




Infrastructure financing and urban development:: The economics of impact fees

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Abstract

Historically, additions to public infrastructure necessitated by urban growth have been financed under a cost-sharing approach. In the last several decades, however, financing of growth has increasingly relied on land-use exactions, where new residents pay for the cost of incremental infrastructure. Despite the emergence of a formal growth-control literature, there has been virtually no formal analysis of the connection between infrastructure financing and urban development. To provide such an analysis, this paper investigates three different schemes for financing incremental infrastructure within an urban growth model. The analysis compares an *impact-fee* scheme to two types of cost-sharing schemes, deriving the effects on urban growth and land values of switching to the impact-fee scheme. The efficient financing scheme is also identified.

Introduction

The provision of public services to urban residents requires infrastructure investment as well current inputs. For example, education of city's young population requires the construction of long-lived school buildings and playing fields in addition to the hiring of teachers and the purchase of books and other supplies. When a city's population is growing and its residents wish to maintain a constant level of public services, both infrastructure and current inputs must increase over time. The city must then decide how to finance the costs of both. In the latter case, the answer is clear: additional current inputs can be paid for by the people who use them, the new urban residents. Since existing residents make similar payments, all the city's inhabitants can be treated symmetrically in the financing of current inputs.

Because infrastructure costs are largely nonrecurring, the choice of an infrastructure-financing scheme is less straightforward. On the one hand, each group of new residents could be charged for the cost of the

additional infrastructure required by their presence in the city. For example, the residents of a new neighborhood could pay the cost of constructing a school to educate their children. This scheme involves a large one-time cost for new residents while exempting existing residents, who paid at an earlier date (when they were new). An alternative approach would require the cost of the incremental infrastructure to be shared among *all* current residents, existing and new. In this case, existing residents help pay for the cost of schools in the new neighborhoods, schools their children do not attend. This burden is offset by a previous benefit, however, in that the infrastructure used by the latecomers among existing residents was partly finance by their own predecessors.

Historically, infrastructure financing in U.S. cities relied on the cost-sharing approach. Moreover, instead of making up-front payments, cities typically acquired funds through the sale of bonds, with interest payments shared among all taxpayers. In the last several decades, however, cities have increasingly turned to the alternative scheme, where new residents pay for the cost of incremental infrastructure. Such payments are made through *land-use exactions* levied on real estate developers. Exactions take two forms: in-kind provision of infrastructure, and cash payments. In the first case, the developer is asked to build streets, water mains, sewers, parks, and even school structures as a condition of carrying out a development project. While in-kind provision is feasible when the infrastructure is “on-site” (within the confines of the development), infrastructure expansion may be required elsewhere in the city. Such off-site investment is financed via cash payments known as “impact fees”, which the developer again pays in order to undertake the project.

Altshuler and Gomez-Ibanez (1993) provide a succinct summary of trends in the use of exactions (pp. 124–125). They note that while only 10% of localities in the U.S. used exactions before 1960, 90% did so by the mid 1980s. Prior to 1960, most exactions were levied in-kind. By the mid 1980s, however, impact fees were used along with in-kind levies in around 60 percent of localities. Altshuler and Gomez-Ibanez point out that while exactions are sometimes levied according to formula, negotiation between developers and the local government determines their extent in many cases. Whatever the method, the level of exactions has risen along with their frequency of use. A Southern California survey cited by Altshuler and Gomez-Ibanez showed that the level of impact fees rose by over 500% between 1975 and 1983, while a Florida survey showed a tripling of impact fees between 1985 and 1991. Altshuler and Gomez-Ibanez believe that exactions account for 5–10% of construction costs in fast-growing communities, citing a survey figure of \$5–7 per square foot for both residential and commercial development. This translates into exaction costs of around \$12,000 for a typical 2000 square-foot house. For additional discussion of current trends, see Downing and Frank, 1983, Snyder and Stegman, 1986, Frank and Downing, 1988.¹

To explain the shift from traditional cost-sharing methods of finance to the use of exactions, most commentators point to a desire on the part of local governments to control growth. By forcing developers to pay for incremental infrastructure, exactions are thought to raise the cost of development above the level that would be incurred under a cost-sharing scheme, thus retarding urban growth. The aversion to growth that underlies this explanation may in part reflect a dislike of traffic congestion, pollution, and crime. In addition, under traditional cost-sharing schemes, growth may have created a rising burden from provision of incremental infrastructure. By adopting an exaction scheme, current residents could ease this burden by shifting future infrastructure costs onto new residents, while simultaneously enjoying a better quality of life through limited growth.

A city's growth can also be slowed by imposing explicit growth controls, which limit new construction. While growth controls have been analyzed in a number of theoretical papers,² there has been no parallel analysis of the connection between infrastructure financing and urban development. As a result, many of

the claims found in the informal literature (such as those in the preceding paragraph) can be difficult to evaluate. The purpose of the present paper is to provide the missing formal analysis.

The model investigates three different schemes for financing incremental infrastructure. Under the *impact-fee* scheme (IF), the infrastructure cost is paid in full at time of development. As in actual practice, the cost is paid by the developer, who is also the owner of the land. Under the *current-sharing* scheme (CS), the infrastructure cost is again paid up-front, but it is now shared among all the city's landowners. Under the *perpetual-sharing* scheme (PS), the cost is financed by the sale of infinite-maturity bonds, and the interest payment at any future date is shared among all the owners of urban land at that date.³

The above financing schemes are inserted into the urban growth model of Capozza and Helsley (1989), which was adapted by Brueckner (1990) to study growth controls.⁴ In the model, the landowner/developer chooses when to convert land from agricultural to urban use in a setting where urban land rents rise exogenously over time. By affecting the landowner's costs, the infrastructure-financing scheme influences the timing of development and thus urban growth. After the schemes are formalized in Section 2, the analysis in 3 Urban Development under the IF and PS Schemes, 4 Urban development under the CS scheme compares the urban growth path under the impact-fee scheme to the growth paths under the two cost-sharing schemes. The results can be used to predict how the city's growth responds to an unanticipated switch from one of the cost-sharing schemes to the IF scheme, as has occurred in practice. In addition, the discussion explores how land values in different locations are affected by switching schemes, identifying potential gainers and losers. Turning to a normative issue, Section 5 derives the efficient growth path for the city and shows that the impact-fee scheme generates it. Section 6 considers a closed city, where population growth is exogenous, showing that choice of the infrastructure-financing scheme is mainly a distributional matter in this setting. Overall, the analysis provides precise results on a number of questions that have been discussed in the informal literature on land-use exactions, including growth effects, incidence, and efficiency.

Section snippets

The financing schemes

As noted above, provision of public services requires a combination of infrastructure and current inputs. For simplicity, the ensuing analysis ignores the need for current inputs, assuming that services can be produced by infrastructure alone. In addition, it is assumed that once built, public infrastructure does not depreciate, obviating the need for replacement investment.

The level of public services, denoted z , is assumed to be the same for all residents of the city, regardless of...

The growth model

The growth model posits a linear city with an employment center (the CBD) at one end. For simplicity, the linear city has unit width. Distance to the CBD is represented by x , and kx gives commuting cost per unit time from a residence at location x , where k is positive and constant over time.⁸ The city is occupied by identical renters who consume land as well as a...

Growth comparisons

Suppose that instead of relying on the sale of bonds to pay for incremental infrastructure, as under PS, the city adopts the current-sharing scheme, where infrastructure costs are paid up-front but continue to be shared among landowners. This section compares urban development under this alternative CS scheme to development under the IF scheme.

The landowner's objective function under CS is identical to Eq. (12) except that Eq. (2), the path of payments under CS, appears in place of Eq. (3) in the ...

Efficient financing of infrastructure

The above analysis is positive in nature, exploring the effects of different infrastructure-financing schemes on urban development. The next step is to ask the following normative question: what are the characteristics of an efficient financing scheme? To answer this question, the efficient population growth path for the city is derived. The efficient scheme is the one that generates that path.

Since consumer welfare is fixed, the efficient population path is chosen to maximize the aggregate...

The closed-city case

The analysis so far has focused on the open-city case, where the population is freely mobile and the time path of consumption in the economy is exogenous. An alternate approach is to assume that the city's population growth path is exogenously given. In this situation, the consumption level u for urban residents becomes an endogenous function of time. To see how consumption is determined, suppose that infrastructure is financed under the PS scheme and refer to Fig. 1. In order for the city to...

Conclusion

This paper has provided a needed extension of the informal literature on infrastructure financing by showing the effects of different financing schemes in the context of an urban growth model. The analysis has shown how a city's growth is affected when it switches from a cost-sharing scheme to the IF scheme, and how such a switch affects the value of land. The efficiency of the IF scheme has also been established.

Although more theoretical work (especially general-equilibrium analysis) is needed ...

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...Several types of compensation schemes have emerged within planning procedures of different countries. One of the earliest compensation schemes is “impact fees,” which became commonplace in the late 1980s as an alternative stream of revenue to offset municipal budget shortages and to fund public services or infrastructure [82]. In some cases, impact fees are implemented by linking the issue of building permits by local government to the development of public services and infrastructure, such as affordable housing or educational and recreational facilities, by the developer [83]...

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...In addition, since urban agglomeration provides significant economic benefits for the whole society (Melo et al., 2009), the development of a particular area may be more desirable for the whole society than to the individual property owners. At the same time, however, public infrastructure spending per capita may increase when a city becomes more populated (Holcombe and Williams, 2008), making the financing of infrastructure an important issue, as well (Brueckner, 1997). The usual method by which public authorities intervene in the markets is some sort of land-use planning system that restricts the allowed uses of land...

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