Time is money: An empirical examination of the effects of regulatory delay on residential subdivision development ☆

Douglas H. Wrenn [a],*, Elena G. Irwin [b],1

[a] Department of Agricultural Economics, Sociology, and Education, Pennsylvania State University, 112A Armsby Building, University Park, PA 16802, United States
[b] Department of Agricultural, Environmental, and Development Economics, The Ohio State University, 316 Agricultural Administration Building, 2120 Fyffe Road, Columbus, OH 43210, United States

ARTICLE INFO

ABSTRACT

Variation in regulatory costs over time and across different types of investment projects creates risk for developers who hold land. These so-called implicit costs, which arise as a result of regulatory delay in the land development process, are hypothesized to be potentially large, but empirical evidence of their influence on development outcomes is limited. Using a unique micro-level data set on parcel-level subdivision development that includes data on the timing of subdivision approvals, we test the effects of implicit costs that arise as a result of increased subdivision approval times on the timing and pattern of residential subdivision development. Consistent with theory, we find that these regulation-induced implicit costs reduce the probability of subdivision development on any given parcel. In addition, we find that systematic variation in regulation-induced implicit costs across space has reduced development in more heavily regulated urbanized areas intended for development and intensified development in less regulated exurban areas located farther away. The results provide a new explanation of scattered, low-density urban development as the result of optimal land development with multiple development options and heterogeneous regulatory costs.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

Land development projects are often risky investments. Because development projects take time to complete risks related to future revenues and costs can significantly alter investment behavior. This is especially true when those future risks are outside the control of the investor. New land use regulations that are enacted after the start of a project or existing land use regulations that are differentially applied based on the time and place of a project can impose such risks. The main implication of such regulations is often to extend the time that it takes to complete a project thus increasing the *implicit* costs associated with the project. These so-called implicit costs arise from any regulation-induced delay in the completion of a given real asset investment project, which increases costs by extending the time required to tie up capital and delays revenue generation by postponing the time of sale of the asset (Mayer and Somerville, 2000). Because these costs are not explicit their impact on development outcomes and the

resulting inefficiencies that are introduced in the land market are unlikely to be fully anticipated by policymakers.[2]

While many land use regulations represent *de jure* increases in the explicit costs of land development, e.g., impacts fees or taxes, real options theory suggests that a *de facto* increase in implicit costs can have an even larger impact on housing and land market investments (Pindyck, 1993; Bar-Ilan and Strange, 1996; Mayer and Somerville, 2000; Quigley and Raphael, 2005; Gyourko and Saiz, 2006). However, despite this theoretical interest in implicit costs, there is little empirical evidence of how these costs influence housing markets. Mayer and Somerville (2000) provide one of the few empirical investigations using metro-level data on housing starts and a national survey of planners to estimate the impact of regulation-induced increases in expected approval times on the number of new houses being built. They divide regulations between those that add explicit costs and those that induce cost increases by extending approval times. They find that regions with increased approval times for subdivisions can have up to 45% fewer starts and elasticities that are more than 20% lower, and that those regulations that lengthen the approval process serve to decrease the supply response the most. Their results provide key evidence of the potentially

---

* Corresponding author. Tel.: +1 814 865 9216; fax: +1 814 865 3746.
E-mail addresses: dhw121@psu.edu (D.H. Wrenn), irwin.78@osu.edu (E.G. Irwin).
1 Tel.:+1 614 292 6449; fax: +1 614 292 0078.

2 In economic terms, they are neither endogenous to the developer nor anticipated.

large impact that implicit costs can have on housing supply.[3] However, the aggregate scale of analysis precludes consideration of how implicit costs influence individual development decisions and the spatial structure of land markets within an individual metropolitan region.

Other empirical studies of regulation and housing markets focus on the overall impact of regulatory stringency on housing supply at a metropolitan level (Green et al., 2005; Glaeser and Gyourko, 2005; Glaeser et al., 2005, 2006; Ortalo-Magne and Prat, 2007; Paciorek, 2011). These studies largely confirm the relationship between increased regulatory stringency and a reduction in housing supply at the regional scale, but are also unable to identify the impact of implicit costs on micro-level investment decisions from their aggregate measure of regulatory stringency. On the other hand, parcel-level models of residential development have considered the impact of specific land use regulations on the timing, density, and spatial pattern of land development (Newburn and Berck, 2006; McConnell et al., 2006; Cunningham, 2006, 2007; Towe et al., 2008). These studies provide a number of interesting insights about the relationship between spatially-heterogeneous regulations and the timing, density, and location of development, but do not consider the role of implicit costs.

The purpose of this paper is to investigate the impact of regulatory-induced delay on the investment decisions of individual land developers and the spatial distribution of residential development. First, given their non-diversifiable nature, we hypothesize that an increase in the implicit costs associated with regulatory delay should delay the optimal timing of starting a given subdivision project (Pindyck, 1993). In the context of the land development investment problem, any policy that extends the time that it takes to gain final approval for a project will extend the time that capital must be tied up, thereby increasing costs and reducing the probability of the investment. Second, we hypothesize that differences in the intensity with which smaller versus larger subdivisions (in terms of number of buildable lots created) are regulated imply meaningful differences in their implicit costs that favor the development of lower cost, smaller subdivisions. An implication of this second hypothesis is that, because smaller subdivisions tend to occur farther from the urban areas, this difference in implicit costs has fostered greater exurban development.

We test these hypotheses using data from an exurban to suburban county located in the Baltimore, Maryland metropolitan region that grew rapidly over our study time period from 1995 to 2007. We construct a parcel-specific measure of expected implicit costs using data on the spatial, temporal, and parcel characteristics of previously-approved development projects to estimate a measure of expected approval time for each undeveloped parcel in each year from 1995 through 2007. We use this measure as a proxy for the actual implicit costs of regulatory delay in a series of discrete-time duration models that include a variety of controls for parcel-level explicit costs, land prices, and the prices of housing services. The identification strategy relies on the model specification providing sufficient controls so that our measure of implicit costs is uncorrelated with any omitted variables that may influence implicit costs. The absence of an exogenous shift in the regulatory environment and the lack of a viable instrumental variable for these implicit costs make this a difficult assumption to test. Instead, we examine the potential for omitted viable bias by estimating a series of models that control for a range of other parcel-level and neighborhood effects and subject our model to a series of powerful tests.[4]

Our findings confirm the hypotheses that implicit costs resulting from regulation-induced delay exert a significant influence on both the overall development process and the spatial pattern of development. We demonstrate through a series of robustness checks that, even after controlling for a number of other spatially and temporally varying factors, the sign and significance of our implicit cost result continues to hold. We find that a 1% increase in average expected approval time results in a decrease in the probability of development by 0.94%, suggesting that the overall impact of implicit costs on the probability of conversion is fairly unit elastic. Our results also reveal significant spatial variation in the impact of implicit costs on the location of development. Using the coefficient estimates from our preferred model, we compare the baseline probability predictions before and after a one-month increase in expected approval times between areas of the county primed for development and those restricted or protected from development. The results reveal that the predicted probability of development is greater in more restricted development areas. Moreover, we find that a one-month increase in expected approval time leads to a 13% reduction in the probability of development in areas primed for development, but that only leads to an 8% reduction in areas not primed for development. Both of these results are counter to the intentions of most of the policies restricting growth in our study region and suggest that at least some of the increased sprawl in the region may be the result of spatial heterogeneity in the way land use policies are applied.

This paper makes several contributions to the literature on land use regulation and urban spatial structure. The role of heterogeneity in generating discontinuous development patterns has long been emphasized in the theoretical literature (Mills, 1981; Wheaton, 1982; Newburn and Berck, 2011), but empirical evidence thus far has been lacking. Instead, previous empirical studies have focused on the role of demand-side amenities and disamenities and the role of these local land use spillovers in generating scattered suburban and exurban land development (Irwin and Bockstael, 2002; Walsh, 2007; Klaiber and Phaneuf, 2010). Using a unique parcel-level panel data set on subdivision development, we provide the first empirical evidence of the impact of implicit costs associated with the supply of residential land on individual land conversion decisions and on the spatial structure of land markets. Our main results are that implicit costs due to increased approval times for subdivision projects significantly influence the timing and spatial distribution of subdivision development and in ways that generate unintended consequences for the spatial pattern of development. The results offer a new explanation of scattered, low-density residential development as the outcome of heterogeneous regulatory costs and optimal land development decision making.

In next section, we present our basic theoretical framework. In Section 2, we present our empirical model followed by Section 3, which briefly describes our study region and policy context in terms of land use regulations and shows descriptively, using our unique micro-level dataset of subdivision approval times, how it is entirely possible that spatial differences in these approval times could be leading to more urban expansion and a fragmentation a pattern that most counties are looking to change. Section 5 presents our data and the construction of our implicit cost variables, Section 6 presents our results, and Section 7 concludes.

2. Conceptual framework

Our conceptual framework follows from Pindyck (1993) who developed a theoretical model describing how implicit costs impact real asset investment decisions. Implicit costs are defined as increased project costs that follow from increased approval times.[5] In our study region

---

[3] A number of more-recent papers have extended the idea of regulatory delay and the impact that this delay has on the "right to build" and found very similar results in terms of reductions in the both the timing and quantity of housing supply and attendant rise in the overall level of housing prices (Glaeser and Ward, 2009; Paciorek, 2011; Murphy, 2013).

[4] This approach is similar to the one used in Albouy et al. (2013). In the absence of a clear instrumental variable strategy, the author's propose testing the robustness of the findings using a series of model specifications and powerful controls.

[5] Pindyck (1993) considers two types of costs — technical costs, which vary with the decisions made by the investors, and input costs, that change regardless of the actions taken by the investor. In the context of the investment option facing the land developer, these input costs are analogous to the implicit costs generated by regulatory delay — i.e., the time that it takes to get final approval for a subdivision often changes as a result of factors, such as changes in land use regulation, that are outside of the control of the land developer.