based on the demand characteristics for manufactured housing in that model, or exogenous instruments related to those demand characteristics (for example, crime-rate to model neighborhood homogeneity, or growth in industrial jobs to model the rise of factory towns). The eventual dataset, for the

project expanding on this thesis, will contain state-by-state information on the following states: Alabama, Arkansas, Arizona, Colorado, Delaware, Florida, Georgia, Idaho, Kentucky, Louisiana, Maine, Mississippi, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, South Dakota, Tennessee, Washington, West Virginia and Wyoming. These states were chosen as they represent those with the highest levels of manufactured homes from 1980-2010, namely those with at least 9.5% housing stock as manufactured homes, and up to 21.5%. The first dataset we constructed, and the one used in the following empirics, includes block group level data for 47 counties in North Carolina, coming out to 2,736 block groups. For a list of these counties, please see the appendix. Each block group contains panel data for between 600 and 3,000 people, with the standard block group having data for around 1,500 people.

Before moving towards modeling a specific model from one of the four theoretical models, we first had to design a general econometric problem to test. Drawing on the different case studies mentioned before and the hedonic form for housing demand, we have designed a general regression in which block groups are divided into being trailer park dense or not, then compared based on demographic variables and case variables:

$$T_i = \beta_0 + D_i' \beta_1 + X_{\#_i}' \beta_2 + PD_i \beta_3 + \varepsilon_i \quad (29)$$

Where X_i is a vector of Case Variables, with # relating to (1,2,3,4) for each model, D_i is a vector of Demographic Variables, PD_i is the population density of the block group, and T_i is a variable indicating whether or not the block group is trailer park dense, taking a value of 1 if dense and 0 if not dense in trailer parks. The demographic variables include income, education, white/blue collar, race, and unemployment, and the case variables are those discussed at end of each theoretical discussion.

It was apparent early on that D_i and $X\#_i$ are comprised of a large number of variables. In order to reduce the number of variables in each vector, we use *Principal Components Analysis*. In this way, we can retain much of the randomness (variance) of the observed data, but reduce the dimensionality of the independent variable vectors. By running principal components analysis on the demographic characteristics, we were able to reduce the number of demographic variables, those in D_i , from 10 to 7, which account for 90% of the observed variance of the originals. The chart below shows an example correlation table between the original variables and the resulting components. Those boxes with correlations contributing to how we renamed each component are italicized.

Table 4

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
% Asian	-0.1013	0.2020	<i>0.3966</i>	-0.8083	0.1292	0.3122	0.0846
% Black	0.2806	-0.3712	<i>0.2537</i>	-0.0417	-0.7345	0.2190	-0.1475
% Hispanic	0.2026	<i>0.5266</i>	<i>0.3485</i>	0.1902	-0.2268	0.0583	0.1392
% Other Race	0.2046	<i>0.5239</i>	<i>0.3235</i>	0.2810	0.0727	-0.1585	-0.2088
% Low Income	<i>0.4522</i>	-0.0320	-0.0115	-0.1285	-0.1104	-0.0925	-0.0557
% High Income	-0.3510	-0.0635	0.1924	<i>0.4357</i>	0.0051	<i>0.6825</i>	0.1984
% Low Education	<i>0.4456</i>	0.0343	-0.3297	-0.0134	0.0244	0.2579	0.1496
% Blue Collar	<i>0.3802</i>	0.1971	-0.3866	-0.0234	0.1832	<i>0.4271</i>	0.1745
% Unemployed, Male	0.2678	-0.3462	<i>0.3941</i>	0.0991	0.2523	-0.2450	<i>0.7079</i>
% Unemployed, Female	0.2924	-0.3235	<i>0.3188</i>	0.1133	<i>0.5264</i>	0.2068	-0.5583

From using PCA, we can reduce the dimensionality of the original D_i , and rename the components to create an updated D_i to include the following principal components: poor, uneducated, blue collar workers (this component accounts for 35.34% of the variance in observed variables, by far most significant component), non-black minorities, unemployed minorities, affluent whites, high female unemployment, high male unemployment, and social

heterogeneity (only low and high income within the block group). These demographic principal components will be used across cases as a means by which we can compare block groups.

Before moving towards an individual case's regression, it is important to consider the bias against trailer parks inherent in the collected data. Because we are trying to determine the factors that influence development on trailer parks, it is important that the data have both an experimental group and control group that are alike in all aspects except their assignment to trailer park dense block groups, or block groups lacking trailer parks. In order to establish a comparable control, the dataset collected must be trimmed, and we use the *Propensity Score Matching* (PSM) method to do so. The goal of PSM is to assign a propensity score to each block groups based on their demographic characteristics. This score measures the likelihood that based on defined characteristics this block group would be trailer park dense. First, we divide block groups into those that are dense in trailer parks (manufactured housing % > 50%) and those that are not (manufactured housing % < 50%). Next, we match each block group dense in trailer parks to a block group not dense in trailer parks, conditional on the two block groups having the same, or very close, propensity score. In order to ensure a larger resulting sample size, we have allowed for ties to also be matched. Finally, we trim the dataset to only include matched block groups – this eliminated the bias within the data against trailer parks and ensures that the control group (not trailer park dense) is similar in all demographic aspects to the treatment group. With a control set established, we can move on to discuss methods to measure each case.

We begin work by focusing on the third model of risk-sharing and uncertain growth, or housing choices in boom-and-bust housing. In order to determine the validity of this

model, we collect data from the years of 2009 and 2010 on employment levels and numbers of businesses in the manufacturing, construction, utilities, mining, agriculture, fishing, forestry, and hunting industries. We chose growth between 2009 and 2010 because the percentage of the housing stock made up of manufactured housing peaked in North Carolina in 2009 before falling markedly in 2010. We posit that the growth of manufactured housing should be highly correlated with growth in both industrial jobs and businesses, as these are two instruments that can measure the growth rate of factory towns. We distinguish between industries associated with urban growth and rural growth, assigning construction, utilities, and manufacturing to urban growth, with agriculture, mining, fishing and forestry to rural growth. This leaves us with four variables comprising the case 3 vector of characteristics: rural employment levels, rural business counts, urban employment levels, and urban business counts. Because the model measures the relation between trailer park growth and industrial growth, we take first differences on both the measures of trailer park density and on the aforementioned four industrial variables. This means that we no longer use T_i as a binary variable, but rather the percentage of manufactured homes in each block group. Growth is defined as percentage of housing stock in year t less percentage of housing stock in year $(t-1)$, this allows for both growth and contraction. We again run principal components analysis on the four growth variables in case 3, using the trimmed dataset from the original PSM method. We end up reducing the dimensionality from four to two, with the new components “Urban Industrial Growth” and “Rural Industrial Growth” replacing the original variables in the X_{3_i} case characteristics vector.

Finally, we can regress the growth in manufactured housing on the demographic principal components vector and the boom/bust principal components vector, using the following regression:

$$\Delta T_{i(t-j)} = \beta_0 + D_i' \beta_1 + \Delta X_{3_{i(t-j)}}' \beta_2 + PD_i \beta_3 + \varepsilon \quad (30)$$

The results are shown in the table below, with * denoting 90% significance, ** 95% and *** 100%:

Table 5

Independent Variable	Trailer Park Growth
Low income, low education, blue collar workers	0.060 (0.096)
Non-Black Minorities	-0.069 (0.065)
Unemployed Minorities	0.022 (0.105)
Affluent Whites	0.006 (0.148)
Unemployed Females	-0.056 (0.101)
Class Division	-0.062 (0.175)
Unemployed Males	-0.059 (0.112)
popdense_10	0.001 (0.000)***
Urban Industrial Growth	0.107 (0.060)*
Rural Industrial Growth	0.129 (0.064)**
Constant	-2.352 (0.159)***
<i>N</i>	332

We look to the coefficients on Urban Industrial Growth and Rural Industrial Growth, as those variables stand for the indices we created during the principal components analysis on the case 3 variables. The coefficients on both are positive as predicted, and the coefficient

on Urban Industrial Growth is statistically significant at 90%, while the coefficient on Rural Industrial Growth is significant at the 95% level. We can interpret the coefficient on urban industrial growth to mean that with each unit increase in the industrial growth index (our component variables), we expect trailer parks' percentage of housing to grow by 0.11, for each unit increase in rural industrial growth index, trailer parks' percentage of housing will increase by about 0.13. More intuitively, if the rural industrial growth index derived from business counts and employment increases by a unit, we would expect the percentage of manufactured homes in the housing stock would increase by 0.13, for example from 51% to 51.13%. The higher and more significant coefficient on rural industrial growth is reassuring, as space limitations would favor trailer park growth in rural environment as opposed to urban environments.

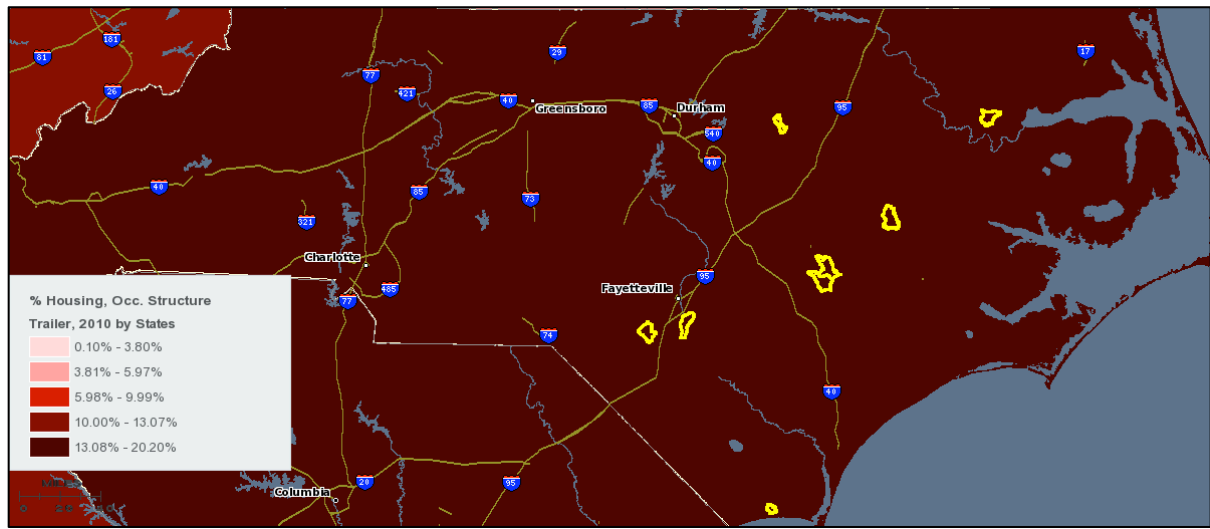
What can one take away from this regression and results? We look to a number of block groups that hold particularly strong to the above regression in order to see individual characteristics of block groups either suffering economic expansion or contraction. Because data was taken between 2009 and 2010, examples of growth were limited, but one notable block group stands out: block group 9602003 in Robeson county. This block group saw manufactured housing as a percentage of occupied housing rise from 37.08% to 58.08%, a growth rate of 56.6%! Additionally, the indices for both urban and rural industrial growth were high, with the urban industrial growth index at 2.23 (1.67 standard deviations above the mean urban industrial growth index), and the rural industrial growth index at 2.75 (2.06 standard deviations above the mean rural industrial growth index). The Robeson case is unique, in that it was a case of growth. For the most part, North Carolina experienced stagnant industrial growth and contraction in manufactured housing. Two block groups

experienced both significant urban industrial contraction along with trailer park decline, defined as having negative trailer park growth as well as urban industrial growth index at least 0.85 standard deviations above the mean. The results for the rural industrial growth index are more reassuring. Take as examples some five block groups showing contraction in the rural industry by over two standard deviations from the mean, along with manufactured housing as a total percentage of occupied housing falling by at least 2.52%. The table below describes the block groups discussed above, and the following map pinpoints their locations, with the block groups outlined in yellow (SimplyMap, 2011).

Table 6: Block Groups with High/Low Industrial Growth

Block Group	County	% Man. Housing 2009	% Man. Housing 2010	Urban Industrial Growth Index	# Std. Dev. From Mean	Rural Industrial Growth Index	# Std. Dev. From Mean
9602003	Robeson	37.08	58.08	2.23	1.67	2.75	2.06
9604002	Bertie	32.23	29.83	-1.18	0.88	n/a	n/a
0608001	Franklin	52.95	50.5	-1.13	0.85	n/a	n/a
0204012	Brunswick	61.70	59.13	n/a	n/a	-4.80	3.91
0030004	Cumberland	50.69	48.10	n/a	n/a	-6.02	4.91
9901003	Duplin	49.60	47.01	n/a	n/a	-9.64	7.87
9501007	Greene	38.96	36.44	n/a	n/a	-4.98	4.07
0006023	Wayne	57.51	54.73	n/a	n/a	-2.53	2.07

Figure 5: Map of block groups in Table 6



Further discussion of the aforementioned block groups reveals interesting demographics within each block group. Please refer to Table 7 for block group specifics. First, it should be noted that the PSM trimmed sample of 332 block groups has a higher percentage of blue collar workers, people with less than college education, household income of less than \$25,000, male and female unemployment, black population and “other race” population than does the state of North Carolina as a whole. Additionally, the trimmed sample has lower percentages of white and Asian populations, with the Hispanic population similar across North Carolina and the trimmed set. Within the trimmed dataset, the eight sample block groups we have chosen to look at closely have rates higher than the trimmed dataset in all of the characteristics excepting white population and Asian population, which are both lower than the trimmed set’s means. What does this say about our selected block groups? In general, cases with very high(low) industrial growth and high(low) trailer park growth, will have high populations of non-Asian minorities, very high unemployment across gender, low education attainment, high poverty rates, and high rates of blue collar jobs, many of which are industrial. None of this economic data is surprising, for we expect individuals in

trailer parks to be characterized as poor, less educated, and in blue collar jobs, but the demographic data is more intriguing. While we began this paper assuming many trailer park residents would be the traditional white, rural poor, the demographic results clearly show high minority populations within growing (contracting) trailer parks. Moving forward, this questions the stigma of “white trash” as well as the idea that poor minorities are focused in the cities. Lastly, it should be noted that in many cases in which populations identify themselves as “other race” on their census form, they have additionally identified as another race (many times “white”), meaning the sum of the racial percentages will be larger than 100%.

Table 7

Demographic Characteristics Comparison Chart – 2010 Census Data					
	North Carolina	PSM Trimmed Sample	Standard Deviations	Robeson, BG9602003	Bertie, BG9604002
% Blue Collar	26.42	39.78	9.86	50.85	44.44
% Less than college educated	45.50	64.01	9.53	74.17	77.74
% Income < \$25,000	23.24	32.09	11.07	39.34	47.72
% Male Unemployed	8.43	10.36	8.65	16.78	20.96
% Female Unemployed	7.82	10.82	8.76	10.06	11.54
% White	68.65	58.84	27.61	29.54	37.00
% Black	20.87	26.15	23.61	36.48	60.63
% Hispanic	7.47	7.78	9.16	8.65	1.04
% Asian	2.03	0.85	1.50	0.33	0.85
% Other Race	8.46	14.16	18.73	33.65	1.52

Table 7 cont.

Demographic Characteristics Comparison Chart – 2010 Census Data, cont.						
	Franklin, BG0608001	Brunswick, BG0204012	Cumberland, BG0030004	Duplin, BG9901003	Greene, BG9501007	Wayne, BG0006023
% Blue Collar	41.23	28.81	40.02	44.09	37.62	41.27
% Less than	72.00	56.34	67.57	59.98	72.35	66.79

college educated						
% Income < \$25,000	28.88	31.92	19.35	32.96	31.55	36.12
% Male Unemployed	10.70	22.69	7.41	21.42	0.00	8.76
% Female Unemployed	13.93	7.10	5.72	2.82	15.60	12.27
% White	55.61	75.42	64.06	42.60	48.49	44.36
% Black	27.91	19.76	28.07	4.05	32.52	7.00
% Hispanic	13.10	2.28	2.57	64.00	13.29	51.77
% Asian	0.68	0.00	0.16	0.16	0.00	0.17
% Other Race	15.80	4.82	7.72	53.19	19.00	48.46

While the regression and results support our hypothesis in case 3 that industrial growth should be positively correlated with growth in trailer parks, many characteristics of the dataset are limiting. For example, with data collected on manufactured housing percentage for the years of 2000, 2008, 2009, and 2010 we observed that the largest change in manufactured housing percentage occurred between 2009 and 2010, so this was the period of growth we used in the final dataset. Because this is a short amount of time when making housing decisions, it is possible that in areas of industrial contraction, trailer park residents laid off from industrial jobs have not yet moved to a new location. In future datasets, multiple growth periods should be used over longer time horizons, allowing people time to make such a large decision as purchasing or abandoning housing. An additional concern is the lack of information about zoning laws; the Robeson case discussed above should be a red flag. In areas with very lenient zoning laws regarding trailer parks, one would expect large jumps in trailer parks, as new ones are set up along with industrial growth. On the other hand, in cases with very strict zoning laws, we would expect smaller changes spread out among neighboring block groups to accommodate an increase in the industrial labor supply. Even taking into considerations all of the discussed limitations, the empirical results do support our hypothesis

and we find that industrial growth, both urban and rural, is positively correlated with trailer park growth.

8 Conclusion

After noting the holes in housing literature with respect to American trailer parks, we developed four theoretical models to explain the development of trailer parks, both in a housing market in equilibrium, and in a housing market experiencing growth shocks. The first model, “Bad Tenants” provides a game scenario in housing market equilibrium, in which tenants choose to hire a third party regulator to ensure movement from a Prisoner’s Dilemma game with an unfavorable outcome, to a multi-party assurance game with two outcomes, one which predicts highly-regulated trailer parks with high property values and neighborhood cooperation, and one which predicts trailer parks with low regulation and low upkeep. This basic model provides the intuition for how multiple types of trailer parks arise, ranging from retirement-only trailer parks, to migrant-worker trailer parks, to family-oriented trailer parks. The model shows that across the trailer park market, trailer parks are very heterogeneous, but within parks, neighbors are homogenous.

Our second model in a housing market equilibrium, “Capital Constraints”, shows how capital restrictions and/or limitations on both the landowner and the tenant force the two parties to work together in order to provide all units of capital and land necessary for an independent housing structure. In this way, the landowner ends up providing a plot of land for rent, with the tenant providing the capital structure to place on the land. Both share the capital burden in the means by which they can each maximize profit and utility.

Our third model, “Risk Sharing and Uncertain Growth” moves towards a model responding to housing shocks. Perhaps better understood as the “boom and bust” model, we

have shown, both theoretically and empirically, that growth in manufactured homes will arise when the landowner responds to the high need for housing in the current period, but is uncertain about profits in the next period. He can extract high rents in the first period responding to a shortage in housing supply, but worries that in the next period, the growth may reverse, and so the landowner minimizes this loss by requiring tenants to provide their own capital structure. Empirically, we did find support in North Carolina that in times of industrial contraction, trailer park growth is negative. This supports our hypothesis as well as demonstrates the magnitude of the shifts in trailer park populations during an industrial contraction.

The last model, “Short vs. Long Run Urban Growth” is based on the fact that many developers intentionally developed trailer parks on land zoned as commercial, in the hope that they could convert the land into a more profitable use after urban growth occurred and their land value appreciated (Hart et al., 2002). In this way, a landowner can judge, based on interest rates and initial costs, what marginal revenues he can extract from the development he plans. In the case that marginal revenues are high, he will develop a stick-built community, and with low marginal revenues, he will develop a trailer park. He can then take advantage of the high urban growth rate and convert his property in the near future, with little startup and teardown costs in the meantime.

Much groundwork still remains to build a solid foundation for trailer park economics. We believe that the above models and empirical results provide interesting and dynamic groundwork for this development. In the future, the individual models not yet empirically confirmed, and the model interactions should be tested. Expansion to the other 22 states

suggested in the Empirical Methods section, as well as other time periods, is another future path of research.

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Appendices

APPENDIX A: Code for Empirics in Stata

```
/*
Project: Trailer Park Estimation
Data Source: Census, EASI, SimplyMap
Student: Caitlin Gorback
Faculty: Charles Becker
Date Created: 2/26/11
Date Last Updated: 4/1/11

goal: Econometric analysis of trailer park models 1-4 as outlined in "Trailer Park
Economics" Paper
*/

/*PREAMBLE*/
#delimit;
clear;
set more off;

/*SET DIRECTORIES*/;
**set directory;
local dir "/Users/caitlingorback/documents/Honors_Thesis";
**set curent directory;
cd `dir';

/*SET MEMORY*/;
set mem 5g;

/*data source*/;
use demographic_case3, clear; /*data in Stata format edited from excel*/;

/*rename variables. In future, this will be done in a separate dataset*/;

rename var1 location;
rename var2 state_name;
rename var3 state_fips;
rename var4 county_name;
rename var5 county_fips;
rename var6 blockgroup_fips;
rename var7 per_trailer_10;
drop var8;
drop var9;
drop var10;
```



```
rename var11 asian_10;
rename var12 black_10;
rename var13 hisp_10;
rename var14 otherrace_10;
rename var15 white_10;
rename var16 unem_male_10;
rename var17 unem_female_10;
rename var18 emp_blue_10;
rename var19 emp_white_10;
rename var20 inc_0_15k_10;
rename var21 inc_15k_25k_10;
rename var22 inc_25k_35k_10;
rename var23 inc_35k_50k_10;
rename var24 inc_50k_75k_10;
rename var25 inc_75k_100k_10;
rename var26 inc_100k_125k_10;
rename var27 inc_125k_150k_10;
rename var28 inc_150k_200k_10;
rename var29 popdense_10;
rename var30 educ_lesshs_10;
rename var31 educ_hs_10;
rename var32 per_emp_affhm_10;
rename var33 per_emp_cons_10;
rename var34 per_emp_manu_10;
rename var35 per_emp_twu_10;
rename var36 num_emp_cons_10;
rename var37 num_bus_cons_10;
rename var38 num_emp_affh_10;
rename var39 num_bus_affh_10;
rename var40 num_emp_manu_10;
rename var41 num_bus_manu_10;
rename var42 num_emp_min_10;
rename var43 num_bus_min_10;
rename var44 num_emp_util_10;
rename var45 num_bus_util_10;
rename var46 per_trailer_09;
rename var47 num_bus_manu_09;
rename var48 num_emp_manu_09;
rename var49 num_bus_cons_09;
rename var50 num_bus_util_09;
rename var51 num_bus_min_09;
rename var52 num_bus_affh_09;
rename var53 num_emp_cons_09;
rename var54 num_emp_util_09;
rename var55 num_emp_min_09;
rename var56 num_emp_affh_09;
```

```

destring per_trailer_10 per_trailer_09 asian_10 black_10 hisp_10 otherrace_10 white_10
unem_male_10 unem_female_10 emp_blue_10 emp_white_10 inc_0_15k_10
inc_15k_25k_10 inc_25k_35k_10 inc_35k_50k_10 inc_50k_75k_10 inc_75k_100k_10
inc_100k_125k_10 inc_125k_150k_10 inc_150k_200k_10 popdense_10 educ_less_10
educ_hs_10 per_emp_affhm_10 per_emp_cons_10 per_emp_manu_10 per_emp_twu_10
num_emp_cons_10 num_bus_cons_10 num_emp_affh_10 num_bus_affh_10
num_emp_manu_10 num_bus_manu_10 num_emp_min_10 num_bus_min_10
num_emp_util_10 num_bus_util_10, replace;

```

```

egen low_inc_10 = rowtotal(inc_0_15k_10 inc_15k_25k_10 inc_25k_35k_10
inc_35k_50k_10);
label var low_inc_10 "Percent Low Income 2010";
egen mid_inc_10 = rowtotal(inc_50k_75k_10 inc_75k_100k_10 inc_100k_125k_10
inc_125k_150k_10);
label var mid_inc_10 "Percent Middle Income 2010";
gen high_inc_10 = 100-low_inc_10-mid_inc_10;
label var high_inc_10 "Percent High Income 2010";
egen low_educ_10 = rowtotal(educ_less_10 educ_hs_10);
label var low_educ_10 "Percent Individuals with Low Education Levels";

```

```

/*Perform Principal Components Analysis on demographic variables to determine leading
components and reduce redundancy in variables.*/;

```

```

pca asian_10 black_10 hisp_10 otherrace_10 low_inc_10 high_inc_10 low_educ_10
emp_blue_10 unem_male_10 unem_female_10;

```

```

/*keep first 7 principal components*/;
predict pc1_d pc2_d pc3_d pc4_d pc5_d pc6_d pc7_d;

```

```

/*separate block groups into trailer park dense and non-trailer park subsections, define trailer
growth*/;
sort blockgroup_fips;
by blockgroup_fips: gen trailer_growth = per_trailer_10 - per_trailer_09;
by blockgroup_fips: gen Trailer=0;
by blockgroup_fips: replace Trailer=1 if per_trailer_10>=46.5 & per_trailer_09>=46.5;

```

```

/*calculate propensity scores, sort by component:pc1_d, "low education, low income, blue
collar workers".*/
sort pc1_d;
psmatch2 Trailer pc1_d pc2_d pc3_d pc4_d pc5_d pc6_d pc7_d popdense_10, logit n(1) ties;

drop if _weight ==.;

```

```
*****
*****
```

```
/*MODEL 1: Bad Tenants and Homogeneity*/;
```

```
*****
*****
```

```
/*MODEL 2: Capital Constraints*/;
```

```
*****
*****
```

```
/*MODEL 3: Boom and Bust Cycle*/;
```

```
/*Perform Principal Components Analysis on boom and bust variables to determin leading components and reduce redundancy in variables*/;
```

```
pca num_emp_cons_10 num_bus_cons_10 num_emp_affh_10 num_bus_affh_10
num_emp_manu_10 num_bus_manu_10
num_emp_min_10 num_bus_min_10 num_emp_util_10 num_bus_util_10;
```

```
/*2010 Data*/;
```

```
egen emp_rural_boom_10 = rowtotal(num_emp_min_10 num_emp_affh_10);
label var emp_rural_boom_10 "Rural Boom - Number of Workers, 2010";
egen bus_rural_boom_10 = rowtotal(num_bus_min_10 num_bus_affh_10);
label var bus_rural_boom_10 "Rural Boom - Number of Businesses, 2010";
egen emp_urban_boom_10 = rowtotal (num_emp_cons_10 num_emp_manu_10
num_emp_util_10);
label var emp_urban_boom_10 "Urban Boom - Number of Workers, 2010";
egen bus_urban_boom_10 = rowtotal(num_bus_cons_10 num_bus_manu_10
num_bus_util_10);
label var bus_urban_boom_10 "Urban Boom - Number of Businesses, 2010";
```

```
/*2009 Data*/;
```

```
egen emp_rural_boom_09 = rowtotal(num_emp_min_09 num_emp_affh_09);
label var emp_rural_boom_09 "Rural Boom - Number of Workers, 2009";
egen bus_rural_boom_09 = rowtotal(num_bus_min_09 num_bus_affh_09);
label var bus_rural_boom_09 "Rural Boom - Number of Businesses, 2009";
egen emp_urban_boom_09 = rowtotal (num_emp_cons_09 num_emp_manu_09
num_emp_util_09);
label var emp_urban_boom_09 "Urban Boom - Number of Workers, 2009";
egen bus_urban_boom_09 = rowtotal(num_bus_cons_09 num_bus_manu_09
num_bus_util_09);
label var bus_urban_boom_09 "Urban Boom - Number of Businesses, 2009";
```

```

/*Growth*/;
gen emp_rural_boom_09_10 = emp_rural_boom_10 - emp_rural_boom_09;
gen emp_urban_boom_09_10 = emp_urban_boom_10 - emp_rural_boom_09;
gen bus_rural_boom_09_10 = bus_rural_boom_10 - bus_rural_boom_09;
gen bus_urban_boom_09_10 = bus_urban_boom_10 - bus_rural_boom_09;

pca emp_rural_boom_09_10 bus_rural_boom_09_10 emp_urban_boom_09_10
bus_urban_boom_09_10;

/*rename first two components in order to use in regression*/;

predict pc1_x3 pc2_x3;

/*regress the change in trailer parks on the level demographic principal components, and the
differenced industry principal components*/

reg trailer_growth pc1_d pc2_d pc3_d pc4_d pc5_d pc6_d pc7_d popdense_10 pc1_x3
pc2_x3;

*****
*****
/*MODEL 4: Urban Growth Rates*/;

*****
*****
*/
save case3_data, replace;

```

APPENDIX B: List of Counties used in Empirics

Alamance, Alexander, Alleghany, Anson, Avery, Beaufort, Bertie, Bladen, Brunswick, Burke, Cabarrus, Caldwell, Camden, Carteret, Caswell, Catawba, Chatham, Cherokee, Chowan, Clay, Cleveland, Columbus, Craven, Cumberland, Dare, Davidson, Davie, Duplin, Durham, Edgecombe, Forsyth, Franklin, Gaston, Gates, Graham, Granville, Greene, Guilford, Halifax, Harnett, Onslow, Pitt, Robeson, Wayne