Feasibility Analysis for Mixed-Use Development Projects

by Stephen E. Roulac

Planners are increasingly called upon to make decisions based on the economic impact of development programs. This discussion centers upon a step-by-step application of a model to a specific project—a suburban city faced with evaluating a development proposal which offers to provide low-income housing in exchange for the opportunity to exploit the substantial demand for commercial office space. How do those responsible for either the adoption or rejection of the plan determine its feasibility and the trade-offs inherent in its public purpose and profit-maximizing components?

THE CRITICAL ISSUE

Economic trade-offs inherent in decisions regarding different types of development, as well as development versus no development, are perhaps the issues most critical to the planning function. Although local land use controls specify precise criteria for new projects, and advocacy politics are highly developed, means for evaluating economic impacts of new proposals are less well advanced.

In San Francisco, as in other communities, the economic impact of highrise development has been clearly controversial. Studies argue on the one hand that highrise buildings are uneconomical, that they consume more in services than they contribute in revenues, and on the other hand that the city's best long-run economic interest lies in intensive highrise development. In assessing these divergent positions, it should be recognized that arguments pro and con focus on municipal cost-revenue operating relation-

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ships. Also of concern is the cost-value development economics relationship controlling the private sector decision of whether to initiate the project.

The proliferation of land use controls at multiple levels of government has focused attention on the economic impact of government requirements. As example, a study by the Environmental Protection Agency (as reported in the March 26, 1975 issue of *Appraisal Briefs*) found that the expense involved in collecting and analyzing traffic and air quality data for preparation of an indirect source regulations application was approximately one-tenth of one percent of the total project cost. That research assessed the impact of the EPA requirements for six different projects in terms of total cost and return on investment.

While increased concern with economic impacts of government regulations is commendable, the approaches to date have not been totally satisfactory. It is suggested that many analytical methods are deficient in that they are overly rigid and lack flexibility, concentrate primarily on the impacts on certain actors to the exclusion of others, and have limited application for public policy analysis. The preferred approach is one that focuses on key variables and allows the analyst to manipulate those variables of most direct interest.

PARAMETERS FOR A MODEL

As suggested initially, presentation of a model for evaluating the financial feasibility of multi-objective, mixed-use new development projects is facilitated by its application to a specific project proposal. In our case example, a mature suburban community, committed to a program to redevelop its urban core, desires to evaluate the financial feasibility of different development proposals. While certain basic information is known, much more is not; consequently, there is need for a financial model to test different approaches and different assumptions.

The suburban city in question, with a population of approximately 200,000, has a strong economic dependency on the medical services business. The rapid expansion of medically-oriented services has created tension between the demand for more office space and reluctance of the community to make available land for development in close proximity to the downtown urban area, which now is inefficiently used for run-down single family dwellings. In addition to the pressure for more office space, there is increased demand for close-in residential units, particularly for elderly and lower income persons. The political situation requires that any development of office space concurrently feature development of new low-income housing. Although the provision of low-income housing is an important objective for the city, the city is reluctant to fund such a project directly or to commit its credit rating, in the form of providing guarantees for financing, to the project. Thus, any development must be of mixed use, and it must be economically self-sufficient.

The area under consideration comprises approximately 40 acres and the overall cost for land acquisition and clearing is stated to be $120,000 per

acre. A strong market exists for commercial space, and it is stipulated that at least 250,000 square feet annually can be absorbed for each of the next six years. Planning restrictions for the commercial development include a floor area ratio of five, a maximum height of 120 feet, and a ground coverage ratio of 50%. The city desires to provide a minimum of 500 residential units, one-half available at rentals of $165 for three-bedroom units and $150 for two-bedroom units, and one-half to be sold as condominiums at $22,500 for three bedrooms and $20,000 for two bedrooms. For both condominiums and rentals, the three-bedroom units will consist of 1,150 square feet, 1½ baths, and a fully equipped kitchen, and the two-bedroom units will include 960 square feet, one bath, and a fully equipped kitchen. Some studios and larger units will be included with comparable characteristics.

DESCRIPTION OF THE MODEL

The model introduced focuses on the economic relationships inherent in development of property. In this sense, it should be recognized that the costs and benefits implicit over time in terms of revenues provided by the subject development are disregarded. At the same time, to the extent one had specific knowledge of those factors, expanding the subject model to incorporate this additional dimension would be straightforward.

As described above, the community in question desires to evaluate an urban redevelopment plan which will include both commercial and residential space. The residential housing is intended primarily for low-income households and, consequently, will be priced below market rates. The planning question, then, is: what amount of subsidy is required from the commercial space to offset the deficit on the residential space? Also, can the commercial space carry the residential space? Will the combined project show a surplus or a deficit? The model presented here provides insight to these questions.

Fundamental to the model is the belief that it is possible to identify, from the perspectives of private sector developers and investors, the anticipated value to be realized from developing and owning the project, as well as the costs required to create this value. If value exceeds costs, there is an extraordinary profit, or "quasi-rent" in classic economic terms. This extraordinary profit represents a premium above the economic returns necessary to motivate the participation of developers and investors since it is stipulated that where value equals cost, which necessarily includes a "normal" profit, adequate incentive exists to motivate the participants to proceed with the project. If costs exceed value, a deficit exists and the private sector will not proceed unless this deficit is offset by a direct transfer payment or by profit realized on some other component part of the total project.

Once the net surplus or deficit for each component part of the total project is known, it is a simple matter to determine the surplus or deficit for the overall project. Where a deficit exists, the community in question may well

be willing to cover the deficit because of the indirect non-financial benefits, such as the addition of new low-income housing, it realizes by the project. Alternatively, if a surplus exists, then the project participants have the opportunity to use this element of economic value as they choose.

The model can be shown symbolically as follows:

$$(V_O - C_O) + (V_r - C_r) - X - C_T$$

Where:

V_O = Value of office development
C_O = Cost of office development
V_r = Value of residential development
C_r = Cost of residential development
X = Total project surplus (deficit)
C_T = Cost of land for public purposes

In turn, each of the component elements of the above equation can be expressed in terms of variables, with the variables used to calculate that particular term. The equation for this next step is shown in *Exhibit 1*.

Considering first the value of the project, it is equal to the present value of the anticipated income to be realized from leasing and selling space in the new development. Thus, value is a function of the amount of space available for sale or lease, the selling price or lease rate per unit of space, and the cost of providing continuing services for leased space. The expression for V_O, then, is as follows:

$$V_O = M_O (1 - E_O)(R_O S_O)$$

Where:

M_O = Net income multiplier for office space
E_O = Ratio of expenses, vacancy and reserves to scheduled gross revenue for office space
R_O = Scheduled gross revenue per foot for office space
S_O = Total office space available for rent.

The net income multiplier is the inverse of the capitalization rate, and in effect is a measure of how the market values a dollar of income from the proposed development. How much of the scheduled income must be allocated for operating expenses, replacement reserves, and allowance for vacancy and collection loss determines the ultimate value of the project. Clearly, the lower the claim on scheduled income for such factors, the higher the value of the property. The amount of space available, and the rate at which such space can be leased, are clearly highly significant in determining the property's value.

V_r (value of residential development) consists of two component elements because part of the residential space is for sale condominiums, rather than rental space. Thus, the value of the residential space is a function of the present value of anticipated income from that space which is rented plus the "for sale" housing which has a value today equal to what it can be sold for. The first component of V_r is identical to that used for V_O with the modification that a new factor, P_r, which indicated the proportion of total

EXHIBIT 1

MIXED USE DEVELOPMENT FINANCIAL FEASIBILITY MODEL

$$[V_o - C_o] [V_r - C_r] = X + C_t$$

$$([M_o[1 - E_o] [R_oS_o]] - [1.265\ K_oS_o + W_oL_o + Y_o]) -$$

$$([(M_r[1 - E_r] [R_rS_rP_r]) +$$

$$\left(\frac{S_r(1 - P_r)G_r}{N_r}\right)] - ([1.265\ K_rS_r + W_rL_r + Y_r]) = X + [J - W_t)L_t]$$

Where:

$V_o - C_o$ is equal to the value of office development

$V_r - C_r$ is equal to the value of residential development

$X = C_t$ is equal to the value of the overall project

The above quotation can be simplified by factoring to facilitate calculation. The result of this process is as follows:

$$S_o[R_oM_o(1 - Z_o)(1 - E_o) - (1.265 + i_oB_o + T_o)K_o] -$$

$$(1 + T_o)(W_oL_o) + S_r[R_rM_r(1 - E_r)(P_r - Z_r) + \left(\frac{1 - P_r}{N_r}\right)G_r -$$

$$(1.265 + i_rB_r + T_r)K_r] - (1 + T_r)(W_rL_r) =$$

$$X = [1_t(J - W_t)]$$

Notes Explaining the Various Symbolic References

V_o, V_r	=	Value of office/residential development
C_o, C_r	=	Cost of office/residential development
X	=	Total project surplus (deficit)
C_t	=	Cost of land for public purpose
M_o, M_r	=	Net income multiplier for office/residential
E_o, E_r	=	Ratio of expenses, vacancy and reserves to scheduled gross revenue for office/residential space
R_o, R_r	=	Scheduled gross revenue per foot for office/residential space
S_o, S_r	=	Total space (in feet) of office/residential development
W_o, W_r, W_t	=	Acres used for specific development of office/residential/total. See below for derivation of acres used for development.
L_o, L_r, L_t	=	Land acquisition and clearing cost per acre for office/residential/total project
Y_o, Y_r	=	Development costs for interest, property taxes, marketing for office/residential. See below for derivation of these costs.
P_r	=	Proportion of residential space rented
N_r	=	Average square foot size of residential "for sale" units
G_r	=	Average selling price of residential "for sale" units
J	=	Total acres in project

residential space rented, is introduced to reflect the amount of space which is actually available for rent. The second component of V_r, that which relates to the "for sale" condominium housing, can be expressed as follows:

$$\frac{S_r (1 - P_r) G_r}{N_R}$$

Where:

S_r	=	Total residential space in square feet
P_r	=	Proportion of total residential space rented
G_r	=	Average selling price of residential "for sale" units
N_r	=	Average square foot size of the residential "for sale" units

The expression $(1 - P_r)$ is equivalent to that proportion of total residential space that will be offered for sale as opposed to offered for lease.

Now attention can be directed to the component elements of C_o and C_r. First, the expression for C_o from *Exhibit 1* is as follows:

$$C_o = 1.265\ K_o S_o = W_o L_o + Y_o$$

Where:

K_o	=	The construction costs per foot for office space
W_o	=	Acres used for office development
L_o	=	Per acre land acquisition and clearing costs for office development
Y_o	=	Costs incurred for interest and property taxes during construction plus marketing and holding costs for office development

The 1.265 factor is used to reflect a 10% profit allowance to the general contractor on constructon, and a 15% profit allowance to the developer for the total cost of the development project. As seen in *Exhibit 1*, the expression used for C_r is similar to that for C_o.

The amount of acreage required for a particular development depends upon floor-area ratios and coverage ratios. The amount of acreage used for office development is calculated as follows:

$$W_o = O_o \begin{matrix} S_o \\ I_o \\ H_o \\ Q_o \end{matrix} \quad \frac{I_o}{43{,}560}$$

Where:

O_o	=	Ground coverage ratio
I_o	=	*Average* floor size
H_o	=	Maximum building height
Q_o	=	Building height per floor
F_o	=	Floor-area ratio

The relationships expressed above allow the planner to designate the ground coverage ratio, the floor-area ratio and the maximum building

height, which factors define the amount of acres that will be required. Calculation of the acreage requirement for the residential component is as follows:

$$W_r = \frac{S_r}{A_r U_r}$$

Where:

A_r = Average size of units
U_r = Units per acre

Although the residential constraints deal only with units per acre, it is an easy matter to add other planning constraints if desired.

The formulas used to calculate construction costs do not include construction interest and property taxes during the construction period. Further, the formulas used to calculate the value of the different elements of the development project do not provide an allowance for marketing and rent-up costs or for holding costs incurred during the rent-up and marketing period. Consequently, the Y_0 term is used to reflect these costs and its component parts are as follows:

$$Y_0 = i_0 (S_0 K_0)(B_0) + T_0 ((S_0 K_0) + (W_0 L_0)) + Z_0 (M_0 (1 - E_0)) R_0 S_0)$$

Where additionally:

i_0 = Construction interest rate
B_0 = Number of years of construction (weighted to reflect effective loan amount)
T_0 = Property taxes as a % of construction cost and land cost (weighted to reflect multiple periods as appropriate)
Z_0 = Initial rent-up and marketing costs as well as holding costs during rent-up and marketing, as a percent of property value (reflects revenue not realized in case of rentals and delay in realization of revenue in case of for sale space)

The formula for Y_r is similar. No differentiation is made in marketing, rent-up and holding costs between rental and for-sale housing, although such adjustment is easy to make if desired.

The model just described is a fully integrated, pre-tax valuation model based upon multiplier factors, which are intended to reflect market behavior in the form of capitalization rates. Since such a model will likely be more often used for large development projects than for small ones, the associated substantial dollar size of investment suggests that such projects will most probably attract institutional investors, particularly pension funds and foreign investors, who will likely invest on an all-equity basis. In the case of pension funds, an all-equity investment negates tax considerations. At the same time, it is suggested that the analyst using the subject model can make appropriate allowances for tax considerations in the selection of his multiplier values. A preference for a more direct approach to valuing the tax factor can be accommodated relatively easily

since the primary tax factor in question is the right to take depreciation deductions. To the extent greater detail is desired, the model can be appropriately modified.

As with any model, the output can be no better than the quality of the input. It is suggested that particular emphasis be directed to verifying the reasonableness of assumptions regarding costs and revenues. If the market is unwilling to consume space or to proffer services at the prices and costs assumed, the model will be for naught. Indeed, these are the very conditions that lead to problem real estate ventures with associated foreclosures and bankruptcies.

DESCRIPTION OF THE MODEL

Of the some thirty plus variables in the model, not more than half are specified by the project participants. Consequently, the remaining factors must be estimated. Rather than viewing this condition as a deficiency of the model, it should be recognized that it in fact is a fundamental strength of the model. The flexibility of the model facilitates testing various sets of assumptions as well as the sensitivity of important assumptions in alternative development programs. This model can be effectively used to show impact of changing planning controls, and cost-revenue relationships on overall project value.

The ultimate use of this model is to generate overall guidelines for assessing development projects and to test various proposals. To reach this goal requires further specificity of objectives as well as increased sophistication of the model. The extra input needed can be of considerable importance, however, since it makes it possible to evaluate several different assumptions. Particularly desirable is the addition of probabilities to reflect ranges of values for key items. This is essential because the present assumption of certain items being fixed is unrealistic. The values for operating economics—especially effective revenues—need to be manipulated to reflect the different possible outcomes. At the same time, great care must be devoted to determining the goals and values which underlie the planning controls.

Values for the different components of the model, including both those specified by the municipality as well as those assumed for purposes of illustration are presented in *Exhibit 2*. In *Exhibit 3* the result of using these assumptions in the model is shown.

Based on these values, the total project has an overall deficit of $7,451,000. While the value of office space exceeds the costs incurred to create it, this surplus value is more than offset by the significant deficit resulting from the fact that the residential space costs much more to create than it generates in revenue. Residential development is not inherently uneconomic; here the space is purposely priced below the market so as to subsidize the housing needs of those unable to pay market rates for the quality of housing that is to be provided in this project. At the same time, it must be recognized that development economics today do not favor new projects.

EXHIBIT 2

STANDARD ASSUMPTIONS USED IN MIXED USE DEVELOPMENT FINANCIAL FEASIBILITY MODEL

E_r	= .5	Q_o	= 12
M_r	= 10	F_o	= 5*
M_o	= 10	P_r	= .5*
E_o	= .5	Nr	= 1000*
R_o	= $10*	L_r, L_o	= 120,000*
R_r	= $2*	G_r	= 21,000*
S_o	= 1,500,000*	A_r	= 1000*
S_r	= 500,000*	U_r	= 40*
K_o	= $30	J	= 40*
K_r	= $20	i_o, i_r	= .1*
O_o	= 2*	B_o, B_r	= 1
I_o	= 43,560	T_o, T_r	= .04
H_o	= 120*	Z_o, Z_r	= .1

*Note—Specified by municipality; others assumed for purposes of illustration. These assumptions are intended merely to show the application of this model, as they are materially different from costs and prices.

Among the alternative assumptions that can be considered are increasing the amount of office space, eliminating rental housing, eliminating for-sale housing, increasing the net income multiplier, decreasing the size of residential units, and increasing the amount of residential space. The implications of manipulating these primary variables are shown in *Exhibit 4*. Changes in space size do not materially improve the project value, reflecting that the basic revenue-cost relationship does not feature meaningful quantity elasticity. Changes that involve manipulation of size, thereby effecting both revenue and cost, result in less overall impact than those which adjust only one element of the equation. Not surprisingly, the rental housing is less efficient in an economic sense than the "for-sale" housing. In fact, the rental rate for residential space must be increased from the stipulated $2 per foot to $6.94 per foot, if it is to be economically self-sufficient. Similarly, the selling price of "for-sale" units must be raised from the specified $21,000 level to $32,220.

Reviewing standard assumptions for the values of various components in the model, it is possible to isolate certain critical economic relationships. Among the significant economic relationships of the data used in this illustration are the following:

1) *Density*–While planning parameters allow a five-floor-area ratio for commercial development, the equivalent allowed floor-area ratio for residential units is approximately 1, based on a limit of 40 units per acre and assuming an average unit size of somewhat more than 1,000 feet. The effect of this difference is to reduce on a per rentable foot basis the cost of land for commercial uses as compared to residential.

EXHIBIT 3

APPLICATION OF STANDARD ASSUMPTIONS TO MIXED USE DEVELOPMENT FINANCIAL FEASIBILITY MODEL

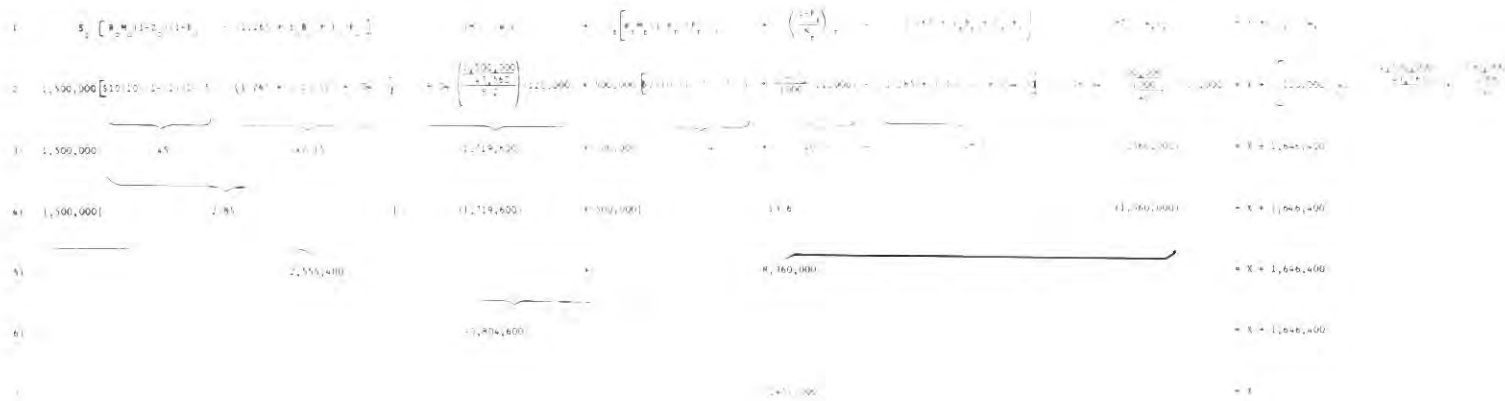

EXHIBIT 4

SUMMARY OF PROJECT VALUES UNDER ALTERNATIVE ASSUMPTIONS

Description of Assumptions	Value of Revenue from Office Space	Construction Cost of Greater Office Space	Cost of Office Space Land	Value of Revenue from Residential Space	Construction Cost to Greater Resid. Space	Cost of Residential Space Land	Net Project Value	Cost of Public Land	Project Surplus (Deficit)
	$S_o(R_oM_o)(1-Z_o)(1-E_o)$	$S_o(1.265+i_oB_o+T_oK_o)$	$(1+T_o)(W_oL_o)$	$S_r\left[R_rM_r(1-E_r)(P_r-Z_r)+\left(\frac{1-P_r}{S_r}\right)C_r\right]$	$S_r(1.265)+i_rB_r+T_rK_r$	$(1+T_r)(W_rL_r)$	$X+[L_t(1-W_t)]$	$L_t(1-W_t)$	X
(1) Standard Assumptions--1,500,000 feet of office space	67,500,000	- 63,225,000	- 1,719,600	+ 7,250,000	- 14,050,000	- 1,560,000	= -5,804,600	- 1,646,400	= -7,451,000
(2) Standard Assumptions--2,000,000 feet of office space	90,000,000	- 84,300,000	- 2,290,800	+ 7,250,000	- 14,050,000	- 1,560,000	= -4,950,800	- 1,096,800	= -6,047,600
(3) Standard Assumptions--2,500,000 feet of office space	112,500,000	- 105,375,000	- [illegible]	+ 7,250,000	- 14,050,000	- 1,560,000	= -4,100,600	- [illegible]	= -4,643,400
(4) Standard Assumptions--3,000,000 feet of office space	135,000,000	- 126,450,000	- 3,438,000	+ [illegible]	- 14,050,000	- 1,560,000	= -3,248,000	+ [illegible]*	= -1,248,000
(5) Standard Assumptions--1,500,000 feet of office space P_r = 1.0 (all residential space rented)	67,500,000	- 63,225,000	- 1,719,600	+ 4,500,000	- 14,050,000	- 1,560,000	= -8,554,600	- 1,646,400	= -10,201,000
(6) Standard Assumptions--1,500,000 feet of office space P_r = 0 (all residential space sold as condominiums)	67,500,000	- 63,225,000	- 1,719,600	+ 20,500,000	- 14,050,000	- 1,560,000	= -2,554,600	- 1,646,400	= -4,201,000
(7) Standard Assumptions--1,500,000 feet of office space M_o, M_r = 12.5 (lower capitalization rate assumed to value project income)	84,375,000	- 63,225,000	- 1,719,600	+ 7,250,000	- 14,050,000	- 1,560,000	= 11,570,400	- 1,646,000	= 9,924,400
(8) Standard Assumptions--1,500,000 feet of office space A_r, N_r = 800 (average size of residential units reduced from 1000 feet to 800 feet)	67,500,000	- 63,225,000	- 1,719,600	+ 7,435,000	- 14,050,000	1,951,200	= -6,380,800	- 1,270,800	= -7,651,600
(9) Standard Assumptions--1,500,000 feet of office space 750,000 feet of residential space	[illegible]	- 63,225,000	- 1,719,600	+ 11,242,500	- [illegible]	- [illegible]	= -[illegible]	- 446,400	= -10,[illegible]
(10) Standard Assumptions--1,500,000 feet of office space 1,000,000 feet of residential space	[illegible]	- 63,225,000	- 1,719,600	+ [illegible]	- [illegible]	[illegible]	= -11,794,600	- 146,400	= -11,[illegible]
(11) Standard Assumptions--1,500,000 feet of office space 1,500,000 feet of residential space	[illegible]	- 63,225,000	- 1,719,600	+ [illegible]	- [illegible]	[illegible]	= -[illegible]	+ [illegible]*	= -[illegible]

*Positive value for public land indicates that the amount of land required for the designated assumptions exceeds that which is available. This can be resolved by making more land available, increasing density or reducing space until equilibrium is achieved.

2) *Rentable Space*–The commercial element has approximately three times more rentable space than does residential. This is premised upon some 1,500,000 square feet of commercial space, reflecting six years demand of 250,000 square feet per year, as compared to approximately 500,000 square feet residential space, based on some 500 units of approximately 1,000 square feet each.

3) *Revenue*–Commercial space generates approximately five times the revenue per rentable space as does residential. Whereas the commercial space is projected to rent for approximately $10 per foot, the residential rate is approximately $2, reflecting approximately 16¢ per foot monthly rents. Assuming similar ratios of expenses, vacancy, and reserves to revenues, the net operating income per foot for commercial space will be five times that for residential.

4) *Construction Costs*–Construction costs for commercial space exceed those for residential space. The precise measure of this relationship depends upon a number of factors, some of which are controllable and others of which are not.

5) *Tax Considerations*–Residential space enjoys more favored tax treatment than commercial space in that double declining balance depreciation may be elected for the former while the latter is limited to 150% declining balance depreciation. As an offset, though, it should be remembered that commercial space, because of its higher density pattern, enjoys a higher ratio of depreciable assets to total project cost than does residential space.

CONCLUSION

As suggested, the model described here is a tentative means of assessing mixed use development projects. It is suggested that the overall surplus or deficit is determined by the combined surpluses or deficits of the component parts of the total project. In the situation examined here, the project surplus or deficit for office space is defined as the value of revenue per foot (the capitalized net income less marketing and holding costs), less the costs to create the space (the construction cost inflated by a factor to reflect C & D profit as well as interest and property taxes during construction), less the cost of the land and its related holding costs during construction. Similarly, the project surplus or deficit for residential space is defined as the value of revenue per foot from both leasing (the capitalized net income less marketing and holding costs) and sales (the selling price per unit times the number of units), less the costs of creating the space (construction cost inflated by a factor to reflect a C & D profit as well as interest and property taxes during construction), less the cost of the land and its related holding costs during construction.

Study of the valuation model can yield insights into the significant economic relationships between cost and revenue factors. This model allows the planner to determine the economic impact of specific controls and enables the private sector participants to precisely "price" various features of the project. With properly considered objectives, such a model can contribute to more rational land use and development decisions.

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