RESEARCH REPORT

ZONING AND AFFORDABLE HOUSING
A CRITICAL REVIEW OF GLAESER AND GYOURKO'S PAPER

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Zoning and Affordable Housing: A Critical Review of Glaeser and Gyourko's Paper

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Abstract

Zoning and Affordable Housing: A Critical Review of Glaeser and Gyourko's Paper

One of the most pressing policy issues regarding housing markets is the concern that the high price of housing, especially in markets such as Vancouver and Toronto, shuts many households out of the financial benefits associated with homeownership. ‘‘The Impact of Zoning on Housing Affordability’’ by Professors Edward Glaeser and Joseph Gyourko examines the role of land use regulation in worsening housing affordability. This report is a critical review of Glaeser and Gyourko's paper, which shows how their paper fits in with the existing academic research on land use regulation, analyzes general usefulness of their theoretical model in explaining the relationship between all facets of affordability and government regulations on new housing construction, tests the validity of their findings with different and more precise data, and finally draws lessons from their findings for Canadian housing and land use policy. The basic finding of the analysis presented here is that despite a large number of simplifications and oversights that weaken the specific findings of their paper, Glaeser and Gyourko's fundamental qualitative results stand: government land use regulations distort housing market outcomes. These distortions raise the price of housing above what it might otherwise be. An important caveat in understanding the implications of their paper is that their analysis ignores many of benefits that proponents assign to land use regulation.

RESEARCH HIGHLIGHT

April 2005

Socio-economic Series 05-012

THE IMPACT OF ZONING AND BUILDING RESTRICTIONS ON HOUSING AFFORDABILITY

As Canada's housing agency, CMHC has an ongoing interest in understanding a wide range of issues relating to housing, such as affordability and affordability problems. CMHC monitors international research developments in these areas and occasionally sponsors careful investigations of such developments. This highlight describes one such investigation.

In 2002 two prominent American economists co-authored a thought-provoking article on housing affordability. Professor Glaeser of Harvard University and Professor Gyourko of the University of Pennsylvania published a National Bureau of Economic Research working paper titled *The Impact of Zoning on Housing Affordability*. The authors begin their paper by arguing that in the absence of policies that artificially inflate housing prices, problems of housing affordability are really problems of insufficient income. Then they investigate the extent to which government policies have caused housing prices to be artificially inflated. The authors present evidence that suggests government policies have drastically inflated housing prices in certain, limited parts of the United States. This implies that the United States does not have a national housing affordability crisis—but rather a poverty crisis—which, in some areas, is exacerbated by artificially inflated housing prices. The distinction between housing affordability problems and income problems is important because optimal policy responses for each problem may be different.

Glaeser and Gyourko's article received widespread media in the United States and was published in an abridged format in the journal Regulation. Glaeser and Gyourko have since published a revised version of the article, with the revised title *Impact of Building Restrictions on Housing Affordability*, in the Federal Reserve Bank of New York Economic Policy Review.

Glaeser and Gyourko argue that zoning and other building restrictions effectively reduce the supply of developable land. By effectively reducing the supply of developable land, these restrictions push prices upward. It is a fundamental law of economics that prices rise when supply is scarce. This law is true regardless of whether the scarcity is intrinsic or the result of government policies such as zoning. Zoning rules can artificially constrain the supply of developable land and available lots in various ways. Minimum lots sizes—which are extremely common throughout much of the United States—effectively reduce the number of lots available for residential construction. Growth boundaries and greenbelts can do the same. Furthermore, a variety of other non-zoning building restrictions can have the same ultimate effect as reducing land supply and thus can also increase housing prices.

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Glaeser and Gyourko use several statistical techniques to examine the relationship between building restrictions, such as zoning, and house prices. Comparisons between home prices and construction costs are key to their analysis. The authors measure the divergence between home prices and construction costs in a large number of American cities and suburban areas. They find that home prices are close to construction costs throughout much of the United States, but are substantially higher than construction costs throughout parts of the Northeast and the West Coast.

After measuring differences between home prices and construction costs, Glaeser and Gyourko investigate why these differences exist. They suggest two possible causes, both of which relate to the price of developable land and lots: First, the demand for land may be particularly great in some areas. Second, zoning and other building restrictions may be particularly onerous in some areas. The authors use a variety of advanced, statistical techniques to determine which explanation plays a bigger role. They find that "in places where housing is quite expensive, building restrictions appear to have created these high prices." Based on this finding, Glaeser and Gyourko recommend: "If policy advocates are interested in reducing housing costs, they would do well to start with zoning reform."

Glaeser and Gyourko focus on the United States. They use American data to estimate the impact of building restrictions in the United States. Nonetheless, there is reason to believe that their work may have some relevance to Canada and other countries. Essentially, Glaeser and Gyourko base their work on the fundamental law of economics that prices rise when supply is scarce. This law is generally as true in Canada as it is in the United States. Thus it is reasonable to suspect that Glaeser and Gyourko's findings—if valid with respect to the United States—may have some relevance to Canada. To better understand the relevance of Glaeser and Gyourko's work to Canada, CMHC hired Professor Somerville of the Sauder School of Business at the University of British Columbia.

Professor Somerville was charged with three related tasks. First, he was asked to help CMHC understand how the work of Glaeser and Gyourko relates to other research on the topics of land use regulation and housing affordability. Second, Somerville was asked to examine the robustness of the results obtained by Glaeser and Gyourko. Would these authors have obtained dramatically different results if they had used different data or made slightly different assumptions? Third Somerville was asked to relate Glaeser and Gyourko's work to Canada.

Somerville begins his discussion by agreeing with Glaeser and Gyourko's key thesis that "government land use regulations distort housing market outcomes [and] these distortions raise the price of housing above what it might otherwise be." He also agrees with the proposition that in the absence of policies that artificially inflate housing prices, problems of housing affordability are really problems of insufficient income. Somerville makes various comments and criticisms regarding the exact methods and data used by Glaeser and Gyourko. He addresses his concerns by redoing some of Glaeser and Gyourko's work using slightly different methods and data. He obtains results that are qualitatively similar to those obtained by Glaeser and Gyourko. In general, Somerville finds the results of Glaeser and Gyourko to be robust.

Although Somerville concurs with much of the Glaeser and Gyourko analysis, he draws attention to two important limitations of their study. First, Glaeser and Gyourko do not fully address the benefits associated with zoning and other land use regulations. Thus their work should not be viewed as meaning these regulations are all bad. Rather, their work merely suggests that policy makers and housing advocates should be aware of both the good and the bad impacts caused by regulating land use. Second, Glaeser and Gyourko focus solely on affordability as measured through home prices; they do not focus on rents or rental markets. This does not mean that their work does not apply to rental markets; it does. Equilibrium in the market for real estate assets demands a strong correlation between rents and house prices. However, this connection can breakdown when considering particular segments of the housing market. Thus, some caution is required in translating Glaeser and Gyourko's results to rental markets.

It is also difficult to translate Glaeser and Gyourko's results to Canada. The main reason for this difficulty is that Canadian researchers do not have as much statistical information about Canada as American researchers have about the United States. Somerville suggests that Canada should gather and publish more detailed information about its housing stock. Moreover, Somerville argues that Canada should develop a set of measures chronicling the types of land use regulations that are imposed in specific localities. These measures should capture not only whether a specific type of regulation is imposed in a specific area, but also the extent to which it is enforced. Without these measures, it is impossible to empirically measure the effects of zoning and land use regulations on housing affordability in Canada.

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LE POINT EN RECHERCHE

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L'INCIDENCE DES RESTRICTIONS EN MATIÈRE DE ZONAGE ET DE CONSTRUCTION SUR L'ABORDABILITÉ DU LOGEMENT

À titre d'organisme responsable de l'habitation au Canada, la SCHL s'intéresse toujours de près à une vaste gamme de questions relatives au logement, comme l'abordabilité et les problèmes connexes. La SCHL surveille les études publiées dans d'autres pays sur ces questions et commande à l'occasion des enquêtes minutieuses sur celles-ci. Voici la description d'une de ces enquêtes.

En 2002, deux économistes américains renommés rédigent ensemble un article qui donne à réfléchir sur l'abordabilité du logement. Le professeur Glaeser de l'Université Harvard et le professeur Gyourko de l'Université de Pennsylvanie publient leur document de travail du Bureau national américain de recherche économique intitulé *The Impact of Zoning on Housing Affordability*. Les auteurs commencent par soutenir qu'en l'absence de politiques qui gonflent artificiellement le prix du logement, les problèmes d'abordabilité du logement sont en réalité des problèmes de revenu insuffisant. Ils examinent ensuite dans quelle mesure les politiques gouvernementales ont fait augmenter artificiellement le prix du logement. Ils présentent des preuves qui semblent démontrer que les politiques gouvernementales ont fait augmenter considérablement le prix du logement dans certaines parties limitées des États-Unis, ce qui signifierait qu'il n'y a pas de crise de l'abordabilité du logement aux États-Unis, mais plutôt une crise de la pauvreté, exacerbée dans certaines régions par la hausse artificielle du prix du logement. La distinction entre les problèmes d'abordabilité du logement et les problèmes de revenu est importante parce que la meilleure politique pour régler l'un ne s'applique pas nécessairement avec autant de bonheur à l'autre.

L'article de Glaeser et Gyourko suscite la curiosité des médias aux États-Unis et est publié en format abrégé dans le journal Regulation. Glaeser et Gyourko publient quelque temps après une version révisée de l'article (*Impact of Building Restrictions on Housing Affordability*) dans l'*Economic Policy Review* de la Federal Reserve Bank de New York.

Les deux auteurs y prétendent que les restrictions en matière de zonage et de construction réduisent véritablement l'offre de terrains à bâtir. Elles font ainsi monter les prix. L'une des lois fondamentales de l'économie est que les prix augmentent quand l'offre est limitée. Cette loi est vraie, peu importe si la rareté est intrinsèque ou si elle est le résultat de politiques gouvernementales comme le zonage. Les règles de zonage peuvent limiter artificiellement l'offre de terrains à bâtir et les lots disponibles de diverses façons. Les dimensions minimales des lots, qui sont extrêmement communes dans la plus grande partie des États-Unis, réduisent effectivement le nombre de lots disponibles pour la construction résidentielle. Les limites de la croissance urbaine et les ceintures de verdure peuvent avoir le même effet. En outre, une gamme d'autres restrictions en matière de construction qui ne concernent pas le zonage peuvent avoir le même effet final que la réduction de l'offre de terrains à bâtir et peuvent donc faire augmenter aussi les prix du logement.

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Glaeser et Gyourko utilisent diverses techniques statistiques pour examiner le rapport entre les restrictions en matière de construction, comme le zonage, et le prix du logement. Les comparaisons entre les prix du logement et les coûts de construction sont la clé de leur analyse. Les auteurs mesurent la divergence entre les prix du logement et les coûts de construction dans un grand nombre de villes et de régions suburbaines des États-Unis. Ils constatent que les prix du logement sont près des coûts de construction dans la plus grande partie des États-Unis, mais qu'ils sont considérablement plus élevés que les coûts de construction dans certaines parties du nord-est et de la côte ouest.

Après avoir mesuré les différences entre les prix du logement et les coûts de construction, Glaeser et Gyourko examinent pourquoi ces différences existent. Ils proposent deux causes possibles, toutes les deux liées au prix des terrains et des lots à bâtir : premièrement, la demande de terrains peut être particulièrement élevée dans certains secteurs. Deuxièmement, les restrictions en matière de zonage et de construction peuvent être particulièrement lourdes dans certains secteurs. Les auteurs utilisent une gamme de techniques statistiques évoluées pour déterminer l'explication qui joue le plus grand rôle. Ils constatent que dans les endroits où le logement est très dispendieux, les restrictions en matière de construction semblent avoir créé ces prix élevés. S'appuyant sur cette constatation, Glaeser et Gyourko recommandent que les défenseurs de politiques qui s'intéressent à réduire les coûts du logement feraient bien de commencer par réformer le zonage.

Le travail de Glaeser et Gyourko est axé sur les États-Unis. Ils utilisent des données américaines pour estimer l'incidence des restrictions en matière de construction aux États-Unis. Il y a néanmoins raison de croire que leur travail pourrait présenter une certaine pertinence pour le Canada et d'autres pays. Essentiellement, Glaeser et Gyourko fondent leur travail sur la loi fondamentale de l'économie qui dit que les prix augmentent lorsque l'offre est limitée, une loi qui est en général aussi vraie au Canada qu'aux États-Unis. Il est donc raisonnable de penser que les constatations de Glaeser et Gyourko, si elles sont valides pour les États-Unis, peuvent avoir une certaine pertinence pour le Canada. Pour mieux comprendre en quoi le travail de Glaeser et Gyourko peut être pertinent pour le Canada, la SCHL a engagé le professeur Somerville de la Sauder School of Business de l'Université de la Colombie-Britannique.

Le professeur Somerville a été chargé de trois tâches connexes. Il devait en premier lieu aider la SCHL à comprendre comment le travail de Glaeser et Gyourko se rapproche des autres études sur les questions de la réglementation de l'utilisation des terrains et de l'abordabilité du logement. Il devait en second lieu examiner la robustesse des résultats obtenus par Glaeser et Gyourko. Est-ce que ces auteurs auraient obtenu des résultats considérablement différents s'ils avaient utilisé des données différentes ou s'ils avaient posé des hypothèses légèrement différentes? Il devait en troisième lieu faire le lien entre le travail de Glaeser et Gyourko et le Canada.

Le professeur Somerville a entrepris sa discussion en se disant d'accord avec la thèse clé de Glaeser et Gyourko, selon laquelle la réglementation gouvernementale de l'utilisation des terrains fausse les résultats du marché du logement et ces distorsions augmentent le prix du logement au-delà de ce qu'il pourrait être autrement. Il est également d'accord avec la proposition selon laquelle en l'absence de politiques qui gonflent artificiellement le prix du logement, les problèmes d'abordabilité du logement sont en réalité des problèmes de revenu insuffisant. Il présente des critiques et des commentaires divers concernant les méthodes exactes et les données utilisées par Glaeser et Gyourko. Il décortique les points particuliers qui l'intéressent en refaisant une partie du travail de Glaeser et Gyourko avec des méthodes et des données légèrement différentes. Il obtient des résultats qualitativement semblables à ceux obtenus par Glaeser et Gyourko. Le professeur Somerville trouve de façon générale que les résultats de Glaeser et Gyourko sont robustes.

Si le professeur Somerville est d'accord avec la plus grande partie de l'analyse de Glaeser et Gyourko, il attire néanmoins l'attention sur deux limites importantes de leur étude. Premièrement, Glaeser et Gyourko ne traitent pas entièrement les avantages associés au zonage et aux autres types de réglementation de l'utilisation des terrains. Ainsi, il ne faudrait pas considérer que leur travail signifie que toutes ces formes de réglementation sont mauvaises. Leur travail laisse plutôt croire que les décideurs et les défenseurs de politiques devraient être très au courant des bonnes et des mauvaises incidences de la réglementation de l'utilisation des terrains. Deuxièmement, Glaeser et Gyourko axent leur travail uniquement sur l'abordabilité, mesurée par l'entremise des prix du logement; ils ne se concentrent pas sur les loyers ou sur les marchés locatifs. Cela ne signifie pas que leur travail ne s'applique pas aux marchés locatifs; il s'y applique. L'équilibre du marché des actifs immobiliers exige une forte corrélation entre les prix des logements loués et les prix des maisons. Mais cette connexion peut être brisée quand on considère des segments particuliers du marché du logement. Il faut donc être prudent en appliquant les résultats de Glaeser et Gyourko aux marchés locatifs.

Il est également difficile d'appliquer les résultats de Glaeser et Gyourko au Canada. Cette difficulté s'explique principalement par le fait que les chercheurs canadiens n'ont pas autant d'information statistique sur le Canada que les chercheurs américains en ont sur les États-Unis. Le professeur Somerville propose que le Canada réunisse et publie plus d'information détaillée sur son parc de logements. Il affirme aussi que le Canada devrait élaborer un ensemble de mesures établissant la chronique des types de réglementation de l'utilisation des terrains qui sont imposés à des localités particulières. Ces mesures devraient permettre de saisir non seulement si un type particulier de réglementation est imposé dans un secteur particulier, mais également dans quelle mesure elle est appliquée. Sans ces mesures, il est impossible de mesurer de façon empirique les effets de la réglementation du zonage et de l'utilisation des terrains sur l'abordabilité du logement au Canada.

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LAND USE REGULATION AND AFFORDABILITY: EXECUTIVE SUMMARY

Objectives

One of the most pressing policy issues regarding housing markets is the concern that the high price of housing, especially in markets such as Vancouver and Toronto, shuts many households out of the financial benefits associated with homeownership. For poor renters, the problem can be even more acute as high rental prices may force the poorest households to consume "less" housing, crowded and poor quality units, than we as a society deem to be acceptable. At the same time, governments aggressively use a menu of policies to intervene in the land market to affect the density, type, and location of development. It has long been a concern among observers of housing markets that land use regulations can potentially create hardship by raising the cost of housing. While policy makers may introduce these regulations in an attempt to achieve a set of particular land use goals, an objective understanding of the costs of achieving these goals depends on understanding the effect of regulations on housing markets. ''The Impact of Zoning on Housing Affordability'' by Professors Edward Glaeser and Joseph Gyourko represents an important contribution to this debate. In the spring of 2003 CMHC put forth a call for a critical review of this paper.

The terms of reference for this critical analysis has three distinct objectives. First, to understand the place of the Glaeser and Gyourko paper in the literature on land use regulation and to determine the extent of the general usefulness of the theoretical model in explaining the relationship between all facets of affordability and government regulations on new housing construction. Second, to ascertain the robustness of the authors' results: are they are a unique artifact of the authors' data or can they be replicated with a different dataset and alternative measures of construction costs and land use regulation? Third, does the work have lessons for Canadian housing policy and could this analysis be undertaken here. These three parts represent the elements of an overall objective to determine whether differences in house prices and housing affordability across Canada can be explained by land use regulations.

Assessment of the Glaeser and Gyourko Paper

The most important contribution of the Glaeser and Gyourko paper is that they clearly force us to understand the relative roles of housing and labor markets in explaining affordability problems. Their starting point of analysis is that in the absence of policies that artificially inflate housing prices through constraints on the supply of housing, problems of housing affordability are really problems of unequal distribution of income. Affordability has two components: the level and distribution of household income – especially for poorer households – and the asset or rental price of housing. Glaeser and Gyourko note, that the only explicit question for housing markets about affordability is whether government regulations constrain the supply of housing. Do government policies causes prices and rents to exceed their free market level? The critical lesson Glaeser and Gyourko provide is that in the absence of this type of housing market distortion, if the free market price of housing creates hardship for poorer households, then attention must be placed not on housing markets, but on labour markets. Why is labour income distributed in such away that some households are so far below the metropolitan area median or mean income level?

The basic finding of the analysis presented here is that despite a large number of simplifications and oversights that weaken the specific findings of their paper, Glaeser and Gyourko's fundamental qualitative results stand: government land use regulations distort housing market outcomes. These distortions raise the price of housing above what it might otherwise be. Where they are most acute they increase the marginal cost of housing above what it would otherwise be. In the United States, this increase is greatest in the higher priced housing markets found on the West Coast and in the Northeast. An important reminder, though, is that their analysis ignores many of benefits that proponents assign to land use regulation in terms of neighborhood preservation and urban form.

A complaint of the author of this review is that Glaeser and Gyourko limit their analysis to house prices. Clearly, access to homeownership is an important concern of policy makers. Governments in all market economies provide explicit supports for households to achieve ownership and tax systems favour homeownership over other asset classes and over renting. Still, the status of low income renters is also of concern. Equilibrium in the market for real assets demands a strong correlation between rents and house prices. However, this connection can breakdown when one looks at particular segments of the housing market. This is especially true for the availability of lower rent units from the stock of existing housing as opposed to new construction. It is also relevant for the supply of new multi-family rental structures instead of detached single family houses. The authors could have made a broader contribution to our understanding of land use regulation and affordability by addressing the rental side of the equation.

Glaeser and Gyourko and the Literature

The literature on the economic effects of land use regulation is voluminous, so that this report places the Glaeser and Gyourko paper in the context of a small part this corpus of work. Most of the empirical literature in this area has tried to test for the effect of land use regulation on house prices. What distinguishes the Glaeser and Gyourko paper from most of the empirical work in the field is that they develop their empirical tests from a model of housing production. Their three tests directly relate to how regulations might interfere in a market outcome. In contrast, the vast majority of papers in this area simply look at a correlation between the presence of regulations and the level of housing prices.

On the whole, the results from other work have been somewhat inconsistent. The clearest result is the rather obvious finding that growth controls that limit development raise house prices. Yet, growth controls are a bulky, rarely used instrument for intervention in land use decisions. The finding of higher prices need not be an indictment of land use regulations if these convey a benefit. While the early work did not properly address this question, the more recent, better quality work does. It has tended to find that the social benefits of most land use regulations from reducing negative effects associated with particular uses or with growth are smaller than the costs from supply restrictions and constraints on consumer choice. Perhaps what has been most clear is that the alternative hypothesis, that large-scale, regulatory-driven separation of uses and controls on density provide clear social benefits.

One of the challenges in evaluating the effects of local land use controls on the supply of housing is the absence of a complete, comprehensive, measurable, and empirically testable definition of what they are. The primary reason for this is the wide variety of approaches to regulation and differences in the intensity with which the same set of regulations might be enforced in a single jurisdiction. Zoning is the single term most often used to describe land use regulations, and it is the one Glaeser and Gyourko use, yet it is far from comprehensive. Strictly, it identifies allowed uses, structure density, building heights and massing, and placement on a lot. Yet, controls are often a web of explicit zoning policies with some combination of exactions and fees, heritage preservation, growth limits, the dynamics of the planning review process, requirements for off-site infrastructure, rules on the amount and configuration of on-site local infrastructure such as drainage systems, sidewalks, gutters, and streets, the nature of the variance process, and anything that is not codified. Often in research work this entire mix of activities is either reduced to a single measure such as the ratio between the amount of structure embodied in the real estate and the amount of land used for that structure. Less rigorously, there may just be an indicator for the presence of some type of regulations.

In total, the literature struggles with these challenges in phenomenon measurement, one to which Glaeser and Gyourko are also not immune. Relative to this literature, the authors do make several explicit contributions. First, they ground their tests more explicitly in a theoretical model of how builders combine land and structures. Second, they provide the clearest test of whether lot sizes different from what market demand would want. Third, they add to the examination of whether density is constrained by zoning.

Glaeser and Gyourko's Theoretical Model

Glaeser and Gyourko's analysis of the effect of land use regulations on housing affordability is fundamentally correct, but several methodological flaws that weaken the form of their argument.[1] The mathematical characterization they use to describe the relationship between the construction of new housing and land use regulation ignores certain important features. Their reasons for doing so are that they are able to present a very clear description of this relationship, but at the expense of finding that land regulations have a much larger effect on the gap between the cost of constructing a structure and the price for which it sells than is actually the case.

In their paper the authors approach the theoretical treatment of land use regulations in several different ways. One approach adds a dollar cost of regulation directly to the costs a builder or developer faces in supplying new housing. The second compares the costs and benefits of being able to subdivide land. The third relies on an assumed mathematical form in the relationship between land and structure to predict the density of development with and without regulation. These three approaches yield three different tests for identifying whether zoning constrains the market. The first suggests a wedge between house prices and basic construction costs. The second predicts an inequality between the marginal and average values of land. The third, predicts differences between predicted and actual density.

The flaws in the theoretical foundations of these tests are varied. It is important to emphasize that the flaws result in effects on the predicted magnitude of the constraint of land use regulation and not the existence of the constraint. First, they characterize regulations as a lump sum cost per housing unit, which is certainly not the case, as regulatory intensity varies with type, location, density, and quality level of a proposed development. Second, they ignore the potential benefits conferred by zoning. Third, there are costs associated with subdivision and assembly that would yield a result similar to their predicted zoning effect even in the absence of any regulatory constraints on subdivision.

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[1] One complaint the author of this text has is that while Glaeser and Gyourko use the term zoning, at times their arguments refer to land use regulations more generally.

Testing the Robustness of Glaeser and Gyourko's Findings

The empirical work in Glaeser and Gyourko's paper forms the heart of their argument that land use regulations causes higher prices by increasing the cost of supplying new units. Their analysis uses three data sources. The first is the national sample of the American Housing Survey (AHS), which provides data on owner estimated house value, lot size, and the structure characteristics of individual units in different metropolitan areas across the United States. The second is the metropolitan area specific per square foot construction costs from the RS Means Company. The final data source is the Wharton Urban Decentralization Project survey of land use regulations.

What we do is use more refined data to conduct similar tests. First, we use the AHS metropolitan surveys, which allows us to obtain substantially greater numbers of observations per MSA, instead of the national survey used in their paper. Second, we perform more detailed and unit specific estimates of the value of the structure component of each of the houses identified in the AHS data. Finally, we use a much more substantial set of land use regulation measures from the same Wharton data as the authors use. We find clear support for the tenor and pattern of the Glaeser and Gyourko results, though our values for individual metropolitan areas vary from theirs.

Our analysis supports their general conclusions. First, the ratio of house to structure value varies dramatically across different metropolitan areas in the United States. Second, this ratio is highest in the areas thought of as having stricter land use regulation: the West Coast and Northeast. Third, this pattern shows up in different measures of land prices, as measured through both marginal prices and average values. The difference between these two, Glaeser and Gyourko's "zoning tax" is highly correlated with both measures. Finally, the variation in the estimated land value per square foot, and thus by extension the "zoning tax", follows to a significant degree the variation in the land use regulatory environment as captured in large number of different variables. The results of these robustness tests provide support for Glaeser and Gyourko's qualitative results. We obtain different point estimates and values than they do, sometimes significantly so. However, the patterns are consistent.

Some of the tests for the impact of regulations that Glaeser and Gyourko use depend on accurate measures of construction costs. More critically, if their estimates are inaccurate or biased, this cannot vary systematically across different metropolitan areas. We find that our more careful approach results in estimated structure values that are 34 percent higher than those estimated by Glaeser and Gyourko. More worrisome, there approach would seem to have difference margins of error depending on the characteristics of the housing stock, a factor tat very clearly has defined and substantial variation across metropolitan areas.

In a formal test of the link between specific land use regulations and the measures of housing market distortions, the zoning tax, Glaeser and Gyourko's approach raises concerns. First, they use a measure of land use regulations, the time delays in negotiating the regulatory process that is inappropriate for their model. The latter demands a variable that describes constraints on the subdivision of land, such as minimum lot size regulations. Second, the data set they use contains a large number of other possible measures that they ignore. The latter turns out to matter: we find a much more robust connection between land use regulation and the gap between the two land value measures than is apparent in Glaeser and Gyourko's paper. Of the 45 different measures of land use regulation we examine, for 75 percent of them, they show a negative effect of regulations on housing market outcomes, and of this fully 50 percent are with a high degree of statistical confidence.

The nature of this type of analysis makes the attribution of direct causality problematic. And while the Glaeser and Gyourko paper has a number of faults, which are outlined in more detail in the report, viewed within the context of the broader literature on the theoretical and empirical effects of land use regulation, their work further strengthens the case that land use regulations, whatever their positive effects, do increase constrain supply, raising housing prices. The importance of this work is less from their particular empirical findings, but from the emphasis that to identify housing market affordability problems, we need to study the supply side and not just the relationship between housing prices and incomes. The theoretical construct of their empirical analysis is intended to identify how regulations reduce affordability by their effect on the supply side. As a pure test their analysis comes up short, but the more general implications are both clear and robust.

Recommendations for Canada

Despite the many differences, Canadian and U.S. housing markets share more in common with each other than either does with the housing markets of any other country in the world. These fundamental similarities ensure that the qualitative implications of Glaeser and Gyourko's theoretical arguments are surely to be as pertinent for Canada as they are for the U.S. However, the differences in incomes, preferences, urban form, the location of employment within the urban area, transportation infrastructure and policy, and the instruments and application of land use planning and regulation between the U.S. and Canada ensure that the precise empirical findings are high unlikely to translate across the border. Unfortunately, we are unable to apply Glaeser and Gyourko's methodology to Canadian data. The absence in Canada of any national survey of land use regulations and no public access nationwide survey of household units with detailed information about the individual units at a level of detail provided by the U.S. Department of Housing and Urban Development's American Housing Survey (AHS) means that their empirical findings cannot be tested in Canada.[2]

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[2] The Department of Housing and Urban Development (HUD) is the federal government agency in the U.S. charged with overseeing and implementing federal housing policy initiatives. Together with the U.S. Census Bureau they put out the AHS. The AHS is a large survey of individual housing units. The housing units themselves rather than occupants are tracked over time and the occupants or owners for vacant units, are asked a to answer a large number of questions about themselves (demographics and income), house values, rents, financing, housing related expenditures, and house and neighborhood characteristics. The

The principal recommendation for how to improve our understanding of the effects of land use regulation on Canadian housing markets is the development of better data for researchers to use to measure these regulations. The information needed to measure these conditions can only be gathered through a well-designed survey. To prevent local building and development policy and development administration from being driven by casual anecdotes, policy makers and land use regulators should have access to a set of easily understood measures that will allow them to compare different regulatory policies and the impacts of these policies in different Canadian municipalities. The survey described here is intended to generate a database that would provide researchers, policy analysts, and local officials and others with this information.

A secondary recommendation that may be of less critical to this goal, but more important for understanding housing in Canada in general is a Canadian version of the American Housing Survey (AHS). Ideally, both would provide for users of detailed metropolitan area housing data an inexpensive, easy to access source of information. They differ in both the cost to develop them. An AHS like data set would involve a substantial outlay of financial resources but with a broad base of potential users among researchers, governments, non-profits, and industry.   A regulation survey would be cheaper, but be less in demand.

AHS has two components, a national survey and a metropolitan area survey. The former is conducted bi-annually and is designed to reflect the complete housing stock of the United States. The metropolitan sample surveys 47 metropolitan areas over a four year cycle.

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SECTION 1:
INTRODUCTION

One of the most pressing policy issues regarding housing markets is the concern that the high price of housing, especially in markets such as Vancouver and Toronto, shuts many households out of the financial benefits associated with homeownership. For poor renters, the problem can be even more acute as high rental prices may force the poorest households to consume "less" housing, crowded and poor quality units, than we as a society deem to be acceptable. At the same time, governments aggressively use a menu of policies to intervene in the land market to affect the density, type, and location of development. It has long been a concern among observers of housing markets that land use regulations can potentially create hardship by raising the cost of housing. While policy makers may introduce these regulations in an attempt to achieve a set of particular land use goals, an objective understanding of the costs of achieving these goals depends on understanding the effect of regulations on housing markets. ''The Impact of Zoning on Housing Affordability'' by Professors Edward Glaeser and Joseph Gyourko represents an important contribution to this debate. However, there remains a question as to the validity of their work and its appropriateness to Canada.

This report is the response to CMHC's call for a critical review of Glaeser and Gyourko's paper. This report has three objectives. First, to understand the place of the Glaeser and Gyourko paper in the literature on land use regulation and to determine the extent of the general usefulness of the theoretical model in explaining the relationship between all facets of affordability and government regulations on new housing construction. Second, to ascertain the robustness of the authors' results: are they are a unique artifact of the authors' data or can they be replicated with a different dataset and alternative measures of construction costs and land use regulation? Third, does the work have lessons for Canadian housing policy and could this analysis be undertaken here. These three elements represent the parts of an overall objective to determine whether differences in house prices and housing affordability across Canada can be explained by land use regulations.

The most important contribution of the Glaeser and Gyourko paper is that they clearly force us to understand the relative roles of housing and labor markets in explaining affordability problems. Their starting point of analysis is that in the absence of policies that artificially inflate housing prices through constraints on the supply of housing, problems of housing affordability are really problems of unequal distribution of income. Affordability has two components: the level and distribution of household income – especially for poorer households – and the asset or rental price of housing. Glaeser and Gyourko note, that the only explicit question for housing markets about affordability is whether government regulations constrain the supply of housing. Do government policies causes prices and rents to exceed their free market level? The critical lesson Glaeser and Gyourko provide is that in the absence of this type of housing market distortion, if the free market price of housing creates hardship for poorer households, then attention must be placed not on housing markets, but on labour markets. Why is labour income distributed in such away that some households are so far below the metropolitan area median or mean income level?

The basic finding of the analysis presented here is that despite a large number of simplifications and oversights that weaken the specific findings of their paper, Glaeser and Gyourko's fundamental qualitative results stand: government land use regulations distort housing market outcomes. These distortions raise the price of housing above what it might otherwise be. Where they are most acute they increase the marginal cost of housing above what it would otherwise be. In the United States, this increase is greatest in the higher priced housing markets found on the West Coast and in the Northeast. An important reminder, though, is that their analysis ignores many of benefits that proponents assign to land use regulation in terms of neighborhood preservation and urban form.

The structure of this report is as follows. In Section 2 we review of the empirical and some of the theoretical literature on the impacts of land use regulation. The goal of the section is to provide the context for understanding Glaeser and Gyourko's contribution.

Section 3 is a critical analysis of the theoretical approach that Glaeser and Gyourko use for to frame their empirical analysis. The heart of the analysis pursued here is in Section 4, where we conduct a series of empirical tests of the robustness of Glaeser and Gyourko's work. Finally, in Section 5 we develop a set of recommendations for how to make use of Glaeser and Gyourko to develop better land use regulation policies in Canada. The principal recommendation for how to improve our understanding of the effects of land use regulation on Canadian housing markets is the development of better data for researchers to use to measure these regulations. To prevent local building and development policy and development administration from being driven by casual anecdotes, policy makers and land use regulators should have access to a set of easily understood measures that will allow them to compare different regulatory policies and the impacts of these policies in different Canadian municipalities.

SECTION 2:
GLASER AND GYOURKO'S PLACE IN THE LITERATURE

The literature on the economic effects of land use regulation is voluminous. Only a small portion of this corpus of work is explicitly described here. The intention of this summary is to provide enough exposure to the range of issues and approaches to be able to understand the context of the Glaeser and Gyourko paper. The main thrust of research in this area has focused on testing for the effect of land use regulation on house prices. Generally, the results have not been sufficiently consistent beyond the obvious that growth controls that limit development raise house prices. However, the newest, better quality work does suggest that the welfare benefits of most land use regulations from reducing negative externalities associated with particular uses or with growth caused congestion of public facilities are smaller than the costs from supply restrictions and constraints on consumer choice. What is certainly true is that there is sparse evidence that large-scale, regulatory-driven separation of uses increases aggregate welfare.

Local land use controls present a research challenge because everybody knows them when they see them, but coming up with a complete, comprehensive, measurable, and empirically testable definition is nearly impossible. This is both a language problem and reflects the wide variety of approaches to regulation. Zoning is the single term most often used to describe land use regulations, yet it is far from comprehensive. Strictly, it identifies allowed uses, structure density, building heights and massing, and placement on a lot. Often in research work this entire mix of activities is either reduced to a single measure such as the capital (structure) to land ratio or a dummy variable for a class of zoning that identifies the allowed use. More problematic is what zoning does not cover: exactions and fees, heritage preservation, growth limits, the dynamics of the planning review process, requirements for off-site infrastructure, rules on the amount and configuration of on-site local infrastructure such as drainage systems, sidewalks, gutters, and streets, the nature of the variance process, and anything that is not codified. It is this last element that causes the greatest difficulty because empirical analysis requires that a phenomenon be measured. Despite this breadth, it is not uncommon to proceed as do

Glaeser and Gyourko by saying zoning, but really meaning either land use regulation more generally or a specific aspect for which the researchers have a measure.

The relationship between regulations and affordability has been much more the subject of assertion and speculation then of study. The nexus is always implicit: if regulations increase house prices, then they must worsen affordability. However, correlation is not causation and if the consumption bundle is improved through the elimination if negative externalities, the quality controlled price may be lower. That the explicit effects of regulations on affordability have not really been studied is not for lack of interest in affordability. Numerous papers and especially reports by governments, institutes, and interested parties exist on both the affordability of homeownership and of rental space. It is in looking at this relationship in greater detail and with more sophistication that Glaeser and Gyourko make a contribution to the literature.

Glaeser and Gyourko rightly observe that housing affordability is composed of a housing market and a labour market problem. For the former, if regulations act primarily to constrain supply, they will result in increased rents and prices. All else being equal, i.e. without any change in incomes, this will worsen the affordability of a given housing consumption/ownership bundle. For the latter, when jobs are unavailable or wages for those with lower levels of human capital are extremely low relative to the aggregate income levels that determine land prices, then the poor will find consuming a fixed amount of housing requires a greater portion of their income.

The most important contribution of Glaser and Gyorko is that they clearly focus the discussion of land use regulation and housing affordability on the effects on housing supply. This is where the constraints on housing supply that regulation are presumed to have will affect housing market outcomes. This is in contrast to preceding work on this subject, which has tended to compare house prices or rents with incomes. In doing so, the existing work on affordability just mixes housing and income issues without offering clarity on causation.

Glaeser and Gyourko compare housing prices to structure value to identify the effect of land use regulations. The intuition in this approach is that while supply restrictions will shift in the supply curve, thus increasing the equilibrium – and marginal - price of housing, the marginal cost of the structure itself will be unaffected, or actually fall as the demand for inputs shifts in. The greater this gap, the greater the affect regulations have had in moving away from the market equilibrium. Glaeser and Gyourko's regressions, then test whether this difference between house prices and structure costs can be explained with higher levels of regulation. While there's is not a unique method, Fu and Somerville (2001) present a model that measures regulatory strictness via the difference between the marginal price and cost of density, they are the first to emphasize the link with affordability.

As noted above and developed further below, the explicit, thorough, academic literature on regulation and affordability is sparse. The greater part of this review focuses instead on the broader land use regulation literature to help understand the approaches, innovations, and problems in this area of study. As the purpose here is to highlight the important issues and discuss some of the more notable papers in this area, I present only a small subset of the papers on land use regulation. For more complete reviews of the empirical literature on growth controls and zoning, see Fischel (1990) and Pogodzinski and Sass (1991) respectively.

The structure of the material presented here is as follows. The review is divided into two sections, the first on land use regulation and the second on affordability. Within the former, the discussion is separated into a brief summary of the theoretical literature, a presentation of William Fischel's arguments on understanding and measuring the impact of zoning and land use regulations, a discussion of data issues, and subsequent looks at different streams in the empirical literature. The second major section on affordability is more succinct because of the paucity of studies explicitly linking land use regulations and affordability.

Land Use Regulation Literature

Theoretical Predictions

While the primary purpose of this review is to examine the empirical literature as it relates to the paper by Glaser and Gyourko, some familiarity with the predictions from theory is helpful in understanding the empirical research. Pogodzinski and Sass (1990) provide a well written critical review of the theoretical work on zoning. They look at zoning as a constraint on density, the capital to land ratio, and on the allowed uses. The imposition of this type of constraint can restrict the supply of housing, constrain households' choices of their optimal consumption bundle, affect consumers' choice of locations, limit the effect of externalities, including classic negative amenity effects, but also negative externalities on the consumption of public goods and creation of agglomeration externalities, and reflect rent seeking behavior by governments and households who use zoning in the pursuit of self-interest. Different models, with different land uses, either homogeneous or heterogeneous agents, comparing existing land users to new potential entrants, and with alternative other assumptions and structure, can find that zoning either reduces or enhances welfare, depending on whether the reduction in consumer choice and higher prices and rents dominate the positive amenity effects from controlling negative externalities or not. In the end the Pogodzinski and Sass review makes clear that theory does not offer an explicit answer on the effect of zoning, because the results depend too heavily on model assumptions, where a range of different assumptions may all be reasonable.

The studies on the impact of zoning treat it as an exogenous force, which begs the question why do we have it? Attempts to identify the motivation for the adoption regulations have fostered two significant areas of research in economics. The first looks at the imposition of regulations by jurisdictions within the context of the interests of local governments. The second looks at land use regulations, typically at zoning, as an endogenous outcome rather than as an exogenous parameter.

In a seminal paper, Hamilton (1978) argues that any analysis of land use regulation has to look at the cost-benefit calculations of regulators. Hamilton's monopoly zoning thesis argues that the probability a government utilizes land use controls rises with their expected effectiveness. This he characterizes as a function of a jurisdiction's share of the market for developable land. Monopoly zoning is taken a step further in work by Helsley and Strange (1995), who model the land use regulation decisions by local government in a strategic context, where individual governments model the reaction functions of their neighbours in drawing up their policies.

One area that is important to developers, but that academics have neglected is the role of uncertainty. The outcome of the regulatory process is typically unknown, both in terms of outcome, time until an outcome is known, and the ultimate cost of the process. One of the few papers to look at this is Ellson and McDermott (1987). They examine the effect that uncertainty about zoning approvals has on the decision of firms to acquire raw land, apply for approvals, hold approved but as yet undeveloped land in a reserve, and the construct units. The important aspects of their paper are the uncertainty about approvals and the two stage process: raw land to approved land and then approved land to completed units. They find that while undeveloped land prices may be unaffected by regulatory uncertainty, the price of developed land rises. As well, the equilibrium outcome of this two stage process in the presence of uncertainty about the outcome of the regulatory process is a level of output below the level that would prevail in the absence of the uncertainty and multiple stages.

Zoning can help to mitigate the impact of certain types of uncertainty. The main purpose of Titman's (1985) paper is to show how real estate development can be understood as the exercise of a real option, and in this it is one of the seminal papers in the real options literature. The chief result for real estate development of this literature, is that development is delayed, less likely to occur, and lower in the aggregate when developer's face greater uncertainty.[3] Titman relates this to a positive effect of zoning, in that it can reduce uncertainty about future effects from development on neighbouring parcels.

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[3] The uncertainty has to be of the kind that delaying a decision allows the uncertainty to resolve itself.

Fischel's Contributions to the Study of Land Use Regulation

William Fischel has made a number of significant contributions to the study of land use regulation. His most notable work is his 1985 book on the property rights approach to zoning laws.[4] The main thrust of the text is to argue how zoning goals can be achieved through an allocation of property rights, an approach to externalities pioneered by Nobel Prize winner Richard Coase in the Coase theorem. Fischel argues that not only can the same outcome as with taxation or regulation of externality generating activities be achieved, but that given the way zoning works in practice, only the property rights approach can achieve the economic benefits associated with separation of uses at a minimum social cost. The book also makes a number of other important conceptual and empirical contributions.

Fischel offers perhaps the clearest presentation of the political economy framework for understanding why communities impose land use regulation. Regulations exist because residents see their interests served by controlling development. This can be either because it increases land values, creates an amenity, excludes a disamenity, or limits congestion of local public goods. Fischel demonstrates that the outcomes of this political process, the types of regulations and the allocation of costs and benefits, not only vary by location, rural vs. suburban vs. urban, but also depend on the relative power of the groups involved in the political process. For instance, existing residents in a suburb are more likely to enact regulations that yield benefits to them at the expense of developers and prospective residents than would be the case in an urban or rural setting.

In summarizing the existing empirical literature, Fischel (1990a) argues that much of the empirical work is poorly thought out. He identifies four key points that empirical work

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Otherwise the effect is just a higher project specific discount rate. This can stop a project from proceeding, but it is not real options process.

[4] The main argument of the 1985 book is summarized in Fischel (1987).

must recognize to adequately study the effects of land use regulations: 1) land use regulations must be viewed not as a set of distinct individual ordinances but "as a flexible and decentralized network of restrictions"; 2) the benefits and costs from land use regulations for individual properties are capitalized into property values; 3) the regulations imposed in a community are an outcome of a rational political process and must serve the interests of the group best able to control this process; and 4) the change in aggregate land values (both developed and undeveloped sites) is the best way to measure the net effect of land use regulations on social welfare.

The most important aspect of these criteria for understanding the empirical studies of land use regulation draws on point number 2 and 3. As is described below, the most common approach to land use regulations is to regress house prices on controls for housing characteristics (and hopefully location) and include a dummy variable to indicate the presence of some type of regulation. The coefficient on this dummy is thus deemed to identify the effect of the regulation on house prices. Fischel points out that just because this coefficient is not statistically different from zero does not mean that zoning has no effect. He notes that in an urban area where zoning has been in place for some time, the external effects of zoning will not be observed. When zoning is both flexible and rational, any time there are large potential gains from zoning arbitrage, as measured precisely by zoning caused differences in land prices across space, there will be pressure on the regulatory process to change the zoning. Thus, large price differences caused by zoning alone are unlikely to be observed in equilibrium, but zoning may be correlated with these factors. Furthermore, the rational process is likely to lead to incompatible uses being located, and thus zoned, at those locations that minimize their negative effects on other properties.

Data

Empirical studies of the effects of land use regulations face a number of challenges. First, as Fischel observes what matters is not the presence of an individual regulation or zoning ordinance, but the network of explicit and implicit controls, which is hard to measure. Unfortunately most studies just use a dummy variable to identify the presence of a single regulation of interest, which is the most naive approach. Second, the best way to study these regulations is to take advantage of the introduction of a new regulatory environment with variation across space or time. Instead, the vast majority of papers perform a static analysis using data from a single time period for a limited geographic area. Differences in the characteristics of regulations and the difficulty and cost of the survey work necessary for using data on multiple jurisdictions contribute to this choice. There are a relatively small number of papers that look at the effect of regulations on metropolitan area (in the U.S. referred to as MSA or metropolitan statistical area) measures such as starts and the MSA housing price level or mean/median house value. Researchers that do study inter-metropolitan differences either use their own survey data or take advantage of small number of published datasets that measure inter-urban differences in regulations.

There are not many examples of papers that use cross-MSA survey data. Black and Hoben (1985) used an Urban Land Institute (ULI) expert panel ranking of MSA land use restrictiveness. Their qualitative survey variable, while not “scientific”, has the distinct advantage over quantitative measures of being able to capture the whole atmosphere of explicit and implicit controls. Segal & Srinivasan (1985) also use a unique survey, in their case of planners, to get an estimate of the share of suburban land removed from the development process by growth controls. Both of these papers used small, focused surveys.

Two larger more detailed surveys have been used in a number of different papers. The first is the dataset assembled as part of the Wharton Urban Decentralization Project (Linneman and Summers 1991). In addition to a large group of economic, demographic, and public finance measures, the dataset includes the results from a comprehensive survey sent to local planners in 60 MSAs. The survey questions cover fees, zoning, growth management, and the time to negotiate the regulatory process. Glaeser and Gyourko choose to use only one of the variables from this data. Variables from the survey have been used directly in Mayer and Somerville (2000) and Somerville (1999), 2003). Malpezzi (1996) uses the data to construct an ad hoc index of regulation (variables are just summed), which others (Phillips and Goodstein 2000) have also used.[5] The other major survey data set is Glickfeld and Levine's (1992) comprehensive multi-jurisdictional dataset on growth control measures in California. They have survey responses from all 57 counties and 386 cities in California, with data on 18 different types of measures looking at a variety of different ways local governments control growth, including specific initiatives, caps on construction, and zoning. These data are used in Brueckner (1998) and Levine (1999).

Tests of Land Use Regulation and Prices

The basic empirical approach to test for land use regulation has been to construct a hedonic equation for house prices or values and then to add a variable of interest to that equation. The addition has been either a direct test, by including a measure of land use regulation itself – often a dummy variable for the type of regulation – or to try to identify the negative externalities that zoning is meant to control for. These studies typically exploit some cross-sectional variation in the regulatory measure or the location of land uses presumed to impose externalities to identify these effects. The underlying presumption is that if zoning is effective it should raise prices by ensuring that uses with negative impacts will not locate in the vicinity. However, if these non-conforming uses have higher land prices, which can occur with commercial uses or with higher density residential uses, then by preventing conversion, zoning will tend to depreciate prices, making identification problematic.

The standard defense for zoning has been that it is necessary to separate uses to prevent one type from imposing negative externalities on another. The validity of this explanation depends on the existence of these externalities. Among the first papers to test for negative externalities between broad classes of land uses are Crecine, Davis, and

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[5] Malpezzi (1996) also uses the American Institute of Planners (1976) survey of state level controls. With the exception of his paper and Shilling, Sirmans, and Guidry (1991), most researchers use local rather than state level measurement of regulations.

Jackson (1967) and Reuter (1973). They find that non-residential uses have no clear effect on residential values. However, as Fischel argues, not observing a relationship between zoning and price effects does not mean that zoning does not matter. As well, and because they cannot separate potential positive and negative effects, they do not have clear tests of the hypothesis of interest. A twist on this is pursued by Lafferty and Frech (1978), who find that it is not the fraction of land use in non-residential uses that matters for residential values, but its distribution: concentrated non-residential land use raises residential values, but diffuse use lowers them. One of the important implications of Lafferty and Frech is that it explains the introduction of use separating zoning as a rational decision by local residents. Rather than look at broad land use categories, Li and Brown (1980) look at the effect on single family house prices of proximity to specific commercial and industrial establishments, noise levels, and visual amenities. They find clear evidence that proximity to sites that have noxious externalities lowers land values.

A number of other papers find that zoning does not matter. Using data from Vancouver, Mark and Goldberg (1981 and 1986) look at several issues associated with zoning. First, whether a parcel's zoning affects its value. Second, if rezoning changes a property's values. Finally, what happens to prices for lots near rezoned properties? In general their results show little conclusive, robust evidence that zoning affects parcel values. The exception is their 1986 paper, where they find that lot size matters for up-zoning to higher densities: smaller lots that might not themselves benefit from a rezoning, because of redevelopment or land assembly costs, had no price effect; prices for larger lots, better suited for higher density redevelopment, rose. The authors conclude that zoning does not matter. This paper is a clear example of Fischel's chief criticism of the zoning literature, that treating zoning as an exogenous act is incorrect. For instance, the rezoning observed in Mark and Goldberg occurs exactly in those areas ripe for rezoning and is already captured in prices.

As previously noted, non-residential uses can have conflicting affects on residential land uses. Greison and White (1989) attempt to avoid the identification problem of positive and negative effects by using different dummy variables depending on the relationship between a site zoned single family and the surrounding land uses; whether they are consistent or not and whether they hold uses likely to impose negative externalities or not. Their results confirm the mixing of effects, that there are positive and negative but their small sample size mean their results are not statistically significant.

Most studies of land use regulations have been limited to zoning, but a number of others look at growth controls and a few examine the effects of impact fees or development cost charges (DCCs). Studies of growth controls have the advantage that their implementation is much more transparent than is the case for zoning. Katz and Rosen (1997) examine the price effect of growth controls in the San Francisco Bay Area using a hedonic specification for house prices and a dummy variable for the presence of growth controls. They found a rather large positive price effect from the presence of these controls, on the order of 17 to 38 percent. The magnitude of this effect raises concerns with their work about whether there are any excluded jurisdiction specific amenities that are correlated with the presence of growth controls. In fact, Schwartz and Zorn (1988) find growth controls in other Northern California jurisdictions only raised prices by 9 percent, though this difference may reflect the greater distance of their two communities from the San Francisco urban core then is the case for the communities studied by Katz and Rosen.

Black and Hoben (1985) compare a qualitative, survey based ranking of MSA land use restrictiveness with MSA land prices for standard suburban lots and unimproved acreage on the urban fringe. Like their measure of regulatory strictness, their dependent variable also comes from a ULI survey, this time of local real estate experts. Because they use stepwise regressions and a unique measure of regulations, coefficient estimates that can be compared with other studies are unavailable. They do find that a large part of the variation in land prices is accounted for by their land use regulation measure.

The bulk of studies of zoning have tended to focus on urban areas. However, there is a literature that looks at rural environmental zoning meant to preserve amenities. Spalatro and Provencher (2001) analyze the effects of minimum frontage zoning for lakefront property in rural Wisconsin designed to reduce development around lakes subject to resort development. The authors assume that owners of developed lakefront property prefer low density development, an amenity affect, but that since lake access is a quasi-public good the welfare effects may be negative. They find strong evidence for the amenity effects, as greater lakefront frontage requirements raised the price of undeveloped lakefront land. The economic loss from reduced development appears to be smaller than the gain from the amenity effect in their data.

Identification Problems: Externalities vs. Supply Constraint

A problem with single equation reduced form estimation is that improperly done it cannot differentiate between competing price effects. On the one hand there is the positive amenity effect from eliminating the threat of negative externalities. On the other hand there is the constraint on supply that will also raise prices. While the first provides a clear gain in aggregate social welfare, the latter is rent seeking behavior that is a transfer from prospective residents and owners of vacant land to existing resident-owners. There have been a number of different approaches to address this situation.

In their paper, Shilling, Sirmans, and Guidry (1991) attempt to address explicitly these different effects through their estimation procedure. They present a simultaneous three equation model (supply, demand, and equilibrium) that allows them to test for the effect of state level land use controls separately on supply and demand. To test their model they use data on Federal Housing Administration (FHA) financed new homes, using the average land price and quantity developed as dependent variables with broad descriptive measures of state level tools for regulating development, typically for environmental purposes. They find that land prices tended to be higher and building activity lower in the presence of these state level regulations. Unfortunately, the data do not allow for a clear differentiation of the supply and benefit effects because the link of the regulations to sites in question is never made clear, the effect on land prices never fully distinguishes supply and benefit effects, and the negative effect on demand is difficult to understand, unless it is operating via state-level employment.

One of the better studies on zoning and land use regulation that addresses benefit and supply constraint factors is Pollakowski and Wachter (1990). Their paper makes two important contributions. First, they look at how regulations in one area affect adjacent areas. This allows them to use spillover effects from unmet demand in the neighboring area with higher regulations that reflect the supply constraint element of price effects, since the amenity effects should be localized.[6] The other aspect of the paper is that they show that it can be important to capture the web of regulations, rather than just one aspect. Their paper uses data from distinct planning areas within Montgomery Co., MD, where each area has a different limit on the number of allowable permits and a different mix of allowable densities. Mixing hedonic and repeat sales techniques to control for unit quality identifying cross-sectional and inter-temporal price differences, they look at the evolution of prices in their sample. They find that individually the regulations do not have a statistically significant effect on prices, but that in combination they do. As well they find the spillover effect exists. Regulations, especially more restrictive residential zoning, drive up prices in a zone and in adjacent zones. One problem that both this paper and others that construct indexes have is that the index weightings are completely ad-hoc and we are never shown whether there is any robustness in the results across alternative constructions.

In rural areas and on the urban fringe, preservation of farmland is an important policy issue. Henneberry and Barrows (1990) examine whether the benefit to farmers from agricultural zoning laws that restrict non-farm development in agricultural areas outweighs the loss from a reduction in the lands development value. They obtain mixed results. Exclusive agricultural zoning has a positive effect on larger parcels, more distant from the city, where the short-run development potential is presumed to be small. For smaller parcels, closer to urban areas the reverse was true, indicating that for these parcels the reduction in development potential was more important. In identifying this distinction, this work provides a clearer test than the work that has preceded it, such as

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[6] A concern is that if the amenity affects are based on reduced congestion of public facilities, this positive benefit could spillover to adjacent areas, especially for traffic congestion.

Vallaincout and Monty (1985) who find that restricted zoning reduces farmland values in Quebec.

Modeling Government Behavior

Empirical studies have sought to use Hamilton's hypothesis to explain the extent and effectiveness of land use regulation. The approach is presented in Ozanne and Thibodeau (1983) and is reflected in more recent work by Potepan (1996), where the researchers use the number of political jurisdictions who have land use regulatory authority to measure the regulatory environment: the smaller the number of jurisdictions, the greater a given local government's share, and thus control and market power, of available land or the housing stock. These papers find that house prices are higher the smaller the number of jurisdictions. The monopoly zoning approach is limited because the only parameter of importance is a jurisdiction's market power in some part of the land market, there is no allowance for a response by the competing governments.

While not of direct relevance to the Glaeser and Gyourko paper, there is a very developed political economy literature that attempts to understand which jurisdictions impose regulations and why they choose to do so. One branch of this research focuses on the social-economic characteristics of jurisdictions that adopt regulations.[7] Rolleston (1987) tests this question in a more explicit economic framework, examining the tradeoff between the negative externalities associated with non-residential land uses and the presumed fiscal benefits from these uses for municipal government coffers. In her analysis she looks at both the type of land use and the type of restrictions on residential density.[8]

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[7] Papers in this area begin with Davis (1963) and include later work by Dubin, Kiewiet, and Noussair (1992).

[8] Albeit like most other researchers who construct an index of restrictiveness the indexes construction and weighting are completely ad-hoc.

Brueckner (1998) tests the strategic interaction model of Helsley and Strange (1995) using data on the land use regulations imposed by different local Southern California governments. He finds support, as distance between communities is an important factor in the government's choice of land use intensity. His paper builds on both the Helsley and Strange model and the empirical political economy literature that attempts to explain the decision to impose land use regulation as a function of the socio-economic makeup of a community.

Tine Series and Event Studies: Looking for Identification

Studies on the effects of land uses regulation tend to be static, examining the effect at a given point in time using a cross-section of states, metropolitan areas, jurisdictions, or zones. The first work to examine the effects over time is Avrin (1977), which while path breaking, has problems with identification of effects. Mark and Goldberg (1986) look at price changes in two different neighbourhoods in Vancouver, BC between 1957 and 1980 as a function of zoning classification, zoning changes, and whether non-conforming uses are allowed to enter. They find that their results vary between the two neighbourhoods, but that there is no robust evidence that zoning affects prices.

The more explicit time series studies take advantage of the introduction of new ordinances to conduct an event study. This approach has the advantage of addressing part of the problem Fischel identified that when zoning is working, large differences in land price are hard to observe. It is when a new ordinance is introduced that we might expect to see price effects. Chressanthis (1986) looks at the introduction of three separate ordinances, a unified zoning ordinance, a restriction on the locations of mobile homes, and stricter building codes on the price path of MLS mean prices in West Lafayette, IN. He finds that the introduction of the first, which allowed for the construction of lower price, smaller houses, in what had been the more exclusive and affluent community, depressed housing prices there, as prior to the unified zoning ordinance; the local residents had managed to exclude this type of housing. This paper and other event study and time series work face certain challenges in estimation. First, are unobserved temporal effects a problem? Second, any study that examines demand for land in one part of a larger labour market is going to subject to excluded variable bias. Third, it is critical to addressing the timing of the capitalization of expectations: if everyone knows a change is coming, the effect will be capitalized into land prices in advance of the actual introduction.

In the United States, the first wide-scale adoption of comprehensive zoning ordinances occurred in the early 1920's.[9] McMillen and McDonald (1993, 1998, 1999, and 2002) take advantage of this introduction and detailed data on land use and appraised land values for all tracts in Chicago to pursue a research program that studies effects of the 1923 introduction of a comprehensive zoning on land values and zoning choices in Chicago.[10] If zoning is primarily a benefit, from reducing negative externalities, the introduction of the zoning ordinance should increase aggregate land values, and especially in locations where conflicts are likely to occur. In their (1993) empirical work they find that decisions, whether to zone a block residential, non-residential, or allow mixed was primarily a function of the uses already in place on the block. More critically, they find that while excluding uses does raise land values in some areas, the effect is not sufficiently great for zoning to uniformly increase land values.[11] Their 2002 paper builds on this work, but finds a clearer and greater benefit from zoning. They use a difference in differences strategy to see what happened to land value growth rates in areas with different zoning. They find that land values rose faster in the residential only areas, despite grandfather clauses that permitted non-conforming uses to continue to operate and controlling for the tendency of the zoning board to assign non-residential zoning to blocks with low growth rates. This result is consistent with a clear benefit view of zoning, from the exclusion of uses with negative externalities, since residential growth in general was not constrained. One of the strengths of this paper is very strong econometric techniques that account for endogenous zoning, allow for price effects to be non-linear, and address concerns about spatial auto-correlation.

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[9] The first comprehensive municipal zoning ordinance in the U.S was adopted in 1916. The U.S. Supreme Court's ruling in *Village of Euclid v. Ambler Realty Co., 1926* that zoning was a permissible application of government police powers not requiring compensation to the owners for any change in economic value was the final catalyst for the widespread option of comprehensive citywide ordinances.

[10] Chicago has further advantages that by the early 1920's the city reflected the 50 years of unregulated development that followed the Great Chicago Fire of 1871, rather than any older patterns of land use.

[11] The actual test looks at how land values are affected by the mix of residential and non-residential uses on a city block: the value of a lot with non-residential uses is higher when it is located on a block with residential uses while residential values in industrial areas are unaffected by the percentage of lots on a block in residential use.

Supply Effects

A more standard approach to dealing with the problem of separating positive and negative effects is to identify how the regulation in question affects the supply of housing. Like Chressanthis, Thorsen (1997) uses time-series data, but looks at the effect of the introduction of a down-zoning on new construction. In 1979, McHenry Co., IL introduced a zoning ordinance to preserve farm land in the unincorporated area of the county, raising the minimum lot size per structure on agricultural land from 5 to 160 acres.[12] Thorsen finds that over the first five years the change had no meaningful effect on the number of starts, which he ascribes to grandfathering. Thereafter, starts are lower.

Levine's (1999) work on local growth controls uses the Glickfeld and Levine (1992) California data. Like Thorsen, he too finds that growth control only restrict growth with a lag because builders act with foresight. More importantly, he finds evidence that when only a part of jurisdictions in a region undertake controls, the reduction in aggregate construction is dampened because growth is redistributed to areas with fewer controls. The result is sensitive to demand and supply side elasticities and demand conditions, and the supply of available land that Levin does not address. Even so, diverting demand to other areas would cause a welfare loss as those diverted would not have their first choice of location.

Mayer and Somerville (2000) look at the dynamic effects of regulations on housing starts. They use a panel of MSAs and a structural model of new construction to show that land use regulation not only lowers the steady state level of new construction, but can also reduce the speed of adjustment of new construction to demand and cost shocks. They find that purely financial regulations, such as development fees, have a much smaller effect on new construction activity than regulations that induce additional delays and lengthen the construction process.

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[12] The down-zoning was upheld in a famous court decision: *Wilson v. County of McHenry, 1981*.

There are a small number of other supply studies of interest. Mayo and Sheppard's (1996) evaluation of variation in regulatory oversight and housing supply in Korea, Malaysia, and Thailand; McFarlane (1997) and Skidmore and Peddle=s (1998) work on building permits and impact fees; and the rudimentary regressions by Glickfield and Levine (1992) on local growth control initiatives and construction activity in California. Overall, the supply side works shows that land use regulations do reduce supply, indicating that at least some part of the price affects attributed to regulations are a result of reductions in supply, rather than merely reflecting a positive amenity associated with the controls.

Endogenous Zoning

The endogenous zoning literature asks whether zoning changes to reflect market conditions, so that in the long-run it is consistent with market demand. In this framework, any observed price effects for zoning are just a short-run transitional phenomenon. This approach argues that zoning really does not matter because it ends up replicating the market. The first explicit empirical test of this hypothesis is Wallace (1988). She makes the fundamental contribution by showing that given an underlying process for generating zoning by local governments, simple tests of the relationship between a land use category and land prices will be biased because of a sample-selection process by the governments. Her correction offers the test for whether zoning follows the market, responding to economic stimuli, which she finds to be the case for most land uses.[13]

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[13] Wallace's work is expanded upon and refined using different data and specifications by McMillen and McDonald (1989 and 1991) to examine how the selection bias affects estimates of land price gradients.

Pogodzinski and Sass (1994) attempt to integrate this endogenous zoning literature with the more general analysis of the impact of land use regulations on the operation of housing markets. They do so by looking at how local fiscal and zoning variables affect the estimated implicit prices for housing characteristics in hedonic regressions on single family house prices. Unlike the other papers in the endogenous zoning literature, they do not focus on the selection of allowed land use types (they are limited to the percentage single family rather than a menu of different residential and non-residential uses), but at characteristics such as minimum lot area, set backs, and maximum height requirements. They find that zoning decisions reflect fiscal returns, exclusionary behavior, and that it also follows the market. This mix suggests that jurisdictions are weighting the tradeoffs among competing costs and benefits to zoning ordinances.

Housing Affordability: Rental and Ownership

Defining Affordability

A problem with the affordability literature is in understanding just what affordability means. Many reports and advocacy groups decry the loss of affordable housing, yet there is no single accepted definition of what defines this stock. The most naive approach is to determine housing expenditures as a percentage of income and identify the percent of the designated population paying above some level, typically 30-35 percent.[14] A slightly more sophisticated approach is to identify those units affordable to renters whose household income is a given percentage of the MSA median household income without fully compensating for quality (Nelson [1994] and Nelson and Vandenbroucke [1996]). Among the standard approaches, the most complete is that used, albeit in different forms, by CMHC and the U.S Department of Housing and Urban Development (HUD). This methodology identifies a rent cutoff associated with a given level of unit quality and a designated appropriate size. This is then compared with the distribution of renter incomes. An alternative that is more accurate is to use a consumption bundle-based shelter-poverty methodology such as Stone's (1993). This approach determines whether household income net of paying for a threshold non-housing consumption bundle is sufficient to obtain housing of an appropriate size and quality. The advantage of this technique is that it does not impose a determination of the "appropriate" percentage of income one should spend on housing. However, because it is much more data intensive and subject to difficulty in determining the appropriate non-housing consumption bundle, it is rarely used.

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[14] For rental units this will be based on what renters actually pay. For home ownership the study will identify a sample house, set a down payment percentage, and compare the derived mortgage payments to incomes.

Affordability Research

Affordability research can be separated into work that examines home ownership and papers that look at affordability issues for renters. Much of output that examines access to ownership comes from reports such as the RBC Financial Group's Annual Affordability Index.[15] Reports like this with greater and lesser degrees of complexity and accuracy look at the percentage of a population whose income allows then to make mortgage payments on a typical home. Evidence on rental affordability is fewer and less frequent. In the U.S. reports such as *Rental Housing Assistance at a Crossroads* (1996) have helped to identify the problems facing America's poorest households in obtaining suitable and affordable shelter. CMHC has also sponsored a large number of research reports on a wide variety of issues connected to the provision of affordable housing. For instance, Melzer (2001) uses 1996 Canadian Census data to look at the group of Canadians with inadequate housing, yet spending more than 50 percent of their income on housing.

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[15] In the United States the *State of the Nation's Housing* (annual) produced by the Joint Center for Housing Studies does much of the same type of work.

Land Use Regulation and Affordability

Homebuilding and developer industry advocacy groups such as the Urban Development Institute and the Canadian Home Builders Association have been keen to identify the dollar cost of government actions on homebuilding, from levies such as fees, taxes, or development cost charges.[16] These organizations then claim that these costs contribute directly to problems with affordability. Since there is no efforts to measure the benefits households receive from the monies raised by these costs, it is impossible to identify their true effect on homeownership affordability without making a series of assumptions, some better and some worse.[17] More serous work identifies the net cost of regulations and observes that any increase in costs not matched by benefits must exacerbate problems with affordability. Glaeser and Gyourko fall into the latter category. They differ in that instead of measuring the explicit effect of regulations on prices, they look at how prices diverge from input costs. This they cite as the effect on affordability.

It is quite surprising that while one of the policy concerns relates regulation to questions of affordability, little work has explicitly examined this connection, though Somerville has a 1995 CMHC report that discusses the relationship. In his 1999 work on regulation in Waukesta Co., WI, Green tries to identify this effect. His measures of regulation are explicit zoning by-laws on minimum requirements for setbacks and frontage, lot and street widths, gutter curb, and sidewalk requirements, and whether mobile homes are allowed. While he does not find any effect on rents and homeownership rates, Green does find that restrictions on mobile homes and increased frontage requirements both increase prices, and more critically for affordability issues, reduce the percentage of units below a threshold deemed to be affordable.[18]

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[16] CMHC also has a report (Lampert, 2002) on the same subject.

[17] For instance, DCCs levied to pay for public infrastructure valued by homeowners may raise house prices, making the purchase more difficult, but also increase consumer welfare. With out comparing marginal and aggregate costs and benefits it is impossible to evaluate their net effect. Industry groups view the GST as a tax making homeownership more unaffordable. However, economists typically view consumption taxes as more desirable than income taxes or taxes on capital.

[18] Green uses $75,000 as the affordable threshold, using the criteria of loan eligibility (based on Fannie Mae/Freddie Mac guidelines) for a two income household with both adults employed as blue-collar

The biggest problem with work on affordability and regulations is that it focuses on homeownership. Studies on rental affordability have focused on trying to measure the affordable stock.[19] Nelson and Vandenbroucke's (1996) do not explicitly look at regulations, but their seminal work charts the size of and change in the aggregate low-income housing stock. They use the panel nature of the American Housing Survey (AHS) metropolitan area survey data to chart the movements of individual units in and out of various segments of the low-income housing stock. Critically, theirs is the first work to look at the relationship between these movements and measures of the overall MSA housing supply and some neighborhood characteristics.

In a report for CMHC, Corbett (2002) examines the effect land use relations have on limiting the use of mobile homes or manufactured housing as a source of affordable units. They show in great detail how widespread the limitations by municipal governments are on this type of unit. The problem is zoning, building codes, and other type of by-laws. The focus of the work though tends to be on policy recommendations to remove inter-provincial barriers for the industry.

A different twist on affordability and zoning is found in Somerville (2003). He identifies the relationship between government controls on housing supply and changes in the stock of market housing affordable to low-income households. In sharp contrast to other supply side work that looks at new construction of for-sale units, this paper focuses on the supply of affordable rental units from the existing stock. It is the first effort to test how government controls on the construction of new units affects the supply of affordable rental accommodations using a filtering model, where units move between quality sub-markets depending on demand and the maintenance, renovation, and repair decisions of landlords. The paper finds the greater the supply elasticity for new construction, the less likely are affordable rental units to filter up and out of the

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workers in manufacturing in the area.

[19] Among the many papers in this literature are Bogdon, Silver, and Turner (1994) on the relationship between affordability and adequacy, Nelson (1994) on the match between the affordable stock and low-income households, and O'Flaherty (1996) on the economics of homelessness.

affordable stock; restrictions on new construction are likely to reduce the affordable stock as it increases the probability that an affordable unit becomes unaffordable; and a surprising result that as the percentage of rent controlled units in an area rises, the remaining affordable non-rent controlled units actually have a lower probability of filtering up relative to staying affordable.[20]

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[20] Somerville argues that this might be an artifact of a selection bias in the identification of market-rate units that are affordable in the presence of rent control; these units might have lower unobserved quality or suffer from a negative externality from poorly maintained rent control stock.

SECTION 3:
THEORETICAL ISSUES IN GLASER AND GYOURKO'S ANALYSIS

Introduction

Glaeser and Gyourko's analysis of the effect of land use regulations on housing affordability is fundamentally correct, but several methodological flaws that weaken the form of their argument.[21] The way they model and test their hypothesis is both simple and subject to both specification and left out variable bias. These errors mean that they are likely to find that land regulations have a much larger effect on the gap between the cost of constructing a structure and the price for which it sells than is actually the case. Furthermore, their focus on single family owner-occupied units, that is ownership affordability, ignores the more important problem of shelter affordability for the least well-off members of society.

Glaeser and Gyourko's Approach

In their paper Glaeser and Gyourko present three related theoretical approaches to motivate their tests for identifying the effects of zoning on affordability. One is based on the difference between the marginal and average values of land. The second compares predicted and actual density. The third is to test for a correlation between high land prices and the presence of land use regulation. These describe regulation as a process that affects the supply of new units. As such, they reflect their basic premise that the only aspects of the problem of housing affordability that are a result of the housing market are those that affect housing supply. Explicitly, if zoning worsens affordability, we should see this by finding a wedge between the cost of constructing units and the market price of these units. With this as a starting point, they then generate estimating equations to be used in the empirical analysis.

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[21] One complaint the author of this text has is that while Glaeser and Gyourko use the term zoning, at times their arguments refer to land use regulations more generally.

Glaeser and Gyourko's theoretical treatment of these approaches share certain features. First, they characterize regulations as a lump sum cost per housing unit. The implication is that regulations neither affect the composition of inputs into or the make-up of the housing services provided by the unit nor do they generate any benefits that manifest themselves in a higher land price.[22] Second, although capital appears on the cost side, it does not enter the demand side; instead the inverse demand function depends on the quantity of land alone, or in the second approach land and local amenities. For this approach to be consistent with the literature and what we know of housing consumption there has to be an assumption of a fixed ratio of capital to land, which holds within and across metropolitan areas.

Urban and housing economists have taken a variety of different approaches to characterizing the housing consumption functions. Households are either assumed to derive utility directly from structure capital K and land L or more typically from the consumption of housing services H. With the latter approach, there is a production function that converts structure capital and land into housing services: $H=F(K,L)$. With this specification, regulation induced changes in land prices or constraints on the capital land ratio K/L from regulations affect the amount of housing services through substitution in the production process. Glaeser and Gyourko assume this away, in favour of an approach that makes it easy for them to derive a test for the impact of regulations. While the underlying logic of the test is correct, its expression is not.

Utilizing a more standard approach, let the inverse demand be a function of housing services:

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[22] They do indicate that they ignore this aspect: "we have done nothing to assess the possible benefits of zoning, so we cannot suggest that zoning should be eliminated." The article is critical of zoning as a feature of housing markets that raises costs, but if residents value those amenities, than on the whole that the bundle is more expensive may not be a problem.

$$P(H) = P\{F(K,L)\} \tag{1}$$

The derivate with respect to land is now as follows:

$$\frac{dP}{dL} = \frac{\partial P}{\partial L} dL + \frac{\partial P}{\partial K} \cdot \frac{\partial K}{\partial L} dL \tag{2}$$

$$\frac{dP}{dL} = p + \frac{\partial P}{\partial K} \cdot \frac{\partial K}{\partial L} < p \tag{3}$$

The signs of the derivates are as follows: $\partial P/\partial K > 0$ but $\partial K/\partial L<0$ by substitution in the production process. Consequently, we would expect the hedonic estimate of the implicit price of land to be biased downward. As a result, the findings in Table 4 will tend to imply an exacerbated problem with regulation. This goes at least part of the to explaining why Glaeser and Gyourko find that the regulatory cost in Anaheim of $36.10 is 12.5 times as high as their imputed price of land, a difference well in excess of any reasonable assessment.

Characterizing Regulations

Given the wide range of forms that land use regulations can take, it is hard to characterize them in a simple single equation expression. Zoning regulations either constrain unit characteristics to be above or below some threshold, limit the locations of land use type, or restrict the capital to land ratio (usually in the form of a maximum floor area ratio of building space to land area). Growth constraints create a vertical segment in the supply curve by operating either as caps on the number of new units or as restrictions on the locations where they can be constructed. Development cost charges force developers and builders to pay up front charges for public infrastructure, where the marginal benefit to future residents of the project of the improvements can typically be expected to be below the marginal cost charged.[23] Finally, the regulatory process with uncertainty, delays, and the time and financial costs of proceeding through the hoops and clearing the hurdles placed by municipal guidelines and various boards of variance, design, and planning is a particularly hard form to characterize in a simple equation.

Glaeser and Gyourko take a very simple approach, expressing regulations as a lump sum fixed cost. While this is a gross simplification of complexity alluded to above, and one undertaken for mathematical convenience in generating the estimating equation, at a philosophical level, it is not egregious. The first reason why the simplification can work is that most constraints can be converted into a financial cost. All regulations impose some explicit monetary cost. Those that force a developer to build a unit with attributes different than what they would choose to do can be characterized in financial terms. Two ways exist to quantify these costs. One looks at the cost of overcoming the constraint, the second looks at the utility loss that it causes.

With sufficient time or money, and assume that all time costs can be converted to monetary costs, various regulations such as minimum building standards, placement and siting on a lot, density, or lot sizes can be overcome.[24] This can be via a sufficiently high payment, either as an illegal or quasi-legal payment for a vote or though the provision of amenities to any affected individuals or to the regulating jurisdiction, or by working through the appeals and electoral process for a sufficiently long time. Usually, if a developer is willing to fight long and hard (read spend enough money) enough, approvals will eventually be forthcoming.

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[23] If the marginal benefit (MB) to future residents exceeded the marginal cost (MC) of providing the infrastructure we would expect profit maximizing developers to provide infrastructure that would increase the price buyers would be willing to spend by more than the cost of providing it. However, this private solution might not occur if the relevant scale of infrastructure exceeded the size of individual developments. In that case it would be more efficient to have the government administer the construction, using DCCs. This is not to say MB>MC, but that the absence of a private solution is not evidence that MC>MB. Second, if the infrastructure yields positive externalities, so that individuals not in the developments benefit, than even though the MC>MB for the development in question, it is worthwhile from a social perspective. The problem for an economist is making a developer pay for something that benefits the public in general. The efficient solution is to provide a subsidy to the developer for the part that is the gap between the MB of the future residents of the development and that of society.

[24] The empirical evidence for this claim is the large number of papers such as Wallace (1998) and McDonald and McMillen (1991) that show that zoning follows the market. Discussions with developers support this observation, that persistence results in changes, and that after some developers get approvals, it is easier for others.

The second way to characterize the diversity of government regulations as financial costs is by identifying the dollar value of the divergence from the optimal outcome.[25] This can be done on either the demand or supply side. When regulations force consumers to consume a bundle different from their optimum, given incomes and market input prices, then the amount consumers would be willing to pay to return to their optimum is one measure of the dollar cost. From the supply side, the solution uses shadow prices. Let X define a vector of housing characteristics. The inverse demand curve is $P(X)$ and there is some cost function $C(X)$. The constraint bundle is $\hat{X}$, so that firms solve the following equation:

$$\max_{X} \quad \pi = P(X) - C(X) + \lambda(X - \hat{X}) \tag{4}$$

Here λ is a vector of shadow prices. While this works well for those zoning regulations that alter the consumption bundle, for instance through mandatory large lot zoning, curb and gutter requirements, or rules on setbacks, it is a particularly poor methodology for explicit supply restrictions or anything that increases production costs without clearly affecting the set of characteristics in the final bundle.

The biggest conceptual problem with the Glaeser and Gyourko approach is that they ignore the Fischel critique: regulations are the outcome of a political economy process with rational utility maximizing agents. Some bloc of interests benefit from regulations and this should be reflected in the model. The motivation can be either rent-seeking, as existing residents use quantity restrictions to extract the surplus from owners of raw land, or by creating a benefit from controlling negative externalities, protecting congestible public facilities, or smoothing growth paths. Depending on how a regulation induced benefit, and land consumption actually enter the utility function, Glaeser and Gyourko's empirical tests will yield biased coefficient estimates.

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[25] This can be done by comparing the outcome without externalities – based on estimates of the supply and demand curves with and without regulations. The loss in producer and consumer surplus, which is measurable given the estimated curves, is the cost. Measuring these accurately, though, is not easy.

Land use regulations that create benefits or protect amenities should increase both supply costs and the price consumers are willing to pay for the house. The former holds because of the cost of meeting the constraint, while for the latter it is because utility is rising in the amenity. As long as the benefit is not linear in the quantity of land consumed, the first empirical methodology that the authors use, the difference between house prices and construction costs or the ratio of the two, will yield a biased result. Prices should be concave in land consumed: $P`(L)>0$ and $P``(L)<0$. Thus, the benefit does not increase with additional land consumption, forcing a concave price function in land.[26] In the context of regulations tied to land, this might arise if the benefit associated with a location, and thus consumption of land, exists from being in a location, but is independent of the amount of land consumed, for $L>0$. Most location specific amenities, including those caused by zoning would fall into this category. By Jensen's inequality, the marginal price of land as estimated from a hedonic equation will be less than the average price of land captured in the price: structure cost ratio or difference (the extensive land cost). If regulations cause or are correlated with the benefit, the gap between the marginal and average prices will be positively correlated with them. In the Glaeser and Gyourko tests, they would find that regulation worsens affordability. This claim is invalid because the measure of the cost of regulation results from a specification error on their part.[27] Drawing an explicit conclusion about the relationship between regulations and affordability is then problematic because in addition to the cost side, one has to measure the income elasticity of the amenities delivered by regulation.

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[26] The concavity of price with respect to land should hold in any event if the utility function is typical, so that the bias holds even without a benefit that this non-increasing or severely concave in land consumed.

[27] The precise effect depends on the income elasticity of the benefit. If it is income elastic, then setting a level of the benefit through regulations equal to what richer households would want, would yield a level different than that chosen by poorer households. In this case the utility gained from the increase in the benefit is more than offset by the negative effect of higher house prices.

The second methodological approach used by Glaeser and Gyourko does include benefits in their formulation. House prices depend on land and local amenities. However, they assume that while the monetary cost of regulations in the supply equation varies across communities the amount of capital consumed does not. This conflicts with the standard urban theory described above, where *K* will vary with the price of land, which captures among other things location specific amenities and regulatory costs.

Urban Form

Most urban economic analysis is rooted in the Alonso-Mills-Muth monocentric model of urban form. However, more recent theoretical and empirical work has looked at urban form in the presence of sub-centers, reflecting the decentralization of employment aptly presented in Garreau's Edge City (1991). Urban structure has implications for the analysis. In particular, areas with more centralized employment will have higher average house prices. Since one part of the Glaeser and Gyourko analysis looks at the ratio of price per square foot to construction cost per square foot, failure to control for this type of difference in urban form across cities can bias their results.

In the monocentric model equilibrium house rents depend on city size, measured by the distance from the core to the city border b, unit transport cost k, structure cost c_h, discount rate i, and agricultural land rent r_a. At time T and distance d from the city center (so $b \geq d$), the price of a house is given by the present discounted value of house rents:

$$p(d,t)=\int_T^{\infty}\left[r_a + i\cdot c_h + k(b_t - d)\right]e^{-i(t-T)}dt \tag{5}$$

Compare the price of the median house a distance $\bar{d}$ from the city center with the price of a house in a completely polycentric city. In the latter case, all production takes place in the home – think of everyone with a home office – and there is no rent gradient, because all locations are equally well located. The location premium term in equation (5) will be missing in the world of home offices. Prices in this extreme polycentric city must always be equal or below land prices:

$$p(\bar{d},t)=\int_T^{\infty}\left[r_a+i\cdot c_h+k(b_t-\bar{d})\right]e^{-i(t-T)}dt \quad \geq \quad p(t)=\int_T^{\infty}\left[r_a+i\cdot c_h\right]e^{-i(t-T)}dt \tag{6}$$

Thus, in the Glaeser and Gyourko context, the ratio of price to construction cost will always be higher in a more concentrated urban center. As a generalization, cities in the Sun Belt tend to be more decentralized and in the common perception less regulated. If this is true, the estimates of the effect of regulations on price: cost ratios will be biased upwards. This would be even more exacerbated if cities with stronger urban cores impose more regulations.

Marginal vs. Average Prices

One of Glaeser and Gyourko's tests for the effect of land use regulations is the difference between the marginal and average price of land. If the marginal price is lower (higher) than the average, landowners would have an incentive to subdivide (assemble) land and profit. Without regulations **and** subdivision or land assembly costs, arbitrage will cause these to be equal. A necessary but not sufficient condition for zoning that distorts the market by forcing land into lots larger than those demanded by consumers is for the marginal price of land to be below the average price. This is indeed what Glaeser and Gyourko find. The question is whether this is evidence of zoning acting to constrain supply, in this case of smaller lots. The answer is that the evidence presented is insufficient to reach a meaningful conclusion.

Transaction costs associated with subdivision and the distribution of lot sizes in a metropolitan area can both work to create a wedge between area average and marginal prices without distortions caused by zoning. Papers by Colwell and Munneke (1999), and Thorsnes and McMillen (1998) find that land prices per square foot are either constant or declining in lot size. The downward element occurs for large lots where there is a need to take land away from end users to create infrastructure such as roads, not because of zoning constraints. Colwell (1999) highlights the multitude of non-regulatory transactions costs associated with subdivision and assembly that create non-linearities in land prices, and thus deviations between average and marginal prices. Furthermore, he emphasizes that land is not atomistic, the arrangement of the lot, between frontage and depth, matters considerably for value.

There are a number of potential problems with an empirical test of this phenomenon. If the demand at the margin that is determining the coefficient on lot size reflects demand for larger suburban lots, it will be lower than the average, since the average also captures the values for smaller urban lots, which by virtue of their location command higher land values. The arbitrage condition will not apply since the suburban lots can not be subdivided into land in other locations. More problematic, is that as Rosen shows extracting demand curves, which is necessary for comparing the marginal and average values is problematic. Hedonic prices reflect tangency between implicit offer and supply curves and not an intersection. Finally, the implication of the coefficient on land for this type of test is sensitive to the specification. For instance, if we use a semi-log functional form, which is much more common in hedonic analysis than a linear form, then the coefficient will mean that the marginal value of land does vary with the estimated unit value, since the coefficient in that specification describes the percentage increase in house value from a unit increase in lot size.[28]

In their regressions, Glaeser and Gyourko do not directly test whether the measured zoning tax is a function of large lot zoning. Even though the Wharton data set that they use in their regressions has measures of the supply vs. demand balance for different groups of lot sizes, Glaeser and Gyourko choose instead to use a time measure that indicates how long the regulatory process takes. We might expect this measure to be correlated with other types of zoning restrictions, but it need not be.

Vintage Effects

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[28] Glaeser and Gyourko use a linear hedonic equation for house values. This has more typically been estimated using a semi-log specification. Many authors have used a Box-Cox test that compares linear vs. log-linear form and never in my recollection have they found linear to be the correct specification.

The characteristics of the housing stock vary across cities in part because of the differences in the economic conditions that prevailed at the time units were built. Structure characteristics and structure densities reflect economic conditions at the time those areas of a city were constructed. Cities with older housing stock tend to have smaller denser developments because incomes were lower and transportation costs higher when the older structures were built. If income and population growth has not been sufficient high to encourage the redevelopment of the older areas, then a greater portion of the housing stock in these older cities will not reflect current demand. This has implications for the price: structure cost ratio that is one of the key parameters in the Glaeser and Gyourko paper.

One of the points O'Flaherty (2003) raises in his commentary on the Glaeser and Gyourko paper is the naïve treatment of depreciation. They assume that all structures depreciate following a fixed step-process.[29] This makes depreciation a structural parameter rather than a choice variable for building owners and occupiers. However, maintenance of structure is an economic process, as owners invest in the existing structure in response to rents, maintenance input costs, a building's age and quality, and the price of new structures.[30] The AHS data that Glaeser and Gyourko choose to use to estimate house value do not adjust effectively for unit quality, only for gross structural characteristics and building age. Consequently, we would expect Glaeser and Gyourko to underestimate the value of the structure in those cities where owners have had greater incentive to invest in maintenance, renovation, and repair. These would be in faster growing cities.

Both of the effects described here can result in biased coefficients because unit quality is an excluded variable. Following Fischel's approach, assume for the moment that land use regulation is greatest in cities with greater growth, as local residents either respond to congestion in public infrastructure, strive to preserve the vanishing "essence" of their communities, or take advantage of greater opportunities to extract rents from owners of undeveloped land and from people who would like to enter their community. From above, we would then find that stricter regulation is correlated with newer structures, more investment in maintenance, and higher quality older structures. Since, the method Glaeser and Gyourko for depreciating biases their estimates of structure value downward in just these types of cities, and by symmetry upward in cities with lower incentives for redevelopment and investment and maintenance, they will find higher price: structure cost ratios to be correlated with the presence of regulations. This is not causation. Both the stricter regulatory environment and the higher price: structure cost ratios are caused by the same factor, growth, and it is an econometric failure that causes the regulatory factor to be assigned a causative role. If there were accurate controls on structure quality and historic patterns of maintenance and repair for each unit, then this bias could be avoided. That, however, is not readily done with the data.[31]

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[29] They use dummies for 5 age groupings and regress building value per square foot on these age dummies to extract their depreciation factors.

[30] The theoretical treatment of this process is well documented in Sweeney (1974) and Arnott, Davidson, and Pines (1983). Empirical evidence of this can be found in Bogden (1996), Montgomery (1992) and Somerville and Holmes (2001).

The second approach to estimating the effect of regulations on affordability looks at density. The implication of the basic urban model is that higher prices should increase density. Aside from the flawed assumption taken for mathematical convenience that K will not vary with the regulatory cost, this approach ignores the role of history. First, central cities are not fixed. The size of the central city and its characteristics relative to the metropolitan area vary dramatically. San Francisco is small in population and land mass relative to the San Francisco CMSA, and effectively has no vacant land. In contrast, the City of Houston is large relative to the area of the Houston MSA and has substantial tracts of raw land available for development. Thus average densities will differ dramatically, even if the metropolitan area house price levels are the same. Second, history matters. The standard urban model upon which the specification rests essentially is a city without durability. As land prices change, houses are instantly remade with the appropriate *K/L* ratio. However, with durable capital, cities will have densities that reflect historic patterns of growth. A city that grew a lot between 1850 and 1940, but not afterwards will have a density pattern that reflects a period of lower incomes and without automobiles. This is very different from a city that has grown in the age of the automobile, and perhaps that because of topography has a smaller land base.

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[31] More recent AHS surveys do provide information on renovation and repair activity for the two years prior to the survey date.

Price vs. Rent

The Glaeser and Gyourko paper focuses on affordability through the lens of house prices. This is not to imply the challenges in helping Canadians to transition between renting and owning is not important, especially given the evidence that homeownership generates a number of important neighbourhood externalities (see Coulson 2002 among many others). However, it is the opinion of this author that this is less important than the challenges facing poorer Canadians in finding affordable accommodation.[32] If prices and rents track together perfectly, this should not be a problem. However, both theoretical and empirical evidence suggest that a correlation between current rents and current prices is below one. DiPasquale and Somerville (1995) show that capitalization rates derived by comparing prices and rents for comparable properties range by a factor of two, from 5.06 to 10.00 percent in the years and MSAs they study, across metropolitan areas. These were lowest in the high price cities, suggesting that the variance in rents is lower than that of prices.

The classic model of housing as a financial asset generates the result that house prices are a function of discounted rents. The correlation between current house prices and current rents depends on expectations of growth in future rents. As the expected future growth rate increases, the wedge between current prices and rents will grow as the rental capitalization rate falls. From (5) we can characterize the growth in rents as a function of the growth in city size, as more people move to a city the border expands, driving up rents at all internal locations. For a known growth rate *g* to model the growth in b_t over time, the relationship between current rents and prices can be described by solving the integral in (5) as:

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[32] Somerville (1995) points out that for 1991, in over half of surveyed CMAs, the median poor renter paid over 45 percent of their income for housing.

$$p(d,t) = \frac{r_a}{i} + c_h + \frac{k(b_t - d)}{i} + \frac{kb_t g}{i(i-g)} \tag{7}$$

The first three terms describe the capitalization of current equilibrium rents into a price, while the last term is the capitalization of future growth in rents. This last term is strictly increasing in the expected future growth rate *g*. Thus, cities with high and thus unaffordable house prices may still have reasonable rents. Empirical evidence finds clear variation across cities in capitalization rates, which differ by up to a factor of two (Phillips (1988) and DiPasquale and Somerville (1995)).

As with vintage effects this problem may appear to be caused by regulations when it is instead a correlation. Again, relying on Fischel's arguments about rational motivation for regulation, assume that communities facing growth pressures, i.e. higher *g*, are more likely to impose regulations, for the same reasons presented above. In this case we would again find a correlation between high prices and stricter regulatory environments. However, this correlation would not be manifest in current rents. By excluding *g* from the regression, not only would the coefficient on regulation as a causative factor for high prices, or in this case a high price: construction cost ratio, be a biased upwards, but the relationship would not even be evident if instead of prices we looked at rents.

Conclusion

This section looked at the theoretical foundations for the methodological approach used by Glaeser and Gyourko to identify the cost of land use regulations. While their qualitative result, that the spread, as a ratio or difference, between house prices and construction costs, is consistent with the literature, their point estimates are highly likely to bias the costs of regulation upwards.[33] This occurs because of errors in their assumptions about the relationship between structure capital, land prices, land consumption, local amenities, and regulations. This specification error applies to all three empirical tests: i) the difference between marginal land price and average land value, ii) the relationship between density and location, and iii) and ratio of house price to structure cost. In each case the problem is different. There results are also biased because of errors in measuring structure value and a failure to accurately measure unit quality. The flaws are unfortunate because the basic premise of the paper is both sound and important. The role of housing markets in worsening affordability must come from factors that increase the cost of supplying a consumer's preferred group of structure and location characteristics bundled together in a house. The policy importance of the paper is furthered weakened because the gravest problem with affordability is not the inability of households to find some unit somewhere in a metropolitan area to buy, but the huge burden the cost of shelter imposes on society's poorest members.

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[33] The actual effect of the bias depends on a number of factors such as the nature of regulations, extent of land use externalities, and the dynamic effects of regulations on uncertainty faced by developers and in the market. Depending on these factors other predictions are possible. To explicitly identify the effecrs requires a more careful empirical study than has been done to date that integrates the standard housing market tests with estimation of the demand functions for regulations. The problem from an empirical perspective is that we tend to lack enough sources of variation to differentiate among these effects.

SECTION 4:

TESTING THE EMPIRICAL ROBUSTNESS OF GLAESER AND GYOURKO'S RESULTS

Introduction

The empirical work in Glaeser and Gyourko's paper proves the support for their argument that land use regulations causes higher prices by increasing the cost of supplying new units. For this analysis, Glaeser and Gyourko use the national sample of the American Housing Survey (AHS) to identify the owner's estimated value of their house, lot size, and the structure characteristics of individual units. They combine this with cost parameters from RS Means to generate an estimate of the structure value of each unit in their AHS sample. With these data they construct two tests of whether zoning constrains supply or raises the supply price of residential structures. A third test compares mean density and prices across metropolitan statistical areas (MSAs) and the difference between these values for the central city and non-central city areas of each MSA.[34]

The purpose of this section is to test the robustness of the Glaeser and Gyourko results. We do this for two of their tests. In the first, they compare the implicit marginal price of land derived from a hedonic regression with the value of land estimated by differencing the estimated house and structure values. Glaeser and Gyourko term this difference the "zoning tax". Their second test is a regression of this tax against demand side measures and a measure of land use regulation severity. We recreate their analysis using a different set of data from the AHS, a more careful, precise estimate of structure value, and we compare the zoning tax against a much larger set of land use regulation variables. The results of these robustness tests provide support for Glaeser and Gyourko's qualitative results. We obtain different point estimates and values than they do, sometimes significantly so. However, the patterns are consistent.

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[34] This section focuses on the first two tests. To properly evaluate the third test one would need data on urban structural form, location of sub-centers and degree of decentralization of employment, the location of each unit, and better information on the distribution of non-developable land. The theoretical discussion highlighted some of these issues. Additionally, comparing central cities with suburbs is problematic because the relative size of central cities compared to MSA size is not random.

Data Sets

The AHS is a large survey of individual housing units conducted under the auspices of the U.S. Department of Housing and Urban Development. Within each wave of the survey, housing units are tracked over time and the occupants (owners for vacant units), respond to a detailed questionnaire about themselves (demographics and income), house values, rents, financing, housing related expenditures, and house and neighborhood characteristics. What distinguishes the AHS from other surveys is that i) it contains extremely rich information about dwelling unit characteristics and costs and ii) the unit of observation is the dwelling unit rather than the households. One consequence of the former is that between two surveys the respondent may change.

The AHS has two components, a national survey and a metropolitan area survey. The former is conducted bi-annually and is designed to reflect the complete housing stock of the United States. For a given survey wave, the initial sampling begins with approximately 55,000 units. The actual number of observations is smaller because of both non-respondents and because some respondents drop out of the survey over time. The national AHS's geographic weighting is structured around regional representation and the breakdown between central cities and suburbs, rather than reflecting distributions across MSAs.[35] The metropolitan sample surveys 47 metropolitan areas over a four year cycle, with approximately 12 MSAs per survey. Typically, there might be 3,500-5,000 units surveyed for a given MSA, so that this survey offers a much more thorough coverage of metropolitan areas, at a cost of examining only the largest 47 of the over 300 MSAs in the United States. The two questionnaires are almost identical. The chief difference is that information on intra-MSA geography in the national data is limited to central city vs. suburbs, while the metropolitan survey provides limited geocoding, grouping all observations into geographically contiguous clusters (zones) of approximately 100,000 in population, which are claimed to share similar social-economic characteristics.

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[35] The exception is for a few cities that in more recent years have been over-sampled in the national survey (Chicago, Detroit, Los Angeles, New York, and Philadelphia).

We use data from the metropolitan sample of the AHS, as opposed to the national sample used by Glaeser and Gyourko. This allows us to replicate their analysis using a larger and more robust data set. Like them we restrict the units in the sample. We limit our data to single family attached and detached units on two acres of land or less. All units with an owner estimated value of less than $10,000 are excluded. Only surveyed households with valid responses to the set of question about structure characteristics and lots size are included. To match the years from Glaeser and Gyourko's national AHS data we use the AHS metropolitan surveys conducted between 1989 and 1994. This leaves us with 56,146 observations, ranging from 652 in Houston to 2,103 in Detroit.

Calculating Structure Cost and Value

The area where we differ in approach from Glaeser and Gyourko is in estimating the value of the structures. This process is important because the two tests of theirs evaluated here both rely on separating structure value from estimated house value. If there is error in this process that is correlated in some way with marginal land prices or the response of regulations, the results of the analysis would be biased. Both of us use the costs per square foot provided by RS Means. The costing manuals provide a base cost, but allow for multiple adjustments based on house type, quality, size, floors, number of full and half bathrooms, basement type, garage type, and the characteristics of the heating and cooling system. Our estimated structure costs need to be further adjusted for location and depreciation. RS Means provides location adjustments to account for costs differences across cities, which both we and Glaeser and Gyourko use.

Gyourko and Glaeser use only a small amount of the information available in the AHS and RS Means reports to estimate structure value. They choose to only use the RS Means per square foot baseline cost for a single story economy house with an unfinished basement. Rather than using the eight size breakdowns available in the RS Means data they group these into three broader categories, using only the largest sizes. They also appear to only assume that a unit has one bathroom. All of these elements of their approach result in an underestimate of structure value that is correlated with elements of the housing stock. Single story units with an unfinished basement are not reflective of the housing stock. Only 188 observations in our data, approximately 0.3 percent of our sample, are of this type. In the AHS data, of units with basements, finished or unfinished, 48 percent have two floors and 44 percent have three floors. Costs per square foot cost rise with the number of floors. Using per square foot cost numbers for the largest size groupings is a problem as per square foot costs for a house of a given number of floors and quality fall with unit size. If they indeed do not correct for the number of bathrooms in a units, then they underestimate structure value because fully 46 percent of our larger and more comprehensive sample has more than one bath. If they assume no half baths, a similar problem emerges as 49 percent of the units in our sample have at least one half bath.

The goal of our approach has been to try to be more precise. We matched units to cost values. Absence of information in the AHS on structure materials forced us to assume that all homes and garages are wood frame with wood siding. The absence of complete layout data in the AHS also forced assumptions about unit type, such as assuming that detached units with three floors without a basement are assumed to be tri-levels. Most problematic was identifying construction quality, as RS Means provides separate construction cost values for “economy, average or custom” homes, but the AHS does not provide any explicit information on initial structure quality level. The only information is the occupant’s current satisfaction with the unit and neighborhood quality. We used these responses to partition the sample into three groups: the 25 percent with the highest values for unit and neighborhood quality are classified as being in “custom” homes, the bottom 15 percent in “economy” homes, and the rest “average”.[36] We had to follow a similar process with the type of garage, as the AHS identified the presence but not size of garage. In this case, we used unit size as the indicator.[37] Unlike Glaeser and Gyourko we adjust the construction cost estimates using the information in the AHS for number of bathrooms, number of half bathrooms, presence of garage, type of heating, type of central air conditioning and whether or not the unit was attached or detached. For 6,295 observations, the AHS was missing values for unit size. For these observations we estimated unit size, using regressions coefficients from MSA specific linear regressions of unit size on the number of rooms, bedrooms, baths, half baths, floors, and whether the unit is attached or detached and in the central city of the MSA or not. We used the RS Means historic index to index estimates back from the 1996 cost manual to the AHS survey year, from 1989 to 1994, of the data. This process generated values for what it would cost to build a unit to its existing specifications and approximate quality level.

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[36] Explicitly, those units whose owners report both unit and neighbourhood satisfaction scores of 10 (out of a possible 10) are assigned the higher RS Means structure quality level of “custom.” Those with a neighbourhood satisfaction score of 6 or lower, a neighbourhood satisfaction score of 7 with a unit satisfaction score of 6 or lower, or a neighbourhood satisfaction score of 8 with a unit satisfaction score of

The average estimated age of the units in the AHS is 29 years. To estimate structure value the construction cost estimates described above must be adjusted for depreciation, both physical depreciation and the change in baseline quality. The former is the actual physical deterioration that occurs with building age and the higher going forward marginal cost of maintaining unit quality, which increases with age. The reason for the latter is that the baseline structure cost estimates in RS Means reflect a 1996 bundle of characteristics and quality. We would expect this to be a package of greater total quality than we would find in a house of the same size and relative quality built at an earlier date. We impose a standard hedonic approach to identify the relationship between unit age and market value, regressing unit value per square foot on building age and age squared with MSA dummies. The estimated marginal effects are that a one year increase in age lowers value by 0.43 percent and a one year increase in age squared that lowers value by 0.00105 percent. Relative to a new unit, these values suggest that a 5 year old house has

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5 or lower are all assigned the lowest RS Means quality level of "economy" The remainder are classified as "average".

[37] The AHS does supply detailed information for garage types we assumed that if a garage was present and the unit was less than 1300 sq. ft. it was a one-car garage. If a garage was present and the unit was less than 3500 sq. ft. and greater than 1300 sq. ft. it was assumed to be a two car garage and if the unit was greater than 3500 sq. ft. and a garage was present it was assumed to be a three car garage.

a 2.2 percent lower value, a 10 year old house is lower by 4.4 percent and the average age of 29 years lowers the estimated value by 13.4 percent.

The differences between our and Glaeser and Gyourko's methods for estimating construction costs have implications for the analysis. First, relative to Glaeser and Gyourko, we find higher average structure costs. They have an average cost per square foot of $50 compared to our average of $67, a difference of 34 percent. Second, and more critically, Glaeser and Gyourko introduce potential bias because the effects of their assumptions are not uniform across MSAs. Of the five cities in their data with the highest imputed land costs (intensive margin), the average number of floors in four of them, all in California, have fewer than the average number of floors in the total sample. The average number of floors in an MSA in our sample varies from 1.08 in San Antonio to 2.67 in Boston. The poor specification of construction costs in their analysis does raise concerns about the accuracy of their analysis because the net effect of their approach is to bias the structure cost downward.

Both our approach and that in Glaeser and Gyourko excludes estimated developer profit, which would be priced into both new and existing units. Developers typically mark-up as a percentage of land and structure costs. Thus, the dollar value of developer profits will be correlated with both land and structure prices. As a result, both our and Glaeser and Gyourko's estimate of extensive value (difference between house and structure value) is biased upward, and the size of the bias is positively correlated with land values. Unfortunately, a proper correction would require information on typical developer profit margins, which vary by MSA with market conditions.

Analytical Results: Testing for Robustness

As indicated in the beginning of this section, the goal of this part of the analysis of Glaser and Gyourko's work is to see how well their results hold using different data. We present a series of tables that are analogous to those in their text. The empirical analysis resolves around three principal measures: i) the ratio of the estimated value to the estimated structure value, ii) the implicit marginal per square foot price of land (the intensive margin), as estimated by a hedonic regressions of house value on lot and structure characteristics, and iii) the estimated land value per square foot value of land (the extensive margin) calculated by subtracting estimated structure value from the adjusted owner-reported house value and dividing by lot size. The owner reported values are adjusted to reflect bias in owner reported values.[38] The levels of these variables are sensitive to how construction costs are calculated. As we noted above, Glaeser and Gyourko's approach is likely to systematically underestimate structure value.

In Table 1 we show the median estimated house values to structure value ratios for each of the MSAs. The variation in ratio across MSAs closely tracks the variation in mean house values, with a correlation of 0.93, so the variation in house prices across cities is driven by the variation in land prices rather than construction costs. The second part of Table 1 shows the percentage of the housing units where the ratio of price to structure cost lies either below 0.9 or above 1.4. This is analogous to Tables 2 and 3 in the Glaeser and Gyourko paper, though they breakdown their results in those for central cities and suburbs, for 1989 and 1999. Comparing the two, in both the MSAs with the greatest percentage of units with prices above 140 percent of structure value are all in California. Differences between the two sets of results are more apparent at the lower end of the distribution where the group of low house to structure value ratio cities does differ. In our Table 1, the three MSAs with greatest percentage of the sample below the 0.9 threshold are Kansas City, Salt Lake City, and Houston. For Glaeser and Gyourko, for their 1989 results, the three central cities with the greatest percentage of units with a ratio below 0.9 are Detroit, Kansas City, and Columbus. For the suburbs the three are Detroit,

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[38] Although authors such as DiPasquale and Somerville (1995) show that the deviation of owner estimated value from market value is a function of length of tenure, we follow Glaeser and Gyourko and assume that homeowners overestimate the value of their unit by approximately 6%. Either approach is unlikely to make a difference in the analysis, which is driven by the large gap between values and structure costs in the high price MSAs.

Houston, and Pittsburgh. In our results, Columbus, Detroit, and Pittsburgh are all among the quarter of the MSAs surveyed with the greatest percentage of units with a price:cost ratio below 0.9. While there are differences in the results between what we show in Table 1 and Glaeser and Gyourko's Tables 2 and 3, the general pattern is the same. High housing price areas, California and the Washington, DC to Boston corridor, are those MSAs with the greatest percentage of units with estimated house value to structure cost ratios over 1.4.

Glaeser and Gyourko use the difference between the marginal (intensive) and average (extensive) prices of land as one proof of the negative effects of land use regulations on the supply of new housing. If land is atomistic with no assembly or subdivision costs, then these two should be equal.[39] If not, then when the extensive value exceeds the intensive value, owners will be able to arbitrage the gap by subdividing their lots. This approach presumes that regulations result in large lot or minimum lot size zoning that reduces the supply of small lots and prevents land owners from exploiting the profit opportunities from subdividing land. We estimate implicit price of land with a semi-log hedonic regression of log estimated house values on lot size, unit size, and other structure measures. The regression is run separately for each MSA with dummy variables for each AHS identified zone within the MSA. While we have tried to be as careful as possible, individual coefficient values for continuous variables from hedonic regressions are notoriously sensitive to data and specification. While we are confident in the relative values, we are less so in their absolute levels. The extensive measure is the difference between the estimated house value and the estimate structure value divided by lot size. This measure is highly sensitive to the estimated structure value, since an underestimate of the true value implies a larger average land value and higher zoning tax. We present these values in Table 2, which is comparable to Glaeser and Gyourko's Table 4.

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[39] The key assumption is the absence of subdivision costs. As described in Phase 2, there are many reasons why this need not apply.

The comparison of the estimated marginal (intensive margin) and average land prices (extensive margin) in Table 2 confirms what we would suspect. Either way we measure it, land values are higher in high house price cities. The gap between the two is also highest, with the implication that the negative effects of regulation on supply are greatest for these cities. The qualitative pattern of our results matches those reported in Glaeser and Gyourko in Table 4: both the measures and the gap between them are highest for the West Coast cities, Northeast cities, and Chicago – in approximately this order. However, our reported levels of the variables different significantly, often by a magnitude of two or more. For the extensive margin, we believe this is because Glaeser and Gyourko systematically underestimate structure cost. Determining the reasons for this difference for the estimated hedonic price of land is more difficult. Without using their data, both the sample and the way they construct variables from the AHS responses, and their unreported hedonic specification, we cannot explicitly identify the source of this variation. One possible reason is that because Glaeser and Gyourko use the national AHS survey, they have many fewer observations for each MSA than do we, so we would expect their point estimates of the implicit price to be less reliable. We better control for location using the zone dummies, which Glaeser and Gyourko cannot do because they rely on the national AHS survey.

In Table 2 we present two measures of average land value. The initial estimates of the structure value resulted in negative average land values for a number of the MSAs. We suspect this is because the estimated depreciation rates are well below the presumed 2-3 percent rate. To adjust for this we apply an additional ad hoc depreciation rate of 3 percent, which effectively eliminates the negative average MSA values, in Kansas City and Salt Lake City the value is still negative, but sufficiently close to zero for our purposes.[40] As the assumed depreciation rate increases, the estimated structure value falls, which raises the estimated extensive land value. To check for any bias we calculate the zoning tax with both this 3 per cent rate and a lower 1 percent depreciation rate.

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[40] If the age distribution is constant across MSAs than this correction would affect levels, but not relative levels. Since this distribution is not, the means for MSAs ranging from 18 years in Phoenix to 47 years in Buffalo, the absolute and relative effects are not. The correlation between the order ranking of median MSA infra-marginal land prices with 0.5 and 3.0 percent annual adjustment rates is 0.77. In Table 3 we show results under different assumed depreciation rates.

In Table 3 we present some simple correlations across the MSA means to see how sensitive the relationships are to our different depreciation rates for calculating average land price per sq.ft. As the correlations indicate, there is little change in the relationships as we move from a 1 percent per year rate to 3 percent. If instead of calculating the zoning gap as a difference, we calculated it as a ratio; we would find more substantive effects.

The results presented in Table 2 and Table 3 provide support for Glaeser and Gyourko's general result. For a small group of cities, which includes those we tend to think of as having greater land use regulation, house prices, land values, and the gap between estimated land prices at the intensive and extensive margins are greatest. And while this gap is not proof of an effect of regulation on supply, it is consistent with regulations that require excessively large parcels.

Glaeser and Gyourko in Table 6 of their paper compare a measure of zoning regulations with different MSA statistics on house prices. Their goal is to see whether the presence of regulations is correlated with housing whose values substantially exceed the value of their structures. They find that indeed both the percentage of units in an MSA with estimated value greater than 140 percent of estimated structure value and the "zoning tax" are greater when the time from rezoning to permit issuance is longer.[41] The implication is that causation runs from the regulation measure to the supply constraint measures.

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[41] The two dependent variables have a correlation in our data of 0.82, so it is not surprising that they would yield the same result in a regression of 40 observations and two right hand side covariates.

To fully describe land use regulations, Glaeser and Gyourko select one variable from the Wharton Urban Decentralization Dataset (Linneman and Summers 1991). This dataset is a comprehensive survey of a large number of economic, demographic, and government measures for a cross section of 60 MSAs in the United States. The section on regulation includes more than 50 different measures of the relationship between government policy and land use. The land use regulation measures are constructed from the responses of government planners in the MSAs, though no documentation is given for the response rate or coverage of the responses, and in particular whether this varies by MSA.

Two issues standout with the Glaeser and Gyourko analysis in their Table 6. First, the measure they choose is neither strictly appropriate for the test they describe nor the dependent variables they use. As presented in the theoretical section, the land use regulation is a lump sum cost on development. The best pure test of this characterization would be an impact fee or development cost charge and not necessarily a time to develop variable, though one can place pecuniary value on delay. The zoning tax, the dependent variable in the regressions, explicitly measures the potential returns to subdividing existing lots because the implicit marginal price of land is so far below the average value. This will strictly only hold when there is minimum lot size regulation that binds. In this case the proper measure is a variable that conveys the tightness of this constraint. The point is not that delay is not an important negative aspect of land use regulations (see Mayer and Somerville (2000) for a treatment of the effect of regulatory delay on housing supply); but that it does not match up as cleanly with the theoretical treatment or dependent variable as do other measures in the Wharton data.[42] Second, given the large number of variables in the survey, it is a concern whether Glaeser and Gyourko's analysis in Table 6 is that their results may be an artifact of a single measure and not robust across different measures that better describe the wide scope of land use regulation.

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[42] Other variables more appropriate for the theoretical presentation are available. The Wharton regulation data does include variables for the estimated amount of impact fees. There are also variables in the data set that can identify supply-demand balance by lot size and compare this tightness for small lots, those less than 4,000 sq. ft. or 4,000-8,000 sq. ft., with that for larger lots, such as those greater than 20,000 sq. ft.

Our primary strategy is to test whether the basic Glaeser and Gyourko finding holds across different regulation measures and with a larger data set. The results of this robustness test are presented in Table 4. We use 38 of the variables and construct another 7 measures from the Wharton data.[43] We regress our calculation of the zoning tax measure against each of the different regulation variables. All regressions include log 1989 MSA family income, 1980-90 MSA population growth, and MSA growth in family income 1979-89 as right hand side covariates and the standard errors are corrected for the use of variables aggregated at the MSA level in regressions on individual units. Including these variables obviates some left out variable bias: they would all be expected to affect land prices; land is more expensive in richer, faster growing cities.

The results in Table 4 suggest a much more robust connection between land use regulation and the gap between the two land value measures than is apparent in Glaeser and Gyourko's paper. For 9 or 12 different measures, out of 45 tested, depending on the applied depreciation rate to structure, the effect of regulation is statistically different from zero at the 10 percent level or better. These include approval time, a comprehensive regulation index, supply/demand for different uses, the existence of excess demand for small lot sizes (excessive minimum lot size regulations), and insufficient infrastructure provision. Of these, only for the total acreage of land set asides assessed by jurisdictions and the percent of rezoning approved is the coefficient estimate different than the negative regulation-supply relationship we would predict. Table A-1 in the appendix outlines how the variables are defined or what type of measure they are.

Summary

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[43] These include the average number of months from rezoning approval until permits are granted, which is the average of the time for small and large residential developments; the average number of months from subdivision approval until permits are granted, the average of the time for small and large residential developments; the average of these two measures; a count of the number of ways growth management plans have been introduced in the MSA; whether at least one such plan has been tried; and an ad hoc index that sums a number of the Wharton variables.

This section of the reported is intended to test the robustness of Glaeser and Gyourko's empirical findings. We do so by constructing a similar, but larger and more precise, dataset. We use the AHS metropolitan surveys, which allows us to obtain substantially greater numbers of observations per MSA, instead of the national survey used in their paper. Second, we try to do a much more careful job of estimating structure value by taking as full advantage as possible of both the richness of the AHS data on structure characteristics and range of factors that RS Means identifies in their per square foot cost summaries. Using this larger, more carefully constructed data set we then replicate a selection of their empirical presentations, summaries, and regression findings. In the case of the regression work, we compare the analysis with a much more substantial set of different measures of the land use regulation environment drawn from the same Wharton data as the authors use. We find clear support for the tenor and pattern of the Glaeser and Gyourko results, though our values for individual MSAs varies from theirs.

Our analysis supports their general conclusions. First, the ratio of house to structure value varies dramatically across different metropolitan areas in the United States. Second, this ratio is highest in the areas thought of as having stricter land use regulation: the West Coast and Northeast. Third, this pattern shows up in different measures of land prices, as measured through both implicit marginal prices (intensive margin) and average values (extensive margin). The difference between these two, Glaeser and Gyourko's "zoning tax" is highly correlated with both measures. Finally, the variation in the estimated land value per square foot, and thus by extension the "zoning tax", follows to a significant degree the variation in the land use regulatory environment as captured in large number of different variables.

The nature of this type of analysis makes the attribution of direct causality problematic. And while the Glaeser and Gyourko paper has a number of faults, which are outlined above, viewed within the context of the broader literature on the theoretical and empirical effects of land use regulation, their work further strengthens the case that land use regulations, whatever their positive effects, do increase constrain supply, raising housing prices. The importance of this work is less from their particular empirical findings, but from the emphasis that to identify housing market affordability problems, we need to study the supply side and not just the relationship between housing prices and incomes. The theoretical construct of their empirical analysis is intended to identify how regulations reduce affordability by their effect on the supply side. As a pure test their analysis comes up short, but the more general implications are both clear and robust.

SECTION 5:

RECOMMENDATIONS FOR CANADA

Overview

The principal recommendation for how to improve our understanding of the effects of land use regulation on Canadian housing markets is the development of better data for researchers to use to measure these regulations. A secondary recommendation that may be of less critical to this goal, but more important for understanding housing in Canada in general is a Canadian version of the American Housing Survey (AHS). Ideally, both would provide for users of detailed metropolitan area housing data an inexpensive, easy to access source of information. They differ in both the cost to develop them, an AHS like data set would involve a substantial outlay of financial resources, and the number of likely users, there are likely to be fewer people interested in the regulation measures.

Any meaningful analysis of the effects of land use regulation on Canadian housing markets is critically limited by the absence of cross-CMA or even a publicly available consistent within CMA data on land use regulations. The homebuilding and development industry has generated public relations or lobbying material information on development cost charges, but this falls well short of what would be necessary for meaningful study, especially that intends to look at the aggregate welfare effects of different types of regulation. Without this data, quality analysis will not occur. A periodic study AHS like study that would provide a detailed view of the condition of the housing stock and information on occupants would be a boon to academic, industry, and policy researchers interested in many different facets of Canadian housing.

Why Measure Land Use Regulations?

The development of a set of measures of the types and intensity of municipal regulations present in Canadian communities would improve the ability of local officials to determine the net worth of these regulations. One of the biggest problems with the regulation debate is that it is conducted more with anecdotes than with evidence. As this study has shown, the existing literature has left many questions about regulations and the magnitude of their effects unanswered. To obviate this condition and allow for a more informed discussion, a uniform set of measures of the regulatory environment is necessary. These would permit comparisons of policies and their effects across municipalities. It could also lay the foundation for the creation of an index measure that would indicate changes in the regulatory environment over time for a given locale.[44] Such an index would allow for the possibility of truly meaningful dynamic analysis of the effects of regulations; observing how they evolve over time and how markets respond to these changes and in-turn influence them.

Answers to questions such as: What regulations are used? How effective are they in achieving the objectives of their supporters? What are the impacts of different types of regulations? Are there regulations which can achieve identified goals without harming affordability? Depend on having a set of instruments with which to measure the regulatory environment. These would also benefit activists, builders, community members, and developers. Though these parties can have radically different agendas, their ability to make meaningful contributions to the regulation debate is contingent on a certain level of knowledge. Ultimately it is in the interest of all participants in these debates to expand the universe of publicly accessible information on local government regulations which affect rental and owner-occupied housing. Only thus will it be possible to design regulations which meet the concerns of residents while minimizing their negative impact on issues such as affordability.

Survey Design and Implementation

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[44] A land use regulation index would be created from the responses to the questionare. Every surveyed jurisdiction would receive a point score based on their responses. These scores would then be scaled to give an average of 100 across all jurisdictions. Over time the index for each jurisdiction and for the weighted total would evolve as each annual round of surveying generated new responses. Critically, for the index to be a useful evaluating tool, the weighting scheme for the responses or the points assigned each response, would have to remain unchanged.

The development of accurate and useful instruments that measure the regulatory environment in Canadian cities and towns is critically dependent on a survey of the local officials responsible for planning decisions. The regulatory environment is not a number that is collected by Statistics Canada but a product of interwoven regulations, enforcement strategies, and review processes. This complex web is best revealed through a comprehensive survey. Properly designed, it would provide qualitative descriptions of regulatory conditions and the raw information from which objective quantitative measures can be constructed. These might consist of a set of different variables describing aspects of the regulatory environment, each focusing on a different issue, such as the ease with which zoning densities can be changed, how easy it is to develop higher density multi-family units, or the extent to which the development of agricultural land is limited. The development of these consistent quantitative measures would provide local officials with the tools for evaluating regulatory policies.

The diversity of regulations, the regulatory environment, and the jurisdictions imposing them make the development of accurate measures of this environment a formidable challenge. Municipal regulations can take on a wide variety of forms: including explicit development restrictions, development cost charges, land set-asides, restrictive zoning, building codes, habitat preservation, and agricultural land preservation. As such, observing the existence of one type of regulation only reveals a small aspect of the policy tools available to a single municipality. As well, the regulatory environment is not just the sum of all legislation on the books. The existence of regulations in and of themselves may tell us very little, because what is ultimately of importance is how they are enforced. For example, a town that has a highly structured and detailed zoning code and regulates aggressively, but handles development requests and variances in an expeditious and transparent fashion, has a much more favourable environment for developers than a town that has few regulations on the books, but requires all applicants to go through a long, costly, and uncertain approvals process. The information needed to measure these conditions can only be gathered through a well-designed survey that captures both the scope and intensity of the regulatory enforcement environment. The variance in regulations, enforcement, and community size and types means that any survey must accommodate these differences as well as the varying role of provincial governments. In addition to careful work on survey design and measurement variable construction, there must be attention to geographic scope, response, and follow-up.

To generate a complete consistent set of responses, the questionnaire must be easily and consistently understood by all respondents. Their answers must not only fully describe the regulatory environment, but do so in a way that allows for quantitative measures to be developed from them. Successful survey design is predicated on painstaking preliminary interviews with local government officials, builders and developers, and community groups to insure that the questions on the survey address the essential elements of the regulatory environment. The initial questionnaire must also be field tested. Discussions with test participants will reveal problem areas in the survey design which can be corrected prior to the dissemination of the survey.

Without widespread coverage and a high response rate, a survey and the measures developed from it are of limited use. Coverage must be complete, with the local planning officials in every jurisdiction in Canada’s largest twenty five metropolitan areas receiving the survey and any other jurisdictions to ensure that all provinces and territories are covered. To insure an adequate level of response, officials who do not complete the survey should be contacted individually. Furthermore, once the responses have been received, follow-up interviews with a sub-sample of the respondents will help to insure that the questionnaire was correctly understood. The relative concentration of Canada’s population into a small number of metropolitan areas eases this process because the number of surveyed jurisdictions, though large, is not unwieldy. Finally, it is important to conduct follow-up interviews with local builders and community activists to insure consistency between the responses of government officials and the perceptions of other concerned parties.

Conclusion

As long as development continues, controversy and passions over municipal regulations will continue to flare. The debate over regulations and their impact on housing affordability is frequently conducted in hyperbole. What can be forgotten is that regulations are invariably motivated by legitimate concerns of local residents. Officials must balance the needs of different groups of residents and land owners. To prevent local building and development policy development and administration from being driven by casual anecdotes, they should have access to a set of easily understood measures that will allow them to compare different regulatory policies and the impacts of these policies in different Canadian municipalities. The survey described here is intended to generate a database that would provide researchers, policy analysts, and local officials and others with this information.

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