Industrial Organization of Housing Supply
: Explaining Spatial Variation of Home Builder Size in U.S.

by

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Abstract
The housing supply is affected by the market, regulation, land use, and capital. Research has revealed a strong variation between the supply sector and builders' behavior patterns. Understanding these variations will contribute not only to better performance of private homebuilders, but also to more efficient housing supply policy.

Somerville's impressive research, 'The industrial organization of housing supply (1999)' integrates systematic factors into home builders' organizational structure. In adapting his research model, I explain builders' size distribution in markets defined by Metro Statistical Area (MSA). I divided market factors into size, demand and cost factors, and housing values. The impact of the regulatory environment is refined by separately testing the formal restriction, community discretion and control, and jurisdiction structures' effects. Land issues are measured by amount of developable area and needs of assembly for proper size of development.

The results show that the firm size responds to price changes most sensitively. The effect of market size shows that large area gives more growth opportunities to firms. The amount of developable land shows higher impact on firm size than increased demand does. Density restriction and approval delay tends to increase builder size.

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Wonho Seo
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Chapter I: Introduction

The private sector players in housing development, like those in other private enterprises, try to grow their operational capacity and scale of development. The growth in firm size not only promises more profit within a fixed operational margin, but also scale of economy of internalized costs. The market credibility of builders also tends to increase with their operating capacity. However, from the perspective of preserving public goods, there is a concern that the impact of large development and builders is too great for its neighborhood. Therefore, the regulatory environment, imposed by formal policy or more neighborhood control and discretion, tries to limit development that consumes the resources of a community. However, some researches showed that those regulatory requirements can exact a higher price of housing by transferring the cost to customers[1], failing to restrict development size or builders' size. As such, research on determinants of homebuilder's size matters not only for understanding private sectors' behavior but also for planning effective policies.

In chapter I, I tried to show the importance of size of firms to understand the organizational structure of homebuilders, using simple comparison of historic data in the United States. Firms' behavior adjusting their size in response to a given situation over 20 years gave clues for systematic variation of firm's size. In chapter II, I examine housing supply theories to build assumptions for research design. Chapter III and IV explain research model and data used.

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[1] Edward L. Glaeser, Jenny Schuetz and Bryce Ward's research, 'Regulation and the Rise of Housing Prices in Greater Boston', showed that that housing prices might have been 23 to 36 percent lower if regulation had not greatly slowed new permitting since 1990. Moreover, increasing average minimum lot sizes increases median prices and individual sales prices within a community by over 10 percent.

1. Background of housing supply studies

According to DiPasquale (1999), many studies have investigated the demand for residential housing; numerous studies have focused on pricing and market dynamics. However, substantially less effort has been expended on investigating the housing supply. Many puzzles in housing supply side remain unsolved. Moreover, the empirical evidence on the supply of housing is far less convincing than that on the demand.

There are serious analytic difficulties for modeling the housing supply. First, the housing supply is the outcome of complicated decision making among builders, the owners of housing, landlords, and government policy. Second, the long time lag of development makes it difficult to analyze the determinants of housing supply.[2] Third, we have little direct measurement that permits us to observe the impact of land and regulation issues on the housing supply. Lastly, the residential construction industry is highly fragmented and heterogeneous, so it is difficult to build and analyze a model on the basis of aggregated data.

The difficulties in investigating organization structure of housing supply side are caused by the lack of information to measure the behavior of actors. The housing supply is the outcome of complicated decisions made by builders and owners. In order to understand the micro foundations of housing supply, we want data in which the unit of observation is the supplier, with information on the quality and quantity of housing services offered, maintenance and capital improvement decisions, rents, and asset values. In the case of new supply, no standard data set permits us to observe the behavior of builders of new housing.

[2] Dipasquale and Wheaton indicate that the stock of single-family housing adjusts to its new long-run equilibrium through new construction very slowly; the rate of adjustment is estimated at 2% per year, which implies that it takes 35 years to reach a new equilibrium.

In the conversion of the existing housing stock, household surveys such as the American Housing Survey provide information on the renovation and repair decisions of owner-occupants. No standard data set permits us to observe the behavior of investors in rental housing. This remarkable lack of information on the major actors in housing supply precludes a thorough understanding of housing supply. More effort needs to be made in building new datasets that permit observation of the behavior of these important actors. And most importantly, we need to understand how suppliers make decisions and view the marketplace, incorporating with investors and home owners.

As indicated above, to understand housing supply, research on suppliers' behavior is important. First of all, it is needed to select which specific actors can represent the industrial, integrating various other actors. Players include subcontractors, general contractors and developers. The organization of construction projects involves relationships among the owner, the general contractor, and special trade contractors. Most typically, the owner writes a contract with a contractor who assumes responsibility for carrying out the project. The developer can be generalized as entity that links owner and contractors as leading entity for project. Another major alternative to the owner-general contractor arrangement is when the owner and general contractor are the same party, the "operative" or "speculative" builders.[3]

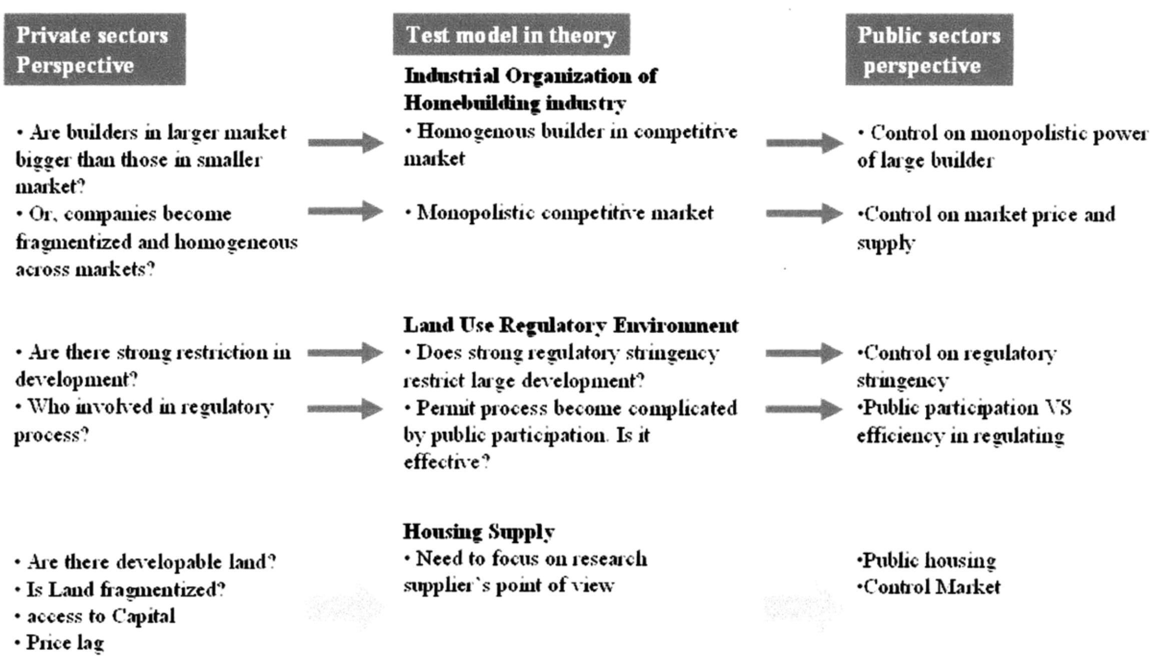
To cover owner, contractor and also developers perspective to market and their behavior

[3] Operative builders are establishments constructing structures for sale by NAICS classification. They build new homes on land that is owned or controlled by the builder rather than the homebuyer or investor.

pattern, operative builders seems integrated entity which encounter most decisions which must be faced by the general contractor, owner and developers. Therefore, I choose the operative builders as entity to observe the builders behavior over market.

2. Research Question

My interest and research questions start from the private sectors' point of view in order to understand builders' behavior. However, many questions are related to public sectors' concerns as depicted in picture 1.



[Picture 1 Summary of research question with needed test in Theory]

For builders, business opportunities in large market are different from ones in small market. In a large market, there could be smaller and more fragmented builders due to competition and low entry barriers. Since the market is large, individual enterprises have less monopolistic power, and this could contribute to the fragmentation. One can argue that as markets grow, large firms need larger development, so they become bigger. Each argument depends on different assumptions; former is based on homogenous competitive market and latter is based on monopolistic competition. To test each assumption is needed to make either business decisions or policy induced one. Industrial organization structure is important for policy makers, because they have to prevent excessive monopolistic power of few large builders. In small market, there might by less competition. Compared to large market, there might be more developable land in less developed market. However, there might not be enough demand for sizable builders. Large builders may require subsidies from public finance. Policy makers can think about attracting smaller builders rather than few large builders. Appropriate firm size at given market structure seems needed for housing supply.

Builders response to given situation by adjusting their size first. They expand or shrink their operational size based on business environment such as market size, changing demand, regulatory stringency and etc. Firm size is direct indicator of builders' response to circumstances. A classical economic model in firm size revealed that most changes of product demand are met by changes in firm size[4]. As indicated in picture I, organization structure, land use regulation, and housing supply are major discipline which includes important assumptions to search determinants of firm size as indicator of builders' behavior. Literatures of each theoretical framework will be reviewed in chapter II in order to set the assumptions for research design.

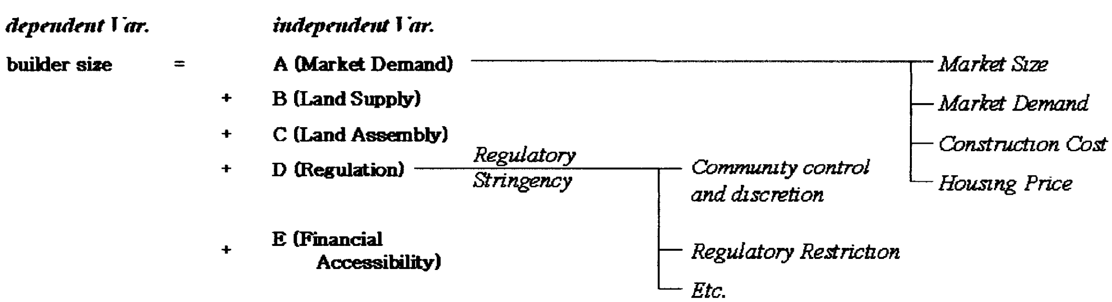
[4] Robert E. Lucas, Jr., 'On the size distribution of business firms', the bell journal of economics. .

Besides testing theoretical model, how to integrate various issues among different actors is important from builders' perspective. Somerville's approach to integrate various elements in his research, 'homebuilders' industrial organization' can be adapted. Picture 2 shows structure of regression model in his research.

dependent Var.		***independent Var.***	***Measurements***
builder size	=	A (Market Demand)	Number of permit
	+	B (Land Supply)	Farm Land's share
	+	C (Land Assembly)	Number of Firms
	+	E (Regulation)	Number of Jurisdiction

[Picture 2 Somervile's framework to integrate key features in housing supply]

Based on his integral approach, I'll try to explain determinants of homebuilders' size. Compared to Somerville's research, I added refined regulatory and market variables which will be tested through this research, as shown in picture 3. Each variable will be gathered and reviewed in Chapter 4.

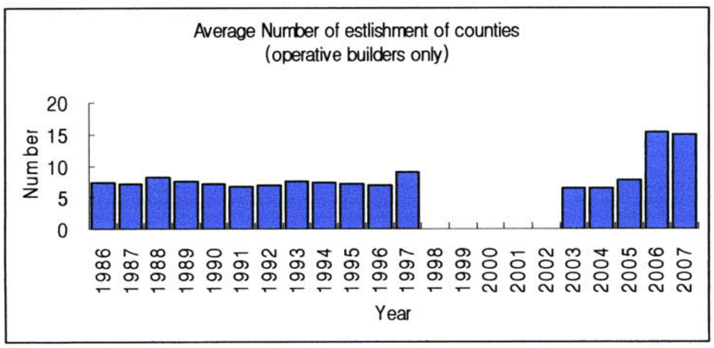


[Picture 3 Structure of dependent variables to explain firm size spatial variation]

I will focus on how those various elements are associated with firm size. And also, each variable's relative impact to firm size variation will be calculated with careful attention. I will focus on the sensitivity test of firms' size by each variable's changes to understand the builders' behavior.

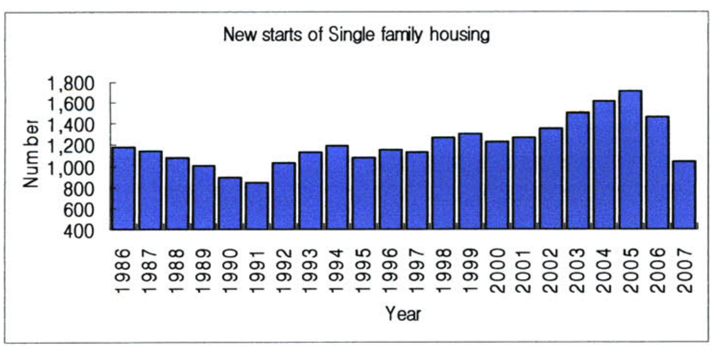
3. A Historical Review of builder's behavior

When we look at builder's employees and establishment statistics from mid eighties to date[5], the builders have been actively synchronized with housing demand by adjusting their size. This is more apparent when we observe the consistent level of number of establishment and more sensitive variation of employees per establishment, under market condition over twenty years shown in graph 1, 2, and 3.



[Graph 1 Number of homebuilders in operation from 1986 to 2007]

As indicated in Graph 1, the average number of establishments of counties was not volatile. One standard deviation per mean value of number of establishments over that period is 0.09.

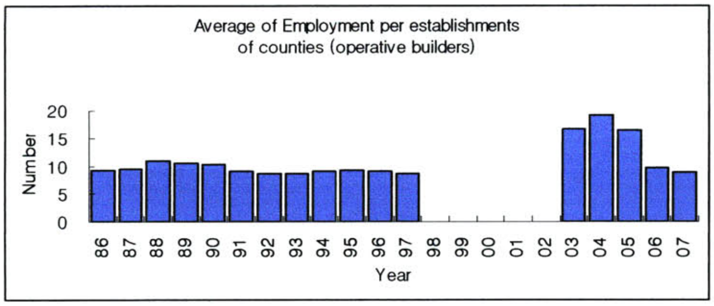


[Graph 2 New starts of single-family housing from 1986 to 2007]

However, over the same period, the average number of new starts of single-family housing unit shows larger volatility; one standard deviation per mean value is 0.17, as shown in

5 The data from 1998 to 2003 is missing, because the operative builders' survey data is integrated into residential construction builders, which group all contractors into one industrial code. The industrial code was changed from SIC to NAICS in 1998.

graph 2. Compared to the volatile movement of newly constructed housing stock, the constant number of establishments made us infer that there could be more volatility in the unit supply.



[Graph 3 Average number of employees per establishment by county over 20 years.]

The builders seem to adjust to the market by rapidly changing their size, not by establishing new firms or closing existing ones (Graph 3[6]). Compared to the constant level of number of builders' establishments, the size shows more volatility than the actual fluctuation of new housing stock. One standard deviation per mean value of employees per establishment is 0.301, greater than one with starts of 0.17.

According to Graph 3 and Graph 2, the fluctuation in firm size was followed by a pattern of housing starts. Firm size decreased from 2004, and starts decreased from 2005. The number of establishments started to increase in 2006. There are some lags between housing supply and establishments and size of firms. The notable increase of establishments from 2006 to 2007 was followed by the increase of new housing starts and in the number of employees per establishment. Therefore, we can infer that the builders' size as the number of employees per establishments changes first to satisfy market demand and that changes of number of firms comes later. The size of firms seems more responsive to market condition

[6] More detailed distribution of firm's size of each year is shown in attachments 1, using box plots.

than changes of number establishments by entering or existing market are.

The size of firms, as measured by employees, shows that builders' behavior is related to the housing supply, when the number of establishments is highly inelastic. Therefore, size of firms seems good measure to understand builder's behavior.

However, there are points of contention in this assumption, so more rigorous research on direct causality between size and market clearing process in demand is needed. However, because the dynamics of demand and supply equilibrium is not within the scope of this research, I will depend on the classical theory about the role of firm size.

Chapter II: Literature Review

The table summarizes the assumptions extracted from the literature to build research model.

[Table 1 Summary of assumptions explaining firm size]

Field	Theories	Theorists
Firm size distribution	**-Most changes in product demand are met by changes in firm size** -New entry and exit of establishments explain the demand shock	•Classic, Viner (1932) •Bonini (1958), Ijiri (1964)
Industrial organization	**-Homebuilding industry is following monopolistic competitive model** -Builders are homogeneous under perfect competition	•Classic •Somerville(1999)
Housing Supply model	① Reduced form Approach (mainly focus on price effect on supply) ② Structural approach - investments approach – focusing on price and cost impact on supply **- urban spatial approach – adding land issues to price, and cost factor**	•Follain (1979) • Topel, Rosen (1988), •DiPasquale and Wheaton(1994)
Financial Aspects	Access to capital markets affect to Market share of homebuilders (Where more problem in construction loan, market share of private owned builders suffered at the expense of the public homebuilders')	•Brent W. Ambrose and Joe Peek (2008)
Land use regulatory	-Strong regulatory stringency leads to increase of cost factor of builders rather than being effective to preserve public good -More fragmentized jurisdiction leads to smaller development	•Maisel(1953) and Kinzy(1992) •Fishcel(1985)

Each theoretical model includes different assumptions. For example, for firm size distribution, one argues that product demand is met by existing firm's adjusting its size. On the other hand, others argue that market demand is adjusted by new entry and exist of establishments of which size is fixed. As reviewed in historical data, homebuilders tend to adjust their size to meet changes of market demand. Therefore, I assume the former argument in firm size distribution. Similarly, industrial organization, housing supply, and land use regulatory model are reviewed in this chapter. Based on that, I extracted assumptions for research models, highlighted in table 1.

1. Urban Spatial Theory Approach to Housing Supply

DiPasquale (1999) states that the housing supply literature relies in reduced-form and structural models. She also notes that the vast majority of empirical studies use aggregate rather than micro-level data, and that future studies of the mechanics of housing supply will require micro-level data.

Reduced-form models are useful in estimating the price elasticity of the housing supply. For example, Follain (1979) models the supply of housing as reflecting house prices, construction costs and the builder's cost of capital, with an interest rate serving as the proxy for the cost of capital. Similarly, Mayer and Somerville (2000a, b) use the change in the prime rate as a control variable in their analysis of housing supply.

The second line of literature focuses on structural models that directly model housing supply. For example, in one of the first studies in this line of research, Poterba (1984) follows the investment literature to examine how the housing market adjusts to a shock in the steady state. Topel and Rosen (1988), following Poterba (1984), examine housing supply by studying the relationship between asset prices and the marginal cost of production. General market interest rates are again used as one of the indicators for builder supply costs.

Urban spatial theory treats land as an input in the production of new housing. In these models, no supply theory deals with construction flows since new construction or the flow of housing simply equals the growth in population. Since land is different from other factors, the literature on urban spatial theory has revealed that land prices depend on the housing stock, not on building activity. As a result, a rise in house prices initially generates excess returns, but the flow of construction increases only temporarily above the normal level. As housing stock grows, land prices rise, absorb the excess returns, and then construction returns to its normal level.

DiPasquale and Wheaton's (1994) model of housing construction combines stock adjustment with a long-run spatially based definition of equilibrium housing stock. In this research, I used urban spatial theory to examine the elements affecting firm size.

2. Organizational Structure of the Homebuilding Industry

Some research has focused on the industrial organization of homebuilding like Eccles's (1981) research on builder-subcontractor relations and the vertical structure of homebuilding. Strategic behavior by developer-builders is part of the theoretical literature on city formation. Landis (1986) compared two cities and postulated that land-use regulations account for differences in the size of builders active in different markets. Maisel (1953) and Kinzy (1992) found some economies of scale at the project level in homebuilding. However, the empirical literature is limited to general reviews of homebuilding, providing statistics without detailed analysis.

C. Turiel Somerville's research on the industrial organization of housing supply (1999) was the first to develop a picture of industrial structure from market and regulation perspectives. He found that builders are larger in more active housing markets and where there is a greater supply of land suitable for large developments. He also found that the size and concentration of builders are sensitive to the jurisdictional regulations on land use.

However, he did not consider the relationship between builders' size and access to capital. The sample of regulatory variables is too small and showed very low statistical evidence. There is now a larger body of literature on the financial and regulatory aspects of the homebuilding industry.

3. Impact of Credit Availability on the Homebuilding Industry

Bren W. Ambrose and Joe Peek (2008) studied the relationship between credit availability and the structure of the homebuilding industry. They revealed that the growth in private homebuilder market shares is positively related to the bank capital-to-asset ratio and negatively related to the NPL for construction loans, while that of public homebuilders is affected in the opposite direction. Regression analysis of in this research at the metropolitan statistical area level supports the hypothesis that, in areas where banks were less well capitalized and had more problem construction loans, the market shares of large private homebuilders that relied primarily on bank credit to finance their production suffered at the expense of the public homebuilders that had better access to external funds, in large part due to their direct access to public capital markets.

Mayer and Somerville (1996) noted that the linkage between residential real estate development and economic cycles is related to the traditional dependency of developers/builders on debt financing. Somerville (2002) examines the impact of distance on the financing activities of local lenders versus national lenders for homebuilders in British Columbia. He documents that smaller banks are more likely to provide financing to smaller builders, while larger, national financial institutions are more likely to extend financing to larger developers. Based on this literature, I assumed that builders' accessibility to financial sources affects firm size.

4. Land use regulation and housing supply

Fishcel (1985) argued that regulations exist because residents have an interest in controlling development. In smaller jurisdictions a project of a given size is more likely to consume local public goods. When this happens, residents restrict development to preserve the value of the public goods. In contrast, Hamilton (1978) argued that governments adopt land-use controls. Regulation is based on a jurisdiction's market power, which decreases as the number of municipalities and townships increases.

Christopher J. Mayera and C. Tsuriel Somervilleb (2000) suggest that land use regulations lower the steady-state of new construction. They also find differences by type of regulation: development or impact fees have relatively little impact on new construction, but regulations that prolong the development process or constrain new development have larger and more significant effects.

Joseph Gyourko et al.'s (year) Wharton Residential Land Use Regulatory Index project adopted a broader approach to the regulatory environment. Their stylized index for regulatory environments measured the differences in regulatory climate. They suggested a spatially more heterogeneous regulatory environment, with substantial variation across metropolitan areas, and somewhat less variability across communities within a given market area. The most highly regulated communities tended to be more restrictive on most of the dimensions and community wealth is strongly and positively correlated with land use regulations.

I test the stringency of the regulatory characteristics of Wharton survey, which are classified by their regulatory motivation based on literature, rather on the basis of assumptions about regulatory impact. First, firm size is a cost factor to builders. In addition, for public goods preservation, the regulatory stringency limits large development by large builders. The effect of the jurisdiction's structure on firm size also is tested.

5. Size Distribution of Business Firms

The classic theory of firm size explains a unique size distribution based on minimization of cost factor over long-run operation. This theory proceeds under the assumption of product market competition. In contradiction to the theory, most changes in product demand are met by changes in firm size, not by entry or exit of firms. Moreover, firm growth appears to be independent of firm size. Finally, Simon, in collaboration with Bonini (1958) and Ijiri (1964), observed that by examining the distribution of firms by size at a single point in time, one can make inferences about the process governing firm growth and confirm that firm growth is independent of size.

As mentioned earlier, I will assume that the builders have been actively synchronized with housing demand by adjusting their size. Historical pattern of homebuilder's size supports that understanding the determinants of builders' size as an indicator of the housing supply is important.

Chapter III: Research Design

We will test each perspective's impact on firm size based on the comparison of markets in the U.S. metropolitan statistical area (MSA). The MSA is the most inclusive single market and uses a more rigorous statistical methodology.

1. Methodology I: Cross-sectional Comparison of Builder Size over Regions

Comparison between MSA markets will be tested with a regression model for the years of 2002, 2005, and 2007. Cross-sectional comparison based on MSA level, depends on the homebuilder's monopolistic characteristics. Builder groups have traditionally been treated as the subject of supply under a perfect-competition paradigm. Researchers cite the large number of builders and the small share of the national market held by the county's largest builders to support this assumption. For example, surveys of the National Association of Homebuilders (NAHB) indicate that the 50 largest builders in the U.S. accounted for less than 10% of total national single-family starts. However, recent research has found a richer variation in industrial structure across markets. Somerville has argued that the industrial organization of homebuilders is more complex and varied has traditionally been argued. He showed that instead of a homogeneous competitive industry, there is a rich variation in market structure across metropolitan areas.

1.1. Is It Random or Systematic Variation?

Variation does not necessarily reflect an underlying systematic process. If builders of different sizes are randomly distributed across cities, the city-level mean builder size and market share will also vary across cities, but will be invariant to exogenous factors. Therefore, we have to test for randomness. With a random distribution, distribution of the aggregated data of firm size of whole MSAs will mirror the within-MSA distribution. Graph 4 reports the distribution of firm size by employment level, classified by population; first bar is for all MSAs; second bar shows upper quartile MSAs firm size distribution; third one is for bottom quartile; Forth shows the middle.. All are right-skewed; most operative homebuilders are small, whose employees less than four per establishments. The MSA size distribution is different from the distribution of each group. Upper class MSAs distribution shows a flatter pattern with large firms, while middle and bottom quartile MSAs distributions show a more right-skewed pattern. Therefore, it is hard to say that spatial variation of firm size is random. It does not show a systematic characteristic of spatial variation of firm size over region. However, it warrants more analysis of systematic variation of builder size rather than treating them as randomly distributed.

Level of employees	All MSAs	Upper Quartile	2nd & 3rd Quartile	Bottom Quartile
50~	701	506	185	10
20~49	790	470	291	29
10~19	958	518	383	57
5~9	1435	772	535	128
1~4	6043	3216	2275	552

No of firms in each employment rang

[Graph 4 Distribution of builder size classified by employees and population of MSAs[7]]

[7] Establishment's distribution by each employment class level is shown in attachment 2

1.2. Idiosyncratic elements of firm size

Although there is evidence of the systematic variation of builder size across MSA, there are also idiosyncratic elements of firms' size. For example, the quality of the labor force is significant when we consider the firm size in terms of the number of employees. Entrepreneurship, corporate strategy, or leadership are important aspects of firm size, but not systematic determinants. For example, the companies' growth strategies are not always rational, but can be induced. Someone set the strategic purpose more aggressively or conservatively than average. These idiosyncratic elements are related to the validity of MSA's aggregate values. It is hard to say that MSA market size offsets those elements to average mean value. In addition, although the market is big enough for aggregate value, the extent of product differentiation is also problematic, which is more accurate when market size is more narrowly defined. However, the research is focused on explaining the systematic variation because the homebuilding industry is highly limited to its operational aspects. In addition, when we try to extract the result for the long-run perspective, this feature is more apparent, considering the low volatility of the real estate cycle.

2. Methodology II: Regression analysis

I based the regression analysis on aggregated data for MSAs. The average firm size of MSAs (over 250 MSAs, mainly 2002, 2005 and 2007) is the dependent variable. Possible explanatory variables such as demand, cost, price, MSAs area, developable land area, regulatory environment, and financial accessibility are used and tested to explain firm size with valid statistical providence.

I group the data by MSA size (geographical area and number of housing units) and compare the elasticity of variables in large and small MSAs.

The general regression model follows the Somerville's framework of the industrial organization of housing supply. It revealed a rich variation in market structure across metropolitan areas. As summarized in Table 2,[8] the elasticity of firm size is captured from the demand, cost, land supply and regulatory perspectives. His intention is to reveal structural differences and to prove a monopolistic hypothesis. He explained the product differentiation effect to determine if there is theoretical support for cross-market differences in builder firms and the likely causes of any differences. A single development occupies a unique site, giving the builder or developer a highly localized monopoly. Product differentiation refers to variations within a product class that (some) consumers view as imperfect substitutes.

[Table 2 Somerville's modeling in organization structure]

<table>
<tr><th></th><th>one standard deviation increase of</th><th>Employment per establishment</th><th>Construction Value per establishment</th></tr>
<tr><td rowspan="2">As Market demand</td><td rowspan="2">Single family permit</td><td>46~57% increase</td><td>76% increase</td></tr>
<tr><td colspan="2">more demand → larger the builder firm</td></tr>
<tr><td>As Costs</td><td>construction cost index</td><td colspan="2">cost and builder size relationship : hard to control cost data</td></tr>
<tr><td>As Demand for high end home</td><td>per capita income</td><td colspan="2">income and builder size : no certain relationship.</td></tr>
<tr><td rowspan="2">As developable Land supply</td><td rowspan="2">farm land's share above MSA</td><td>13%~15% increase</td><td>27% increase</td></tr>
<tr><td colspan="2">more available developable land supply → larger builder firm</td></tr>
<tr><td rowspan="2">As the Likelihood of land assembly</td><td rowspan="2">Number of farms</td><td>21%~28% decrease</td><td>42% decrease</td></tr>
<tr><td colspan="2">more the need to assemble the land, smaller size of project → smaller firm size</td></tr>
</table>

[8] The data source and summary of statistical result is shown in Attachment 3.

Therefore, his approach is based on reduced form model where price is generally a function of supply and demand. For example, rather than investigating the price's effect on firm size, he treated that as a function of demand and supply. However, with this focus on builders' behavior as entity of aggregated supply, it would be better to investigate firm size with all possible variables.

Moreover, when we consider the fact that numbers of establishments are constant over 20 years and size fluctuated with housing demand as indicated by the number of permits, urban spatial theory's approach is better for seeing the variation in firm size. I prefer the simple model of housing construction combining stock adjustment process with a long-run spatially based definition of the equilibrium housing stocks.

In this model, price level and cost shifters determine the long-run equilibrium stock, affecting firm size more directly. Therefore, I focus on a structural approach and manipulate the variables to explain firm size under the assumptions of urban spatial theory.

3. Research Model and Variables

Based on the assumptions and research scope mentioned in the previous chapter, picture 4 shows the regression model's schematic form with variables which are measured by empirical data. Each data's assumption will be addressed in detail by the descriptions in the data. The market-related, land, and financial can be fundamental factors that determine firm size. A wider spectrum of regulatory environments was segmented by community control as local autonomy to react market and jurisdiction structure as political machine to regulate the policy, which is mostly survey through Wharton project.

[Picture 4 Structure of variables and measurement to assess firm size spatial variation]

	Equation	Variables	Measurement	No
	builder size		Employees per establishment	1
=	**A (Market Activity)**	Demand	single-family/multi-family permits	2
		Cost	Construction Value per permit	3
+	**B (Market Size)**	Geographical Size	area of MSAs	4
		market size	Existing Housing Stock	5
+	**C (Housing Price)**	Rent level	Fair market rent based on two-bed	6
		Price level	Median housing value Housing Price Index	7
+	**D (Land Supply)**	Land Supply	Farmland as percentage of MSA area	8
		Land Assembly	Number of farms in MSAs	9
+	**E (Regulation)**	Regulatory Stringency	Factor loaded aggregated index	10
		Jurisdiction Structure	State Court Involvement Index (SCII)	11
			State Political Involvement Index (SPII)	12
		Democratic in approval	Local Political Pressure index	13
			Local Zoning Approval Index (LZAI)	14
			Local Project Approval Index (LPAI)	15
			Local Assembly Index (LAI)	16
		regulation as cost for development	Supply Restrictions Index (SRI)	17
			Density Restrictions Index (DRI)	18
			Open Space Index (OSI)	19
			Exactions Index (EI)	20
			Approval Delay Index (ADI)	21
+	**F (Financial cost)**		Mortgage cost and interest rate	22
			Accessibility to financial institution	23

Chapter IV: Data[9]

1. Measuring Firm Size

For variables measuring firm size, finding an appropriate measure of the average builder size is not easy. A count of all establishments is not acceptable, because not all general contractors build new units. Among those that do, new constructions will comprise a varying part of their activities.

I will measure average builder size by the average number of employees per operative builder that builds structures for sale. The data source is the County Business Pattern[10] from 1987 to 2007 (table 3). It covers 51 states and includes data on employees and establishment of builders[11] based on NAICS and SIC classifications.

[Table 3 County Business Pattern data set coverage and industry code summary]

Year	Number of Counties	Industry Classification	Year	Number of Counties	Industry Classification
1987	1547	SIC code for operative builders:1530	1998	N/A	NAICS code include Operative builders data in general contractors
1988	1520		1999	N/A	
1989	1468		2000	N/A	
1990	1433		2001	N/A	
1991	1398		2002	N/A	
1992	1398		2003	1659	NAICS code for operative builders:236117
1993	1470		2004	1649	
1994	1481		2005	1696	
1995	1492		2006	2213	
1996	1542		2007	2184	
1997	1791				

These dataset is based on number of employees and salaries of each establishment.

9 Summary of data source, year, and geography land of aggregation is shown in attachment 4.

10 Detailed layout of county business pattern dataset is shown in attachment 5.

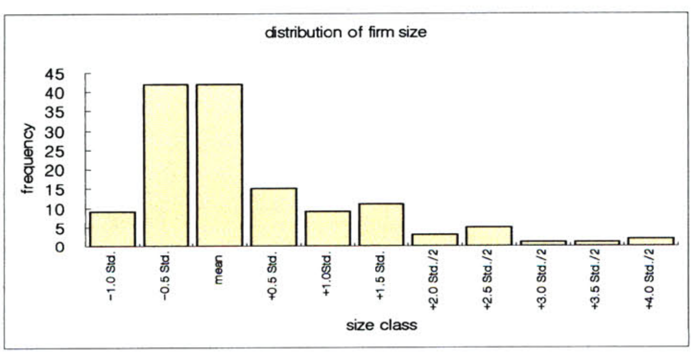
11 New housing operative builders are primarily engaged in building new homes on land that the builder owns or controls. The land is included with the sale of the home. Establishments in this industry build single and/or multifamily homes. These establishments are referred to as merchant builders, production, or for-sale builders.

Therefore, there is issue for disclosure of data which captured as zero or data suppression flag. To handle this, I exclude zero value, which means there are no operative builders in that county or the data was not disclosed. Table 4 compares data description with and without zero value in the 2005 data set. A layout of yearly data is attached. Generally, establishment number does not show zero value. However, some establishments avoid revealing data about their employees.

[Table 4 Summary of employment and establishment]

	Employment		Establishment
	All Records	Except '0'	All Records
Mean	104	245	15
Std. Dev.	8	18	1
Min	0	1	1
Max	6029	6029	459
Observation	2213	938	2213

In 2005, the mean number of employees in each of the 2213 counties was 104.



[Graph 5 2005 MSA base number of employees per establishment distribution.]

The distribution of firm size of each MSAs which calculated by aggregating counties within MSAs depicted in Graph 5.

The firm size variation is quite large. The distribution is right-skewed, meaning that there is wider size variation among large firms. Around 69% of establishments are within 0.5 standard deviations from mean firm size and 83% of firms are within one standard deviation from the mean firm size value. Seventeen percent of firms are more than one standard deviation from mean value.

2. Measuring Independent Variables

2.1 Measuring Demand

For variables measuring demand, I will use single-family permits to describe aggregate demand, because they are available for a large cross section of MSAs. Though equilibrium quantity does not equal demand, the cross-MSA variation in housing permits will reflect differences across these MSAs in aggregate demand. Changes to the status of buildings often take place after the permit has been issued. Therefore, as actual equilibrium quantity between supply and demand, housing starts can be a more accurate measurement. However, there is no cross-MSA variation in housing starts. In addition, completions can be different from the number of starts. Based on the Census Bureau's survey on permits, starts, and completion, starts of single-family units were 2.5% greater than the number of permits. The number of completions of single-family units was 3.5% less than the number of starts. Therefore, the actual amount of supply under the assumption of equilibrium is 1.0% less than the number of permits. Therefore, permits seem not to be biased significantly as a measurement of market demand.

2.2 Measuring construction cost

Data source is manufacturing, mining and construction statistics' MSA level statistics for yearly building permits. Because the available permit data is organized at the MSA level, it is important to manipulate the data with same MSA definitions and corresponding counties. I focus on the years after 2003 with the 2003 MSA definition by the OMB.

One way to measure construction cost is to use the construction cost index. The index is based on a sample of single housing units sold or under construction. However, construction cost indexes have performed poorly, due to the incorrect measurement of labor costs and a failure to address the endogeneity of construction costs and construction activity. Therefore, in this research, I will use aggregated construction value in counties. Construction cost per unit can be calculated by newly added single-family construction value divided by single-family permit in same data set in Census Bureau. I will focus on newly added units' reported construction value rather than construction prices in the region. Because the purpose of this research is to find the elements which affect the spatial variation of firm size, measurement for construction value which represents regional difference seems more proper than cost index. Summary statistics are presented below.

[Table 5 Summary statistic of number of permit and construction cost]

Year	Number of MSAs	Average Number of unit permitted in each MSAs				Average total construction cost in each MSAs (in thousands dollars)			
		1unit	2unit	3&4 unit	5- unit	1unit	2unit	3&4 unit	5- unit
2007	364	2258	64	76	928	427239	6461	7296	92981
2005	361	4015	92	110	1003	684998	9032	10294	95135
2003	360	3527	95	100	906	535230	9130	8231	64010

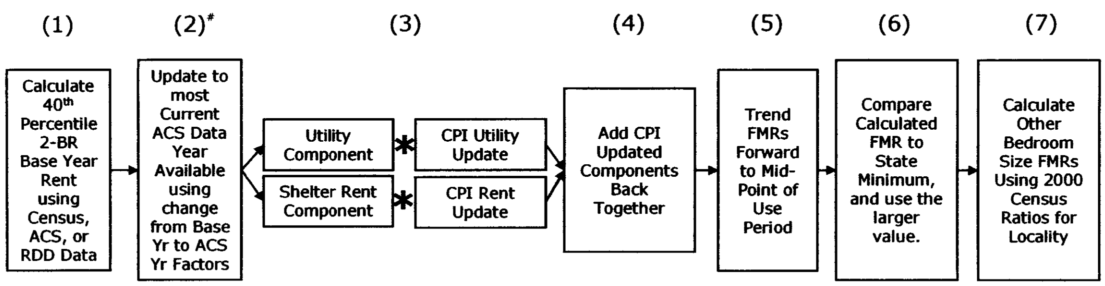
2.3 Measuring Housing Price

For housing price, I use median housing value in census data, Fair Market Rent (FMR)[12] by Department of Housing and Urban Development, and housing price index by federal housing financial agency. Both fair market rent and housing price index are estimated by each institution rather than an actual measurement of the market. However, both are

[12] Fair Market Rents (FMRs) are used to determine payment standard amounts for the Housing Choice Voucher program, The U.S. Department of Housing and Urban Development (HUD) annually estimates FMRs for 530 metropolitan areas and 2,045 nonmetropolitan county FMR areas.

adjustable because they have spanned 20 years.

FMR is gross rent estimates at the county level. They include the shelter rent plus the cost of all tenant-paid utilities, except telephones, cable or satellite television service, and internet service. FMR estimates are based on two-bedroom units, although there are slight differences among fiscal years. .



[Picture 5 Estimation of fair market rent based on two-bedroom survey

The summary of data used is below. The number of counties is slightly different from actual number of counties, especially in 2007. That is because some towns in one county value are estimated separately. In my analysis, I treated data about multiple towns in one county as one average data to represent the counties.

[Table 6 Fair market rent of 2003, 2005, and 2007 data set

Year	No. of Counties	FMR (0 bed)	FMR (1 bed)	FMR (2 bed)	FMR (3 bed)	FMR (4 bed)
2003	3183	353	418	519	682	782
2005	3186	410	456	552	720	812
2007	4681[13]	490	552	669	863	978

The Housing Price Index is a broader measure of the movement of single-family house

[13] Borough, Census Area, Municipality

prices. It is an accurate indicator of geographical trends in housing prices. The HPI is a measure designed to capture changes in the value of single-family homes in the U.S. The HPI is published by the Federal Housing Finance Agency (FHFA) using data provided by Fannie Mae and Freddie Mac. The Office of Federal Housing Enterprise Oversight (OFHEO), one of FHFA's predecessors, began publishing the HPI in the fourth quarter of 1995. I used all transaction indexes based on the seasonally unadjusted MSA. It is a quarterly index and the percentage change in home values relative to the same quarter one year earlier. I set the last fourth quarter as standard to see the housing value changes. From 2003 to 2007, average housing price of 350 MSA increased 141%, 182%, and 200% each, relative to the previous year.

2.4 Measuring land supply and land assembly effect

There were no explicit measures of the supply of land for development. Instead, we use variables that measure the total amount of land that can be readily developed and the extent to which land assembly is likely to be a problem. Farm and ranch land and MSA should be a rough measure of the supply of land that can be developed into lots for residential construction. Agricultural data on farm and ranch land in an MSA describes the supply of land suitable for development.

While all MSAs have undeveloped land on the outskirts of the urban area, much of this land can be costly to develop because of topography, the presence of wetlands or bodies of water or because the land has been dedicated to some other use.

Other variables measuring land supply are the likelihood of land assembly. If the parcel is highly fragmented, the process of acquiring the land will be more difficult. If the farms are owned by a single household or firm, the expected probability of land assembly available for development will rise. We can infer that given supply of land area, indicated as a percentage of farm area normalized by whole land area, if the number of farms increases, lands are more fragmented. Therefore, using percentage of farm land and number of farms in MSAs, we could measure the impact of fragmentation and the amount of developable land to firm size. The data source are the 2002 and 2007 county censuses of agriculture.

Year	Number of counties	Number of farms	Farmland (acres)
2002	3078	692	301496
2007	3078	717	296697

[Table 7 Developable land area and fragmentation of land, 2002 and 2007]

2.5 Measuring Financial Cost and Accessibility

For financial accessibility, it is hard to get the direct data, because most of the data is classified. Previous studies used the data of publicly traded companies. However, operative builders are medium or small size, and are not on the stock market. First, I used mortgage rates and mortgage costs over regions as indicators of the difference in financial markets. I also use an indirect way of finding financial accessibility, based on the assumption that national financial markets do not spread their costs across the nation. On that basis, I use quantitative amount of financial institute which can be critical to financing construction. In this case, I used number of establishment of investment banking and securities which are normalized by total number of financial establishments in each MSA (NAICS code: 523110 (investment banking), 52: financial establishment).

I choose investment banking and securities as indicators of financial market activity, because I assumed that they showed a wider spread of return than the interest rate.

3. Measuring Regulatory Stringency

For variables measuring regulation, I will use the Wharton Urban Decentralization Project (WUDP) data set which includes results from a survey of local planners in MSAs. Data explain the regulatory environment such as the estimated number of months between an application for rezoning and the receipt of building permits. I will include measures of regulation, including the estimated number of months required for subdivision approval, the ways in which growth management techniques have been introduced in the MSA, and whether development or impact fees have been imposed in the cities in the MSA. In the survey, time for subdivision approval is a categorical variable for the estimated number of months until approvals are obtained to subdivide a properly zoned property of given size for residential development.

The data source is 2007 the Wharton Residential Land Use Regulatory Index (WRLURI). It covers 2729 records from each type of jurisdiction's response to survey[14]: 51 states, 319 MSA/PMSAs15, 2729 places (730 unknown MSA/PMSAs, 1999 places in 319 known MSA/PMSAs). The simple jurisdiction statistics is indicated in table 8. Not every record is distributed equally over upper jurisdiction level. All data layouts with simple statistical descriptions are attached.

[14] Each questionnaire's specification and summary statistics are shown in attachment 6 and 7.
[15] Metropolitan areas are based on 1999 boundaries, and primary metropolitan statistical areas (PMSAs) within a consolidated metropolitan statistical area (CMSA) are considered distinct areas.

[Table 8 Summary of jurisdictions in Wharton regulatory data set]

Max of No. of MSA/PMSAs in one State	25	(California)
Min of No. of MSA/PMSAs in one State	1	(Alaska, District of Columbia, Hawaii, Rhode Island, Vermont, Wyoming)
Max of No. of Places in one MSA/PMSA	100	(Chicago, IL PMSA)
Min of No. of MSA/PMSAs in one State	1	(Kankakee, IL PMSA et all, 71 MSA/PMSAs)

WRLURI is using fifteen specific questions with a complete copy of the survey. The overall response rate was 38%, with 2,649 surveys returned, representing 60% of the population surveyed. It creates a series of sub-indexes that summarize different aspects of the diverse landscape characterizing the local regulatory environment as below[16].

The Local Political Pressure Index (LPPI)	It reflects the degree of involvement by various local actors in the development process. It is a standardardized variable with a mean of zero and standard deviation of one.
The State Political Involvement Index (SPII)	It is formed as the standardized sum of two components ranked by surveyors. The first is based on the fifty state profiles of state-level legislative and executive branch activity pertaining to land use regulation. It is ranking of 1, 2, and 3. A score of 1 indicates that there had been little recent activity towards fostering such restrictions, with a 3 indicating that state government has exhibited a high level of activity, not only studying the issue via commissions and like, but acting on it with laws or executive orders. A score of 2 was achieved if a state was in between dormancy and intense activity on land use issues. The second component of this subindex is based on the answers to the survey question on 'how involved is the state legislature in affecting residential building activities and/or growth management procedures'. The answers take on values from 1 to 5, with a higher score indicating a greater role and influence for the state legislature. Lower values of this index imply less activity towards more general state land use control.
The State Court Involvement Index (SCII)	The judicial environment was assessed based on the tendency of appellate courts to uphold or restrain municipal land-use regulations. The judicial environment was assessed based on the

16 Components and equation for each sub index are shown attachment 8.

	tendency of appellate courts to uphold or restrain four types of municipal land-use regulations -- impact fees and exactions, fair share development requirements, building moratoria, and spot or exclusionary zoning. The state score here reflects the degree of deference to municipal control, with a score of 1 implying that the courts have been highly restrictive regarding its localities' use of these particular municipal land-use tools. On the other end of the spectrum, a score of 3 is given if the courts have been strongly supportive of municipal regulation. A score of 2 is given if the courts have been neither highly restrictive nor highly supportive of municipal regulation.
Local Zoning Approval Index (LZAI)	The LZAI is the simple sum of the number of entities whose approval is required.
Local Project Approval Index (LPAI)	This sub index value is the simple sum of the number of organizations that must approve a project that does not need any change to current zoning.
Local Assembly Index (LAI)	The Local Assembly Index is a measure of direct democracy and captures whether there is a community meeting or assembly before which any zoning or rezoning request must be presented and voted up or down. This subindex takes on a value of one if the community both has a regular town meeting and a requirement for a popular vote in order to approve changes to zoning regulations, and is zero otherwise.
Supply Restrictions Index (SRI)	The Supply Restrictions Index (SRI) reflects the extent to which there are explicit constraints or caps on supplying new units to the market. The SRI is the simple sum of the number of 'yes' answers to each of these questions.
Density Restrictions Index (DRI)	It reflects if communities clearly care about (low) density. DRI=1 if the locality has at least a one acre minimum lot size requirement somewhere withing its jurisdiction and a zero if it has not.
Open Space Index (OSI)	It reflects whether home builders in the community are subject to open space requirements or have to pay fees in lieu of such dedications. OSI=1 if the community imposes such regulation and equals zero otherwise.
Exactions Index (EI)	This index is a dummy variable that takes on a value of one if exactions for associated infrastructure improvements are mandated by the locality and is zero otherwise. EI=1 if developers must pay allocable shares of infrastructure improvement costs and is zero otherwise.
Approval Delay Index	This subindex can be interpreted as the average time lag in months

(ADI)	and is calculated. Survey asked respondents about the average duration of the review process, the typical amount of time between application for rezoning and issuance of a building permit for hypothetical projects, and the typical amount of time between application for subdivision approval and the issuance of a building permit conditional on proper zoning being in place. More specifically, respondents were asked to reply to the first of these three questions with the number of months for the review process. The latter two questions provided ranges of possible answers (also in months) and the midpoint of the relevant interval to reflect the expected delay is used. In addition, the answers is averaged across the three hypothetical projects described in the questions: a relatively small, single-family project involving fewer than 50 units; a larger single-family development with more than 50 units, and a multifamily project of indeterminate size.
WRLURI	Overall measurement of regulatory environment as a linear combination of the sub-indexes.

Using each characterized sub indexes, it created overall regulatory environment index, as noted WRLURI. Detailed components of index are attached. Factor analysis of the sub-indexes is employed to create the WRLURI. The factor loadings are the weights that are used when multiplying by each of the standardized component indexes to obtain the WRLURI as a linear combination of the sub indexes.

Table 9 is summary statistics of sub indexes and correlation with WRLRI. The correlations of WRLURI with the component indexes provide a sense of what information contained in the sub indexes did or did not 'make it through' to the WRLURI. The WRLRI is very highly correlated with the Average Delay Index (ADI), but also clearly is being influenced by many other components. The aggregate index loads positively on nine of the eleven sub indexes. It loads most heavily on the Average Delay Index (ADI), with the state and local political involvement indexes (SPII and LPII) also being relatively influential. The Exactions Index (EI), the State Courts Involvement Index (SCII), and the Local Zoning

Approval Index (LZAI) have very small factor loadings, with the latter being very slightly negative.

[Table 9 Summary statistic of components of factor loading regulatory measurement]

Factor	Loadings	Correlation with WRLURI	Obs	Mean	Std. Dev.	Min	Max
ADI	0.3	0.73	2678	5.61	3.90	-0.62	29.39
LPPI	0.22	0.56	2729	0.02	1.01	-1.85	7.49
SPII	0.22	0.57	2728	0.01	0.99	-2.16	2.42
DRI	0.19	0.53	2729	0.22	0.41	0	1
LPAI	0.15	0.37	2718	1.56	1.03	0	6
OSI	0.14	0.38	2660	0.55	0.50	0	1
LAI	0.14	0.32	2729	0.03	0.18	0	1
SRI	0.09	0.25	2714	0.20	0.84	0	6
EI	0.02	0.05	2659	0.75	0.43	0	1
SCII	-0.03	-0.18	2728	2.13	0.67	1	3
LZAI	-0.04	-0.1	2728	2.04	0.91	0	6

3.1 Interpretation of regulatory index

Besides WRLRI is constructed to rank localities in terms of the degree or overall strictness of the land use regulatory environment, the above sub indexes averages allow us to say about the typical land use regulatory environment in sample.

Firstly, mean value of LZAI of '2.04' (the simple sum of the number of entities whose approval is required) shows that two entities, be they a zoning commission, city council, or environmental review board, are required to approve any project requiring a zoning change

Secondly, mean value of LPAI of '1.56' (the simple sum of the number of organizations that must approve a project that does not need any change to current zoning) shows that more than one entity also is required to approve any project, even if it does not involve a zoning change;

Thirdly, the very low mean values of both LPPI of '0.02' (the degree of involvement by various local actors in the development process) and LAI of '0.03' a measure of public participation and captures whether there is a community meeting or assembly before which any zoning or rezoning request must be presented and voted up or down). It is highly unlikely that any form of direct democracy is practiced in which land use issues and projects must be put to a popular vote.

Fourth, the mean value for DRI of 0.22 (the degree of density restriction) seems that there probably is no onerous density restriction such as a one acre lot size minimum anywhere in the community, although some less stringent minimum constraint generally is in place.

Fifth, 0.55 and 0.75 for each mean value of exactions and open space requirement shows that there exist probably, even though they are not as omnipresent as is the case in the more highly-regulated places Lastly, 5.61 ADI (delay index in month) shows that there is about a six month lag (on average) between the submission of an application for a permit and permit issuance for a standard project.

Table 10 reports summary statistics on the distribution of the WRLURI as indicator for whole strictness of localities.

[Table 10 WRLURI summary statistics]

WRLURI classification	Full Sample	Metro Area	Non-Metro Area Sample
Mean	0	0.17	-0.46
Standard Deviation	1	1	0.86
10th percentile	-1.18	-1.03	-1.42
25th percentile	-0.72	-0.55	-1.1
50th percentile	-0.1	0.06	-0.56
75th percentile	0.59	0.74	0
90th percentile	1.29	1.5	0.6
No. of Observations	2,611	1,904	707

The first column uses the full national. There are 2,611 communities in this sample, 73 percent (or 1,904) of which are in metropolitan areas as defined by the Bureau of the Census. By construction, the mean of this index is zero and the standard deviation is one.

The second columns report index values at the mean and across the distribution of communities within metropolitan areas. The average community within a metropolitan area with mean value of 0.17 is more regulated than the average community in the nation which is set as zero. This suggests there could be fairly large gap in the degree of regulation between places in metropolitan areas and those outside them. And the 707 jurisdictions outside of metropolitan areas have measures of regulatory strictness that are less than the national average.

The WRLURI shows the regulatory climate in central cities tends to be less strict according to our data. The mean WRLURI value for central cities in sample is -0.14, with the median being -0.25. There is considerable heterogeneity across central cities, but they have a less restrictive land use regulatory environment on average than their suburbs. The gap between their mean and that for the suburbs is about one-third of a standard deviation.

3.2 Spatial variation of regulatory stringency

The data of Wharton survey shows the spatial variation of regulatory environment. Their analysis showed that the places whose regulatory strictness indicated by WRLURI quite close to mean value distribute over national wide. They pick up 164 communities whose WRLURI values are within 1/10th of a standard deviation of the metropolitan area mean of 0.14 (i.e., 0.05<WRLURI<0.24, given the mean of WRLURI=0.14 in the metropolitan area sample; above Table). These places are not concentrated in only a few states or areas.

Rather, they span 30 states and 89 metropolitan areas. Given the narrowness of definition of average (within 1/10th of standard deviation), this means a lot of geographic variation, and emphasizes the point that 'average' places in terms of land use regulatory strictness are spread throughout much of the nation. Below table reports more detailed providence about spatial variation showed above.

[Table 11 Summary Statistic of sub index]

	Means	
	164 Communities within 1/10th standard deviation from mean WRLURI	Full Metro Sample (n= 1,904)
Sub indexes		
Local Political Pressure Index (LPPI)	-0.03	0.11
State Political Involvement Index (SPII)	0.27	0.05
State Court Involvement Index (SCII)	2	2.04
Local Zoning Approval Index (LZAI)	1.94	2.04
Local Project Approval Index (LPAI)	1.73	1.64
Local Assembly Index (LAI)	0	0.03
Supply Restrictions Index (SRI)	0.19	0.23
Density Restrictions Index (DRI)	0.16	0.26
Open Space Index (OSI)	0.72	0.6
Exactions Index (EI)	0.73	0.75
Approval Delay Index (ADI)	6.03	6.09
Local Traits		
Median Family Income (2000)	$57,486	$57,610
Median House Value (2000)	$136,017	$136,790
Percent College Graduates (2000)	22.40%	24.30%
Percent Poverty (2000)	6.10%	6.50%
Percent White (2000)	79.40%	81.00%
Population (2000)	27,283	27,924
Land Area in Square Miles (2000)	14.8	17.9
Density, Population per Square Mile (2000)	2,545	2,211

The values of the eleven component indexes for these 164 places (column 1) allow us to compare them to the average values for the metropolitan area sample (column 2). The mean values of the subcomponents of our sub index tend to be quite close to the metropolitan area means. The same is true for the income, house value, and demographic variables reported in the bottom panel of this table. Thus, there does not appear to be anything that is special or abnormal about places that have the typical land use regulatory environment in the country. Therefore, we can verify that the normal mean places with traits above distributed over nation very widely.

4. Data Processing

4.1 Matching each data set using geographical reference

Not all data is organized in the same way. For example, regulatory indexes are based on place level; permits and price variables are based on MSA, and other datasets are based on county level.[17] Moreover, the definition of MSA has changed, and this makes data operation difficult. However, the most accurate and consistent level of geographic reference is county level FIPS code over 20 years. Therefore, I set the county Fips code as standard to manipulate the data's geographical reference, linking place codes to county level.

First, transferring place FIPS code to county FIPS code which includes the places is operated, with care attention. I proceeded with data based on counties. I created new records for regulatory place base records by aggregated place data within same counties.

[Table 12 Summary of place records linking to county level]

Number of place records	1245
Average number of places in one county	4.448996
Median number of places in one county	2
Max number of places in one county	102
Min number of places in one county	1

The data set summary about jurisdiction indicating number of counties in each MSAs is shown in

[17] Detailed information about each geographical land of aggregation is shown in attachment 4.

table 12. Each county has a different number of survey responses about land use regulation. The number of aggregated places records in counties is scattered. However, I used aggregated value, excluding all null values. MSA and county matching process is done as above, using the 2003 MSA definition.[18] There is no way to be accurate so I tried not to use the data using other MSA definition. It is hard to say that transforming the previous definition of PMSA/MSA to the one used by MSA and CSA after 2003 could be reliable. However, OMB's reference can make those transforming process enable in some extent of correctness.

Through matching process, the initial 1696 counties of 2005 were converted to 140 MSAs which include all variables used in regression models. First, 1696 counties' outlier which has zero value for employees is excluded, resulting in 559 counties. These counties are aggregated in MSA level with 309 records for firm size, 361 records for permit and construction costs, 921 farms and demographics data, 384 records for housing price index, 414 records for finance data, and 605 regulation data. Among these records, common MSA including all variables value is 140 MSAs.[19]

4.2 Simultaneity and Multi co-linearity bias among variables

Picture 4 shows the range of covering variables. The issues in handling the dataset are simultaneity between independent and dependent variables and multi co-linearity among dependent variables. For example, if there are effects of builder size on levels of new home

[18] Detailed operation process exemplified by 2005 data base is shown in attachment 9.
[19] Detailed variables for each record in Access data base are shown in attachment 10. And summary statistics of each dataset is shown in attachment 11.

construction, then the coefficient on permits in Equation 2 in Picture 5 will suffer from simultaneity bias. Similar problem can happen in Equation 3 with construction cost, 5 with housing stock and 7 with housing price index and housing value. In this case, the reverse causality or effect of builder size to dependent variables can lead to overestimations or underestimations of the elasticity of explanatory variables effect. One method of handling this is to use instruments for permits to control this simultaneity, using two-stage least square IV methods.[20]

However, this research focuses on how each variable affects industrial organization in the long run. In the long run, the housing supply is stabilized under fixed number of establishments with variations in firm size. Therefore, I will limit this thesis to long-run variations in organizational structure. However, the problem of multi collinearity is handled because it reduces the explanatory power of the dependent variables. This thesis reveals many aspects' independent effect on firm size. Therefore, if the correlation among dependent variables is relatively high, these variables are treated or substituted to sustain the independency among explanatory variables. Therefore, the analysis will be based on correlation tests among variables before the regression.

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[20] Interpretation as two-stage least squares: In the first stage, each endogenous covariate in the equation of interest is regressed on all of the exogenous variables in the model, including both exogenous covariates in the equation of interest and the excluded instruments. The predicted values from these regressions are obtained.

Stage 1: Regress each column of X on Z, ($X = Z\beta$ + errors) and save the predicted values:

$\hat{\beta} = (Z'Z)^{-1}Z'X$ Therefore: $\widehat{X} = P_Z X.$

In the second stage, the regression of interest is estimated as usual, except that in this stage each endogenous covariate is replaced with the predicted values from its first stage model from the first stage.

Stage 2: Regress Y on the predicted values from the first stage:

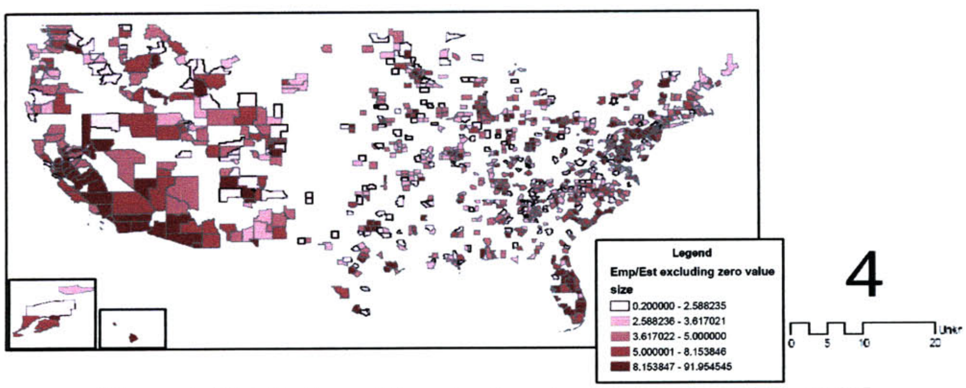
$Y = \widehat{X}\beta + \text{noise}.$

The resulting estimator of β is numerically identical to the expression displayed above. A small correction must be made to the sum-of-squared residuals in the second-stage fitted model in order that the covariance matrix of β is calculated correctly

Chapter V: Analysis of the variables

1. Firm size variation and spatial distribution

The map below[21] shows the spatial distribution of builders' size with number of the employees per establishment based on 2216 counties in 2003. Although there was little variation of firm size over 20 years, the cross-sectional regional difference in firm size is dramatic. However, there seems some correlation between firm size and county area. For this reason, more detailed analysis is needed of the normalization of area to see a more accurate regional spatial variation.



[Picture 6 Distribution of firm size based on county boundary, 2005]

Based on the 2005 county level comparison, the highest average number of employees per operative builder was 212.3 in Kenton County of Cincinnati-Middletown, OH-KY-IN Metropolitan Statistical Area; 28722 counties' mean value is 14.3 per establishment. The

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[21] Null points are counties where one of four data sources is not captured. However, each variable, especially Wharton survey which is not available at the county level, can be presented separately, using latitude and longitude of each surveyed places which is linked by populated places code.

[22] The number of counties is based on County Business Pattern's classification. For the 2005 dataset, 559 counties showed non-zero value for employees among 1696 counties which have operative builders' data. And 287 counties showed all record during 20 years from 1985 to 1995. To see the growth rate and size distribution, I set these 287 counties as those which have valid and reliable counties which have employees and establishment data.

growth rate of firm size from 1995 to 2005 ranged from a high of 920% (Loudoun County in Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area) to a low of -87% (Lake County in Orlando, FL Metropolitan Statistical Area).

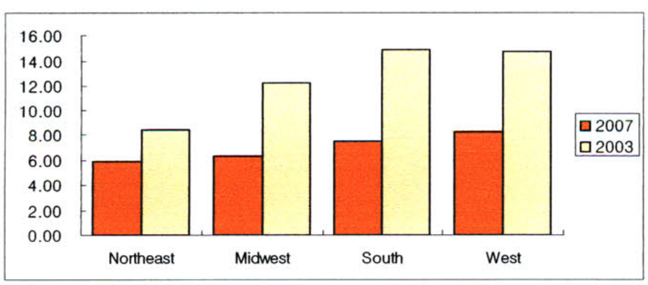
[Table 13 County Base average number of employees per establishment summary]

	2005_size	1995_size	1986_size	Δsize(05-95)	Δsize(95-86)	Δsize(05-86)
Mean	14.3	8.8	8.9	87%	24%	91%
deviation	17.07	8.37	6.82	1.53	1.41	2.19
count	287	287	287	287	287	287

[Table 14 2005 counties' average number of employees per establishment]

Size max	212.3	Kenton County of Cincinnati-Middletown, OH-KY-IN Metropolitan Statistical Area
Growth max	920%	Loudoun County in Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area
Growth min	-87%	Lake County in Orlando, FL Metropolitan Statistical Area

This firm size variation is clearer when we see nationwide regional comparisons. The below graph shows the average number of employees per establishment based on simple aggregate number of MSAs of each region for 2007 and 2003 data[23].



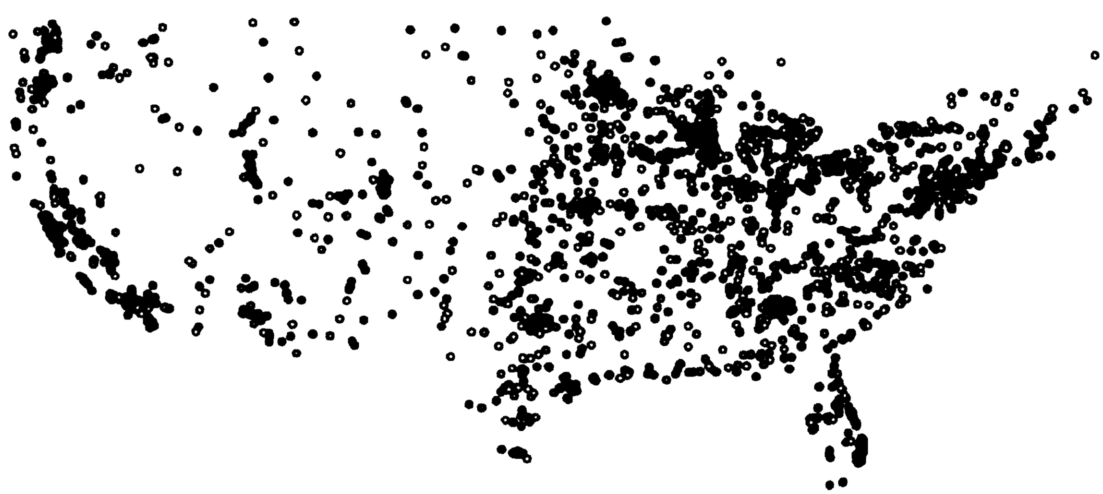
[Graph 6 Regional comparison of firm size of 2007 and 2003]

The South and West showed bigger builder size and faster growth than the Northeast and Midwest. Therefore, there is a certain regional variation. The different environment of each region can reveal the determinants of regional differences in firm size.

[23] Five hundred and fifteen MSAs for 2007 and 285 MSAs for 2003 are included for average number for each region. Both are based on 2003 MSA definition by Office and Management Budget.

2. Regulatory environment variation by region

There is also wide variation among regions. Below is showing regulatory environments strictness based on Wharton survey index. It includes all places surveyed rather than the county or MSA definition, because the Wharton survey is not available at the county level. It uses the latitude and longitude of each surveyed place, and these are linked by populated places code. This picture allows us to contrast places across the full distribution of WRLURI values. I divide the sample into three groups: lightly, moderately, and heavily regulated places. Lightly-regulated places are in the bottom quartile of WRLURI values (WRLURI<-0.55 in this case); moderately-regulated places span the inter-quartile range of the data (-0.55<WRLURI<0.74); and highly-regulated places are those with WRLURI index values above 0.74 which is the top quartile.



[Picture 7. WRLURI distribution based on place level]

Below is the average subindex values for each group, with the bottom panel providing community income, house value and demographic descriptors based on Census 2000.

[Table 15 Sub index table with its demographic features]

	Means		
	Lightly-Regulated WRLURI < -0.55 (n=476)	Average-Regulated -0.55<WRLURI<0.74 (n=952)	Highly-Regulated WRLURI > 0.74 (n=476)
The Eleven Subindexes			
Local Political Pressure Index (LPPI)	-0.46	0.07	0.93
State Political Involvement Index (SPII)	-0.68	0.17	0.74
State Court Involvement Index (SCII)	2.15	2.04	2.03
Local Zoning Approval Index (LZAI)	2.13	1.99	1.91
Local Project Approval Index (LPAI)	1.16	1.67	1.99
Local Assembly Index (LAI)	0	0.002	0.12
Supply Restrictions Index (SRI)	0.03	0.18	0.53
Density Restrictions Index (DRI)	0.04	0.18	0.57
Open Space Index (OSI)	0.26	0.68	0.75
Exactions Index (EI)	0.66	0.79	0.75
Approval Delay Index (ADI)	3.2	5.7	10.5
Local Traits			
Median Family Income (2000)	$50,742	$58,641	$72,576
Median House Value (2000)	$110,926	$150,576	$216,748
Percent College Graduates (2000)	23.60%	27.00%	35.40%
Percent Poverty (2000)	8.50%	7.00%	4.80%
Percent White (2000)	78.60%	76.90%	81.10%
Population (2000)	62,760	43,408	51,567
Land Area in Square Miles (2000)	21	18.4	31.1
Density, Population per Square Mile (2000)	2,599	2,886	2,046

The differences between lightly- and highly-regulated places are fairly large for most of the subindexes making up the WRLURI. The only exceptions are the State Court Involvement Index (SCII) and the Local Zoning Approval Index (LZAI). The results for the Local Project Approval Index (LPAI, row 5) indicate that highly-regulated places tend to have about one more entity that is required to approve a project, even if that project does not require a zoning change. Having multiple approval (and, thus, rejection) points must make the regulatory environment more burdensome for those wanting to supply new product to the market.

There literally are no lightly-regulated places with direct democracy requirements that zoning changes have to approved by popular vote at an announced meeting (LAI=0.00). While this type of requirement is relatively rare throughout the sample, 12 percent of the highly regulated places have it, and they are concentrated in three states—Massachusetts, Maine, and New Hampshire. We would expect it to be easier to block projects in such situations. There also are very few explicit restrictions on new supply in communities, but those who have them are much more likely to be in the top quartile of the WRLURI distribution as indicated by the results in the next row for the Supply Restrictions Index (SRI). Density restrictions as reflected in one acre minimum lot sizes are more widespread, but they still are much more heavily concentrated in places that are highly restrictive on average. The data in row 8 show that 57 percent of the most highly regulated places have a one acre minimum lot size requirement in at least one neighborhood, while only 4 percent of the most lightly regulated places have such a minimum.

Open space requirements are even more omnipresent, but there still is a meaningful gap between highly- and lightly-regulated places. Seventy-seven percent of the top quartile of the WRLURI distribution has an open space requirement (i.e., OSI=1) versus only 26 percent of the bottom quartile of the WRLURI distribution. Even with respect to exactions, which are the most widespread local regulatory feature, there is a difference across highly- versus lightly-regulated places. Seventy-five percent of the former have some type of exactions requirement (i.e., EI=1) versus only 66 percent for the bottom quartile of the most lightly-regulated communities. Finally, the average project delay time is more than three times longer in the highly-regulated places versus the most lightly-regulated places. More specifically, the Approval Delay Index (ADI) indicates a mean delay of 10.5 months in the more regulated areas versus 3.2 months in the less regulated areas.

In sum, highly regulated places tend to be so almost across the board. The top quartile of places in terms of WRLURI values tends to be communities with more intensely involved local political environments relating to land use regulation. They also tend to be in states whose executive and legislative branches are facilitating the adoption of statewide land use rules. However, their courts may or may not be adding to this process. Highly regulated places also tend to have multiple veto points for project approval, although there is no apparent difference in this dimension for project-level zoning approval. Direct democracy in terms of requiring a popular vote for zoning changes is almost exclusively a characteristic of highly-regulated places. And, the most highly-regulated quarter of the metropolitan sample is disproportionately likely to have some type of formal restriction on new supply, a relatively onerous one acre lot size minimum, as well as open space and exaction requirements. Finally, these places have by far the highest average project delay times.

The bottom panel of Table 14 documents that highly-regulated places also are richer, much more highly educated, and have substantially higher house values than the most lightly-regulated places in terms the WRLURI distribution. Median family income is more than $20,000 greater in the most highly-regulated prices and has a simple correlation coefficient of 0.35 with our regulation index. Median house value in highly regulated places is nearly double that in lightly-regulated places and has a 0.33 correlation with WRLURI. The 12 percentage point gap in the fraction of households headed by college graduates is quite large considering the sample average is 28 percent. Its simple correlation with the degree of local land use regulation is 28 percent. The most highly-regulated areas by our measure have a greater fraction of white households, but the difference with the most lightly-regulated areas is modest.

The same holds for average population across these places. However, the most highly-regulated areas are physically larger and they are a 25 percent less dense. The density result is strongly suggestive. If regulation were being driven primarily by the fact that places literally were running out of land, then we would expect the most highly regulated places to be the densest. That the reverse is true strongly suggests that this is not a primary motivation for more intense regulation in many places.

3. Correlation Test between firm size and regional character

3.1 Firm size

I tested the average number of employees per establishment. For convenience, black cells have a positive correlation and white cells have a negative one in table 16. Grey cells mean that there is no correlation between regulation and firm size. I tested each level of firm size and choose the correlation value which show consistent signage with each class of dataset.

First, population and housing unit show high correlation with firm size as of 35-36%. A large population means a large number of employees regardless of the number of establishments. Geographic components like land area and density do not show a meaningful correlation. The housing market indicators like occupation rate or vacancy rate show high correlation with firm size as of 36%. The occupancy rate seems reasonable because it is directly related to market demand. High correlation of firm size with vacancy rate seems controversial to one with occupancy rate. However, the demand in the market shows the amount of existing stock, whether occupied or not. Rental market factors impact to firm size is interesting and needed more research further. Rental or owner-occupied units are also highly correlated with firm size.

[Table 16 Correlation test of firm size with demographic factors of MSAs]

	1[24]	2	3	4	5	6	7	8	9	10	11
Emp all	**35%**	**37%**	2%	0%	2%	**12%**	**11%**	**36%**	**36%**	**17%**	**26%**
Emp>0	25%	26%	**5%**	**1%**	**5%**	6%	6%	26%	26%	10%	19%
Emp>10	23%	24%	4%	0%	4%	5%	4%	24%	24%	8%	16%
Emp>15	21%	21%	2%	-1%	3%	4%	3%	21%	22%	6%	15%
MAX	**35%**	**37%**	**5%**	**1%**	**5%**	**12%**	**11%**	**36%**	**36%**	**17%**	**26%**
	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

	12	13	14	15	16	17	18	19	20	21	22
Emp all	-12%	-13%	-11%	**40%**	**30%**	**13%**	-22%	-7%	-27%	**-16%**	6%
Emp>0	-11%	-7%	-6%	29%	21%	11%	-18%	2%	-15%	-23%	**11%**
Emp>10	-10%	-6%	-5%	26%	19%	11%	-14%	2%	-11%	-21%	8%
Emp>15	**-9%**	**-5%**	**-4%**	24%	17%	10%	**-12%**	**2%**	**-8%**	-20%	8%
MAX	**-9%**	**-5%**	**-4%**	**40%**	**30%**	**13%**	**-12%**	**2%**	**-8%**	**-16%**	**11%**
	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE

	23	24	25	26	27	28	29	30	31	32	33
Emp all	-5%	**31%**	7%	18%	19%	**16%**	**-19%**	**34%**	**34%**	**36%**	**34%**
Emp>0	-2%	28%	**8%**	18%	**21%**	16%	-24%	22%	21%	24%	22%
Emp>10	-2%	25%	7%	**18%**	20%	16%	-22%	18%	17%	20%	18%
Emp>15	**-1%**	23%	7%	17%	18%	15%	-21%	15%	14%	17%	16%
MAX	**-1%**	**31%**	**8%**	**18%**	**21%**	**16%**	**-19%**	**34%**	**34%**	**36%**	**34%**
	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

	34	35	36	37	38	39	40	41	42	43	44
Emp all	**40%**	-14%	-12%	-20%	-13%	**27%**	**38%**	**25%**	**42%**	**42%**	16%
Emp>0	30%	-3%	0%	-14%	-2%	15%	24%	16%	30%	30%	**16%**
Emp>10	26%	-1%	1%	-11%	0%	11%	19%	12%	25%	24%	15%
Emp>15	22%	**0%**	**3%**	**-9%**	**2%**	8%	15%	9%	21%	21%	13%
MAX	**40%**	**0%**	**3%**	**-9%**	**2%**	**27%**	**38%**	**25%**	**42%**	**42%**	**16%**
	TRUE	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

Racial aspects seem high in relation to firm size. High ratio of white is negatively related to firm size and mixed treats of races show high correlation with firm size. Income level and housing value components show a high positive correlation with firm size.

[24] Each number is indexed with census variables; the list of variables is shown in attachment 12.

3.2 Effect of Disequilibrium in market on firm size.

Based on literature review, demand and supply determine the equilibrium of price and stock of homebuilding. Within this equilibrium, average firm size in the market is determined. The dynamics of this process are ambiguous. However, there are variations of price and firm size in different market structures, which are useful when searching for the determinants of firm size.

Based on the literature, we can assume that disequilibrium in market and regulatory influence are more critical determinants of firm size than are aggregated demand and regulation which are treated as supply costs. Therefore, we can test those disequilibrium factors' influence on firm size.

First, the rent growth rate is an indicator of the market's dynamic to find an equilibrium price level. Therefore, if rents increase or decrease more rapidly than elsewhere, there is a market clearing process, responding to a demand or supply shock in the market. To test the simple relationship between rent growth rate and firm size, I picked firm size. I tested all records including null value and compared them to the correlation value based on records which did not have null value. I then test only large firm with rent growth rate which have more than five and ten employees separately. I expected a correlation with firm size. However, the correlation between firm size and rent growth rate shows little value. The rent and price of housing market lead co-linearity. I focus on price and housing price index rather than rent and rent growth, since rent level could not explain firm size.

Second, regulatory variables also tested with firm size. Table 17 depicts the correlation of each variable in Wharton survey with firm size. A summary of each regulatory variable is attached.

[Table 17 Correlation between firm size and rent]

Firm size: Whose employees per establishment is	Correlation with percentage of average rent growth,[25] based on aggregated value of places within one county
no less than 10	15.5%
no less than 5	2.5%
greater than 0	10.3%
With all records	2.6%

I tested all components of the sub index with firm size as I did with rent growth. The black cell means a positive correlation and white one is a negative one. The other grey cell means that there is no correlation between regulation and firm size. The ranking is shown in Table 18[26].

[Table 18 Correlation test result]

Correlation	Variables Name
18%	Local council involvement in regulation
17%	Open space index(OSI)
17%	Impact fees/exactions importance(single-family)
16%	Impact fees/exactions importance(multi family)
16%	Council opposition importance(multi family)
13%	Council opposition importance(single-family)
13%	num. of units in multi family dwelling limit
12%	multi family dwelling limit
12%	<=.5 acre minlotsize requirement

Regulations which act as cost factor for a development project showed a high correlation: regulation about extraction fee and open space endowment. Regulations affecting the approval process which is a direct cost to project show a high level of correlation. Therefore, the regulation which induces direct cost to development shows a high positive correlation, meaning that those regulations allow builders to grow, and to be more resistant to the cost effect of regulation.

---

25 % growth rate of FMR = $\left[\frac{1}{4}\sum_{1}^{4}\left(\frac{FMR\_Q_t}{FMR\_Q_{t-1}}-1\right)+1\right]^4-1$

26 All components of regulatory index results are shown in attachment 13.

■ *Results Summary* ■

First, although there was little variation of firm size over 20 years, the cross-sectional difference in firm size over region is dramatic. One standard deviation of mean size of establishments is an average of 97% over 287 MSA regions.

Second, intensity of land use regulatory stringency requires a popular vote for zoning changes, and formal restriction such as density control on new supply and project delay times. Jurisdiction structure does not characterize highly regulated places.

The results of the correlation with the firm size are below.

The variation is explained with	The variation is not explained well with
▪ Population and housing unit with correlation of 35-36%. ▪ Occupation rate or vacancy rate with correlation of 36-40% ▪ Ratio of white in racial component with negative correlation of with 23-31%. ▪ Income level and housing value with correlation of 32-45%	▪ Geographic components like land area and density ▪ Rent growth rate
▪ Cost factor for development project: - extraction fee - open space endowment. - delayed month in approval	▪ Overall regulatory stringency index ▪ Community control and discretion ▪ Jurisdiction structure

Chapter VI: Results and Analysis

1. Refining Somerville's model

I chose the 2005 data set, because the regulatory variables are based on a 2005 survey. As indicated above, the total number of observations used to refine is 140 MSAs[27]. The result is shown in Table 20. As a first step, a previous Somerville's regression model indicated Model 0 is used as a starting point for the most recent data. Financial components, construction costs and housing values are added in Model 2, 3, and 4.

[Table 19 Regression Summary table to refine previous model]

Variables	Model 0	Model 1	Model 2	Model 3	Model 4
Intercept	-2.941 (-0.603)	-1.200 (-1.293)	-0.533 (-0.168)	-0.284 (-0.1)	-4.713 (-2.029)
ln()_ Permit	**0.412** **(4.921)**				
ln()_ Permit/Housing Unit		**0.366** **(3.307)**	**0.400** **(3.440)**	**0.293** **(3.5)**	**0.428** **(3.893)**
ln()_ Housing unit		**0.448** **(4.731)**	**0.376** **(2.318)**	**0.650** **(7.9)**	**0.336** **(4.819)**
ln()_ Farm(No)	-0.194 (-1.523)	-0.226 (-1.648)	-0.207 (-1.510)	-0.372 (-1.5)	
ln()_ Farm(% acre)	**0.253** **(2.358)**	**0.288** **(2.472)**	**0.328** **(2.742)**	**0.321** **(3.3)**	**0.241** **(2.636)**
ln_ Mortgage cost			-0.242 (-0.460)		
ln_ No. IV Est. per No. of Financial Est.			0.066 (0.679)		
ln_ Construction Cost				0.229 (1.5)	
ln_ median Housing Value					**0.421** **(2.016)**
Adj. R^2	0.254	0.268	0.252	0.316	0.274
F	7.918	9.951	15.324	15.0	5.492
Obs.	140	140	140	140	140

* All models independent variables are log form of firm size
(number of employment per number of establishments)

27 Detailed data process about number of data and data description is attached

Model 1 added 'demand' and 'market size' to model 0. 'Demand' represents the number of permits that were normalized by total housing unit, meaning the ratio of newly added housing units to existing stock. Intuitively, it can be easily inferred that MSA area is correlated with homebuilders' size, shown in table 21.

[Table 20 Correlation test in model 0]

	Permit	Farm No	% farm	MSA area
Permit	1			
Farm No	0.49	1		
% farm	-0.17	0.23	1	
MSA area	0.69	0.46	-0.10	1

MSA, area and number of permits all showed high correlations of around 70%, indicating the possibility of multi co-linearity. Other variables showed independency from one another. Therefore, it seems necessary to normalize the market activity with market size. I normalized 'permit' with 'total number of housing units in MSAs,' which showed the newly added stock ratio over existing market size. I measured the total housing unit number as a function of market size. 'Housing unit' is added to measure market size.

In Model 0, land area was measured by the whole MSA area rather than only the land part. The correlation between the MSA area and the number of farms or the number of permits showed a high value of 0.49 and 0.69 each. In model 1, I extracted the water area from the MSA area for measuring only land area. Also, the percent acreage of farm area to MSA area could be refined with 'land area of MSA' which includes bodies of water. With refined data, the correlation table is as below. It showed more independency among variables, resolving the co-linearity problem between market activity and MSA geographic size shown in table 22.

[Table 21 Correlation test in Model 1]

	Housing unit	Permit/stock	Farm No	% farm	MSA Land area
Housing unit	1				
Permit/stock	-0.12	1			
Farm No	0.47	-0.11	1		
% farm(land)	-0.16	-0.17	0.21	1	
MSA Land area	0.42	0.11	0.46	-0.10	1

When we see model 0, as compared to Somerville's result based on 1987, the variables' statistical power is similar. Permit as demand, number of farm as indicator for need to land assembly, percentage of farm acreage as developable land supply shows similar statistical power. However, the sensitivity[28] of firm size by permits' change showed one and half times higher than 1987 dataset, as shown in table 23.

[Table 22 sensitivity test in model 0 (2005) and Somerville's 1987 data results]

Variables	XiΔY/Δ1SD of X		
	1987 data	**Model 0**	**Model 1**
ln()_Permit	46%	71%	
ln()_Permit/stock			63%
ln()_Housing unit			85%
ln()_Farm No	-21%	-21%	-24%
ln()_% farm(land)	13%	19%	20%

Compared to market demand, the number of farms and the area of a farm as developable land results in similar sensitivity of firm size with 1987 data set. Land assembly showed weaker statistical power in models 2, 3, and 4 than what model 0 shows, although Somerville's model showed strong statistical providence between the number of farms and firm size.

The firm size is highly sensitive to the number of permits per housing stock as a function of market activity, as shown in Table 23. Also, housing unit as a function of market size also

[28] Sensitivity of variables is % change of firm size by one standard of deviation increase of dependant variables near mean value.

showed considerable impact to firm size, compared to other variables. Therefore, it said that firm size is sensitively increasing along with market size and demand. Land area as a function of whole area, rather than the sum of land and water area, showed high sensitivity and t value, but still remains incompatible, as evidence by its 95% significance level.

I assumed that the financial cost of the housing market would be relevant. However, mortgage costs, as well as mortgage rates, would not show statistical proof to builder size as shown in Model 2. I cannot reject the H_0 for financial accessibility relevance with respect to firm size. Using the number of investment banking and securities establishments does not show the financial impact on firm size. The financial accessibility's irrelevance to firm size seems somewhat counterintuitive. The construction loan market would affect significantly builders' operations, because the key factor for the builder is access to financial sources with competitive market rates. The financial accessibility may not affect to firm size directly. Rather, it can be affected by firm size as indicated in the literature.

Model 3 reports that it is hard to reject the zero coefficient hypotheses. The construction cost is also an issue for which results are also counterintuitive. However, compared to Somerville's previous results, which showed a very low t-value of 0.005 when using the RS means residential square-foot cost index, the results seems more preferable with higher adjusted r square.

In model 4, I tested the median housing value of each MSA as first indicator for price effect on firm size. It showed a 17% increase in firm size by one standard deviation increase of median housing value over mean value. This showed that there is enough relevance between firm size and housing price level, which is omitted in previous models. Under the urban spatial theory model, rather than the reduced form model of the previous model, the price is, to be sure, the most important factor for housing supply and firm size. However, as compared to market activity and size, the impact on firm size is not so high. And also, there needed to be more consideration of price lag between market and homebuilder's operation perspective. For median housing price, the correlation table is as below. There is no significant co-linearity among variables and the residual plot showed acceptable linearity for regression analysis.

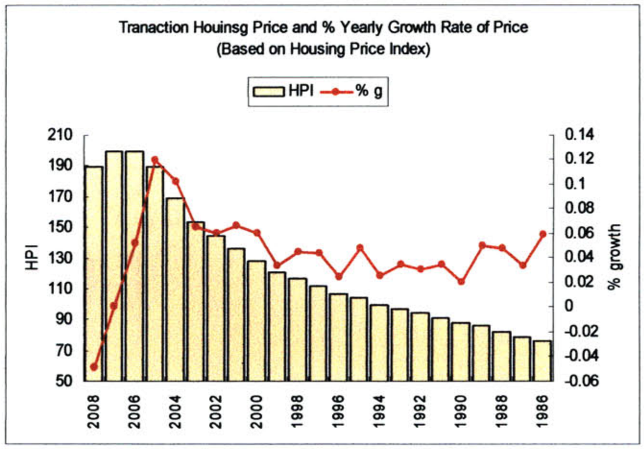
[Table 23 Correlation test after adding median house value]

	Permit / stock	Housing unit	No of Farms	% farm	Land area	median Value
permit/Stock	1					
Housing Unit	-0.132	1				
No. of Farms	-0.103	0.448	1			
% farm	-0.107	-0.176	0.201	1		
Land Area	0.131	0.422	0.455	-0.125	1	
Median Value	-0.168	0.265	-0.072	-0.204	0.039	1

2. Finding price lag

In model 4, one standard deviation increase of median housing price near its mean value results in around 17% increase in firm size with reliable statistical power. However, it is uncertain whether builders react to the market based on the current housing market price or previous price shock with time lag.

Graph 11 showed the housing price pattern's growth rate. As housing price increases steadily, there is a somewhat periodical cycle of price growth rate. Therefore I use housing price index to see the usual time lag that impacts the firm size.[29]



[Graph 7 Transaction housing price and yearly growth rate over 20 years in U.S.]

I assume that the builders react to current price levels and estimates of the future price level based on current growth level. I tested the 5-year price growth rate effect on firm size because, as we see above, the cycle falls within a 5 year span. The below table shows each housing price index, which indicates the relative growth rate over the previous year.

[Table 24 Regression results with 5 years housing price index of 2003, 2005, and 2007]

	2007		2005		2003	
	Obs.	200	Obs.	140	Obs.	171
	Ajd. R^2	F	Ajd. R^2	F	Ajd. R^2	F
	0.355	11.968	0.365	9.000	0.409	14.076
	Coef	t	Coef	t	Coef	t
Intercept	-1.095	-1.895	-1.342	-1.459	-0.228	-0.281
LN_Permit/stock	0.118	1.813	0.329	3.103	0.607	6.333
LN_HUEST	0.347	6.880	0.613	6.663	0.570	7.094
LN_Farms (No)	-0.117	-1.934	-0.306	-3.065	-0.265	-2.921
LN_% Farm	0.121	1.994	0.398	3.970	0.278	3.053
HPI g(Pt ~Pt-1)	-2.240	-1.684	-0.974	-0.873	3.220	1.248
HPI g(Pt-1 ~Pt-2)	1.382	1.125	5.408	2.921	-4.322	-1.051
HPI g(Pt-2 ~Pt-3)	-0.377	-0.458	-3.338	-0.893	4.863	1.397
HPI g(Pt-3 ~Pt-4)	2.970	2.348	-2.930	-0.707	3.716	1.766
HPI g(Pt-4 ~Pt-5)	-2.493	-1.737	3.321	0.952	-3.301	-1.479

[29] Median Housing value cannot reflect the difference of price level over regions. However, housing price index is measured as relative growth rate of housing price for each MSAs. Each MSA's housing price of the base year is set as 100. And housing price index show the relative growth of housing price.

Data from 2007 showed relevance for the previous four years with respect to the housing price index and had a reliable t-statistical reading. 2005 data showed two-year lag of price to firm size with statically power. However, it is hard to generalize the time lag that affected firm size with using all the 5 year housing price index. Therefore, I tested each years housing price index separately and find adjustable year to whole three years data set to further analysis shown in table 26.

[Table 25 Regression results with yearly housing price index over 5 years]

	2007		**2005**		**2003**	
	Obs.	200	Obs.	140	Obs.	171
	Coef	t	Coef	t	Coef	t
LN_Permit/stock	0.190	3.368	0.302	2.937	0.632	6.771
LN_HUEST	0.343	6.749	0.639	6.925	0.593	7.464
LN_Farms (No)	(0.138)	(2.263)	(0.343)	(3.415)	(0.295)	(3.264)
LN_% Farm	0.066	1.170	0.385	3.736	0.300	3.321
HPI $g(P_t \sim P_{t-1})$	(2.868)	(4.567)	1.389	1.873	2.953	2.578
LN_Permit/stock	0.162	2.444	0.318	3.470	0.652	7.017
LN_HUEST	0.399	7.590	0.614	6.797	0.590	7.361
LN_Farms (No)	(0.203)	(3.254)	(0.306)	(3.111)	(0.298)	(3.291)
LN_% Farm	0.085	1.381	0.392	3.899	0.300	3.305
HPI $g(P_{t-1} \sim P_{t-2})$	(0.386)	(0.461)	2.373	3.207	3.291	2.326
LN_Permit/stock	0.087	1.517	0.376	4.131	0.629	6.746
LN_HUEST	0.381	7.688	0.650	7.130	0.586	7.351
LN_Farms (No)	(0.155)	(2.563)	(0.356)	(3.615)	(0.295)	(3.266)
LN_% Farm	0.131	2.293	0.392	3.811	0.298	3.301
HPI $g(P_{t-2} \sim P_{t-3})$	**1.794**	**4.330**	**2.372**	**2.004**	**5.063**	**2.660**
LN_Permit/stock	0.143	2.598	0.392	4.289	0.671	7.208
LN_HUEST	0.365	7.439	0.650	7.053	0.585	7.203
LN_Farms (No)	(0.139)	(2.327)	(0.365)	(3.673)	(0.300)	(3.300)
LN_% Farm	0.139	2.474	0.389	3.750	0.271	2.986
HPI $g(P_{t-3} \sim P_{t-4})$	2.417	5.095	2.082	1.420	2.578	2.065
LN_Permit/stock	0.168	2.924	0.384	4.200	0.666	7.055
LN_HUEST	0.386	7.630	0.651	7.083	0.618	7.628
LN_Farms (No)	(0.181)	(2.969)	(0.365)	(3.691)	(0.329)	(3.606)
LN_% Farm	0.123	2.106	0.387	3.742	0.281	3.056
HPI $g(P_{t-4} \sim P_{t-5})$	2.451	3.196	3.044	1.548	0.461	0.315

I highlight the adjustable statistical value as shown in table 26 and find common years that are adjustable over five years as certain price lags. As we see in table 29, for 2007 dataset, years 3, 4, and 5 showed statistical relevance to firm size. For 2005 dataset, the three years past HPI, and for 2003 datset, 3 and 4 years past HPI, showed statistical evidence of the relevance of firm size. Therefore, three years lag of housing price index satisfy all three dataset.

3. Regulatory impact

Overall, regulatory stringency had a very low impact on firm size as shown below based on the 2005 dataset taken from the Wharton survey. This result seems counterintuitive, because the regulatory environment has, to be sure, a direct or indirect cost on homebuilders. One possible explanation is that two opposite impacts of regulatory stringency on firm size offset the effects of each other, resulting in the statistical irrelevance of size of firm. If regulatory stringency is considered as a cost for builders, large builders can survive under the same regulatory environment. Alternatively, regulatory stringency means that communities encourage small development and discourage those builders who seek to build large projects quickly. Therefore, it is needed to dissect the regulatory stringency with detail treatments of each item, using sub indexes. I tested eleven sub index separately with previous models and the results show that except for the Approval Delay index(ADI) and the Density restriction Index(DRI), most sub indexes showed low statistical power in explaining firm size as shown in table 27.Therefore, I process the analysis with those two variables to build model.

[Table 26 Results summary of each regulatory variables impact to model 5]

	Public participation		State involvement		Approval Stringency		Direct Cost to builders			Direct Restriction	
	LPPI	LAI	SPII	SCII	LZAI	LPAI	OSI	EI	ADI	SRI	DRI
COEF	0.080	-0.336	0.025	0.111	-0.076	0.072	0.211	0.229	**0.043**	0.059	**-0.413**
T	1.131	-0.413	0.398	1.147	-0.629	0.777	1.093	1.068	**1.756**	0.633	**-1.787**

By excluding unrelated variables such as financial variables, the available MSA records increase to 182. Although construction costs show few t statistics, the adjusted r square in model 3 increased greatly as compared to model 0 and model 1, which I kept including in the analysis. The results are shown in table 28.

[Table 27 Regression Summary table with regulation data]

Variables	Model 5	Model 10	Model 11	Model 12	Model 13	Model 14
Intercept	**-2.631 (-3.092)**	**-2.90 (-2.707)**	**-2.714 (-2.47)**	**-2.553 (-2.976)**	**-2.021 (-2.387)**	**-2.042 (-2.380)**
ln()_ Permit/Housing Unit	**0.352 (3.713)**	**0.355 (3.726)**	**0.368 (3.778)**	**0.367 (3.781)**	**0.454 (4.891)**	**0.436 (4.630)**
ln()_ Housing unit	**0.702 (7.99)**	**0.700 (7.950)**	**0.695 (7.763)**	**0.695 (7.791)**	**0.715 (7.948)**	**0.760 (8.504)**
ln()_ Farm(No)	**-0.279 (-2.696)**	**-0.279 (-2.694)**	**-0.281 (-2.684)**	**-0.281 (-2.689)**	**-0.328 (-3.167)**	**-0.368 (-3.539)**
ln()_ Farm(% acre)	**0.397 (3.906)**	**0.396 (3.888)**	**0.384 (3.723)**	**0.384 (3.733)**	**0.361 (3.497)**	**0.363 (3.457)**
ln()_ HPI g(Pt-2~pt-3)	**2.776 (3.383)**	**2.705 (3.221)**	**2.340 (2.508)**	**2.362 (2.551)**		
ln_ Construction cost		0.061 (0.417)	0.036 (0.237)			
ln_ ADI			0.024 (0.868)	0.025 (0.928)	**0.054 (2.199)**	
ln_ DRI			-0.124 (-0.550)	-0.128 (-0.572)		-0.140 (-0.621)
Adj. R2	**0.384**	**0.381**	**0.378**	**0.381**	**0.361**	**0.345**
F	23.603	19.606	14.725	16.913	21.530	20.134
Obs.	182	182	182	182	182	182

* All models independent variables are log form of firm size (number of employment per number of establishments)

As we can see as number of data increase the adjusted r square increase to around 38% compared to 27% of model 4.

There is no significant statistical proof for regulatory impact shown in model 10, 11, and 12. Housing price index increase adjusted r-square with significant t statistics, but it seems to show multi-co-linearity with approval delay index when we compare model 12 and model 13. The correlation between housing price index and approval delay index is 47%, thus supporting the co-linearity of the two variables. However, when we extract the housing price index as shown in model 13, the approval delay index shows significant level t statistical relevance.

4. Grouping data and sensitivity test

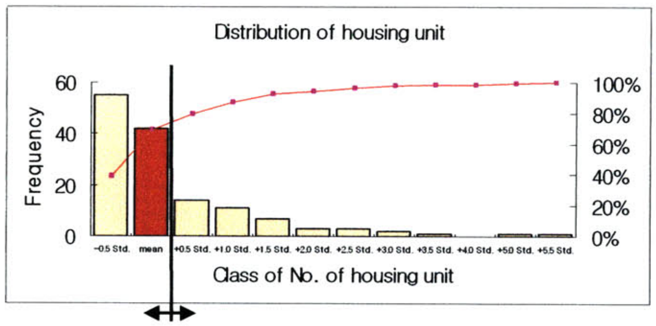
Below is Regional Geographical Difference of Firm Size. The 2005 and 2007 data showed quite strong statistical evidence for regional effect on firm size. It is quite apparent that the firms in Midwest region are smaller than ones in West region.

[Table 28 Regression results after adding regional dummies]

	2002		**2005**		**2007**	
Adj. R^2	0.409		0.412		0.349	
Obs.	172		159		269	
F(MSR,MSE)	15.776		14.817		16.948	
Variables	COEF	T	COEF	t	COEF	t
Y Intercept	(2.345)	(2.470)	(1.878)	(1.911)	0.140	0.222
LN_Permit/Stock	0.615	5.696	0.336	2.950	0.133	2.641
LN_HUEST	0.600	7.398	0.781	8.982	0.327	7.184
LN_% Farm	0.385	4.026	0.502	4.635	0.077	1.561
LN_No Farms	(0.313)	(3.442)	(0.412)	(4.059)	(0.102)	(1.946)
LN_HPI	0.184	2.019	0.010	0.121	(0.010)	(3.814)
Northeast	(0.085)	(0.431)	(0.465)	(2.089)	(0.199)	(1.898)
Midwest	(0.310)	(1.943)	(0.620)	(2.935)	(0.190)	(2.015)
South	(0.104)	(0.772)	(0.498)	(3.210)	(0.155)	(2.006)
West(0,0,0)						

However, among northeast, Midwest, and south regions there are no apparent pattern that can be said to indicate geographical differences that impact firm size. One possible explanation is that the average large MSA area in the West compared to Midwest causes firm sizes to be bigger. So, I tested the firm size by grouping the dataset by market size and price growth rate and comparing the sensitivity of firm size variations of each group.

Firstly, market size is grouped by number of housing units. As indicated in graph 8, the distribution of housing units is highly rightly skewed, which can be biased by outliers in the form of large MSAs. So, I grouped the datasets based on mean value of housing unit and number of MSAs and tested the difference between the two groups. Most MSAs, almost 69% of them, show their number of housing units as not more than the mean value of 362,342 single family unit in MSAs. And as indicated in graph 8's accumulated percentage of stock, the larger MSAs showed very even distribution in housing stock.



[Graph 8 Housing unit distribution and accumulated percentage of stock based on 2005 data]

Compared to housing units, the land area is a more fundamental geographic aspect when compared to firm size, as related to land supply and land assembly issues. Also, market size is, to be sure, constrained by the land area. The distribution of land area shows a similar pattern to 'housing unit.' Around 50% of MSAs' land area is not less than the mean value and they are distributed quite evenly.

As same with above method, I grouped the dataset by HPI to see how the growth rate of housing prices affects firm size. Sixty-four percent of MSAs are showing below the mean value of housing price index, and also show a rightly skewed distribution pattern. Based on 2005 and 2004, the average housing price growth rate is around 7%.

Table 29 showed the result of different sensitivity by grouping.

[Table 29 Sensitivity test by grouping the MSA's size and price]

Grouped by		**Market Size**		**Geographic area**		**Housing Price**	
		Model 15a	Model 15b	Model 16a	Model 16b	Model 17a	Model 17b
Model 5	Whole	< Mean	> Mean	< mean	> mean	< mean	> mean
LN_Permit/Stock	23.5%	20.4%	27.5%	19.1%	24.6%	17.0%	30.6%
LN_HUEST	65.1%	24.0%	35.9%	42.4%	59.3%	83.0%	46.0%
LN_% Farm	36.9%	26.9%	27.4%	27.3%	30.3%	41.4%	25.2%
LN_Farms No.	-21.1%	-20.6%	-22.8%	-25.1%	-20.0%	-28.4%	
HPI g(03)	112.5%	115.7%			138.5%		

* Each number shows % change of firm size by one standard deviation increase of each variable.

First of all, grouping lowers the percent changes of firm size by one standard deviation increase of housing units, particularly as compared to whole aggregated results. Small MSAs and Large MSAs show a rate of 24% and 36% each, as compared to a 65% rate overall. Meaningful results seem to indicate that the lower MSA's showed less sensitivity than small MSAs, thus showing that there is much more growth opportunity in small MSAs as a result of expected increases of the population's housing demand. This result is consistent with the permit per stock results. Large MSAs showed more sensitivty than small MSAs, at 28%, meaning that one standard deviation increase of newly added stock as market activity in large markets enlarges firm size 7% more than in small market.

However, land supply and land assembly data showed similar level between large and small MSAs which seems affected little by MSA market size as determinants for firm size variation.

Overall results showed that geographically large areas showed more sensitivity than small size MSAs, along with all the variables, meaning that a large geographical area is more sensitive to structural elements in variation of firm size. In comparing results based on housing unit, large land areas show more growth opportunity in terms of firm size as well as more developable land and a decreased possibility of fragmentation as indicated in Table 29. In large MSAs, firm size can be more elastic by 3% and 5%, respectively, with respect to land supply and fragmentation issues.

It is unsure that how much land area affects market size and permit per stocks. However, Table 29 shows that geographically large MSAs showed a larger increase in firm size' sensitivity by increase of housing unit than large MSAs classified by housing unit do. And in terms of market activity, they show the opposite. It is hard to say that geographical impact on firm size is greater than that of market size when we compare grouped data with model 5. However, overall, MSAs size in terms of market and geographical definition showed consistent results that the larger area can lead to more opportunities for firm growth. In terms of housing price index, the large area shows more sensitivity of firm size by 26% than model 5 shows. The small area showed little statistical strength. However, although housing unit classification results showed little difference based on market size grouping, geographical difference shows that a geographically large MSA is more sensitive to price growth than a small one or a whole MSA. This result can be inferred that large MSAs with a large developer and fewer assembly needs should be grounds for price sensitivity. When we recall the urban spatial theory model, the large spatial area of markets leads to more diverse price levels for housing depending on commuting distance. The more detailed dynamics can be inferred from more in depth research about a geographical area's variation and price level.

Table 29 also reports that MSAs with low inflation in housing price showed sensitivity by market activity and a market size of 83% and 17% each. I assumed that the firm size would be more sensitive to variables increase where the housing price is high. However, the results doesn't show consistent pattern among variables sensitivity to firm size.

5. Grouping by regulatory variables

The previous results show that regulatory stringency does not show statistical relevance because the overall impact of firm size might be offset by simultaneity among dependant variables. Only approval delay index showed significant statistical power among eleven sub-indexes. However, because the density restriction index shows the possibility to show relevant impact to firm size, I grouped MSAs which have density restriction regulation and compared it with others without that regulation.

As table 30 show, the restriction overall increase the sensitivity of firm size by variables changes. Considering the assumed model that the larger builders are more durable with respect to regulatory environment than those of small size can be, the results show that the regulations impose a scale of economy in builder industries with a more dynamic situation with respect to firm size variations.

[Table 30 Comparison of regression Results by existence of density restriction]

With Density Restriction Index					Without Density Restriction Index			
F	12.56				4.413			
Adj. R^2	0.442				0.207			
Obs.	74				66			
	Coef.	S.E	t	% change of Firm size[30]	Coef.	S.E	t	% change of Firm size
Intercept	-2.20	1.19	-1.84		0.76	1.66	0.46	
ln_Permit/Stock	0.47	0.13	3.67	24%	0.21	0.14	1.49	15%
ln_HUEST_2005	0.75	0.13	5.88	67%	0.45	0.17	2.70	39%
ln_No. of Farm	-0.34	0.14	-2.38	-30%	-0.39	0.14	-2.78	-33%
ln_% Farm	0.41	0.15	2.76	24%	0.26	0.16	1.59	
HPI g(03)	2.47	1.72	1.44		3.18	1.81	1.76	

To measure the impact of the approval delay index as it pertains to the cost of development process, I grouped the data set by the approval delay index. I use first quartile as highly delayed MSAs and forth quartile of index value as lightly delayed MSAs in processing the approval.

Table 31 reports the results, although some variables don't show statistical power, supposedly due to lack of observation for each group. The short approval delays increase the sensitivity by the market activity variable to firm size at a rate of 26%, which is greater than the 22% of long delayed MSAs. This makes sense in that less delay in the process

[30] Measured by % change of firm size by one standard deviation increase of independent variable.

term of approval, makes a firm more active in their reaction to demand shock. Market size that shows a long approval index group shows more sensitivity of firm size by market size. It can be also referred that the highly regulated place with a long delay process induces costs that large firms can endure and the firm size's variation becomes wider based on some other factors, including market size.

[Table 31 Comparison of regression Results by intensity of Approval process]

	1st quartile of Approval delay index: longer delay			4th quartile of Approval delay index: shorter delay		
F	2.75			3.56		
Adj. R^2	0.17			0.23		
Obs.	35			35		
	Coef.	t	% change of Firm size	Coef.	t	% change of Firm size
Intercept	-0.35	-0.16		0.37	0.21	
ln_Permit/Stock	0.50	2.12	22%	0.41	2.23	26%
ln_HUEST_2005	0.70	2.64	55%	0.37	2.13	38%
ln_No. of Farm	-0.46	-1.73	-36%	-0.04	-0.23	
ln_% Farm	0.42	1.49		0.31	1.60	

Chapter VII: Conclusion and policy implication

1. Conclusion

The firm size as measured by employment per establishment shows wide spatial variation over regions. The variation is systematic rather than random and helps to understand homebuilders' behavior. Based on an urban spatial theory approach which assumes supply of housing is constrained to population growth in the long run, this research reports that the limited number of establishments of homebuilders in each region adjusts their size to accommodate variations in housing demand in the market. The analysis shows that the firm size at given time is affected by various factors with statistical proof from the market, land supply, and regulatory perspective.

[Table 32 Results summary based on Model 5]

One standard deviation increase of	% increase of firm size
Demand	24%.
Market size	65%.
Housing price index	112%[31]
Land supply	37%
fragmentation	21%

Assuming new permit as equilibrium amount to demand for housing, market demand increases firm size by 24% from mean value. Market size of region shows most significant impact on firm size. One standard deviation of total housing unit from mean value leads to an increase in firm size of 65%. In the same way, the amount of existing developable land affects firm size by around 37% and necessity of land assembly for project shows a negative impact on firm size of 21%. Increase of housing value results in increasing firm by 20%, and the average price lag over 10 years shows 3 years is the norm.

[31] based on stylized price lag of three years.

Aggregated regulatory stringency's impact on firm size shows little statistical power. This result cannot be seen as sufficient evidence for lack of relationship between regulatory stringency and firm size. However, one possible explanation is that the impact of regulatory stringency is diluted by simultaneities among the regulatory sub index.

Density restriction and approval delay showed meaningful results. The effect of density restriction regulation is shown by comparison of groups. The duration of the approval process show strong statistical proof. One standard deviation increase of delay, measured by month, resulted in an average 110% larger firm in the market, which means that large firms are associated with higher costs of delays on a project. The existence of density restrictions in markets induces firm size to be more sensitive to other structural variables' impact than in MSAs without density restriction articles. When we assume that large builders can have economies of scale in terms of costs accrued by restrictions, or have more effective bargain power in the approval process than small builders do, the firm size increases as regulations become stricter. The results support this explanation by showing firm size association with costs accrued by density restriction and approval delay.

Market size in terms of number of existing stock and geographical area affect firm size in that the sensitivity of firm size to structural elements are higher in larger MSA area. This means that there is more growth opportunity in larger market. Small MSA with less competition or weak market entry barriers can be seen as advantageous for firms to grow faster. However, results support the urban spatial model which assumes that supply is limited to given market conditions such as market size. With the optimal number of establishments in the region, size varies more passively, depending on structural elements.

2. Policy implication of distribution of firm size

Assumptions for regulatory impact to firm size or development size for policy were as below.

Firstly, when large builders can have economies of scale in terms of costs accrued by restrictions, or have more effective bargain power in the approval process than small builders do, the firm size increases as regulations become stricter.

Secondly, if large builders can influence related regulation more easily when there are upper jurisdictions or when Dillon's rule[32] allows them to press their case with the state, then larger developers can survive under that jurisdiction's structure.

The last assumption is that residents see their interests served by controlling development, restricting development to preserve the value of the public goods. If this model prevails, the regulatory stringency will affect firm size negatively.

The results of approval delay index and density restriction index support the first assumptions. However, involvement of the upper jurisdiction and court does not show a reliable statistical relationship vis-à-vis the power to support second assumption. The local assembly index, which captures community meetings or assembly reviews of a project also

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[32] Dillon's Rule: The theory of state preeminence over local governments was expressed as Dillon's Rule in a 1868 case: "Municipal corporations owe their origin to, and derive their powers and rights wholly from, the legislature. It breathes into them the breath of life, without which they cannot exist. As it creates, so may it destroy. If it may destroy, it may abridge and control.

does not show statistical proof enough to test last assumption.

One possible explanation is based on implicit findings about regulations index. Aggregated regulatory stringency shows a high correlation with market and demographic perspective dataset. In particular, rent and income levels of MSAs, measured by fair market rent and per capita income, respectively, show correlation with regulatory stringency at a rate of 47% and 60%. In addition, Table 33 reports more interesting results in terms of regulation. Local political pressure, as measured by the degree of democratic involvement and participation in the development process, as well as other approval indexes show a high sensitivity to rent level with statistical proof. And also, the state political involvement index with strong statistical proof shows that upper jurisdiction's involvement in localities also increases the market rent level.

[Table 33 Rent level and regulatory sub index relevance, based on 2005 county level]

Summary	
F	51.713
Adj. R^2	0.411
Obs.	800

Variables	Coef	SE	t
Intercept	622.824	30.741	20.260
LPPI	49.061	7.974	6.152
SPII	33.467	6.065	5.518
SCII	2.067	8.921	0.232
LZAI	-34.752	8.918	-3.897
LPAI	6.292	7.107	0.885
LAI	57.301	37.197	1.540
DRI	23.401	18.557	1.261
OSI	11.723	14.435	0.812
EI	-45.721	16.256	-2.813
SRI	9.881	8.841	1.118
ADI	26.506	2.024	13.098

* Independent variables are log form of rent level of MSAs

When we adapt the assumption that large builders can have more effective bargaining power with upper jurisdiction entities, the more local level restrictions on large builders leads to more motivation for large builders to negotiate with upper jurisdiction, resulting in escalating the market price of housing.

Although the impact of regulatory stringency to prevent large development is uncertain, regulations seem associated with housing price escalation.

3. Further Research

First of all, compared to MSA level analysis, county level data gathering and analysis seems more accurate and can reveal more facts about industrial structure. For example, comparative studies between counties in MSA regions and others may reveal more fundamental findings about systematic variations in firm size. Secondly, construction cost and income level's impact on firm size shows no relevance to organization structure, which is very counterintuitive. Obviously, updating regulatory surveys with sophisticated definition of municipal boundaries based on county level will help to corporate land use regulatory variables to other ones.

Secondly, a direct survey of builders may find more information about non systematic elements which affect firm size and can be another research topic under frame of systematic variation. The systematic variation of firm size is explained by structural variables at the level of around 30% of adjustable R square. There are, to be sure, many idiosyncratic factors to firm size interrelating to structural factor.

Thirdly, the Gibrat's rule that explains independency between firm size and its growth needs more careful attention and research in the homebuilders industry. Based on 20 years of records, the county level growth rate of firm size shows a high correlation between the current level of firm size. It seems to depend on the fact that local housing builders generally take the role of housing supply in their region over long period.

Lastly, more qualitative models for explaining the impact of firm size on social value, with broader view than just a regulatory perspective seems needed in order to explain and support the industrial structure's implication on policy makers.

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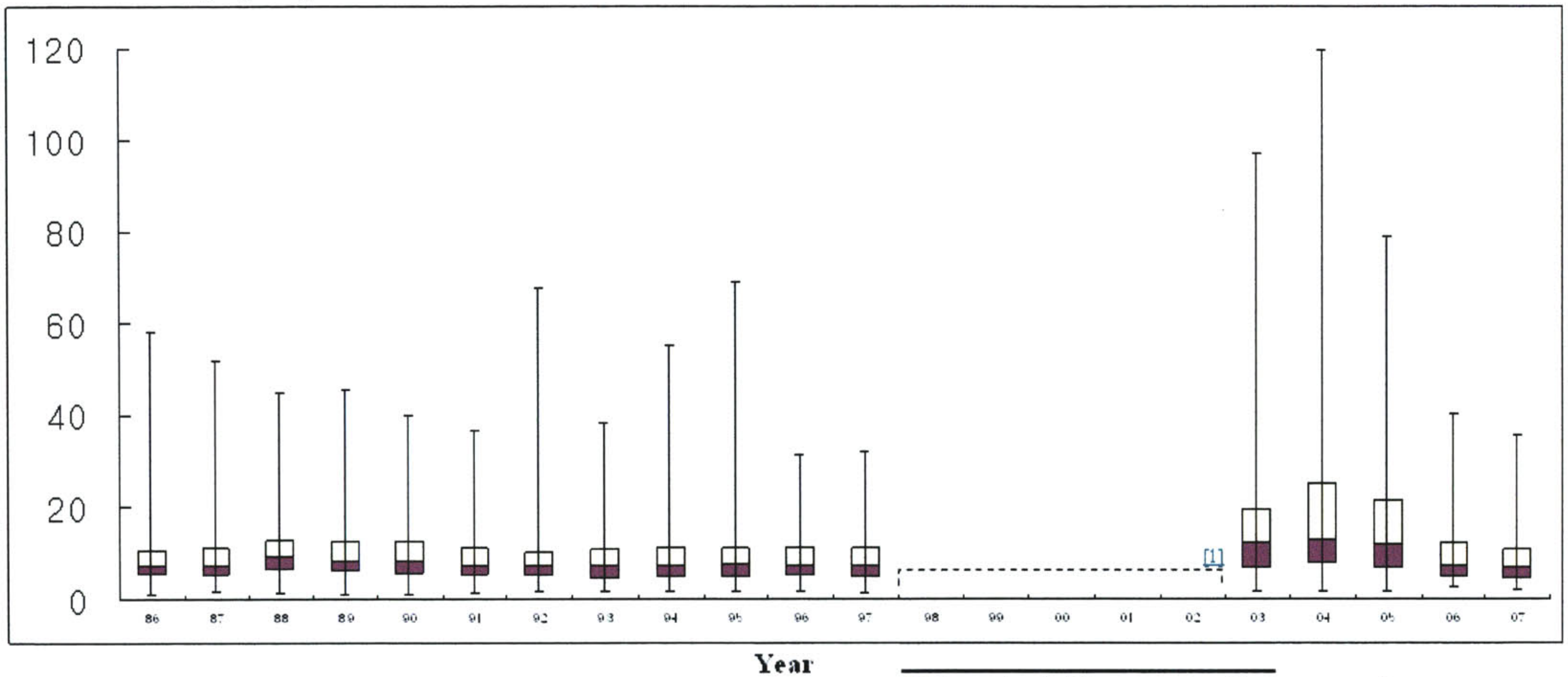
http://www.huduser.org/datasets/fmr.html

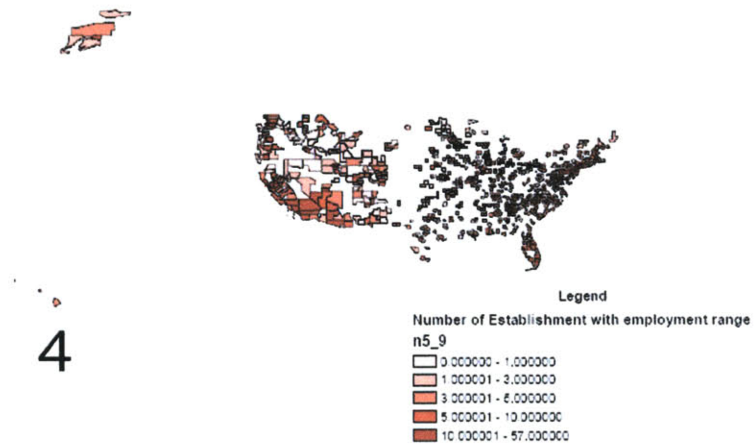
[Attachment 1 Source of Somerville's research and summary of results]

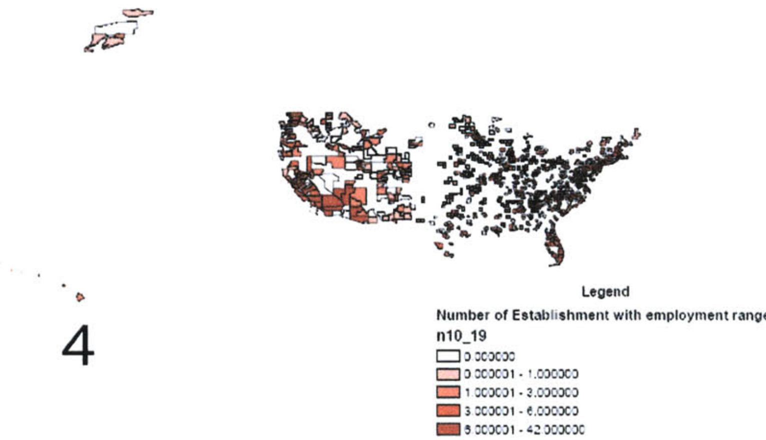
Number of employees per establishments

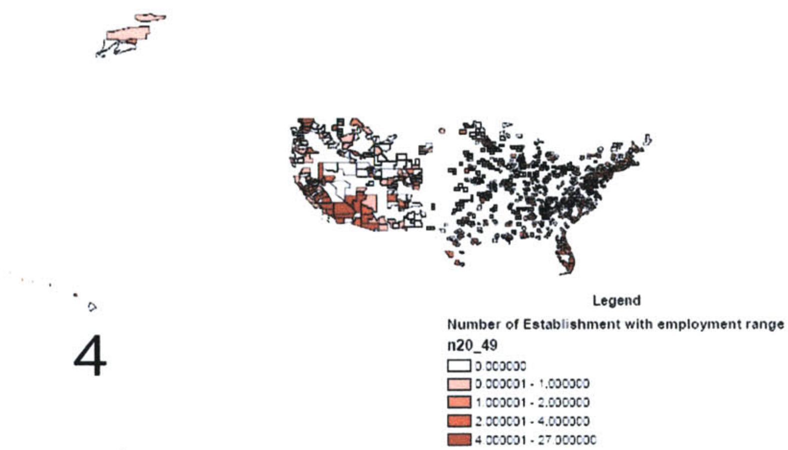


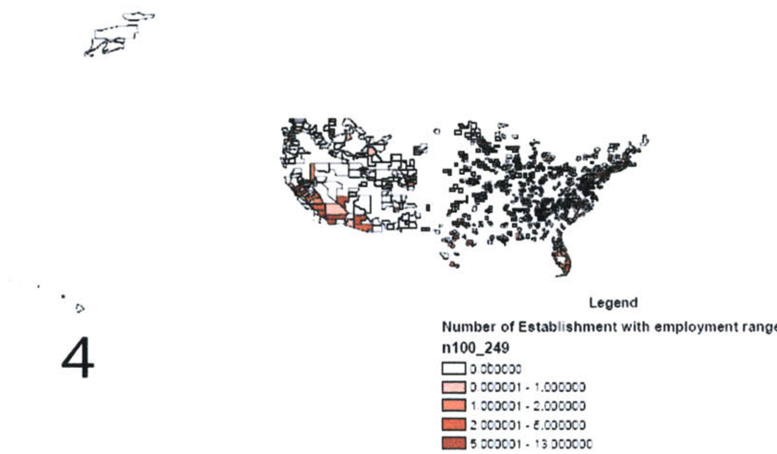
[1] Operative builders are classified to general contractor from 1998 to 2002

[Attachment 2 number of distribution of establishment with employment range]









[Attachment 3 Source of Somerville's research and summary of results]

	Regression 1	regression 2	regression 3
Data Source	County Business Pattern	Census of Construction	National Association of Homebuilders Survey
Year Data source	1987	1987	1992
Dependent Variable	ln (employ. Per estb.)	ln (employ. Per estb.)	ln (employ. Per estb.)
ln(single family permits)	0.276	0.298	0.342
T	9.86	8.28	4.89
ln(no. of farms)	-0.221	-0.226	-0.296
T	-4.80	-4.91	-3.02
ln(farm acreage as % of MSA)	0.232	0.229	0.274
T	5.66	5.73	3.86
No. of observations	302	302	80
Adj. R2	0.297	0.299	0.295
ln(No. of Jurisdiction)	-0.129		-0.185
T	-0.606		-1.603
No. of observations	60	57	33
Adj. R2	0.299	0.309	0.357

[Attachment 4 Data source, year, geography land of aggregation summary]

Data Source	Data	Geography land of aggregation	Year	Use
County Business Pattern	Operative builder's -Number of Employment and Establishment Number of Establishment of -Investment banking and securities -Financial Institute	MSA County	2003, 05, 07	Size Capital Access
Manufacturing, Mining and Construction statistics	Single family -Yearly Number of permits -Value of construction (dollar)	MSA	2003, 05, 07	Demand Cost
Housing and Urban Development	Housing stock estimates	County	2003, 05, 07	Market Size
American Housing Survey	Fair Market Rent estimates	County	2003, 05, 07	Rent
Federal housing financial Agency	Housing Price Index	MSA	2003, 05, 07	Housing value increase
Census of Agriculture data	Number of Farm Land of Farm (acreage)	County	2003, 05, 07	Land Assembly Land Supply
Wharton Urban Decentralization Project data set	Regulatory index	Place	2005	Regulatory variables
Census 2000	Land area	County	2000	Geographical Area Housing Value
Office of Management and Budget	FIPS code	County, MSA State	2003	Indexing
American National Standards Institute	FIPS code	Place, County	2005	Indexing

[Attachment 5 CBP data record layout]

Name	Data Type	Description
FIPSTATE	TXT	FIPS State Code
FIPSCTY	TXT	FIPS County Code
NAICS	TXT	Industry Code - 6-digit NAICS code.
EMPFLAG	TXT	Data Suppression Flag[33] A 0-19 B 20-99 C 100-249 E 250-499 F 500-999 G 1,000-2,499 H 2,500-4,999 I 5,000-9,999 J 10,000-24,999 K 25,000-49,999 L 50,000-99,999 M 100,000 or More
EMP	NUM	Total Mid-March Employees
QP1	NUM	First Quarter Payroll ($1,000)
AP	NUM	Total Annual Payroll ($1,000)
EST	NUM\	Total Number of Establishments
N1_4	NUM	Number of Establishments: Employment Size Class:1-4 Employees
N5_9	NUM	Number of Establishments: Employment Size Class:5-9 Employees
N10_19	NUM	Number of Establishments: Employment Size Class:10-19 Employees
N20_49	NUM	Number of Establishments: Employment Size Class:20-49 Employees
N50_99	NUM	Number of Establishments: Employment Size Class:50-99 Employees
N100_249	NUM	Number of Establishments: Employment Size Class:100-249 Employees
N250_499	NUM	Number of Establishments: Employment Size Class:250-499 Employees
N500_999	NUM	Number of Establishments: Employment Size Class:500-999 Employees
N1000	NUM	Number of Establishments: Employment Size Class:1,000 Or More Employees
N1000_1	NUM	Number of Establishments: Employment Size Class:1,000-1,499 Employees
N1000_2	NUM	Number of Establishments: Employment Size Class:1,500-2,499 Employees
N1000_3	NUM	Number of Establishments: Employment Size Class:2,500-4,999 Employees
N1000_4	NUM	Number of Establishments: Employment Size Class:5,000 or More Employees
CENSTATE	TXT	Census State Code
CENCTY	TXT	Census County Code

[33] This denotes employment size class for data withheld to avoid disclosure. Employment and payroll data are replaced by zeroes.

[Attachment 6 WRLURI data record layout]

variable name	Value label	variable label
state		State
statename		2-letter state abbreviation
id		Identification Code
ufips		FIPS code
name		jurisdiction name
type		jurisdiction type
msaname99		MSA/PMSA Name: 1999 Definitions
msa99		MSA/PMSA Code
stateid		stateid 2-letter state abbreviation
msastate		MSA or State Code
stacode		stacode State Code
namene		nameNE
local		local council involvement in regulation (1-not at all, 5-very)
pressure		community pressure involvement in regulation (1-not at all, 5-very)
countyleg		county legislature involvement in regulation (1-not at all, 5-very)
stateleg		state legislature involvement in regulation (1-not at all, 5-very)
localcourts		local courts involvement in regulation (1-not at all, 5-very)
statecourts		state courts involvement in regulation (1-not at all, 5-very)
commission	questions2_3	planning commission approval required for rezoning, 0=no, 1=yes, 2=yes by superm
loczoning	questions2_3	local zoning board approval required for rezoning, 0=no, 1=yes, 2=yes by superma
council	questions2_3	local council approval required for rezoning, 0=no, 1=yes, 2=yes by supermajority
cntyboard	questions2_3	county board approval required for rezoning, 0=no, 1=yes, 2=yes by supermajority
cntyzoning	questions2_3	county zoning board approval required for rezoning, 0=no, 1=yes, 2=yes by superm
envboard	questions2_3	environmental review board approval required for rezoning, 0=no, 1=yes, 2=yes by
commission_no~z	questions2_3	planning commission approval required (norezoning), 0=no, 1=yes, 2=yes by superm
council_norez	questions2_3	local council approval required (norezoning), 0=no, 1=yes, 2=yes by supermajority
cntyboard_norez	questions2_3	county board approval required (norezoning), 0=no, 1=yes, 2=yes by supermajority
envboard_norez	questions2_3	environ review board approval required (norezoning), 0=no, 1=yes, 2=yes by super
publhlth_norez	questions2_3	public health off approval required (norezoning), 0=no, 1=yes, 2=yes by supermaj
dsgnrev_norez	questions2_3	design review board approval required (norezoning), 0=no, 1=yes, 2=yes by superm
sfulandsupply	question4	supply of land importance (single family) 1-not at all, 5-very
mfulandsupply	question4	supply of land importance (multi family) 1-not at all, 5-very
sfuinfracost	question4	cost of infracture importance (single family) 1-not at all, 5-very
mfuinfracost	question4	cost of infracture importance (multi family) 1-not at all, 5-very
sfudensrestr	question4	density restrictions importance (single family) 1-not at all, 5-very
mfudensrestr	question4	density restrictions importance (multi family) 1-not at all, 5-very
sfuimpact	question4	impact fees/exactions importance (single family) 1-not at all, 5-very
mfuimpact	question4	impact fees/exactions importance (multi family) 1-not at all, 5-very
sfubudget	question4	city budget constraints importance (single family) 1-not at all, 5-very
mfubudget	question4	city budget constraints importance (multi family) 1-not at all, 5-very
sfucouncil	question4	council opposition importance (single family) 1-not at all, 5-very
mfucouncil	question4	council opposition importance (multi family) 1-not at all, 5-very
sfucitizen	question4	citizen opposition importance (single family) 1-not at all, 5-very
mfucitizen	question4	citizen opposition importance (multi family) 1-not at all, 5-very
sfuschool	question4	school crowding importance (single family) 1-not at all, 5-very
mfuschool	question4	school crowding importance (multi family) 1-not at all, 5-very
sfulengthzoning	question4	length zoning process importance (single family) 1-not at all, 5-very
mfulengthzoning	question4	length zoning process importance (multi family) 1-not at all, 5-very
sfulengthpermit	question4	length permit process importance (single family) 1-not at all, 5-very
mfulengthpermit	question4	length permit process importance (multi family) 1-not at all, 5-very
sfulengthdvlp	question4	length development process (single family) 1-not at all, 5-very
mfulengthdvlp	question4	length development process importance (multi family) 1-not at all, 5-very
sfupermitlimit	question5	sf annual permit limit, 0=no, 1=yes
mfupermitlimit	question5	mf annual permit limit, 0=no, 1=yes
sfuconstrlimit	question5	sf annual construction units limit, 0=no, 1=yes
mfuconstrlimit	question5	mf annual construction units limit, 0=no, 1=yes
mfudwelllimit	question5	mf dwelling limit, 0=no, 1=yes

mfudwellunitl~t	question5	num. of units in mf dwelling limit, 0=no, 1=yes
minlotsize	question6	min lot size requirement, 0=no, 1=yes
minlotsize_lh~e	question6	<=0 5 acre minlotsize requirement, 0=no, 1=yes
minlotsize_mh~e	question6	>0 5 acre minlotsize requirement, 0=no, 1=yes
minlotsize_on~e	question6	>1 acre minlotsize requirement, 0=no, 1=yes
minlotsize_tw~s	question6	>2 acres minlotsize requirement, 0=no, 1=yes
affordable	question6	affordable housing requirement, 0=no, 1=yes
sfusupply	question7	sf zoned land supply compared to demand, 1=far more, 5=far less
mfusupply	question7	mf zoned land supply compared to demand, 1=far more, 5=far less
commsupply	question7	commercially zoned land supply compared to demand, 1=far more, 5=far less
indsupply	question7	industrially zoned land supply compared to demand, 1=far more, 5=far less
lotdevcostinc~e	questions8_9	lot development cost increase (last 10 years)
sflotdevcosti~e	questions8_9	single family lot development cost increase (last 10 years)
time_sfu		review time for single family units (months)
time_mfu		review time for multi family units (months)
timechg_sfu	question11	change in review/appr time for sf projects over decade, 0=none, 1=longer, 2=much
timechg_mfu	question11	change in review/appr time for mf projects over decade, 0=none, 1=longer, 2=much
time1_l50sfu	questions12_13	permit lag for rezoning, <50 sf units, mths-midpoint
time1_m50sfu	questions12_13	permit lag for rezoning, >50 sf units, mths-midpoint
time1_mfu	questions12_13	permit lag for rezoning, mf project, mths-midpoint
time2_l50sfu	questions12_13	permit lag for subdivision appr (norezoning), <50 sf units, mths-midpoint
time2_m50sfu	questions12_13	permit lag for subdivision appr (norezoning), >50 sf units, mths-midpoint
time2_mfu	questions12_13	permit lag for subdivision appr (norezoning), mf project, mths-midpoint
submitted		# applications for zoning changes submitted (last 12 months)
alloc_local		Allocation Flag for Variable local
alloc_pressure		Allocation Flag for Variable pressure
alloc_countyleg		Allocation Flag for Variable countyleg
alloc_sfubudget		Allocation Flag for Variable sfubudget
alloc_mfubudget		Allocation Flag for Variable mfubudget
alloc_sfucoun~l		Allocation Flag for Variable sfucouncil
alloc_mfucoun~l		Allocation Flag for Variable mfucouncil
alloc_sfuciti~n		Allocation Flag for Variable sfucitizen
alloc_mfuciti~n		Allocation Flag for Variable mfucitizen
alloc_sfuschool		Allocation Flag for Variable sfuschool
alloc_mfuschool		Allocation Flag for Variable mfuschool
alloc_LPPI		Allocation Flag for Variable LPPI
alloc_time_sfu		Allocation Flag for Variable time_sfu
alloc_time_mfu		Allocation Flag for Variable time_mfu
alloc_time1_l~u		Allocation Flag for Variable time1_l50sfu
alloc_~1_m50sfu		Allocation Flag for Variable time1_m50sfu
alloc_time1_mfu		Allocation Flag for Variable time1_mfu
alloc_time2_l~u		Allocation Flag for Variable time2_l50sfu
alloc_~2_m50sfu		Allocation Flag for Variable time2_m50sfu
alloc_time2_mfu		Allocation Flag for Variable time2_mfu
alloc_ADI		Allocation Flag for Variable ADI
approved		# applications for zoning changes approved (last 12 months)
officialname		name of official filling the survery
execrating		State Legislative Profile (Foster and Summers)
judicialrating		State Judicial Profile (Foster and Summers)
town_meet		Town Meeting for of Government
zonvote		Town Meeting Aproves Zoning Changes
zonvote_super		Town Meeting Aproves Zoning Changes by a Super-Majority
totinitiatives		Total number of initiatives from 1996-2005

[Attachment 7 Descriptive summary of individual data of WRLURI]

Variable	Obs	Mean	Std Dev.	Min	Max
local	2729	4.37	0.96	1	5
pressure	2729	3.18	1.06	1	5
countyleg	2729	1.85	1.05	1	5
stateleg	2659	2.19	1 11	1	5
localcourts	2658	1.65	0 87	1	5
statecourts	2660	1.76	0 95	1	5
commission	2728	0.75	0 50	0	2
loczoning	2728	0.32	0.52	0	2
council	2728	0.94	0 45	0	2
cntyboard	2728	0.06	0 26	0	2
cntyzoning	2728	0 05	0.23	0	2
envboard	2728	0.03	0.18	0	2
commission~z	2718	0.72	0.49	0	2
council_no~z	2718	0 46	0.53	0	2
cntyboard_~z	2718	0 06	0.24	0	2
envboard_n~z	2718	0.07	0.27	0	2
publhlth_n~z	2718	0.11	0.31	0	2
dsgnrev_no~z	2718	0 19	0.41	0	2
sfulandsup~y	2651	3 94	1.35	1	5
mfulandsup~y	2558	3 89	1.38	1	5
sfuinfracost	2638	3 39	1.31	1	5
mfuinfracost	2541	3 34	1.32	1	5
sfudensrestr	2638	3 01	1.39	1	5
mfudensrestr	2541	3 26	1.41	1	5
sfuimpact	2620	2 10	1.23	1	5
mfuimpact	2523	2 13	1.24	1	5
sfubudget	2729	2 32	1.39	1	5
mfubudget	2729	2.31	1.40	1	5
sfucouncil	2729	2 08	1.28	1	5
mfucouncil	2729	2 38	1.42	1	5
sfucitizen	2729	2 47	1.24	1	5
mfucitizen	2729	2 83	1.36	1	5
sfuschool	2729	2 23	1 28	1	5
mfuschool	2729	2 31	1.33	1	5
sfulengthz~g	2643	1 99	1 11	1	5
mfulengthz~g	2547	2 08	1 18	1	5
sfulengthp~t	2641	1 84	1 08	1	5
mfulengthp~t	2545	1 88	1 11	1	5
sfulengthd~p	2642	2.08	1.18	1	5

Variable	Obs	Mean	Std. Dev	Min	Max
mfulengthd~p	2546	2.13	1.21	1	5
sfupermitl~t	2723	0.02	0.15	0	1
mfupermitl~t	2717	0.03	0.18	0	1
sfuconstrl~t	2722	0.02	0.14	0	1
mfuconstrl~t	2717	0.04	0.18	0	1
mfudwellli~t	2718	0.04	0 19	0	1
mfudwellun~t	2716	0.05	0.22	0	1
minlotsize	2648	0.84	0.36	0	1
mi~lhalfacre	1812	0.66	0.47	0	1
mi~mhalfacre	1923	0.39	0.49	0	1
minlot~eacre	1836	0 29	0.45	0	1
minlotsize~s	1813	0 24	0.43	0	1
affordable	2651	0 19	0.39	0	1
sfusupply	2585	3 16	1.13	1	5
mfusupply	2554	3 40	1.05	1	5
commsupply	2584	3.08	0.96	1	5
indsupply	2530	2 97	1.04	1	5
lotdevcost~e	2323	44.15	28 80	10	120
sflotdevco~e	2421	53.09	31.85	10	120
time_sfu	2678	3 49	3 29	-2.58	42
time_mfu	2678	4 19	3 77	-6.96	42
timechg_sfu	2655	0 38	0.57	0	2
timechg_mfu	2616	0.44	0 62	0	2
time1_l50sfu	2678	6 24	5 27	-8.32	27.28
time1_m50sfu	2678	7 53	5.90	-5 27	29 98
time1_mfu	2678	7.12	5 74	-4 36	26 19
time2_l50sfu	2678	5 43	4 71	-7 48	24
time2_m50sfu	2678	6.52	5 44	1 5	24
time2_mfu	2678	6.13	5 28	1 5	24
submitted	2657	10.32	32 22	0	1000
approved	2651	8.51	27 33	0	850
execrating	2728	2.27	0 73	1	3
judicialra~g	2728	2.13	0.67	1	3
town_meet	2674	0.05	0.23	0	1
zonvote	2674	0.04	0.18	0	1
zonvote_su~r	2674	0.02	0.13	0	1
totinitiat~s	2729	0.15	0.50	0	5
weight	2721	15 18	9 59	1	61 4
weight_metro	1993	9.42	4.71	1.00	33 48

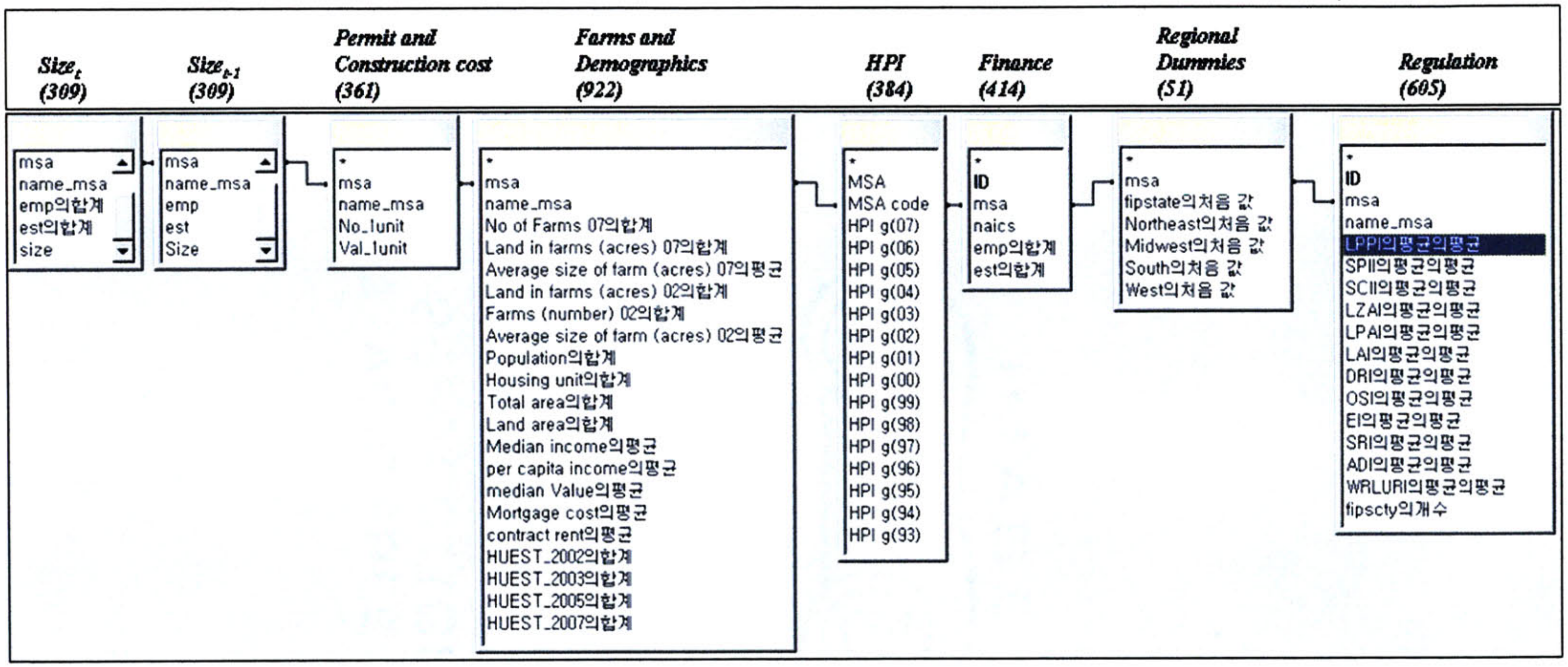
[Attachment 8 Sub index components]

The Local Political Pressure Index (LPPI)	LPPI=STD{STD[localcouncil + pressuregroup + countyleg + (sfubudget+mfubudget)/2 + (sfucouncil+mfucouncil)/2 + (sfucitizen+mfucitizen)/2 + (sfuschool+mfuschool)/2] + STD[totinitiatives]}
The State Political Involvement Index (SPII)	SPII=STD{STD[execrating] + STD[STATE_MEAN{stateleg}]}
The State Court Involvement Index (SCII)	SCII=judicialrating
Local Zoning Approval Index (LZAI)	LZAI=commissionD + loczoningD + councilD + cntyboardD + cntyzoningD + envboardD + zonvote.
Local Project Approval Index (LPAI)	LPAI=commission_norezD + council_norezD + cntyboard_norezD + envboard_norezD + publhlth_norezD + dsgnrev_norezD
Local Assembly Index (LAI)	This subindex takes on a value of one if the community both has a regular town meeting and a requirement for a popular vote in order to approve changes to zoning regulations, and is zero otherwise.
Supply Restrictions Index (SRI)	SRI=sfupermitlimit + mfupermitlimit + sfuconstrlimit + mfuconstrlimit + mfudwelllimit + mfuunitlimit,
Density Restrictions Index (DRI)	DRI=1 if minlotsize_oneacre==1 or minlotsize_twoacres==1; and DRI=0 otherwise.
Open Space Index (OSI)	OSI=1 if the community imposes such regulation and equals zero otherwise.
Exactions Index (EI)	EI=1 if developers must pay allocable shares of infrastructure improvement costs and is zero otherwise.
Approval Delay Index (ADI)	ADI=[(time_sfu+time_mfu)/2 +(time1_l50sfu+time1_m50sfu+time1_mfu)/3 + (time2_l50sfu+ time2_m50sfu+time2_mfu)/3]/3

[Attachment 9 Example of Geographical code matching process]

1.Firm size (example of county level data)	2. MSA level data (example of permit)	3. County level data (example of Housing unit)	4. Place level data (Regulation Data)
① Number of counties for employment and establishment: 1696 ② Number of counties after excluding records including zero value of either employment or establishment: 559 ③ Calculate employment per establishment as average number of employment per establishment at counties level ④ Calculate average of firm size of counties within each MSA ⑤ Number of MSA: 309 - Average number of counties within MSA:1.67 - Max number of counties within MSA:20 (New York-Newark-Edison, NY-NJ-PA MSA) - Min number of counties within MSA:1 (Dublin, GA MSA et al)	① Number of MSA for single family permits : 361	① Number of Counties for total housing unit: 3142 ② Calculate aggregate sum of housing unit of counties within MSA ③ Check MSA level data with aggregated sum (Example: Abberville, LA MSA 20445, 2005 estimates by AHS, 23562, county level sum, # of counties: 1) ④ Number of MSA: 922 -Average number of counties within MSA:1.91 -Max number of counties within MSA:28(Atlanta-Sandy Springs-Marietta, GA MSA) -Min number of counties within MSA:1(Barnstable Town, MA MSA et al)	① Number of place in Wharton data set: 2729 ② Converted places to County level by averaging index ③ Number of counties: 1237 -Average number of places within counties :4.46 -Max number of place within counties:68(Los Angeles county, CA) -Min number of place within counties:1(Dukes county, MA et al) ① Converted counties to MSA level by averaging index ② Number of MSA: 605 -Average number of Counties within MSA :1.6 - Max number of Counties within MSA:21(New York-Newark-Edison, NY-NJ-PA MSA) - Min number of Counties within MSA:1(Fergus Falls, MN MSA et al)
* averaging to MSA * Using MSA data	* Using MSA level	* aggregating to MSA	* averaging to MSA

[Attachment 10 2005 data set, 140 MSA records with variables name]



[Attachment 11 Descriptive statistics of counties and MSAs while data processing]

Total counties number in 2005 CBP data **1696** → Number of counties whose employment number is not zero **559** → Number of MSAs from aggregated Counties data **309** → Number of MSAs (matching with other variables) **140**

• Comparison between counties whose employment is captured and the other counties

		Count	Average of county's			
			Housing Unit	Land Area	Density (housing unit per land area)	Median Housing Value
Counties whose employment is	**not zero**	**559**	**135,956**	**1,068**	**371**	**129,952**
	zero	1137	25,563	1,034	76	90,656
		1696				

• Comparison between counties within MSA and the others, among 1696 counties

	Count	Average of county's			
		Housing Unit	Land Area	Density (housing unit per land area)	Median Housing Value
In MSA	**1,315**	**76,882**	**960**	**218**	**108,536**
Not in MSA	381	10,678	1,339	19	86,694
	1696				

Total counties number in 2005 CBP data **1696** → Number of counties whose employment number is not zero **559** → Number of MSAs from aggregated Counties data **309** → Number of MSAs (matching with other variables) **140**

• Among counties whose employments not zero,
Comparison between counties within MSA and the other counties

	Count	Average of county's						
		Employ-ees	Establish-ment	Size	Housing Unit	Land Area (mile²)	Density (housing unit per land area)	Median Housing Value($)
in MSA	**518**	**281**	**19**	**14.8**	**145,371**	**1,026**	**398**	**131,017**
not in MSA	41	21	5	4.6	17,011	1,596	21	116,498
	559							

[Attachment 12 Index for census data used in correlation test]

No.	Variables	Explanation
1	GCTPH1_US25C0	Population
2	GCTPH1_US25C1	Housing units
3	GCTPH1_US25C2	Area in square miles; Total area
4	GCTPH1_US25C3	Area in square miles; Water area
5	GCTPH1_US25C4	Area in square miles; Land area
6	GCTPH1_US25C5	Density per square mile of land area; Population
7	GCTPH1_US25C6	Density per square mile of land area; Housing units
8	GCTH5_US25C1	Occupied housing units
9	GCTH5_US25C2	Vacant housing units; Total
10	GCTH5_US25C3	Vacant housing units; Percent; For sale only
11	GCTH5_US25C4	Vacant housing units; Percent; For rent
12	GCTH5_US25C5	Vacant housing units; Percent; Seas., rec., or occ. use
13	GCTH5_US25C6	Vacancy rate; Homeowner
14	GCTH5_US25C7	Vacancy rate; Rental
15	GCTH6_US25C2	Occupied housing units; Owner
16	GCTH6_US25C3	Occupied housing units; Renter
17	GCTH6_US25C4	Occupied housing units; Average household size
18	GCTH6_US25C5	Occupied housing units; Percent; Owner
19	GCTH6_US25C6	Occupied housing units; Percent; 1-person households
20	GCTH6_US25C7	Occupied housing units; Percent; With householder 65 years and over
21	GCTP6_US25C1	Percent of total population; Race; One race; White
30	GCTP14_US25C0	Median income in 1999 (dollars); Households
31	GCTP14_US25C1	Median income in 1999 (dollars); Families
32	GCTP14_US25C2	Per capita income in 1999 (dollars)
33	GCTP14_US25C3	Median earnings in 1999 of full-time, year-round workers (dollars); Male
34	GCTP14_US25C4	Median earnings in 1999 of full-time, year-round workers (dollars); Female
38	GCTP14_US25C8	Income in 1999 below poverty level; Percent of families
39	GCTH9_US25C1	Specified owners; Median value (dollars)
40	GCTH9_US25C2	Specified owners; Median selected monthly owner costs (dollars); With a mortgage
41	GCTH9_US25C3	Specified owners; Median selected monthly owner costs (dollars); Not mortgaged
42	GCTH9_US25C4	Specified renters; Median contract rent (dollars)
43	GCTH9_US25C5	Specified renters; Median gross rent (dollars)
44	GCTH9_US25C6	Specified renters; Percent with meals included in rent

[Attachment 13 Correlation test with size of firm]

-Black cell : positive correlation
-White cell : negative correlation
-Grey cell : irregular relation with data level

Size	1[34]	2	3	4	5	6	7	8	9	10	11
>=10	7%	2%	-3%	**7%**	1%	**7%**	-2%	-1%	-7%	-11%	-10%
>=5	15%	10%	2%	4%	-1%	-3%	**9%**	-8%	**-1%**	-8%	**-3%**
>0	7%	2%	**13%**	-6%	1%	-8%	-5%	0%	-6%	-6%	-5%
>=0	**18%**	**10%**	11%	-6%	**7%**	2%	3%	**2%**	-4%	**-5%**	-4%
	12	13	14	15	16	17	18	19	20	21	22
>=10	-6%	-2%	-8%	-6%	-12%	-4%	-13%	-5%	-11%	**2%**	**1%**
>=5	1%	-6%	**11%**	**5%**	-9%	-4%	-1%	4%	0%	-6%	-4%
>0	-4%	-6%	10%	3%	-2%	-8%	-1%	-4%	-4%	-3%	-3%
>=0	**2%**	**-1%**	7%	1%	**0%**	**0%**	**4%**	**15%**	**4%**	-4%	-9%
	23	24	25	26	27	28	29	30	31	32	33
>=10	3%	-1%	5%	2%	**8%**	**14%**	9%	12%	3%	9%	1%
>=5	7%	-4%	6%	6%	-8%	-6%	10%	11%	-4%	-2%	-6%
>0	3%	7%	15%	12%	-5%	-5%	6%	7%	0%	4%	5%
>=0	**9%**	**9%**	**17%**	**16%**	-2%	0%	**13%**	**16%**	**15%**	**17%**	**16%**
	34	35	36	37	38	39	40	41	42	43	44
>=10	0%	-3%	-4%	-1%	0%	-5%	-6%	0%	9%	1%	2%
>=5	-5%	-3%	-5%	**9%**	**7%**	-2%	-4%	-7%	-3%	-7%	-4%
>0	0%	-1%	-2%	2%	2%	**1%**	-3%	**6%**	8%	5%	6%
>=0	**14%**	**1%**	**-1%**	2%	-1%	1%	**-2%**	5%	**12%**	**8%**	**9%**
	45	46	47	48	49	50	51	52	53	54	55
>=10	**12%**	**13%**	**9%**	11%	**6%**	**10%**	8%	-11%	-2%	-5%	2%
>=5	8%	9%	0%	**12%**	4%	-9%	-4%	-1%	1%	-4%	**9%**
>0	8%	6%	3%	10%	5%	-5%	**10%**	3%	1%	-1%	-7%
>=0	6%	5%	-1%	1%	-10%	-6%	5%	**4%**	**21%**	**19%**	4%
	56	57	58	59	60	61	62	63	64	65	66
>=10	3%	-7%	-5%	-9%	-8%	-7%	-11%	-7%	-6%	-9%	-1%
>=5	7%	-10%	-6%	5%	5%	3%	-6%	4%	2%	4%	**7%**
>0	0%	0%	3%	15%	12%	6%	3%	10%	6%	9%	3%
>=0	**8%**	**11%**	**17%**	**18%**	**16%**	**8%**	**7%**	**11%**	**8%**	**13%**	6%
	67	68	69	70	71	72	73	74	75	76	77
>=10	-2%	-3%	1%	2%	-7%	**8%**	N/A	N/A	N/A	3%	8%
>=5	**6%**	4%	-1%	-1%	**3%**	-9%	N/A	N/A	N/A	-6%	-3%
>0	2%	2%	7%	6%	-1%	-10%	-10%	N/A	N/A	**8%**	10%
>=0	4%	**9%**	**10%**	**9%**	1%	-12%	-10%	N/A	N/A	7%	**17%**
	78	79	80	81	82	83	84	85	86	87	88
>=10	-7%	**8%**	-8%	-13%	N/A	**5%**	-4%	-4%	9%	-8%	-7%
>=5	**-2%**	-9%	**-1%**	-1%	N/A	-11%	-1%	7%	-2%	5%	-3%
>0	-9%	-10%	-8%	1%	N/A	-4%	15%	**15%**	8%	9%	7%
>=0	-3%	-12%	-2%	**5%**	N/A	-5%	**17%**	11%	**10%**	**13%**	**15%**

[34] Each number is matched with the individual survey article, which is attached with summary statistics over MSAs.