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The Valuation of Undeveloped Land: A Reconciliation of Methods

*Karl L. Guntermann**

Abstract. **The valuation of undeveloped or "subdivision" land typically is accomplished by using either a single discount rate applied to total projected cash flows or by using a land discount rate applied to cash flows that are net of a developer's profit. The relationship between these two techniques is more complex than is generally recognized and valuation errors easily could result from the way they are typically used by appraisers. This paper reconciles these two techniques and demonstrates the conditions necessary for each to produce a correct estimate of land value. Survey data are used to illustrate the application of each technique and the incorrect value estimate that could result from their misapplication even if appropriate market data are being used.**

Introduction

One of the more interesting and difficult appraisal assignments involves valuing raw land that is ready for development. Important factors that affect the timing and magnitude of cash flows such as local growth rates, the demographics of the market and absorption and capture rates typically are analyzed in market and feasibility studies. Assuming that reasonable estimates of expected cash flows can be made, the reliability of the land value estimate depends upon the reliability of the discount rates that are applied to those cash flows. While discounted cash flow (DCF) analysis is an appropriate valuation technique, its application to undeveloped land is not simple and straightforward since land development typically is associated with multiple returns for various activities. Before appropriate discount rates and profit percentages can be estimated, it is essential to have a clear understanding of the various claims that can be made on a project's cash flows and the risks associated with them.

Land development can be defined as the process of converting raw land to an urban use, such as the preparation of residential lots for sale to homebuilders. Conceptually, land development encompasses both land investment, which tends to be passive in nature, and the active development of land into its ultimate use. Both activities tend to be associated with high expected rates of return reflecting the high levels of risk inherent in them. Land investors receive their return through the appreciation in land values as development becomes more imminent and the land is made ready for development. Land investment is risky because of uncertainty in forecasting the timing and direction of urban growth. A small error in accurately forecasting when land will be ready for development can substantially reduce its present value because of the high discount rates typically used.

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The developer's return usually comes from the cash flows produced by a project. Because of the way development and financing costs typically are incurred, the bulk of the developer's return actually is realized from the cash flows produced during the latter stages of a project. The risk associated with development is due to uncertainty about the market acceptance of a project and the residual nature of the developer's cash flows. In the developer's profit approach to land valuation used by appraisers, an explicit developer's profit, expressed as a percentage of sales revenue, is deducted from a project's cash flows. The residual cash flows are then discounted to an estimate of land value.

The most difficult conceptual issue to deal with in land valuation arises when a developer is also simultaneously acting as an investor by "land banking" land that will not be ready to use for one or more future periods. In this situation, the expected cash flows will have to be allocated between a return on the investment in land, which carries an opportunity cost equivalent to the return expected by a land investor, and a return for developmental activity. Any technique for valuing undeveloped land must reflect the dual claims on the projected case flows and adequately reflect risk either in the cash flows or in the discount rates that are selected.

The requirement to consider a return for both types of activities out of a project's cash flows has led to two methods for valuing undeveloped land. The first method applies a single discount rate to operating cash flows *before* subtracting out a dollar amount as a developer's profit. The single discount rate used should reflect the required return for both the land investment and development-related activities. With the second method, an explicit developer's profit is subtracted from operating cash flows and a different (smaller) discount rate is used to estimate land value from the residual cash flows.

Both approaches to estimating land value (single discount and developer's profit) are discussed in the appraisal literature and are used by appraisers, although the developer's profit approach appears to be the more common of the two. If either of these techniques is used with appropriate market data, it should produce a correct estimate of land value. However, the relationship between the two approaches is more complex than is generally understood. In practice, a single discount rate (say, 25%) often is allocated between a developer's profit percentage (10%) and land discount rate (15%) or the separate rates (percentage and rate) are combined into a single discount rate. It will be demonstrated that it is theoretically incorrect to mix rates indiscriminately and that incorrect estimates of land value are likely to result from the way in which these two methods typically are used. The purpose of this paper is to demonstrate the conditions necessary for these two techniques to be used correctly. In the last section, survey data will be used to illustrate the estimate of land value resulting from their application as well as the erroneous value estimates that can result from their misapplication.

Development Land Value Literature

The evolution of the concept of a developer's profit can be observed in the chronology of published literature relating to the valuation of undeveloped or "subdivision" land.[1] Early articles by O'Rouark (1952) and Baker (1953) addressed

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the difficulty of valuing undeveloped land by the traditional three approaches to value. They realized that it is necessary to make a distinction between a return for developmental activity and a return on the investment in land that a developer typically makes. However, they did not establish a clear procedure for determining undeveloped land value except for single-year developments that do not require the discounting of cash flows.

Fullerton (1965) refers to the "subdivision or development analysis approach" and discusses the need for a developer's profit as an expense item since land value is the residual being determined. He illustrates different techniques for calculating residual land value but most are of limited use because of conceptual problems in their formulation. Boykin (1976) and Kinnard (1971) also advocate the use of a developer's profit in describing, respectively, the "developmental method" and "cost-of-development method" for determining undeveloped land value.

A compilation of the various published approaches to valuing subdivision land is contained in the Appraisal Institute's 1978 Educational Memorandum, *Subdivision Analysis*. Its 1980 seminar, *Subdivision Analysis*, illustrates the valuation of undeveloped land using both the developer's profit and single discount rate approaches. The 1988 revision of this seminar contains an expanded discussion of the two techniques for valuing land with examples illustrating their application under various assumptions.

More recently, a variation on the problem of valuing undeveloped land has appeared in the appraisal literature. Articles by Kimball et al. (1986), Anglyn et al. (1988) and Keith (1991) have focused on discount rates for "bulk" or "wholesale" subdivision valuations. Bulk or wholesale values would apply to subdivisions where all site improvements have been finished but the sale of lots to homebuilders has not yet begun. The same issues relating to the selection of developer's profit percentages and discount rates are raised in both the valuation of raw land and the wholesale value of a subdivision. The wholesale value of a subdivision involves both an equity investor, analogous to the passive land investor, and an active seller of the finished lots, analogous to the developer. Hence, the wholesale value of a subdivision can be determined with either a single discount rate or a developer's (marketer's) profit percentage and discount rate.

Theoretical Basis for Valuing Undeveloped Land

The income approach to value is based on the fundamental economic concept that the value of an asset is the present value of the cash flows it is expected to produce. The application of this technique to income-producing real estate is relatively straightforward, requiring only that careful estimates of cash flows and discount rates are obtained from market data. In applying the income approach to undeveloped land, the dual claims on the expected cash flows must be recognized and reflected in the appropriate discount rate.

The estimated cash flows for a project should reflect all relevant opportunity costs of the developer's human and non-human capital. If there are opportunity costs that are not reflected in the cash flows, then the selection of a single discount rate must

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properly reflect the level and timing of these opportunity costs.[2] In essence, a project's total cash flow provides for the return a land investor would expect to realize through the appreciation in land value over time as well as the return a developer would expect to receive for development activities. Hence, a single discount rate that reflects these opportunity costs should produce a correct estimate of land value.

From a theoretical standpoint, it does not matter if total cash flows are discounted at a single rate or if the cash flows are divided with the residual cash flow discounted to land value at another rate. The developer's profit approach has been advanced as a way to make development-related activities explicit and separate them from land investment activities. This assumes, of course, that the opportunity costs (human and non-human) associated with development can be accurately estimated. The developer's profit deduction from cash flows is an attempt to take the development *risk* out of the cash flows. In essence, this would produce an equivalent cash flow, as if there were no development risk, that could be discounted to a land value estimate at a rate appropriate for land investments.

The discount rate applied to the cash flows net of a developer's profit should be chosen carefully to reflect the timing and duration of those cash flows. This is because the allocation of the total return between land investment and development is not constant but is a function of both the timing and duration of a project's cash flows. For example, if a parcel is not expected to be developed immediately, the return for land banking will be a larger fraction of the total return than if development were to begin immediately. This is because the cash flows calculated as a developer's profit are not discounted, while an expected delay in development would be reflected in a lower present value for the land.

The accuracy of the developer's profit approach depends on how well development risk can be estimated. Theoretically, the developer's profit percentage should vary with the risk of the development. In practice, a constant percentage of sales revenue is allocated each year as a developer's profit, which is unlikely to correspond to the development's risk. For example, in most projects, developer's receive the majority of their profit from cash flows produced later in the project and relatively little, if any, profit from initial cash flows, while risk probably will be just the opposite. Since, the common practice is to use a *fixed* developer's profit percentage, it becomes far more complicated to determine the correct discount rate to use with the residual cash flows to the land. The relationship between the developer's profit percentage, duration of cash flows and appropriate discount rates for both valuation techniques can be demonstrated more rigorously.

Let,

OCF_n = Operating cash flow before developer's profit,
α_n = Developer's profit as a percent of annual revenue,
S_n = Annual gross revenue,
r_0 = Discount rate used with residual cash flows in the developer's profit method,
r_1 = Discount rate used in the single discount rate method,
V_0 = Raw or undeveloped land value,

then,

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$$V_0 = \sum_{i=1}^{n} \frac{OCF_n}{(1+r_1)^n}$$

in the single discount approach, and

$$V_0 = \sum_{i=1}^{n} \frac{OCF_n - \alpha_n S_n}{(1+r_0)^n}$$

in the developer's profit approach. Since land value must be the same irrespective of the valuation technique,

$$\sum_{i=1}^{n} \frac{OCF_n}{(1+r_1)^n} = \sum_{i=1}^{n} \frac{OCF_n - \alpha_n S_n}{(1+r_0)^n}, \tag{1}$$

and, in the n^{th} period

$$1+r_0 = \left(\frac{OCF_n - \alpha_n S_n}{OCF_n}\right)^{1/n} (1+r_1). \tag{2}$$

The only way both r_0 and r_1 can be invariant to n is if

$$\left(\frac{OCF_n - \alpha_n S_n}{OCF_n}\right)^{1/n}$$

is invariant to n. For that to be the case, the developer's profit percentage α_n must increase as n increases, as follows:

$$\frac{\partial\left(\frac{OCF_n - \alpha_n S_n}{OCF_n}\right)^{1/n}}{\partial_n} = \frac{1}{n}\left(\frac{OCF_n - \alpha_n S_n}{OCF_n}\right)^{1/n-1} \cdot \left(\frac{-\frac{\partial\alpha}{\partial n} Sn}{OCF_n^2}\right) = 0,$$

and

$$\frac{\partial\alpha}{\partial n} > 0.$$

In other words, if r_0 and r_1 are market-determined discount rates appropriate for discounting, respectively, residual cash flows to the land or operating cash flows before developer's profit, then the correct application of the developer's profit approach requires that the developer's profit percentage, α, must increase as n increases. The intuition to this finding has to do with the magnitude of r_1 relative to

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r_0 and the effect of discounting longer cash flows. Assume that a correctly determined r_1 has produced a land value estimate. Since r_0 is smaller than r_1, the only way r_0 can produce an equivalent land value estimate, as the length of the cash flows increases, is if the residual cash flows to the land are reduced, i.e., the developer's profit percentage increases with n. The biggest current problem with the application of the developer's profit approach is that α typically does not vary with the expected length of the development. In the case where α is invariant to n, r_0 would have to increase with n for the developer's profit method to produce an equivalent estimate of V_0.

What this analysis has demonstrated up to this point is that the developer's profit approach, in particular, must be used carefully. If the analysis begins with an α, then r_0 must be selected from projects whose cash flows match the proposed development in terms of magnitude, timing and duration. If market data appear to justify the assumption that r_0 is invariant to n, then care must be exercised in selecting an α from market data to ensure that the duration of the cash flows matches those from the proposed development.

A further observation about the relationship between r_0 and r_1 can be seen from equation (2). By taking the limit as $n \to \infty$, it can be seen that the expression,

$$\left(\frac{\sum_{i=1}^{n} OCF_n - \alpha_n S_n}{\sum_{i=1}^{n} OCF_n} \right)^{1/n}$$

approaches 1. This means that as n increases the developer's profit discount rate, r_0, should approach the single discount rate, r_1, reflecting the increasing importance of land investment activities relative to development activities.

Illustration of the Single Discount Rate and Developer's Profit Techniques

Survey data can be used to illustrate the correct application of these two techniques for valuing land as well as the valuation errors that can result from their misapplication. Those surveyed were asked to estimate the present value of a stream of operating cash flows from a hypothetical development under three different assumptions about development timing.[3] In part A, it was assumed that a final tract map had been approved, meaning that development could begin immediately. In part B, it was assumed that the land was zoned, had a tentative tract map, and that final approval for development would take two years. In part C, it was assumed that the land had a general plan, but was not zoned and that development could not begin for four years. The survey also sought information on a developer's profit as a percent of sales. Discount rates were calculated as internal rates of return based on the cash flows that were given in the questionnaire and the present value assigned by each respondent to

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Exhibit 1
Discount Rates and Land Value Estimates from Survey Data

Development Scenario	A (No Delay)	B (Two-Year Delay)	C (Four-Year Delay)
	Correct Discount Rates and Value Estimates		
Land Value Estimate	$1,980,720	$1,290,240	$802,483
Discount Rate (r_1)	25.7%	25.0%	25.5%
Discount Rate (r_0)	13.2	17.1	19.6
	Incorrect Discount Rate and Value Estimates		
Discount Rate, ($r_1 = r_0 + 15\%$)	28.2	32.1	34.6
Land Value, Single Discount Rate Approach	$1,860,693	$968,750	$484,784
Discount Rate, ($r_0 = r_1 - 15\%$)	10.7	10.0	10.5
Land Value, Developer's Profit Approach	$2,129,962	$1,797,334	$1,437,152

the land under each scenario.[4] The questionnaire was designed in this way to avoid the potentially biased responses that might result from asking appraisers directly for the discount rates they would use.

The results of the survey are presented in Exhibit 1 along with the calculated discount rates. The average value assigned to the land under the three scenarios varied from $1,980,720 to $802,483, which would be associated with discount rates under the single discount rate approach of approximately 25%. The relatively constant single discount rate (r_1) that was calculated from these data suggests that appraisers correctly reflect the additional risk associated with delays in development through the discounting process rather than by using higher discount rates.

The median developer's profit was 15% of sales, resulting in a discount rate (r_0) for the residual cash flows to the land that increased from 13.2% to 19.6% for the three scenarios. An increase in r_0 for longer development scenarios, when a constant developer's profit is used, is consistent with the earlier theoretical analysis. A correct estimate of land value could be obtained either by extracting the appropriate single discount rate (r_1) from market data or by using a market-derived developer's profit (15%) along with the appropriate land discount rate (r_0), also extracted from market data.

The bottom half of Exhibit 1 illustrates the incorrect value estimates that would

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result from incorrectly using r_0, r_1 and the developer's profit percentage, even if they have been correctly derived from market data. If r_1 is obtained by simply adding together r_0 and the developer's profit, 15%, the resulting discount rate becomes progressively larger than it should be, resulting in a substantial and increasing undervaluation of the land. Similarly, if the land discount rate, r_0, is obtained by subtracting 15% from r_1, there will be an increasing overvaluation of the land across the three development scenarios. To use either of these techniques correctly, the rates (and percentages) must be extracted or estimated from appropriate market data. In addition, rates, etc. from one approach should not be mixed with data from the other approach.

Conclusions

The valuation of undeveloped land is complicated by the fact that returns for land investment and development must be considered simultaneously for most parcels, since the development and sell-out of a project typically involves a multiyear period. A single discount rate can be applied to operating cash flows prior to making an allowance for a developer's profit. This discount rate should reflect the expected return for both types of activities, whether undertaken by separate parties or combined into one by the developer.

The developer's profit approach is a second method commonly used to value land. The appraiser or analyst must be careful in selecting a developer's profit percentage and residual land discount rate from market data since each is very sensitive to the timing and duration of the expected cash flows. If a fixed developer's profit percentage is used each year, then the appropriate discount rate for valuing the land should be larger for longer development periods. Alternatively, if market data suggest that land discount rates are independent of the length of development, then higher developer's profit percentages should be used for longer development scenarios.

It generally would be inappropriate to split the single discount rate into a developer's profit percentage and residual land discount rate or add the separate rates to develop a single discount rate, as is commonly done at the present time. Even if discount rates and developer's profit percentages are correctly estimated from market data, an incorrect estimate of land value would result from the misapplication of either valuation technique. Evidence from survey data supports the findings from the theoretical analysis on the predicted relationship between discount rates, developer's profit percentages and the duration of expected cash flows.

Notes

[1]The Appraisal Institute's 1988 seminar, *Subdivision Analysis*, contains an extensive bibliography of appraisal literature on this subject.

[2]An analogy in finance would be the problem of using before or after tax discount rates. The accuracy of a valuation using a before tax discount rate depends on how well that rate captures the level and timing of the tax liabilities. Because of this problem, finance textbooks recommend

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the use of after tax discount rates (land residual discount rates) applied to after tax cash flows (after developer's profit cash flows).

[3]The survey was mailed in the late 1980s to Southern California appraisers who held designations as members of either the Appraisal Institute (MAI) or the Society of Real Estate Appraisers (SRPA or SREA). The survey was intentionally designed to be difficult to answer except by someone directly familiar with the valuation of undeveloped land. Of the approximately 290 questionnaires sent out, 31 usable responses were received. Since relatively few appraisers actually value undeveloped land, a response rate of this magnitude is considered acceptable. A copy of the survey can be obtained from the author.

[4]The cash flows in the survey are presented in the following exhibit:

Cash Flow from a Hypothetical Development

	Year 1	Year 2	Year 3
Gross Revenue	$250,000	$3,000,000	$3,700,000
Less: On-Site and Off-Site Development Costs	1,100,000	600,000	400,000
Less: Sales, Overhead and Administration	150,000	400,000	300,000
Operating Cash Flow	($1,000,000)	$2,000,000	$3,000,000

Source: survey instrument

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