BUILDING ECONOMICS
FEEDBACK

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BRIEF FEEDBACK

Opportunity costs

Only actions have opportunity costs. The opportunity cost of an action is the cost/benefit of the next best alternative that is foregone. A property in itself does not have an opportunity cost but the continued use of the property does have an opportunity cost – the value of proceeds that could be realised by selling the property. One should not refer to the opportunity costs of an alternative (action), as this is equivalent to a double negative.

Marginal costs, marginal benefits

The relationship between total costs and gross or net revenue is not the same as the relationship between marginal costs and marginal benefits.

Budget line and isoquant:

Budget lines are not isoquants and isoquants are not indifference curves.

Intrinsic value:

The value of a property is not intrinsic to the property, as it is a relationship between the object being valued and the valuer. Value is based on expectations of the valuer.

The fact that certain properties (land and buildings) have similar characteristics and similar market values does not mean that value is intrinsic to those properties or is intrinsic to that bundle of characteristics. As an analogy, the rest mass of an object is intrinsic to the object, but the weight of an object is not. Its weight, as measured by a spring balance, differs depending on where the object is located i.e. on the top of a mountain, at sea level, on the moon, or in free space. Likewise, the mass of an object depends on the relative motion of the object and the person doing the measurements of mass. The fact that at sea level weight and mass are the same (to the layperson) for all objects does not make the weight of an object intrinsic to the object. Likewise, there are different values for different purposes that are relative to the perceptions, needs, and expectations of the valuer. New information can alter expectations of the future and hence alter the value of an object.

Mixing the terms IRR, returns, NPV, yield, profit, income, revenue, costs:

Yield and IRR are indicators of performance (ratios) whereas revenue and costs have an absolute value. I advise you not to use the term "returns" by itself as it does not convey whether you are referring to an indicator of performance (return on investment which is a rate of return or ratio) or are using a loose expression for revenue. Furthermore, it does matter whether you are referring to gross revenue or net revenue.

Use value:

One reason why you might wish to continue occupying your house as a single-family dwelling, even though changes in rezoning allowed multiple family occupancy, is because you place a higher use value on your home than the exchange or market value of the property. The next best alternative to staying in the house would be to sell up and replace the amenities that you already enjoy at an alternative site. The costs of doing so may be greater than the value you would realise by selling your property, especially if you have over-capitalised on additions and improvements.

Sketch and fully label the capital value profile of an economic process when the discount rate applied is greater than the yield of that process.

If the discount rate is higher than the yield of the process, then the Net Present Value, or Capital Value of the process at time t = 0 is less than zero.

Name two causes of the destruction of capital value.

Destruction of capital value is a loss in capital value that cannot be reversed without direct expenditure in the form of major rehabilitation or retrofit. The primary causes of destruction of capital value are obsolescence and physical deterioration.

Few buildings are lost due to natural disaster. Demolition is the end result of an economic process during which destruction of capital value has taken place. Demolition enables replacement construction to proceed. A building does not need to be demolished in order to destroy its full capital value. It can be left abandoned instead.

How can we justify placing a current value on capital goods which is based on the future use of those goods, especially when the future is uncertain?

Key economic concepts: fund as provider of future services, time preference, uncertainty.

Consumers place a value on the use of capital goods. Durable capital goods, such as buildings, provide a flow of services over a number of years. Consumers have a choice of renting those services, in which case they may pay a monthly or annual rent, or paying in advance for those services. Because consumers place a lower value on future services than current services, future services are discounted. Payment in advance for future services is based on the sum of the value placed on all future services. Even though the future is uncertain, the value of those services in the distant more uncertain future contribute less to the total present value sum of all future services and hence the effect of uncertainty is reduced.

If there is high uncertainty that a capital good will provide future services then a risk premium which is added to the discount rate results in a lower capital value of the capital good. The consumer therefore does not pay in advance for services which are less likely to be provided.

Briefly explain why the demand for land and buildings is a derived demand.

A derived demand originates from elsewhere. A number of students identified the derived demand for land and buildings as the being the demand by the occupants and tenants of buildings and land for land and buildings but failed to identify that this demand was in turn derived from the demand by consumers for the goods and services produced by the owners and tenants of building and land. A number of students more or less stated that a derived demand originates from a supply rather than a demand elsewhere.

Explain how there can be a trade-off between the maintenance and replacement of building components and plant.

A trade-off is an exchange where you give up one thing in order to gain another that is regarded as being more desirable. When the standard or level of maintenance increases, the life of building components and plant is extended. The annual equivalent cost of maintenance increases when the level of maintenance increases. The annual equivalent cost of replacement correspondingly decreases because the costs are annualised over a longer replacement cycle. The trade-off is between levels of maintenance and frequency of replacement. It is possible to not only under-maintain but also to over-maintain building components and plant, thereby increasing the total costs. Total costs are minimised at the optimum level of maintenance. The replacement cycle that enables a minimum total cost is the economic life cycle.

Give an example of an opportunity cost related to the property industry.

The opportunity cost of an action is the value of alternative actions foregone as a result of undertaking that action. Imagine you bought land 5 years ago for $1 million and have been using the site for open-air car parking. In the meantime, the market value of the site has increased to, say, $5 million. If you now decide to develop a high rise building on the site, then the opportunity cost of continuing to use the site for whatever purpose is the value of the next best alternative foregone. In this case, that value is $5 million. You could receive $5 million if you were to sell the site instead of holding onto it.
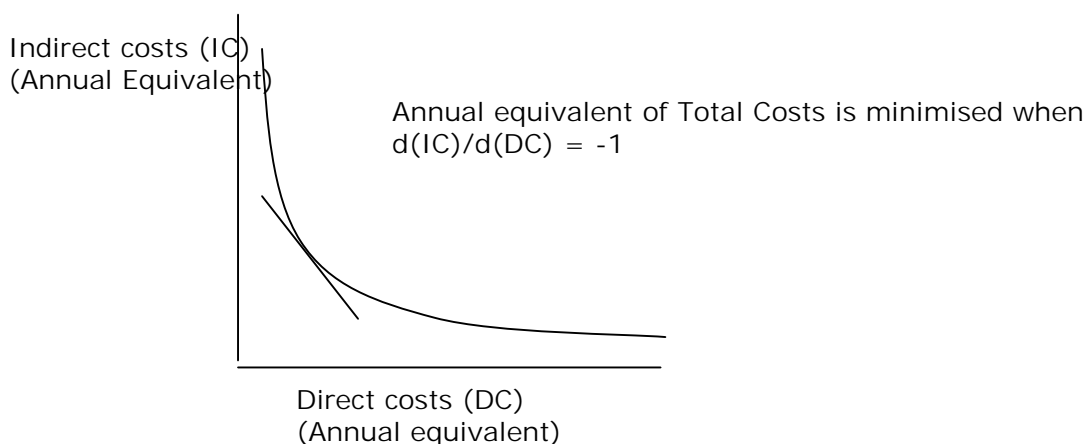
When we refer to the opportunity cost of an action, we should avoid negatives, otherwise we run the risk of making statements which make no sense. The opportunity cost of <u>not</u> taking a particular action is the value of alternatives foregone. The only alternative to <u>not undertaking</u> an action is to <u>undertake</u> that action. Therefore the opportunity cost of <u>not undertaking</u> an action is the value of <u>undertaking</u> that action.

Explain under what circumstances deferral of maintenance can be justified on financial grounds. Give an example.

To defer means to delay or postpone. A number of students based their answer on deferred maintenance as being postponed or cancelled maintenance.

A number of students swapped over the labelling of direct and indirect costs on their diagrams.

Provided deferral of maintenance is selective, the annual equivalent of total costs to maintain a flow of services provided by building components can be minimised by deferring maintenance (decreasing the standards and costs of maintenance) to the level where the marginal direct costs of maintenance are equal to the reductions in the marginal indirect costs (the loss in revenue and additional future costs as a result of deferral of maintenance).

Indirect costs (IC)
(Annual Equivalent)

Annual equivalent of Total Costs is minimised when
$d(IC)/d(DC) = -1$

Direct costs (DC)
(Annual equivalent)

Who is more likely to adopt sophisticated strategies to offset the uncertainties of a risky development - a person who is risk averse or a person who is a risk taker? Briefly explain why.

Key economic concepts: The relationship between risk and rewards.

We refer to risk 'averse' (opposed, disinclined, unwilling) investors and an adverse (hostile, injurious) economic climate, but we do not refer to risk 'adverse' investors.

Given a range of investment opportunities which have differing degrees of risk and rewards, a risk averse investor will tend to avoid risky developments whereas a risk taker is willing to undertake the more risky developments, provided he is suitably rewarded for doing so.

In order to stay in business, a risk taker must adopt flexible strategies to offset or counteract uncertainty and be prepared to modify his business plans on a day to day basis. An investor who is prepared to confront risk has more opportunities and incentives to develop sophisticated strategies to offset risk whereas risk averse investors need only adopt simple strategies to deal with the day to day predictability of a low risk development.

If a low risk development should turns risky, a risk averse investor will tend to dispose of or transfer the risk onto someone else who is prepared to accept that risk at a price. Insurance policies and futures markets enable transferral of risk. For example, a risk averse yacht owner would not be prepared to carry the risk of loss of his yacht so will transfer that risk, at a price, by taking out an insurance policy. A risk taker would be more prepared to carry the risk of total loss and not take out insurance. The risk taker with no insurance would tend to go to greater measures to prevent unauthorised entry into his yacht at night and be more careful when mooring it.

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Describe the circumstances under which the use value and exchange value of a property predominates.

The use value of a property is the value of that property to the user. The exchange value of a property is value of that property upon exchange or, in other words, the market value of the property.

The exchange value of a property can be lower than the use value. For example, a special purpose building for an unusual business activity would have a high use value to the owner/operator, but if the owner were to sell the building then the sale price would be lower than the use value to the owner. The owner would not be able to replace the special purpose building with the proceeds. Prospective purchasers would have to make major modifications to the building in order to change its use to their purposes and hence would build this cost of conversion into their offer.

The exchange value of a property can be higher than the use value. Prospective purchasers of a property would be prepared to pay more for a property than the value of the property in its

current use if they expected to realise capital gains by putting the property to a better and higher use and then selling it. The proceeds of the sale would enable the previous owner to replace his property with an alternative property that is able to provide the same utility at a lower cost. A premium over and above the value of the site in its current use may be paid in order to secure the site. An example is the YMCA at the top of Greys Avenue. A two-storey gymnasium in Greys Avenue is not the highest and best use of the land. Land values in that area have increased to the extent that the opportunity costs of the YMCA remaining in the Greys Avenue building are too high to ignore. The YMCA is better off by selling the Greys Avenue site and using the proceeds to relocate elsewhere where land values are not so high.

Explain the difference between economic depreciation and accounting depreciation.

Economic depreciation is a loss in real value (of property). Economic depreciation can result from a combination of tenure specific or property specific factors. Property specific factors include site value changes and building depreciation Building depreciation includes physical deterioration and building obsolescence.

Accounting depreciation is a system of accounting which aims to distribute the cost or value of tangible assets less salvage (if any) over the estimated useful life of the assets. It is a process of allocation and not valuation. By charging depreciation in instalments against the revenue of successive periods, an overstatement of profits is avoided. The original funds of the firm are left intact by the prevention of excessive drawings or dividend payments against capital in the belief that it is profit.

The charging of depreciation in the accounts against revenue does not constitute a fund for replacement of assets upon the end of their useful life, as would a sinking fund. It is not usual commercial practice to set aside such a fund as normally all funds of a business are actively employed either as ordinary current assets or as fixed assets. When the time for replacement does arrive, frequently the cost of replacement is greater, due to general inflation, innovation, or improvements so that any funds set aside for replacement would be, in any event, insufficient.

Why does the Inland Revenue recognise depreciation on buildings as an allowable deduction against taxable income?

Depreciation is an allowance for tax purposes, to take account of the fact that assets used in a business eventually wear out or become out of date, even though they are maintained or repaired. Land cannot be depreciated for tax purposes. The depreciation rates set by the Inland Revenue Department take into account customary usage and obsolescence in normal circumstances.

In order to claim a depreciation deduction on an asset, you must own it, and it must decline in value while you use it, or have it available for use in your business (i.e. renting it out). When the property is sold or disposed of, generally the difference (if any), between the sale price and the adjusted tax value is either a gain or a loss. This difference has to be accounted for in the year of disposal. When a building is sold for more than its adjusted tax value, the depreciation recovered is assessable income. The recovery is the smaller of the original cost price of the building less the adjusted tax value or the sale price less the adjusted tax value. This ensures that any capital profit made on the sale of a building is not included as assessable income. Losses made on the sale or disposal of buildings are not deductible (IRD Tax Information Bulletin, 1993).

If the proportion of your university fees for building economics is $360 for 12 lectures, what is the opportunity cost to you of falling asleep during three lectures? Briefly explain why.

Key economic concept: opportunity costs.

The opportunity cost of an action is the value of the opportunity foregone by taking that action. The economic way of thinking recognises no objective costs. "Things" do not have costs. Only actions have costs. For example, the costs of obtaining higher education are different from the costs of providing higher education. Actions can entail different costs for different people.

The opportunity cost of paying $360 for 12 lectures is the value of what else you could have done with the $360. Once you have paid your $360 (and the time period for refunds has lapsed) that $360 becomes a sunk cost.
By the time you walk in the door of the lecture room you have forsaken a number of other activities which you could have done instead. The opportunity cost of attending the building economics lectures is a function of foregone alternative employment, leisure, or study opportunities. You could be earning money, enjoying leisure activities, or studying for another paper instead of attending the building economics lectures.

You may have had an assignment to hand in the following day which you had not yet completed. You weighed up the benefits of working all night on the assignment in order to be able to submit it on time versus the costs of possibly falling asleep during lectures as a consequence. Because you decided the opportunity costs of not submitting your assignment on time was far greater than the costs of possibly falling asleep during lectures you therefore worked on your assignment.

The opportunity cost of falling asleep during a building economics lecture would be the value of knowledge thereby not gained. If you had studied the content of the lecture beforehand and the lecture could provide no opportunity to gain additional clarification or enlightenment, then the opportunity cost of falling asleep during the lecture would be zero.

You may have fallen asleep during all tests and the exam. Assume that you were capable of passing the tests and exams if you had stayed awake. The opportunity cost of falling asleep under this scenario would be the value of passing the paper instead. The value of passing the paper would be different for different people.

Your boss tells you in an angry voice, "I don't care what you learned in economics. If you don't include all our sunk costs in your report and recommendations, I'll fire you." Are the sunk costs now irrelevant to your decision making? Explain why.

Key economic concept: sunk costs

All costs relevant to decision making are opportunity costs – the value of the opportunities forsaken in choosing one course of action rather than another. Sunk costs are irrelevant to economic decision making as they are historical costs. The proper stance for making cost calculations is not looking back to the past, but forward to the future.

We must be certain that a cost is really sunk, or fully sunk, before we regard it as irrelevant to decision making. If you were to purchase a new motorbike and immediately afterward regret your decision, then you could resell the motorbike. If you do not, then you would incur a cost (a benefit foregone) equal to its resale value. The genuine sunk cost would be only the difference between what you paid for it and what you can get by selling it. That is the irrelevant part of your cost. In the economist's way of thinking it is no cost at all, for it represents no opportunity for choice. The only relevant cost is the opportunity foregone by not selling the motorbike.

Consider the scenario where the property firm you are working for had purchased the site at the corner of Mayoral Drive and Cook Street opposite the Auckland Police Station (the site has no building on it and is used as a carpark) for $500,000 in 1992. Assume the current market value of the site is $2 million. If you were to carry out a feasibility analysis of a development

on the site and did not take into account the opportunity cost of using the land (the value of the forsaken action of selling the land), then you would be overstating the internal rate of return which could be yielded from the development compared to an alternative development on another site where your firm had yet to purchase the land.

The boss has given you an ultimatum. The costs relevant to your decision - a decision on how to write the report - are now the marginal, not-yet-incurred costs of defying your boss.

You are a developer of a Sydney hotel that is designed to cater for visitors to the Olympics 2000. Piling and excavations for the six level basement car park have been completed when the Olympic Games Organisers decide to hold the Olympics in Los Angeles because the new Olympic Stadium in Sydney cannot be completed in time. Give the conditions under which would you decide to:

a) complete the construction of the hotel regardless.
b) complete the basement car park only.

You would base your original decision to develop a hotel based on your expectations of future demand for hotel accommodation. A hotel would provide accommodation not only for visitors to the Sydney Olympics but also for tourist beyond the year 2000. Guaranteed high occupancy rates immediately following construction would certainly reduce risk and improve expected profits. Your decision to complete the construction of the hotel regardless would be based on your expectations of demand for hotel accommodation without the Olympic Games. The net present value of the investment would still be greater than zero. Alternative investment opportunities would not provide better profits.

You would continue construction and stop short at completing the basement carpark if the opportunity costs of continuing and completing the hotel were high and there was sufficient demand for carpark buildings. Alternative investment opportunities, such as constructing Olympic Games facilities in Los Angeles, would offer greater profits. Further investment in the carpark only would be justified because the net present value of the further investment would be greater than zero. The costs would include opportunity costs, i.e. the value of a site with a hole in the ground and piling. Fully sunk costs would not be taken into account in your decision to complete the carpark.

Note that it is possible for the net present value of an investment to be greater than zero even when the development is sub-optimised. The net present value is maximised only when a development is optimised to its highest and best use

DISCURSIVE FEEDBACK

Does the opportunity cost of undertaking a development project increase or decrease over the planning to construction phase? Briefly explain why.

The opportunity cost of an action is the value of the opportunity foregone by taking that action. The economic way of thinking recognises no objective costs. "Things" like education or property do not have costs. Only actions have costs. For example, the costs of obtaining higher education are different from the costs of providing higher education.

Actions can entail different costs for different people. The opportunity cost of obtaining a BProp is lower for a student who has just left high school than for a student who has been in the work force for 20 years because the older student forgoes a higher income to obtain a BProp. Whether one can justify obtaining a BProp depends upon whether the present value of obtaining a BProp in terms of higher future salaries upon graduation exceed the opportunity costs of obtaining the degree. Once again, the value of job satisfaction must also be included in the value of obtaining a BProp. A person earning a high salary may decide to undergo job retraining to finish up earning less than he did before because he places a high value on job satisfaction and lifestyle.

One should be careful in referring to the opportunity costs of <u>not</u> taking a specific action because the alternative foregone is to take that specific action. For example, what is the opportunity cost to you of <u>not</u> staying in New Zealand upon graduation? The next best (only) alternative is that of staying in New Zealand. It is more illuminating to ask what is the opportunity cost of staying in New Zealand upon graduation. The alternative forgone by staying in New Zealand is the net benefits of working overseas. Working in the United Kingdom may offer you the highest net benefits after taking into account the higher salaries and the higher costs of living. The opportunity cost of staying in New Zealand upon graduation would the net benefits of working in the United Kingdom that you forgo. If the opportunity cost of staying in New Zealand is sufficiently high and exceeds the net benefits of staying in New Zealand, then you would seriously consider working overseas upon graduation. The net benefits of staying in New Zealand would include the benefits you place on the lifestyle as well as the salary you could earn in New Zealand less the costs of living. If you could not find a job in New Zealand and jobs were available overseas, then the opportunity costs of staying in New Zealand would exceed the benefits of staying in New Zealand and you would be compelled to emigrate.

The concept of opportunity cost is widely used in economics in identifying the most efficient use of scarce resources. Rational consumers and producers, by definition, choose activities whose private benefits outweigh their costs. If costs do not include opportunity costs of the resources used, and an activity's benefits outweigh the costs, then this indicates that an activity is financially viable. If the costs include opportunity costs and an activity's benefits outweigh its costs, this indicates that as well as being financially viable the activity is economically efficient. If an activity's benefits do not outweigh its costs, including opportunity costs, this indicates that although the activity may be financially viable, an alternative use of the resources would be more economically efficient.

I now return to the test question. You need resources to undertake a development and the value of undertaking a development project is the net benefits or profits that you are able to generate using those resources. The opportunity cost of undertaking a development project is the net benefits or profit of the next best alternative that you forgo using your resources.

At the planning and design phase we simultaneously encounter the greatest possibilities for influencing the total project and the lowest expenditure associated with the project. Planning and design fees are normally paid for out of the developer's own pocket. The planning and design phases offer the greatest opportunities for economising and these opportunities shrink dramatically during the construction phase. The method and cost of financing plays an important role in pushing the project forward despite the knowledge that further planning and design may be beneficial. Ideally planning and design of alternatives on the same site should proceed until the point where the marginal costs of planning and design equal the marginal savings of a more economical design and/or the marginal benefits of a better design that

generates greater value for the same capital outlay. This does not happen in practice because the driving force behind the rush in building projects lies within the opportunities for profit foregone because of project delays. The longer the delays, the more likely it is that economic conditions will change thus changing the viability of the project. This is the main reason behind the hectic pace of building projects in their early stages.

The opportunity cost of a development project is greatest at the outset. It is reckoned in terms of all other alternatives foregone. As a developer proceeds with undertaking a development project from the planning to construction phase, the opportunities to economise or increase the value of the project within the same budget diminish. The value of the alternative action of undertaking the development of a more economical or better designed project decreases over time and the opportunity cost of undertaking a development project from planning to the construction phase declines as the project unfolds.

The construction period affords many new opportunities to reconsider the project as a whole, well before its completion. With each phase in the building process, the developer perceives the project in the light of ever-new opportunities for profit forgone. Decisions are made at the margin and a developer may be better off diverting his remaining resources over to another development. A number of construction projects are abandoned in mid-course because the developer considers that the remaining opportunity cost of completing the development is too great. Sunk costs should play no part in any decision-making process, bearing in mind that not all sunk costs are fully sunk. It is possible to sell a hole in the ground (at a loss).

Your property development firm and a competing property development firm have each purchased an old building in Queen Street with the intent of constructing a new office tower block on the respective sites. An old building is located on a narrow site between your site and your competitor's site. That property is put up for auction just after you and your competitor have completed your sales transactions. Describe and explain the circumstances under which you would be able to outbid your competitor and any other development firm for the property put up for auction.

The key to answering this question was realising that the narrow site could be used in combination with your existing site. The majority of the class focused on the best and highest use of the narrow site only and not that of the combined site. A large number of students stated that they could outbid their competitors because they had more money to do so as a result of putting the site to its highest and best use. This type of answers begs the question and constitutes a tautology (saying the same thing twice over in different words). Of course you can outbid your competitors if you have more money to do so. The question asked you to <u>explain</u> the <u>circumstances</u> under which you could outbid your competitors. Explanation goes beyond providing standard investment criteria.

In order to purchase the site, your bid would have to at least match the reserve price. Assume that prior to the narrow site being put up for auction, you and your competitor have based your developments on putting your respective sites to the highest and best use. In order to be able to match the reserve price of the narrow site, you would have to satisfy the inequality

$$\Delta V_{combined} - \Delta C_{combined} \geq V_{old} + D_{old}$$

where

$\Delta V_{combined}$ is the increase in the value of the combined development of land and buildings over and above the value of your original development;
$\Delta C_{combined}$ is the additional costs (including normal profit) required to bring about the above increase in value;
V_{old} is the value of the narrow site and building in its current use. We assume that this value is the reserve price;
D_{old} is the costs of demolition and clearing the narrow site.

Assume there are no height restrictions and that there is a demand for the net lettable floor space that you provide. The maximum you could bid for the narrow uncleared site with a building currently on it would be $\Delta V_{combined} - \Delta C_{combined} - D_{old}$ where the residual ($\Delta V_{combined}$ -

$\Delta C_{combined}$) is maximised by increasing the intensity of the site use until the marginal revenue product equal the marginal costs of a unit of capital.

For the moment, assume that you and your competitor have no competitive advantage over each other. The next task is to explain why you or your competitor's bid would be higher than that of any other developer. There are two components to any bid. There is the residual component ($V_{new} - C_{new}$) and there is the cost of demolition. One scenario is where the old building is protected and cannot be demolished. The costs of demolition would be zero to everyone. You and your competitor would be able to retrofit the building at a lower cost than any other developer. Upgraded lift services for the old building on the narrow site could be provided within an adjacent building. It is much cheaper to install lifts in a new building than in an existing building. Economies of scale would enable centralised HVAC services to be provided to the old building, but sourced within an adjacent building, at lower cost. Your and your competitor's residuals would be greater than that of any other developer and you would be able to outbid their bids.

The next scenario is where the old building is demolished and a new structure is built on the narrow site. The costs of demolition would be less for you and your competitor due to economies of scale. The buildings on the sites you have just purchased also need to be demolished in order to put the land to its highest and best use. You would do all the demolition work at the same time. Because the middle site is narrow, the marginal costs of each additional floor would higher to any other developer than to you and your competitor. Other developers would have to provide lifts, ducts, stairwells, and plant rooms. You and your competitor could just tack the extra floor area onto the side of your original buildings and provide additional lifts etc., if necessary, within your adjacent buildings. You would have the advantage of economies of scale by using a centralised HVAC system. Because the marginal costs of providing net lettable floor area would be higher for any other developer, the point at which marginal benefits equal marginal costs would be reached earlier. The intensity of the development would be less and the resulting residual would be less. You and your competitor would be able to outbid any other developer.

Assume that you and your competitor intend to construct the same quality and area of net lettable floor area on the narrow site. The costs of demolition would be the same for you and your competitor. Your residual would be higher than that of your competitor if you have access to borrowed money at a lower interest rates, you adopt a more cost efficient method of construction, the overheads of your operation are lower, or you are prepared to forgo your normal level of profit.

Now completely relax the assumption that you and your competitor have no competitive advantage. There are so many variables at work here that we need to freeze all variables bar that of marginal costs and marginal benefits. Ceteris paribus, you will be able to outbid your competitor if your marginal costs of providing net lettable floor space for the combined site are less than that of your competitor. This depends on the design constraints imposed by the Building Code, local authority regulations, and the area of the site that you have just purchased. The need or legal requirement to add stairs, lifts, ducts, etc. to service the net lettable floor area constructed on the narrow site is a step function. You will be able to provide net lettable floor space at a low marginal cost if there is spare capacity in the optimised design of your original building. Your site can be either larger or smaller than that of competitor and you may be able to outbid your competitor purely on the basis of lower marginal costs. Whether your marginal costs are lower than that of your competitor may be entirely fortuitous. A difference of 2 metres in the length of the frontage of your site is sufficient to cause a step up or a step down in your marginal costs of providing additional net lettable floor space on the narrow site. In some cases it may be clear-cut that your marginal costs will be lower. In other cases you will need to commission a preliminary design for the combined sites in order to estimate benefits and costs.

A formula is a description of a process and not an explanation. A majority of students described the land use succession criterion of $V_n - C_n$ $V_o + D_o$ but did not explain or justify this criterion. $V_n - C_n$ represents a residual that a developer is able to bid for an existing property. It is only when this residual is sufficiently great enough so that a developer can retain a normal profit under a competitive bidding environment that a developer is willing and able to purchase an existing property (valued on the basis of its current use) and demolish and

clear that site for a new use. When a developer successfully bids for an existing property under a competitive environment, the residual $V_n - C_n$ represents the value of the cleared site in its new use.

You own and occupy a large brick house in an old residential neighbourhood. The area is being rezoned to allow multiple family occupancy. Give your reasons and the conditions under which you would decide to:

a) continue to occupy the house as a single-family dwelling.
b) divide the house into several flats.
c) demolish the house and erect a new townhouse complex.

The use value of a property is the value of that property to the user. The exchange value of a property is value of that property upon exchange or, in other words, the market value of the property.

The exchange value of a property can be lower than the use value. For example, a special purpose building for an unusual business activity would have a high use value to the owner/operator, but if the owner were to sell the building then the sale price would be lower than the use value to the owner. The owner would not be able to replace the special purpose building with the proceeds. Prospective purchasers would have to make major modifications to the building in order to change its use to their purposes and hence would build this cost of conversion into their offer.

The exchange value of a property can be higher than the use value. Prospective purchasers of a property would be prepared to pay more for a property than the value of the property in its current use if they expected to realise capital gains by putting the property to a better and higher use and then selling it. The proceeds of the sale would enable the previous owner to replace his property with an alternative property that is able to provide the same utility at a lower cost. A premium over and above the value of the site in its current use may be paid in order to secure the site. An example is the YMCA at the top of Greys Avenue. A two-storey gymnasium in Greys Avenue is not the highest and best use of the land. Land values in that area have increased to the extent that the opportunity costs of the YMCA remaining in the Greys Avenue building are too high to ignore. The YMCA is better off by selling the Greys Avenue site and using the proceeds to relocate elsewhere where land values are not so high.

One reason why you might wish to continue occupying your house as a single-family dwelling, even though changes in rezoning allowed multiple family occupancy, is because you place a higher use value on your home than the exchange or market value of the property. The next best alternative to staying in the house would be to sell up and replace the amenities that you already enjoy at an alternative site. The costs of doing so may be greater than the value you would realise by selling your property, especially if you have over-capitalised on additions and improvements.

You might decide to divide the house into several flats if you liked the area, wanted to live in one of the flats, the house was too big for you, and you wanted the additional rental income. In this case, the use value of your staying in the area would be high. The opportunity cost of your continuing to stay in one of the flats would need to be taken into account. Alternatively, you might decide to divide the house into several flats and rent or sell the flats. In this case, the exchange value would predominate.

You would not proceed with the division into flats unless

$$V_{divide} - V_{existing} \geq C_{divide}$$

where
V_{divide} is the value of the property after dividing into flats;
$V_{existing}$ is the value of the property before dividing into flats;
C_{divide} is the costs of dividing the house into flats, including normal profit.

You might decide to demolish the house and erect a new townhouse complex if you wanted to remain in the area, live in a modern low maintenance townhouse, and you wanted the additional rental income. Alternatively, you might want to sell the entire complex and live elsewhere. The same principles of use value, exchange value, and opportunity costs as above also apply. You would not proceed with the division into flats unless

$$V_{new} - C_{new} \geq V_{existing} + D_{existing}$$

where
V_{new} is the value of the new townhouses;
C_{new} is the costs of constructing the new townhouses, including normal profit.
$V_{existing}$ is the value of the existing house;
$D_{existing}$ is the costs of demolition.

Sketch and fully label a graph showing the relationship between the initial capital costs and ongoing costs of a building without using time as one dimension along an axis.

More expensive building materials (hence more expensive buildings) are generally, but not always, more durable. More durable building components are easier to maintain at a certain quality standard of maintenance and also do not have to be replaced as frequently as do less durable components. Ongoing costs include maintenance and replacement, hence ongoing costs are less in order to achieve a certain standard of maintenance when more durable materials are used for building components. The converse also applies. Ongoing costs are greater in order to achieve a certain standard of maintenance when less durable materials are used for building components.

Ongoing costs also include energy costs. It is possible to reduce energy costs required to keep an office building cool in summer by using horizontal shading devices fixed to the exterior of the building. The additional capital costs of horizontal shading bring about a reduction in energy costs. The subsequent savings can be regarded as being equivalent to receiving benefits, but do not use benefit-cost ratios as a measure of success should you do so. It is worthwhile to invest in shading devices to the point where an extra dollar invested brings about one dollar in savings or, in other words, until marginal capital costs equal marginal reductions in energy costs. This relationship is shown on the graph below. The flow of future energy costs is converted into present value costs. As with most processes, there are diminishing returns involved in trying to bring about a reduction in energy costs. It takes progressively greater capital costs to bring about one unit reduction in energy costs to cool the building in summer. The sum of capital costs and energy costs are minimised when marginal capital costs equal marginal reductions in energy costs or

MCC = - MEC
where
MCC is marginal capital costs
MEC is marginal energy costs (present value)

Energy costs (EC)
(present value)

total costs minimised when
$d(EC)/d(CC) = -1$
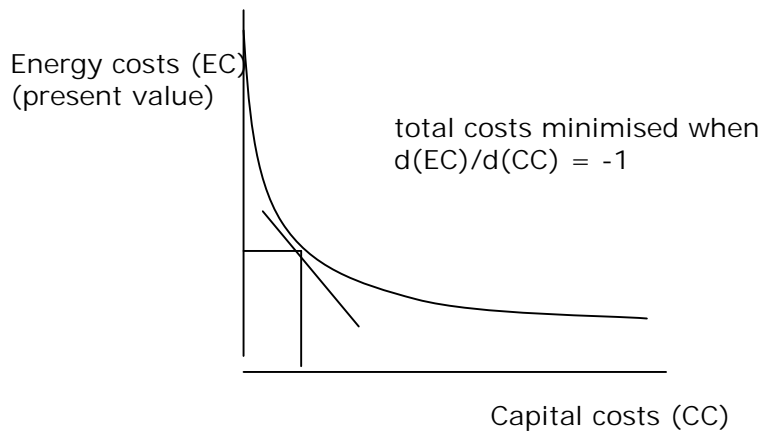
Capital costs (CC)

Technical note: Marginal capital costs can be regarded as being the costs of increments in the depth of horizontal shading up to the limit of what is called 100% horizontal shading. The discount rate used will determine the present value of future energy costs and the combination of capital costs and present value energy costs that minimise total present value costs. A reduction in the discount rate stretches the energy costs/capital costs curve up more on the left hand side (higher energy costs) than on the right (lower energy costs) and the optimal level of capital costs shifts to the right. Low discount rates favour more extensive use of solar shading devices because energy savings have a higher present value and greater capital expenditure on solar shading can therefore be justified.