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Real option valuation of retail properties in South Africa

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REAL OPTION VALUATION OF RETAIL PROPERTIES IN SOUTH AFRICA

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, Johannesburg, in partial fulfillment of the requirements for the degree of Master of Business Administration.

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ABSTRACT

This study focused on real option valuation (ROV) as a complementary method to the popular income-capitalization method (ICM) when valuing retail properties in South Africa.

The ICM may be approached in two ways *viz.* the direct capitalization method (DCM) and the discounted cash-flow (DCF) approach. In South Africa the former is primarily employed to determine the 'fair-value' of a retail property. A combination of the two approaches yields the most accurate valuation but requires a higher dependency on input variables.

Retail centre transactions qualified as suitable case studies if they allowed for additional 'bulk' to be developed (option to expand) and the purchaser paid a premium above a calculated theoretical 'fair value'. A ROV framework based on the binomial (financial) option pricing model was developed to value the expansion option for each case study. The value of this real option accounts for any premium paid over-and-above the theoretical 'fair-value'.

In all four case studies the premium paid was captured by the ROV framework, albeit at differing holding-periods. Although the result is not statistically significant it bestows credibility on ROV as a complementary tool to the ICM. In summary, ROV quantified the 'gut-feel' or intuition-based motives by investors when paying premiums for expandable retail properties in South Africa.

DECLARATION

I, George Nick Christodoulou, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

_____

George Nick Christodoulou

Signed at ……

On the …….. day of …… 2009

DEDICATION

This research report is dedicated to those who have not had the privileges I have had - I hope to do right by them.

ACKNOWLEDGEMENTS

I would like to thank my family for their unconditional love, Leigh-Anne for her loyalty and guidance, and my friends for their support.

I would like to thank my supervisor, Prof Mthuli Ncube, for his professionalism and availability during this research process.

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1 INTRODUCTION

1.1 Context of study

> "Have you ever been involved in a capital investment decision where the NPV [net present value] calculation proved to be negative, but the management team decided to go ahead anyway? Or been faced with a positive NPV project where your intuition warned you not to proceed? Often, it is not your intuition that is wrong, but your time-honored NPV decision-making tools."
>
> (Copeland and Keenan 1998:39)

The discounted cash-flow (DCF) method dictates that if the internal rate of return (IRR) of a corporate project exceeds the 'hurdle rate', thereby yielding a positive NPV, then the project is usually pursued (Damodaran 2000). However, the above excerpt from Copeland and Keenan (1998) challenges the validity of the DCF method when decisions are based on investors' intuition or 'gut-feel'. These decisions are often strategic in nature and the rationale in pursuing projects with negative NPVs may seem counter-intuitive - especially to competitors.

Myers (1977) coined the term "real options" and referred to them as being 'non-financial' or 'intangible' assets. Typically, a situation that has real options involves uncertainty about the future but allows "management to respond [in a step-by-step manner] to what it learns as the picture gradually becomes clearer" (Copeland and Keenan 1998:42). Myers believed that option pricing theory could "explain the gap between finance theory and strategic planning" (1984:126). More recently, Leslie and Michaels (1997:7) stated that "real options can provide a systematic framework that will also serve as a strategic tool". Real or 'embedded' options may account for this 'gap' between investors' 'gut-feel' or intuition and the DCF method.

The income-capitalization method (ICM) is predominantly employed for valuing income-producing properties (e.g. commercial, industrial) in South Africa and

may be approached in two ways: the direct capitalization method (DCM) or DCF approach - the former being more popular due to its relative simplicity (Rode 2005). When applied to valuing income-producing properties the former approach also suffers from the abovementioned ‘gap’. Therefore, real option valuation (ROV) aims to quantify this ‘gap’ (Amram and Kulatilaka 2000), thereby substantiating ‘gut-feel’ or ‘intuition-based’ decisions – especially when faced with negative NPV scenarios.

Another ‘gap’ identified by Rode (1994) is the lower market efficiency of unlisted property (i.e. not on a publically-traded securities exchange) as compared to other investments that are listed - such as shares and bonds. Rode (1994) attributes this ‘gap’ to fewer commercial property transactions in relation to those of listed securities when determining a market value; and to the heterogeneity of commercial properties making inter-transactional comparisons less reliable relative to listed security transactions. In this context, heterogeneity refers to the fact that no two individual properties have the same characteristics regarding tenants, lease profiles, location, grade of building etc. Rode (1994) regards this ‘gap’ (i.e. information asymmetry regarding valuation) as an opportunity for investors who are better-informed and employ ‘best practice’ valuation methods to capitalize on when investing in income-producing property.

1.2 Problem statement

This study aims to determine whether ‘real’ or ‘embedded’ options are reflected in the value of retail property transactions (having expansion rights) in the Gauteng province of South Africa.

Additionally, the sub-problems that this research intends to address are as follows:

- The **first sub-problem** is to calculate the theoretical ‘fair value’ for the existing retail property.

- The **second sub-problem** is to calculate the real option value that would result if the option to expand was exercised which would then be compared to the premium paid over the theoretical 'fair-value'.

1.3 Delimitations and limitations

- This study was limited to retail property transactions in the period of December 2003 through to February 2007 in the Gauteng province of South Africa.

- Only retail property transactions where the property in question has additional 'bulk' or gross lettable area (GLA) allowable qualified as suitable case studies.

- The option for re-development is an implicit option in any commercial-, industrial- or residential-property. In practice, the expansion of a retail property's 'bulk' usually also involves re-development (i.e. improvement) of the existing structure so as to ensure the continuity of the property's overall façade. This may occur concurrently with, or subsequently to, an expansion investment. Real option valuation of the option to re-develop the existing structure and not expand the 'bulk' was considered. However, rental rates for a re-developed retail property would be based on the property owners' estimates and are, therefore, less reliable than estimates for the expanded 'bulk' portion that are based on the existing structure's rental rate. Therefore, only the hypothetical expanded portion was investigated in this study as it is the opinion of the author that it is based on more reliable estimates for both capital expenditure and cash inflows than the relatively 'intangible' re-development option.

1.4 Purpose and significance of study

The purpose of this study is to show that real or 'embedded' expansion options account for the premium paid over the theoretical 'fair value' in retail property transactions, thus justifying investors' intuition when purchasing seemingly over-priced retail properties.

This significance of this study is that it should prove beneficial to property investors and sellers as well as financiers in their evaluation of retail property investments.

1.5 List of abbreviations

ATCI: After-Tax Cost of Interest

CC: Close Corporation

CGT: Capital Gains Tax

DCF: Discounted Cash Flow

DCM: Direct Capitalization Method

g: Constant growth rate in perpetuity

GLA: Gross Lettable Area

ICM: Income Capitalization Method

IRR: Internal Rate of Return

JSE: Johannesburg Securities Exchange

k: kilo

NPV: Net Present Value

PV: Present Value

r: hurdle rate or risk-free rate depending on calculation

RSA: Republic of South Africa

ROV: Real Option Valuation

WACC: Weighted Average Cost of Capital

1.6 Definition of terms

After-Tax Cost of Interest (ATCI) – refers to the tax-deductibility of interest payments which effectively reduces the cost of debt (Brueggeman and Fisher, 2005).

Benefits – see 'free cash flow'.

Bulk – A retail property's "entire building area, but excludes patios, plant boxes, sunscreening, escape stairs, machine rooms, parking (basements or above ground), lift motor rooms, service room, caretakers' flats etc." (Rode 2005:77).

Capitalization (or 'cap') rate – "The first year's expected pre-tax and pre-interest net income (assuming the building is fully let on current lease terms, *viz.* at current market rentals and current market escalation rates) divided by the purchase price/market value in year 0" (Rode 1994:3).

Capital Gains Tax (CGT) – tax liability on gains from long term assets sold above initial cost (Correia, Flynn, Uliana and Wormald 2007).

Commercial property – refers to either office space, retail space, or a combination of both (i.e. mixed-use development) (Brueggeman and Fisher 2005).

Discounted Cash Flow (DCF) – predictions of cash inflows and outflows are discounted to the present value using the cost of capital or a 'hurdle rate' to determine whether the project is financially viable (Smullen and Hand 2005).

Direct Capitalization Method (DCM) – values an income-producing property by dividing its net operating income by the market capitalization rate (Etter, 1994).

Free cash flow (FCF) – "Cash in excess of that required for all of a company's positive net present value activities" (Smullen and Hand 2005:170).

Gross Lettable Area (GLA) – see 'Bulk'

Hurdle rate – “rate of interest in a capital budgeting study that a proposed project must exceed…[to]…be regarded worthy of consideration” (Smullen and Hand 2005:198). When specifically applied to retail property investments it is defined as the “minimum total return (income yield plus expected capital appreciation) required by potential investors…[and]…is similar to a company’s cost of capital…” (Rode 2005:II).

Income Capitalization Method (ICM) – values a property according to its ability to produce cash flow (Brueggeman and Fisher 2005).

Initial yield – “Initial net [operating] income at the date of transaction or valuation expressed as a percentage of the sale price or valuation” (Hungria-Garcia 2004:12); the NOI is “based on existing leases and other income reasonably expected” (Rode, 2005:III).

Internal Rate of Return (IRR) – “That rate which equates the inflows and outflows of a cash flow” (Rode 2005:III).

kilo (k) – “prefix used in the metric system to denote 1000 times” (Isaacs, Daintith and Martin, 1996).

Market Value – “The most probable price that a voluntary, informed and prudent purchaser will pay a voluntary, informed and prudent seller in a normal open-market (arms-length) transaction…when neither party is under any compulsion to sell or purchase, other than their normal desire to transact” (Rode 2005:IV).

Net Present Value (NPV) – “estimating a project’s future cash flows, [then] discounting these cash flows at the company’s required rate of return (cost of capital), and subtracting the cost of the investment from the present value” (Correia *et al* 2007:8-5).

Price – “The amount actually paid for an asset. Not the same as market value, because special circumstances may have applied when the transaction was concluded” (Rode 2005:VI).

Present Value (PV) – "The result arrived at in a discounted cash flow calculation by multiplying a projected annual cash flow figure by a discount factor derived from a hurdle rate of interest and a time period" (Smullen and Hand 2005:322).

Retail property – ranges from very large regional shopping malls to single tenant structures (Brueggeman and Fisher 1995).

Real option – "An option that occurs as a by-product of business activities rather than one traded in financial markets" (Smullen and Hand 2005:340).

Terminal value – "The pattern of cash flow that is expected from the end of the holding period through the end of the useful life of the asset" (Brueggeman and Fisher 2005:266).

Weighted Average Cost of Capital (WACC) – "The average cost of long-term funding, including both the cost of debt and the post-tax cost of equity" (Smullen and Hand 2005:430).

1.7 Assumptions

- The purchaser employed the DCM approach to estimate an 'initial yield' and make a decision whether to purchase the retail property.
- The purchasers were cognizant of the additional 'bulk' that is allowed by the regulatory authorities and this factor was taken into account when deciding on an upper limit for a purchase offer.
- The purchasers did not employ ROV methodology to value the option to expand the existing property's 'bulk' as described in this study.
- The transaction price paid reflects the market value of the retail property and all transactions were conducted at 'arm's-length'.
- Transactions were analyzed from the perspective of the purchasers as it is they who possess the prerogative to purchase; whereas, the current owner remains invested in the property until it is sold.

2 LITERATURE REVIEW

2.1 Options

In the broadest sense there are two types of financial options (Hull 2006):

i. **Call options,** where the holder has the right (but not the obligation) to buy the underlying asset at/by a pre-determined date (expiration or maturity date) for a pre-determined price (exercise or strike price); and,

ii. **Put options,** where the holder has the right (but not the obligation) to sell the underlying asset at/by a pre-determined date for a pre-determined price.

Options may be further divided into (Hull 2006): **American options,** which may be exercised anytime prior, or on, the expiration date; or **European options,** which may only be exercised on the expiration date itself (nomenclature has no geographic relevance). American options are worth at least the same and generally more than European options (Damodaran 2005).

Upon exercising of options, they may either be (Hull 2006:188):

i. **In-the-Money,** where for a call option S (stock price) > K (exercise/strike price) or for a put option where S < K, thereby yielding a positive cash-flow;

ii. **At-the-Money,** where for a call or put option S = K, thereby yielding no cash-flow; or

iii. **Out-of-the-Money,** for a call option S < K or a put option where S > K, thereby yielding a negative cash-flow.

An in-the-money option will always be exercised on the expiration date if transaction costs are absent (Hull 2006).

2.2 Real option types

Copeland, Koller and Murrin (2000) classify real options into five categories:

i. The **option to expand *vs.* contract** a project's scale. The former involves investing additional input resources (e.g. capital) so as to increase the project's capacity (equivalent to an American call option on a company's stock) (Copeland *et al* 2000; Hull 2006). The latter refers to reducing input resources while still allowing the project to continue operating (equivalent to an American put option on a stock) (Copeland *et al* 2000; Hull 2006);

ii. The **option to extend *vs.* shorten** the life of a project. The former refers to a further capital outlay (i.e. exercise price) and is equivalent to a call option on a stock (Copeland *et al* 2000; Hull 2006). The latter refers to shortening the life of project and is equivalent to a put option on a stock (Copeland *et al* 2000);

iii. The **option to scope up *vs.* scope down** a project. The former refers to increasing the number of activities undertaken by the firm (call option) and the latter refers to decreasing the number of activities undertaken by the firm (put option) (Copeland *et al* 2000);

iv. The **option to abandon** a project when the liquidation/salvage value exceeds the projected returns of the project over its lifetime (Damodaran 2000). It is equivalent to an American put option on a stock (Copeland *et al* 2000); and,

v. The **option to defer/delay** a project until conditions are more favourable, for example, until borrowing interest rates decrease (Hull 2006) and is equivalent to an American call option on a stock (Copeland *et al* 2000).

Additionally, Copeland *et al* (2000) recognize the following three more complex real option types:

i. The **option to switch** project operations. This is comprised of both puts and calls, for example, reviving a discontinued project is an American call option and discontinuing a current project is an American put option. A project that offers the option to switch between discontinuing and reviving operations is worth more than one without this flexibility (Copeland *et al* 2000);

ii. **Compound options** are options on options i.e. offering combinations of option types. For example, projects having distinct phases in which either additional capital (exercise price) is invested to **expand** the project or by **abandoning** and liquidating the project (Copeland *et al* 2000); and,

iii. **Rainbow options** are characterized by having multiple sources of uncertainty. For example, where the price of a product in the future becomes less certain as time progresses due to the state of the economy (Copeland *et al* 2000).

Finally, Damodaran (2005:22) identifies **Barrier options**, the value thereof "being capped if the price of the underlying asset exceeds a pre-specified level."

2.3 Option pricing theory applied to real options

A company holding the option to buy an asset and receive cash flow benefits at a future date possesses a 'real option' that, if exercised, is analogous to exercising a financial call option (Dixit and Pindyck 1995). The NPV rule assumes that once a financial call option is exercised it is irreversibly eliminated (Dixit and Pindyck 1995). However, applying the NPV rule to the exercising of real options has the following shortcomings:

i. It ignores the possibility of creating more options by making an initial investment;

ii. It ignores reversibility i.e. exiting the investment and recovering expenditures and possibly even re-entering the investment;

iii. It fails to place any value on waiting for more information (i.e. learning) before exercising the option; and,

iv. It has a binary view regarding the exercising of options i.e. either investing today *versus* never investing (Copeland and Keenan 1998; Dixit and Pindyck 1995).

A more realistic view would be to investigate a range of possibilities, for example, the option to invest today or to delay investment for multiple periods of n, n+1, n+2 years etc. (Dixit and Pindyck 1995). This is in agreement with Trigeorgis, Brosch and Smit (2007) who suggest a plan that systematically breaks down decisions into stages of options for investors to either pursue or decline as new information is obtained.

Copeland and Tufano (2004) identify and explain two additional differences between financial and real options:

1. **Information** required to value financial options is more readily available. However, in the case of ROV, management can estimate the relevant inputs for option-pricing models. For example, an oil company can estimate the value of its reserves.

2. The **simplicity** of exercising financial options as compared to the relative complexity of exercising real options. For example, real options are sometimes 'compound' and exercising them may produce another option. In addition, the maturity of real options is a highly subjective variable i.e. whether the option to expand a project lasts indefinitely or only until a competitor expands first and thus dissolves the option.

Figure 1 outlines the limitations of applying DCF analysis (based on only two variables) to valuing more flexible real options (based on six variables) (Leslie and Michaels 1997). The NPV method often misleads as it assumes that the present values of the two levers/variables of value creation (i.e. fixed costs and expected cash flows) are static (Leslie and Michaels 1997). Scenario analysis mitigates this inflexibility by exploring a range of values instead of only single

values but fails to capture flexibility as comprehensibly as ROV does (Leslie and Michaels 1997).

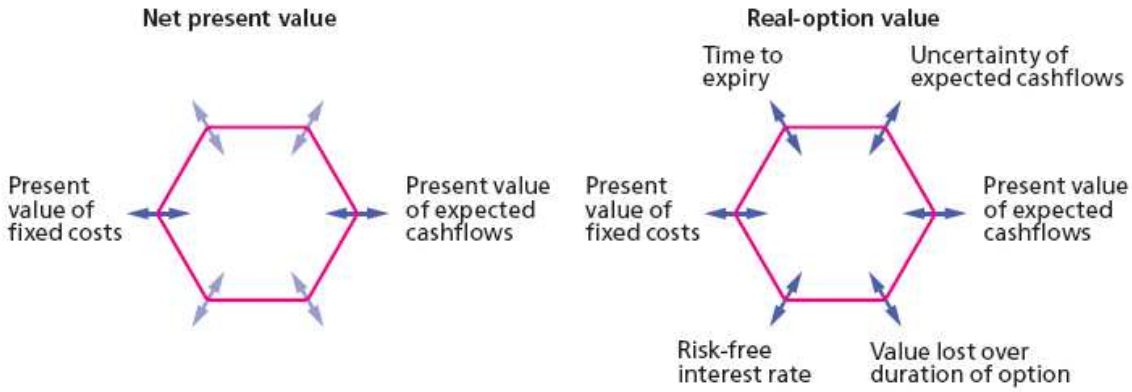


Figure 1: Comparison of NPV and real option value
(Leslie and Michaels 1997:11)

Nevertheless, Leslie and Michaels (1997:7) have drawn "parallels between financial and real options" as shown in figure 2, thus allowing the Black-Scholes-Merton model to be applied to calculate real option values. The Black-Scholes-Merton model (see section 3.2.1) values dividend-paying European call options (Leslie and Michaels, 1997). Financial option values increase with increases in either the stock price, uncertainty of stock price movements, time to expiry, or risk-free interest rate; and decrease with increases in either the exercise price or dividend-payments (Leslie and Michaels 1997). However, real options in this study more closely resemble multi-step American call options thereby necessitating the use of the decision tree-based, binomial (financial) option pricing model developed by Cox, Ross and Rubinstein (1979) instead of the Black-Scholes-Merton model.

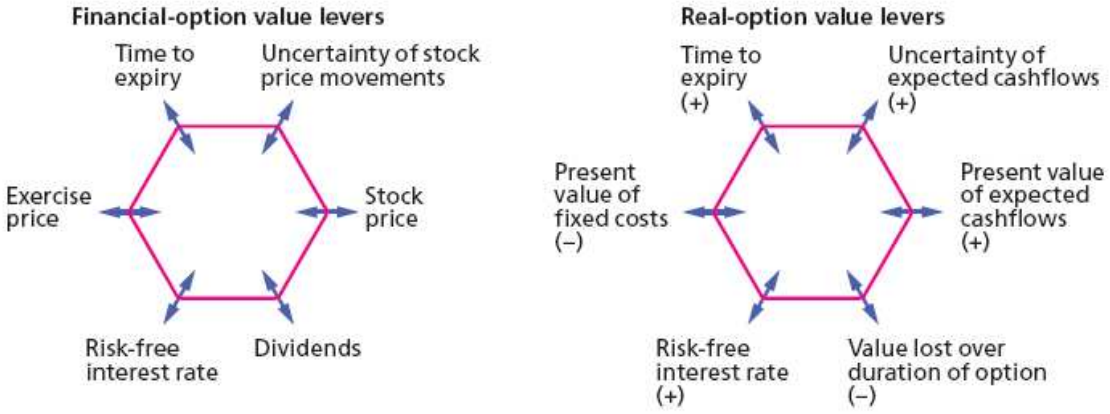


Figure 2: Six levers of financial and real options

(Leslie and Michaels 1997:9)

Additionally, ROV affords the holder both 'reactive flexibilities' i.e. "the option to invest, wait, or divest in response to new information" and 'proactive flexibilities' which allow investors "to take action in ways that will enhance the value of an option once acquired" (Leslie and Michaels 1997:7). Table 1 compares the DCF, decision tree and ROV methods as decision-making tools and highlights the relative advantages of the latter i.e. it is cash flow based, risk-adjusted, multi-period, and captures flexibility (Copeland and Keenan 1998).

Table 1: Key criteria for decision-making tools

(Adapted from Copeland and Keenan 1998:45)

	Cash flow based	Risk adjusted	Multi-period	Captures flexibility
Real option value	√	√	√	√
DCF/NPV	√	√	√	X
Decision trees	√	X	√	√

Copeland and Keenan (1998:40) believe that ROV has not become a widespread method because it is still relatively new, requires complex mathematics and was developed based on uncertainty of worldwide commodity trading (e.g. oil, natural gas, gold). However, critics of ROV question its precision and regard the method merely as justification for investment decisions that do not have sufficient or adequate quantitative backing (Damodaran 2000).

Trigeorgis (1993) lists the following industries to which ROV may be applied: natural resource extraction, real estate development, farming, paper products, research and development (e.g. pharmaceuticals), long-term capital intensive projects (e.g. large-scale construction, energy-generating plants), start-up ventures, fashion apparel, consumer goods, commercial real estate, financial services, consumer electronics, toys, specialty paper, machine parts, oil, electric-power, and chemicals. This study is based on expansion options and Trigeorgis (1993) extends the applicability of ROV to the following: infrastructure-based industries; strategic industries (e.g. high-tech, research and development); industries with multiple product generations or applications (e.g. computers, pharmaceuticals); multinational operations; and, strategic acquisitions.

A review of current literature has shown that ROV of expansion options in retail properties has, to date, not yet been explored. ROV has been applied to the following areas of real estate: real estate finance (Kutner and Siefert 1989); re-development of real estate (Childs, Riddiough and Triantis 1996; Williams 1991); lease contracts (Buetow and Albert 1998); re-development for long-term leases (Capozza and Sick 1991); real estate development (Fourt and Eve 2004; Williams 1991); undeveloped land (Quigg 1993; Titman 1985); and, the effect of pre- and post-development tax rates on timing and intensity of developments (Capozza and Li 1994).

In South Africa, ROV has been applied to a diverse range of investments or projects such as game lodge concessions (Spencer-Young and Durand 2004); vacant commercial land (Dawson 2001); venture capital (Phipps 2001); new mining legislation (Da Costa 2001); a technology development portfolio (Tapper 2001); and, the television industry (De Jaarger 2001).

This study aims to add to the existing body of literature by investigating the reliability of ROV as a complementary tool to the traditional valuation methods when valuing retail properties in the Gauteng area.

2.4 Hypotheses

To satisfy the objectives of this study the following hypotheses were tested:

H_o (Null hypothesis): Embedded real option values do not account for the premium paid over-and-above the theoretical 'fair value' of retail properties in South Africa.

H_A (Alternative hypothesis): Embedded real option values account for the premium of transaction value over-and-above the theoretical 'fair value' of retail properties in South Africa.

3 RESEARCH METHODOLOGY

3.1 Traditional Income-producing property valuation methods

According to Rode (2005) the income-capitalization method (ICM) is the predominant income-producing property valuation method employed in South Africa. It values income-producing property by its ability to produce cash flow and is based on a 'capitalization' or 'cap' rate which is calculated by dividing the upcoming year's forecast net operating income (NOI) by the transaction price (Brueggeman and Fisher 2005). Higher 'cap' rates translate into lower values and, hence, greater returns for the purchaser. The 'initial yield' and 'cap' rate are equal only when a property is fully let at market rental rates which was assumed to be the case in this study (Rode 1994). The methodology to calculate the NOI for an income-producing property is shown in table 2.

Table 2: Calculation of NOI for income-producing property

(Adapted from Brueggeman and Fisher 2005:262)

RENTAL INCOME AT FULL OCCUPANCY + **Other rental income** *(parking, signage, terraces, storage etc.)*
= POTENTIAL GROSS INCOME (PGI) *"Total cash flow possible from all sources and activities relative to the property ownership" (Brueggeman and Fisher, 2005:262).* **- Vacancy and Collection Losses.** *(arrears, vacancies etc.) i.e. 'vacancy factor'*
= EFFECTIVE GROSS INCOME (EGI) **- Real estate taxes** **- Insurance** **- Utilities** *(electricity, water etc.)* **- Repairs and Maintenance** **- Administrative and General** **- Management and leasing** **- Salaries** **- Reserve for Replacements** *(of items such as escalators, elevators, garage/gate motors etc.)*
= NET OPERATING INCOME (NOI) *(this is the figure taken into the 'benefits' calculation)*

Brueggeman and Fisher (2005), Hungria-Garcia (2004) and Rode (1994) describe two approaches to the ICM *viz.* the direct capitalization method (DCM) and discounted cash flow (DCF) method.

3.1.1 Direct capitalization method

This approach is based on estimations of a property's value by forecasting NOI for one year ahead and applying the 'cap' rate or 'initial yield' that has been generated from sales of comparable properties to arrive at a market value (Brueggeman and Fisher, 2005).

According to Rode (2005), the DCM is the preferred approach for valuing income-producing properties in South Africa and is appropriate when a property is fully let at open-market rentals and assumes that cash flow will grow in perpetuity. This method described by Rode (1994) is based on Gordon's Growth Model (Gordon 1959):

$$P_0 = \frac{D_0(1+g)}{(1+r)} + \frac{D_0(1+g)^2}{(1+r)^2} + \ldots + \frac{D_0(1+g)^{\infty}}{(1+r)^{\infty}} \quad (1)$$

where

P_0 = Price or value at year zero (i.e. the theoretical DCM 'fair value')

D_0 = NOI for year one

g = Constant growth rate in perpetuity. Rode (2005) states that 5% capital appreciation is a reasonable growth rate, assuming no change in 'cap' rates.

r = Total return or 'hurdle rate' required by investors.

Provided r > g, the above equation can be simplified as follows:

$$P_0 = D_1 / (r - g) \quad (2)$$

or, the old capitalization formula:

$$P_0 = D_1 / (k) \quad (3)$$

where

$$k = r - g \qquad \text{(cap rate)} \quad (4)$$

However, the ‘cap’ rate is inappropriate as the ‘hurdle’ or ‘discount rate’ because investors expect both income yield **and** capital appreciation and the ‘cap’ rate ignores the latter (Rode 1994).

Therefore, the ‘hurdle’ or ‘discount rate’ is better represented by:

$$r = \frac{D_1}{P_0} + g \qquad (5)$$

This yields ‘r’ as the investors’ expected combined return for any single period as it consists of the **‘initial yield’** (i.e. first year’s income yield) **plus capital appreciation** i.e. “the market’s expected constant growth rate of the cash flow in perpetuity” (Rode 1994:6). The term ‘r’ is also referred to as the cost of capital, required rate of return, or minimum expected internal rate of return (Rode 2005). For example, Rode’s Report for the fourth quarter of 2005 (Rode 2005) dictates that for regional retail centres the minimum ‘hurdle rate’ required by investors should be 14%. This allows one to estimate a theoretical value for a retail centre based on the market research conducted by Rode & Associates CC as per the DCM method.

Brueggeman and Fisher (2005) suggest that when employing the DCM, properties selected as being ‘comparable’ should be similar in quality, size, age, functionality, location, operating efficiency, lease maturities, lease options, rent escalations. However, there are limitations to the reliability of the results even when comparing highly similar properties. An example would be two properties yielding identical NOIs that are in the same area as the one may have four large tenants with long-term leases but the other may have thirty smaller tenants on short-term leases. These subtle qualitative differences must be taken into account when making decisions based on quantitative data.

3.1.2 Discounted cash flow approach

This approach values income-producing properties based on the present value (PV) of all future NOIs (Brueggeman and Fisher 2005). The main difference between this approach and the DCM approach is that the calculation of this method is divided into two parts (Hungria-Garcia 2004):

i. A forecast of NOIs for a finite holding period that is discounted to the PV and summed; and,

ii. A 'terminal value' that refers to "the pattern of cash flow that is expected from the end of the holding period through [to] the end of the useful life of the asset" (Brueggeman and Fisher 2005:266) which is also discounted to the PV and added to the value in (i) to arrive at a net present value (NPV).

The main criticism with this approach is that it estimates a property's value based on future cash flows, hence relying on subjective assumptions for the input variables and a small error may result in "a tremendous misinterpretation in…assessing the value of a property" (Hungria-Garcia 2004:21). For example, annual escalation rate of expenses and rental income as well as vacancy factors are based on either historical data or subjective estimates and their reliability is questionable when used to predict expected future cash-flows.

According to Rode (1994:6), this method alone is inappropriate because it "can only be used in isolation where the cash stream, fixed per the lease(s), is so long – say 40 years or longer – that it approaches perpetuity".

3.1.3 Combined DCM and DCF methods

The two approaches mentioned above have their advantages and disadvantages but Rode (1994) believes that of the two, the DCM approach is the most advantageous as the inputs are derived from the market and no forecasting is required. However, the merits of the latter cannot be ignored, especially as it is deemed to be more accurate by Fiedler and Seville (1992) as well as Tebow (1994). Therefore, both approaches were combined as suggested by Etter (1994), Martin (1993) and Rode (1994) for the valuation methodology of this study.

3.2 Option pricing models

3.2.1 Black and Scholes option pricing model

The pricing of financial options was revolutionized when Black and Scholes (1973) developed a model for valuing European call options that do not pay dividends, taxes or transaction costs (Leslie and Michaels, 1997). The Black and Scholes (1973) formula is as follows:

$$V = SN(d_1) - Ke^{-rt}N(d2) \quad (6)$$

where (Damodaran 2000:31)

S = Current value of the underlying asset

K = Strike price of the option

t = Time to expiration of the option

r = Risk-free interest rate corresponding to the life of the option

σ^2 = Variance in the ln(value) of the underlying asset. This measure is present in the following terms $N(d_1)$ and N(d2),

where

$$d_1 = [\ln(S/K) + (r + \sigma^2/2)t] / \sigma.\sqrt{t} \quad (7)$$

$$d_2 = d_1 - \sigma.\sqrt{t} \quad (8)$$

The terms $N(d_1)$ and $N(d_2)$ refer to the range of probability that the option will be 'in-the-money' at expiration (Damodaran 2000). This model, according to Damodaran (2000), is based on a 'replicating portfolio' that is characterized by the underlying asset and risk-free asset having the same cash flows as the option being valued. Subsequently, Merton (1973) modified the formula to value dividend-paying stocks and is referred to as the Black-Scholes-Merton model.

3.2.2 Binomial option pricing model

This study valued American call options having multiple steps, therefore, the decision tree-based binomial option pricing model developed by Cox *et al* (1979) was used instead of the Black-Scholes-Merton model. The binomial model does not "try to reduce those [real option] complexities into standard

option models…which have only five or six variables" as in the case of the Black-Scholes-Merton model and allows changes to the inputs at each time period so that it more accurately resembles the cash flows of the project (Copeland and Tufano 2004:90).

The Binomial model follows what is called the 'binomial price path' i.e. in any time period the underlying stock/asset (denoted by 'S') can either move up to 'Su' with probability 'p' or down to 'Sd' with probability '1-p' (Damodaran 2005). The 'binomial price path' shown in figure 3 allows one to calculate the option price at the initial node, S.

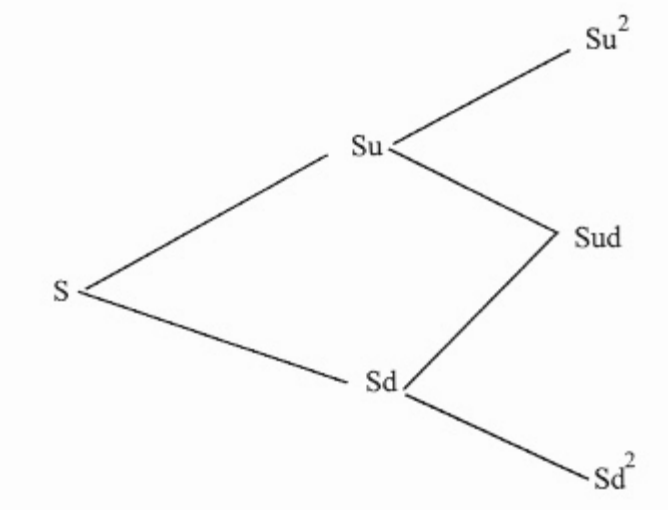


Figure 3: Binomial price path
(Damodaran 2005:10)

A **'replicating portfolio'** is constructed using a similar combination of risk-free borrowing/lending (r) – not to be confused with the 'hurdle rate' - and the underlying asset/stock value (S) that creates the same cash flows as the option we are valuing (Damodaran 2005). In the case of the first movement, the call option values in up (c_u) and down (c_d) states are calculated as follows (Senel 2003):

$$c_u = \Delta.Su - B(1+r) \quad (9)$$

$$c_d = \Delta.Sd - B(1+r) \quad (10)$$

where Δ = units of underlying asset, and B = borrowing at risk-free rate 'r'.

Solving the above equations simultaneously results in the following two equations (Senel, 2003):

$$\Delta = (c_u - c_d) / (Su-Sd) \quad (11)$$

$$B = (c_u - c_d) / (u-d)(1+r) \quad (12)$$

The value of the call option at time zero equals that of the 'replicating portfolio' at time zero as they have the same cash-flows (Senel 2003):

$$\text{Value of the call option} = \Delta.S-B \quad (13)$$

In order to value options in a multi-period binomial model, the valuation starts iteratively from the last period moving backwards until the current time (i.e. time zero) is reached (Damodaran 2005). This results in a value of the option in terms of the 'replicating portfolio' that is composed of Δ number of shares of the underlying asset/stock and B amount of borrowing needed to replicate the option (Damodaran 2005). The value of an option is determined by the underlying asset/stock *CURRENT* price – not its *EXPECTED* price as a consequence of arbitrage i.e. if the option value deviates from that of the 'replicating portfolio' then an arbitrage position may be created (Damodaran 2005).

3.3 Valuation methodology

This study focused on transactions where purchasers paid higher prices (i.e. lower 'initial yield' or 'cap' rate) for a retail property than theoretically viable according to the relevant quarterly Rode Report minimum required 'hurdle rate'. The following three sequential stages of calculations comprise the ROV framework that valued any premium paid above the theoretical DCM 'fair value'.

3.3.1 Valuation of existing retail property

Theoretical DCM 'fair value' (Vt)

In order to determine the theoretical DCM-based 'fair value' for each retail property, the forecasted year one NOI for the EXISTING structure was divided by the minimum 'hurdle rate' (see "Current GLA Valuation" spreadsheet in the

relevant appendix for each case study). This ‘hurdle rate’ (i.e. income yield plus capital appreciation) was obtained from the quarterly Rode Report relevant to the transaction period. The NOI for years two to five was included for illustrative purposes only.

Actual transaction value (Va)

This value was the actual transaction price paid by the investors (at year zero) based on the forecast NOI at year one. In order to qualify for inclusion in this study the ‘initial yield’ was lower (i.e. transaction price higher) than that of the Vt (see “Current GLA Valuation” spreadsheet in the relevant appendix for each case study).

Comparison of Va and Vt

The theoretical DCM ‘fair value’ (Vt) and actual transaction value (Va) (at year zero) were compared and any amount that Va exceeded Vt represented the premium paid (see “Current GLA Valuation” spreadsheet in the relevant appendix for each case study). It is this premium that qualified a case study for the subsequent expansion and real option valuation (ROV).

3.3.2 Valuation of expansion portion

Investment horizon

Rode (2005:23) is of the opinion that “in viability calculations, it is problematic to try and forecast rental growth and operating-cost inflation over a period longer than 5 years”. Tebow (1994), however, states that a “10-year projection is appropriate for DCF analysis…[as] it reflects the long-term nature of real-estate investment, lessens the impact of minor market fluctuations, and provides a consistent basis of comparison for cash flow assumptions”. Therefore, the investment horizon in this study was extended up until ten years with multiple ‘exit-points’ (i.e. selling the expanded portion) from the initial holding-period of five years up-to-and-including the tenth year. This was necessary because different investments required different holding-periods to yield a positive NPV.

DCF valuation of expansion portion

It was assumed that the option to expand would be exercised immediately at the transaction date (year zero) and the development of the expansion would require one year for completion. Income from the expansion was assumed to begin from the beginning of year two.

The annual potential gross income (PGI) of the expansion was calculated by inputting both the additional 'bulk' or GLA allowable and estimated rental per square metre thereof into the "Option to Expand GLA" spreadsheet (in the relevant appendix for each case study). The resulting PGI then had a vacancy factor deducted to calculate the effective gross income (EGI). Operating expenses of the expansion were deducted from EGI to arrive at a potential NOI and were estimated on a *pro-rata* basis according to that of the existing structure. The NOI formed the initial input to the "Benefits Forecast" spreadsheet (in the relevant appendix for each case study) for year two through to year eleven. Year eleven was included to estimate a selling price at the 'exit point' for year ten as per the DCM approach.

The capital expenditure (exercise price, X) required to exercise the option to expand was also inputted into the "Benefits Forecast" spreadsheet and was based on the building cost estimate per square metre as communicated by the relevant investor. The after-tax 'terminal value' was calculated at each 'exit point' (i.e. year five through to year ten) using the five-year risk-free RSA government retail bond as the required return. This required return was assumed to remain constant through to year ten.

Using DCF techniques as suggested by Etter (1994), Martin (1993) and Rode (1994), the 'benefits' figures up to-and-including each 'exit point' as well as the 'terminal value' (i.e. for year five through to year ten) were discounted to the PV by using the after-tax cost of interest (i.e. assumed cost of capital) as the discount rate and then summed. This final figure represented the 'strike price' (S-value) at each 'exit point' and was inputted into the Derivagem software programme developed by Hull (2006) which is based on the binomial option pricing model of Cox *et al* (1979). The 'terminal value' was based only on the

resale of the expansion portion as it is this portion that the option to expand applies to but in reality it would be sold together with the existing structure.

3.3.3 ROV valuation of expansion portion

Damodaran (2000) stressed that not all investments or projects have real or 'embedded' options and if they do, then not all options have value. Therefore, he advises investors to answer the following two questions affirmatively prior to analyzing and valuing real options (Damodaran 2000:40):

1. **"Is the first investment really a prerequisite for the later investment / expansion?"** In this study, purchasing the initial retail property is indeed a prerequisite in order to possess the option to expand.

2. **"Does the firm have an exclusive right to the later investment / expansion?"** Assuming the first question is answered affirmatively, the investor would undoubtedly have exclusivity to expand the purchased retail property while the original structure is owned.

The binomial option pricing model in the Derivagem software package (Hull 2006) was used to value the option to expand (American call option on dividend-paying stocks). This model includes the inputs as discussed in Damodaran (2000) and modified with input from Durand (2007) as follows to be applicable to retail property transactions:

S = **Present value of 'benefits' of expansion in perpetuity** (i.e. sum of 'benefits' and relevant terminal value discounted to PV).

X = **Cost of expansion to property if exercised immediately upon purchase** (i.e. capital expenditure at year zero for development of expansion).

T = **Period for which expansion option applies (in years).** Damodaran (2000) notes that when dealing with the option to expand there is no fixed time horizon to exercise the option. However, an investment horizon of between five and ten years was assumed with ROV being

calculated at each period. The cut-off period of ten years was selected as guided by Tebow (1994).

r = **Risk-free rate.** This was selected as being the RSA government retail bond having a maturity as close to the holding period as possible i.e. maturing in five years from the transaction month. This risk-free rate is assumed to remain constant for subsequent periods until the tenth year. This 'r' term is not to be confused with the previously mentioned 'hurdle rate'.

The relevant strike price was entered into the Derivagem software programme to calculate the real option value (**Vr**) for year 5 through to year 10 - this value should account for the amount (i.e. premium) by which **Va** exceeds **Vt** (see "Derivagem Valuation" and "Binomial Tree" spreadsheets in the relevant appendix for each case study). The premium paid was compared to **Vr** which represents the 'embedded' optionality to expand.

The option to expand (**Vr**) is "at-the-money" when the actual transaction value (**Va**) is equal to the sum of the calculated theoretical 'fair value' (**Vt**) **plus** the real option value (**Vr**) i.e. **Va ≈ Vt + Vr**. However, it would be preferable for the option to be "in-the-money" from the purchasers' perspective i.e. **Va < Vt + Vr**, where the NPV of the 'benefits' plus terminal value exceeds the actual premium paid.

3.4 Data Collection

3.4.1 Data source identification and collection

The data collection process was more difficult than initially anticipated. Commercial property companies listed on the Johannesburg Securities Exchange (JSE) were not forthcoming in providing information so as not to divulge their investment strategy - despite the author's willingness to sign a confidentiality agreement. Therefore, potential qualifying retail properties were sourced in the following three ways:

i. Recent retail properties purchased as advertised in the media;

ii. Retail properties displaying on-site advertising indicating that the structure would be undergoing expansion and renovation (a prior acquisition must have occurred as a pre-requisite); and,

iii. Brokers willing to assist by providing details of retail property transactions.

3.4.2 Data requested

Investors were initially contacted telephonically or via e-mail and if they agreed to participate then the following information regarding the original transaction was requested:

- Purchase month and year
- Purchase price (Rands)
- Potential gross income (Rands) and operating expenses (Rands)
- Current 'bulk' or GLA (square metres)
- Annual rental escalation (%) and vacancy factors (%). These varied greatly depending on the lease for each individual tenant. Therefore, figures of 10% and 5%, respectively, were discussed with the investors and deemed acceptable. Furthermore, standardizing these two inputs enhanced comparability between case studies.

In addition, the following information was requested for the option to expand:

- Additional 'bulk' or GLA (square metres) allowable; and,
- Building cost (Rands per square metre) for expansion and proposed rental rate (Rands per square metre) of the additional 'bulk' as estimated by the investor.

3.4.3 Screening of data and subsequent feedback

The data provided by the investors was analyzed as shown in the "Current GLA Valuation" shown in the appendix. If it was determined that a premium was paid

over-and-above the theoretical ‘fair-value’ then the purchasers’ strategic or ‘gut-feel’ motivations for paying the final transaction price were discussed. This screening process eliminated many cases, as did a lack of expandable ‘bulk’.

The investors involved in the four qualifying cases were categorized as shown in table 3 (identities were requested to remain confidential):

Table 3: Summary of respondents

Respondents	Case Study
Investor 1	1
Investor 2	2
Investor 3	3
Investor 1	4

It is worth mentioning the following case types that were excluded as they fell out of the scope of this study but could be investigated further:

- Retail properties with a negative NOI that would require a substantial investment to return the property to a profitable state. Investors mentioned that even a substantial investment to ‘turn a property around’ could be hindered by neglected surrounding areas and are, therefore, riskier investments.

- Retail property transactions where the property was purchased at a discount to the theoretical ‘fair value’. This is obviously favourable for the purchaser but falls out of the scope of this study due to the absence of a premium having been paid.

3.5 Assumptions for model

- Definitive ‘market’ rental rates are not easily obtainable and if they were they may not be reliably applied to different areas and/or building profiles. This would introduce an additional uncertainty into the calculations so it was assumed that the properties were fully let at market

rentals allowing the terms ‘initial yield’ and ‘cap’ rate to be used interchangeably.

- The purchaser is not obliged to expand the retail property but holds the option to do so at his/her discretion. This is the essence of this study as the purchaser paid a premium for this option. However, in order to apply the ROV framework, it was assumed that the purchaser did exercise the option to expand immediately upon signing of the sales contract. It was also assumed that the expansion would require one year from signing of the sales contract to complete. During the year of development of the expansion it yields no income but the existing structure continues to do so. The additional ‘bulk’ was assumed to be fully let from the beginning of year two.

- Rental income was escalated at 10% per annum and a vacancy factor of 5% was deducted from the potential gross income to arrive at the effective gross income. Expenses were escalated at 6% per annum which is the upper limit of the South African Reserve Bank’s inflation-targeting range (Mboweni 2002). These assumptions were deemed acceptable by the relevant purchasers in forecasting cash-flows for both the existing and expanded structures.

- Building costs per square metre and additional per square metre rental rates for the expansion were inputted according to the relevant developer’s estimations.

- The operating expenses for the expansion were based on the ratio of the additional GLA to the existing GLA.

- The after-tax ‘terminal value’ was calculated at each ‘exit point’ (i.e. year five through to year ten) with the required return being the five-year RSA risk-free government retail bond and was assumed to remain constant through to year ten.

- ‘Benefits’ were discounted to the PV based on the after-tax cost of interest (ATCI) component of the weighted average cost of capital

(WACC) model. The ATCI (i.e. cost of debt) was solely used as the cost of capital for discounting purposes as it was assumed that the expansion was entirely debt-funded over twenty years at 2% below the prevailing commercial-bank prime lending rate.

- The terminal value was also based on the assumption that the property will be sold at the end of the relevant investment holding-period and the funds will not be re-invested. This results in a capital gains tax (CGT) charge which is calculated separately from the existing structure but would obviously be sold together with the original structure. The estimated resale value at each investment period was based on the NOI divided by the risk-free return rate.

- Depreciation of the expanded portion was matched to the loan term (i.e. twenty years) in order to calculate the CGT charge when estimating the 'terminal value'.

- The real or 'embedded' options of retail properties are classed as American call options which may be exercised anytime prior, or on, the expiration date.

- A proxy volatility value for Derivagem software was estimated as shown in Appendix 5 which was based on the volatility of commercial property companies and funds listed on the Johannesburg Stock Exchange (JSE) in the beginning of 2007. However, for instances such as case study 1, the risk-free rate is 9.0% and the proxy volatility from appendix 5 is 8.27% and a "derivative's excess return [e.g. options, futures etc] over the risk-free rate equals the market price of risk multiplied by the variable's volatility" (Hull 2006:603). This presents a problem because the volatility should be greater than the risk-free rate in order for the binomial model to calculate a value for the option to expand. Therefore, the author adjusted the volatility upward so that it exceeded the risk-free rate by the lowest possible amount (i.e. by adding 0.001%). This allowed financial option pricing theory to be applied to real options based on seemingly less volatile retail property cash-flows.

3.6 Limitations of this study

This study remains a largely academic exercise and is subject to the following limitations:

- It is based on only four case studies which disqualifies the findings from being statistically significant but does indicate the reliability of ROV and provide a basis for a more comprehensive study.
- The transaction price was assumed to be the result of an ‘arm’s-length’ business relationship between the buyer and the seller. The basis for this assumption is not as definitive as transactions involving listed products (shares, bonds, financial options etc.) that are traded through a securities exchange that is strictly regulated to ensure no ‘insider trading’ occurs. This lower market efficiency of unlisted properties was highlighted in the introduction.
- Numerous assumptions were required for the inputs as discussed above. This was especially in instances where there was a lack of appropriate and definitive information available. These assumptions were necessary in order to improve comparability of the case studies as well as to apply the ROV framework to valuing expansion options in retail properties.

4 RESULTS AND DISCUSSION

4.1 General

The theoretical 'fair value' (Vt) calculation for each retail centre is outlined in the "Current GLA Valuation" spreadsheet in the relevant appendix. The Vt is compared to the actual transaction price (Va) and the premium paid is calculated (i.e. Va - Vt).

The option to expand was calculated by forecasting the following year's estimated NOI from the additional 'bulk' (see "Option to Expand GLA" spreadsheet in the relevant appendix) and then inputted into the "Benefits Forecast" spreadsheet where the 'benefits' were discounted to the present value to yield the strike price (S-value for Derivagem software). Inputs into this spreadsheet are highlighted adjacent to the cells and the debt-repayments are inputted from the "Loan Repayment Schedule" spreadsheet (in the relevant appendix).

The S-value for the investment holding-periods ranging from five- to ten-years was inputted into Derivagem software (Hull, 2006) which calculated the value of the real option (Vr) at each period (see "Derivagem Valuation" in the relevant appendix). If positive, this value was compared to the premium paid (i.e. Va - Vt) to determine the holding-periods where the real option value is greater and predicted to be 'in-the-money'. The corresponding binomial tree is a graphical representation of Vr (see "Binomial Tree" spreadsheet in the relevant appendix).

A summary of results for each case study appears in the relevant section with Vr values predicted to be 'in-the-money' shown in bold-type.

4.2 Case study 1

Table 4: Summary of retail centre 1

Date purchased	February 2007
Location	Northern Suburbs of Johannesburg
Transaction price (Va)	R45,000k
Theoretical 'fair value' (Vt)	R42,865k
PREMIUM paid (Va - Vt)	R2,135k

Table 5: Summary of real option values for retail centre 1

Year	Derivagem option value (Vr)	Premium paid (Va – Vt)	Difference
5	R8,406k	R2,134k	**R6,272k**
6	R12,369k	R2,134k	**R10,235k**
7	R16,351k	R2,134k	**R14,217k**
8	R20,349k	R2,134k	**R18,215k**
9	R24,377k	R2,134k	**R22,243k**
10	R28,431k	R2,134k	**R26,297k**

The real option valuation (ROV) framework valued the option to expand at five years equal to R8,406k which is R6,272k higher than the premium paid and is 'in-the-money' from this first period (i.e. five years) up-to-and-including the final period (i.e. ten years) This is highly favourable for the investor as the option was obtained at a discount.

The purchaser communicated the following strategic reasons for paying this premium:

- The property is only five-years-old so a major refurbishment is not required in the near future.
- The property is located on a main road that has substantial automotive traffic originating from an adjacent large residential area as well as traffic using the road for thoroughfare purposes.

- It is in close proximity to Lanseria airport which is quickly establishing itself as serious competition to the busiest airport in South Africa *viz.* O.R. Tambo International Airport.

4.3 Case Study 2

Table 6: Summary of retail centre 2

Date purchased	December 2003
Location	North-Eastern Johannesburg
Transaction price (Va)	R120,000k
Theoretical 'fair value' (Vt)	R54,275k
PREMIUM paid (Va - Vt)	R65,725k

Table 7: Summary of real option values for retail centre 2

Year	**Derivagem option value (Vr)**	**Premium paid (Va – Vt)**	**Difference**
5	R0k	R65,724k	(R65,724k)
6	R10,240k	R65,724k	(R55,484k)
7	R27,337k	R65,724k	(R38,387k)
8	R44,563k	R65,724k	(R21,161k)
9	R61,938k	R65,724k	(R3,786k)
10	R79,517k	R65,724k	**R13,793k**

The ROV framework valued the option to expand at five years equal to zero but even when the option did have value, it remained less than the premium paid up-to-and-including year nine. Therefore, the option is only 'in-the-money' at the end of the tenth-year at a value R13,793k greater than the premium paid. In this case, the purchaser overpaid for this option to expand all the way up-to–and-including year nine but is an example of the heterogeneity of the holding-periods of retail property investments.

The purchaser communicated the following strategic reasons for paying this seemingly exorbitant premium:

- This retail centre had exciting potential as it is located in a well-established, affluent residential area benefitting from thoroughfare traffic.
- There exists no undeveloped commercial land of a comparable size and zoning within the surrounding radius.
- Although the property required a major refurbishment - which was envisaged to begin soon after transfer - the existing 'bulk' would definitely be expanded so as to increase the rental income.
- The interest from a number of competing investors resulted in a higher transaction price being demanded by the sellers.

4.4 Case Study 3

Table 8: Summary of retail centre 3

Date purchased	November 2006
Location	Sandton
Transaction price (Va)	R56,000k
Theoretical 'fair value' (Vt)	R17,663k
PREMIUM paid (Va - Vt)	R38,337k

Table 9: Summary of real option values for retail centre 3

Year	**Derivagem option value (Vr)**	**Premium paid (Va – Vt)**	**Difference**
5	R76,700k	R38,337k	**R38,363k**
6	R96,711k	R38,337k	**R58,374k**
7	R116,955k	R38,337k	**R78,618k**
8	R137,465k	R38,337k	**R99,128k**
9	R158,281k	R38,337k	**R119,944k**
10	R179,433k	R38,337k	**R141,096k**

The ROV framework valued the option to expand at five years equal to R38,363k which is twice the value of the premium paid and is 'in-the-money'

from this first period until the final period. This is highly favourable for the investor as in case study 1.

The purchaser communicated the following reasons for paying this premium:

- This retail centre had exciting potential as it is located on Rivonia Road - arguably the busiest road flowing through South Africa's financial capital, Sandton.
- As a result of limited commercial land available in the Sandton area, re-developments have become the norm as a means to increase returns for commercial property investors.
- Although the property required a major refurbishment - which was envisaged to begin soon after transfer - the existing 'bulk' would definitely be increased so as to increase the rental income.

4.5 Case Study 4

Table 10: Summary of retail centre 4

Date purchased	December 2003
Location	Centurion
Transaction price (Va)	R15,000k
Theoretical 'fair value' (Vt)	R10,521k
PREMIUM paid (Va - Vt)	R4,479k

Table 11: Summary of real option values for retail centre 4

Year	**Derivagem option value (Vr)**	**Premium paid (Va – Vt)**	**Difference**
5	R0k	R4,478k	(R4,478k)
6	R0k	R4,478k	(R4,478k)
7	R0k	R4,478k	(R4,478k)
8	R0k	R4,478k	(R4,478k)
9	R2,828k	R4,478k	(R1,650k)
10	R6,100k	R4,478k	**R1,622k**

The ROV framework valued the option to expand at five years equal to zero up-to-and-including the end of year eight. Even when the option did have value, it remained less than the premium paid up-to-and-including year nine and is also an example of the heterogeneity of the holding-periods of retail property investments. The Vr is only 'in-the-money' at the end of the tenth year and by only R1,622k.

The purchaser communicated the following reasons for paying this seemingly exorbitant premium for an option that is only 'in-the-money' at year ten:

- This retail centre is located in a residential area two kilometres from a highway exit between the two major business centres in Gauteng i.e. Johannesburg and Pretoria.
- Although the property required a major refurbishment this was to be delayed until the surrounding residential area had developed further. It is at this point when the purchaser would develop the additional 'bulk' allowable for this retail property and reap the rewards.

This case was unique to this study as the investor was willing to wait before investing further to expand and re-develop the retail property. The investment horizon from the investors' perspective may be longer than ten years which may explain the relatively lower real option value at the tenth year as compared to the other case studies.

4.6 Interpretation of results

In all four cases it was shown that the real or 'embedded' options did account for the premium paid over-and-above the theoretical 'fair value' and are 'in-the-money' at some stage. Therefore, the null hypothesis was rejected and the alternative hypothesis accepted (i.e. embedded real option values account for the premium of transaction value over-and-above the theoretical 'fair value' of retail properties in South Africa). In case studies two and four the real option only had value later in the investment holding period than expected.

Based on consultation with the purchasers, it is the opinion of the author that this ‘gap’ or premium paid included in the actual transaction price over the theoretical value was motivated by strategic reasons that have, until now, been unquantifiable in the case of retail property transactions. Therefore, the ROV framework could undoubtedly serve as a useful complementary tool to the traditional income-producing property valuation methods - provided the assumptions and inputs are based on definitive sources and the financial modelling is performed by researchers proficient in the methodology.

5 CONCLUSIONS

5.1 Conclusions of this study

This study developed and applied a novel method of evaluating retail property transactions by employing real option valuation (ROV) as a complementary method to the income-capitalization method (ICM). In all four case studies, the ROV model developed was successful in quantifying seemingly unquantifiable premiums paid for retail properties based on 'gut-feel' or intuition-based strategic reasons.

In order for the ROV framework to be widely accepted as a definitive and complementary tool to the ICM, a statistically significant number (i.e. greater than 30) of highly similar case studies (e.g. same area, time period, building age, tenant-profiles) must be evaluated and compared. However, there exist certain challenges to achieving this:

i. The relative illiquidity of retail-properties relative to financial options that hampers comparability;

ii. Inputs to the both the ROV and ICM are not always based on reliable and authoritative sources; and,

iii. Property transactions may not be at "arm's-length" as in the case of financial options which are traded on highly regulated electronic exchanges. This is because the purchasers and sellers usually deal with each other personally thereby increasing the opportunity and possibility of 'insider trading'.

In summary, the combined ROV-ICM methods yielded valuation estimates closer to the actual transaction price for retail properties (having the option to expand) than the ICM method alone thereby supporting the case for employing the combined method.

5.2 Recommendations for further research

ROV may be applied to alternative types of income-producing property, for example, offices, hotels, and industrial-properties. Residential property investments may also be investigated but in the context of ‘buy-to-let’ so that income-producing property valuation methods may be applicable.

Data collection, screening and analysis required for this task would require access to a large number of commercial-, residential- and industrial-property industry participants. This would aim to statistically prove the reliability and credibility of the ROV framework so that it may form part of an investor’s arsenal of decision-making tools when purchasing income-producing properties.

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APPENDIX 1

CASE STUDY 1

Retail Centre 1 - Northern Suburbs Johannesburg

Current GLA Valuation

Transaction Date	February 2007	**Initial yield (DCM)**	**11.0%**
Corporate tax tate	29%	GLA (m^2)	7937
Rode 'hurdle rate' for relevant quarter	11.5%	Average Annual Rent per m^2	R 790
Annual rent escalation (10%)	1.1	Average Monthly Rent per m^2	R 66
Annual expenses escalation (inflation target 6%)	1.06	Depreciation of capex over 20 years	R 2,250,000
Vacancy factor	5%	After tax cost of interest	7.8%
Actual Transaction price (Va)	**R 45,000,000**	**Theoretical DCM value (NOI / Rode hurdle rate) (Vt)**	**R 42,865,794**
		Difference (Premium paid) >>>	**R 2,134,206**

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
POTENTIAL GROSS INCOME (PGI)	6,272,133	6,899,346	7,589,281	8,348,209	9,183,030
Less vacancy factor of 5%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)	*5,958,526*	6,554,379	7,209,817	7,930,799	8,723,878
-TOTAL OPERATING EXPENSES	-1,028,960	-1,131,856	-1,245,042	-1,369,546	-1,506,500
NET OPERATING INCOME (NOI)	**4,929,566**	**5,422,523**	**5,964,775**	**6,561,253**	**7,217,378**

Option to Expand GLA ***Assume 1 year to build extension if exercised at transaction date***

Additional GLA (m2)	3000	Additional GLA as % of current GLA	38%
Additional GLA monthly rent (R/m^2)	120	Additional GLA expenses at Year 1	-388,923
Additional Annual PGI	4,320,000	Depreciation of capex over 20 years	750,000
Building cost to extend (R/m^2)	5,000		
Capital expenditure to extend	15,000,000		

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**
POTENTIAL GROSS INCOME (PGI)		4,320,000	4,752,000	5,227,200	5,749,920	6,324,912	6,957,403	7,653,144	8,418,458	9,260,304	10,186,334
Less vacancy factor of 5%		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)		4,104,000	4,514,400	4,965,840	5,462,424	6,008,666	6,609,533	7,270,486	7,997,535	8,797,288	9,677,017
-TOTAL OPERATING EXPENSES		-412,258	-436,994	-463,213	-491,006	-520,466	-551,694	-584,796	-619,884	-657,077	-696,501
NET OPERATING INCOME (NOI)		**3,691,742**	**4,077,406**	**4,502,627**	**4,971,418**	**5,488,200**	**6,057,839**	**6,685,690**	**7,377,651**	**8,140,212**	**8,980,516**

Retail Centre 1 - Northern Suburbs Johannesburg

Benefits Forecast

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CAPEX	-15,000,000	<<<<<<<<<	**X VALUE FOR DERIVAGEM**									
Terminal value	0	0	0	0	0	43,209,373	49,053,051	55,487,172	62,572,079	70,374,262	78,966,982	
PV OF TERMINAL VALUE						**29,667,622**	**31,240,052**	**32,777,760**	**34,285,321**	**35,766,994**	**37,226,746**	
EGI		0	4,104,000	4,514,400	4,965,840	5,462,424	6,008,666	6,609,533	7,270,486	7,997,535	8,797,288	9,677,017
-Total operating expenses		0	-412,258	-436,994	-463,213	-491,006	-520,466	-551,694	-584,796	-619,884	-657,077	-696,501
NOI		**0**	**3,691,742**	**4,077,406**	**4,502,627**	**4,971,418**	**5,488,200**	**6,057,839**	**6,685,690**	**7,377,651**	**8,140,212**	**8,980,516**
-Interest on loan		-1,639,189	-1,613,876	-1,585,633	-1,554,122	-1,518,965	-1,479,739	-1,435,974	-1,387,145	-1,332,665	-1,271,881	
PBT		**-1,639,189**	**2,077,866**	**2,491,773**	**2,948,504**	**3,452,453**	**4,008,461**	**4,621,864**	**5,298,545**	**6,044,986**	**6,868,330**	
-Corporate Tax		0	-602,581	-722,614	-855,066	-1,001,211	-1,162,454	-1,340,341	-1,536,578	-1,753,046	-1,991,816	
-Principal repaid on loan		-218,294	-244,063	-272,306	-303,817	-338,974	-378,200	-421,965	-470,794	-525,274	-586,058	
BENEFITS	**-15,000,000**	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**2,467,807**	**2,859,559**	**3,291,173**	**3,766,666**	**4,290,457**	
Benefits + Terminal value	**-15,000,000**	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**45,321,641**						
	-15,000,000	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**51,520,859**					
	-15,000,000	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**2,467,807**	**58,346,731**				
	-15,000,000	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**2,467,807**	**2,859,559**	**65,863,252**			
	-15,000,000	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**2,467,807**	**2,859,559**	**3,291,173**	**74,140,928**		
	-15,000,000	**-1,857,483**	**1,231,222**	**1,496,853**	**1,789,621**	**2,112,267**	**2,467,807**	**2,859,559**	**3,291,173**	**3,766,666**	**83,257,439**	
PV OF BENEFITS	-15,000,000	-1,722,923	1,059,298	1,194,544	1,324,723	1,450,286	1,571,654	1,689,218	1,803,343	1,914,369	2,022,614	
ATCI for PV of CF	**7.8%**	**<<assumption: 100% debt-funded.**										
Required Return	**9.0%**	**<<Risk-Free Rate (yield of 5 year RSA Retail Bond matched to transaction month)**										
PV OF BENEFITS + TERMINAL VALUE (S VALUE FOR DERIVAGEM)					**>>>>>>>>>**	17,973,549	21,117,634	24,344,559	27,655,463	31,051,506	34,533,873	
IRR of Benefits					**>>>>>>>>>**	**26.1%**	**25.0%**	**24.2%**	**23.6%**	**23.2%**	**22.8%**	

Terminal value of extended section						
Est. resale (NOI for Next Year/WACC)	60,980,000	67,309,318	74,285,448	81,973,902	90,446,796	99,783,510
-Balance owing on loan (capital only)	-13,622,546	-13,244,346	-12,822,382	-12,351,588	-11,826,314	-11,240,256
Subtotal	**47,357,454**	**54,064,972**	**61,463,066**	**69,622,314**	**78,620,482**	**88,543,254**
-Cumulative depreciation	-3,750,000	-4,500,000	-5,250,000	-6,000,000	-6,750,000	-7,500,000
-Initial CAPEX	*-15,000,000*	*-15,000,000*	*-15,000,000*	*-15,000,000*	*-15,000,000*	*-15,000,000*
Taxable Capital Gain	*28,607,454*	*34,564,972*	*41,213,066*	*48,622,314*	*56,870,482*	*66,043,254*
-Capital gains tax for companies at 14.5%	-4,148,081	-5,011,921	-5,975,895	-7,050,236	-8,246,220	-9,576,272
After-tax Terminal Value	**43,209,373**	**49,053,051**	**55,487,172**	**62,572,079**	**70,374,262**	**78,966,982**

Retail Centre 1 - Northern Suburbs Johannesburg

Loan Repayment Schedule

Loan principal	15,000,000	
Loan interest	11%	Assume 2% below prime lending rate
Loan Term (years)	20	
Monthly payment	**R 154,828**	

Month	Principal at beginning of month	Payment at end of month	Interest portion	Cumulative interest	Principal portion	Cumulative principal
1	15,000,000	154,828	137,500	137,500	17,328	17,328
2	14,982,672	154,828	137,341	274,841	17,031	34,359
3	14,965,641	154,828	137,181	412,022	17,647	52,007
4	14,947,993	154,828	137,019	549,041	17,809	69,816
5	14,930,184	154,828	136,856	685,897	17,972	87,788
6	14,912,212	154,828	136,691	822,588	18,137	105,926
7	14,894,074	154,828	136,525	959,113	18,303	124,229
8	14,875,771	154,828	136,357	1,095,470	18,471	142,700
9	14,857,300	154,828	136,188	1,231,658	18,641	161,341
10	14,838,659	154,828	136,017	1,367,675	18,811	180,152
11	14,819,848	154,828	135,844	1,503,519	18,984	199,136
12	14,800,864	154,828	135,670	1,639,189	19,158	218,294
13	14,781,706	154,828	135,495	1,774,684	19,333	237,627
14	14,762,373	154,828	135,318	1,910,002	19,511	257,138
15	14,742,862	154,828	135,139	2,045,140	19,690	276,827
16	14,723,173	154,828	134,958	2,180,099	19,870	296,697
17	14,703,303	154,828	134,776	2,314,875	20,052	316,750
18	14,683,250	154,828	134,592	2,449,467	20,236	336,986
19	14,663,014	154,828	134,407	2,583,874	20,421	357,407
20	14,642,593	154,828	134,220	2,718,093	20,609	378,016
21	14,621,984	154,828	134,031	2,852,124	20,798	398,813
22	14,601,187	154,828	133,840	2,985,964	20,988	419,802
23	14,580,198	154,828	133,648	3,119,612	21,181	440,982
24	14,559,018	154,828	133,453	3,253,065	21,375	462,357
25	14,537,643	154,828	133,258	3,386,323	21,571	483,928
26	14,516,072	154,828	133,060	3,519,383	21,768	505,696
27	14,494,304	154,828	132,860	3,652,243	21,968	527,664
28	14,472,336	154,828	132,659	3,784,902	22,169	549,833
29	14,450,167	154,828	132,456	3,917,357	22,373	572,206
30	14,427,794	154,828	132,251	4,049,608	22,578	594,784
31	14,405,216	154,828	132,044	4,181,652	22,785	617,568
32	14,382,432	154,828	131,835	4,313,486	22,993	640,562
33	14,359,438	154,828	131,624	4,445,110	23,204	663,766
34	14,336,234	154,828	131,411	4,576,522	23,417	687,183
35	14,312,817	154,828	131,197	4,707,718	23,632	710,815
36	14,289,185	154,828	130,980	4,838,698	23,848	734,663
240	153,878	154,828	1,406	22,158,782	153,422	14,999,544

Retail Centre 1 - Northern Suburbs Johannesburg

Derivagem Valuation

Underlying Type: Equity

Stock Price:	17.97
Volatility (% per year):	9.01%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration	5.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

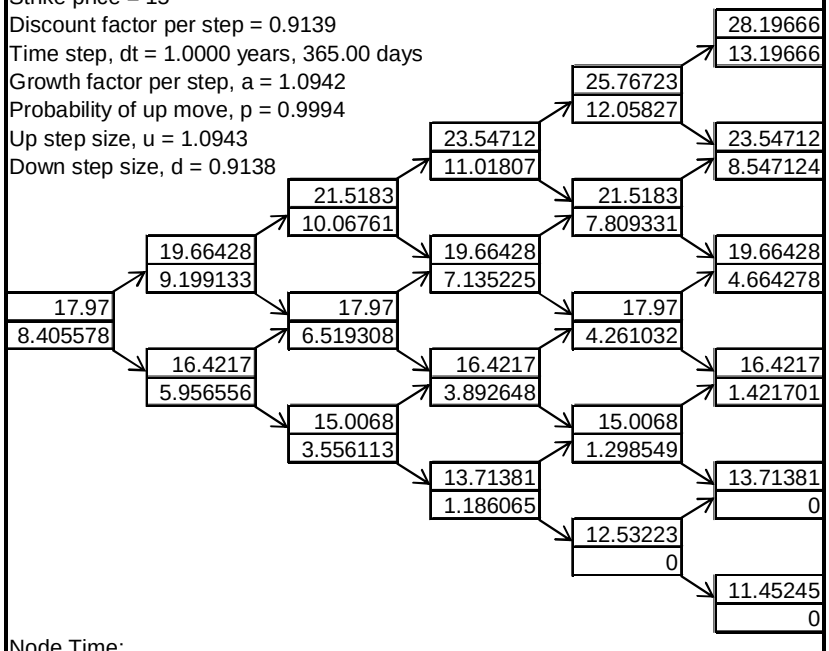
Price:	8.40557773
Delta (per $):	1
Gamma (per $ per $):	1.1223E-07
Vega (per %):	4.9307E-05
Theta (per day):	-0.0025839
Rho (per %):	0.46651547

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.9139
Time step, dt = 1.0000 years, 365.00 days
Growth factor per step, a = 1.0942
Probability of up move, p = 0.9994
Up step size, u = 1.0943
Down step size, d = 0.9138



Node Time:

0.0000	1.0000	2.0000	3.0000	4.0000	5.0000

Retail Centre 1 - Northern Suburbs Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	21.11
Volatility (% per year):	9.87%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	6.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

Price:	12.3687762
Delta (per $):	1
Gamma (per $ per $):	2.4609E-11
Vega (per %):	5.4008E-06
Theta (per day):	-0.0024059
Rho (per %):	0.50904794

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.8976
Time step, dt = 1.2000 years, 438.00 days
Growth factor per step, a = 1.1140
Probability of up move, p = 0.9994
Up step size, u = 1.1142
Down step size, d = 0.8975

Node Time:					
0.0000	1.2000	2.4000	3.6000	4.8000	6.0000
21.11	23.52038	26.20598	29.19823	32.53214	36.24672
12.36878	13.78224	15.35723	17.1122	19.06773	21.24672
	18.94664	21.11	23.52038	26.20598	29.19823
	9.208496	10.26125	11.43435	12.74157	14.19823
		17.00498	18.94664	21.11	23.52038
		6.156222	6.860607	7.645586	8.52038
			15.2623	17.00498	18.94664
			3.176269	3.540562	3.946637
				13.69821	15.2623
				0.2353	0.262297
					12.29441
					0

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Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	24.34
Volatility (% per year):	10.65%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	7.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

Price:	16.351123
Delta (per $):	1
Gamma (per $ per $):	5.4114E-14
Vega (per %):	4.1495E-07
Theta (per day):	-0.0022403
Rho (per %):	0.54009644

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.8816
Time step, dt = 1.4000 years, 511.00 days
Growth factor per step, a = 1.1343
Probability of up move, p = 0.9999
Up step size, u = 1.1343
Down step size, d = 0.8816

Node Time: 0.0000	1.4000	2.8000	4.2000	5.6000	7.0000
24.34	27.6091	31.31727	35.52349	40.29464	45.7066
16.35112	18.54746	21.03881	23.86482	27.07042	30.7066
	21.45798	24.34	27.6091	31.31727	35.52349
	12.39634	14.06154	15.95043	18.09305	20.52349
		18.91722	21.45798	24.34	27.6091
		8.638759	9.799312	11.11578	12.6091
			16.67729	18.91722	21.45798
			5.018622	5.692994	6.457983
				14.70259	16.67729
				1.478565	1.677293
					12.96171
					0

Retail Centre 1 - Northern Suburbs Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	27.65
Volatility (% per year):	11.39%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	8.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

Price:	20.3487162
Delta (per $):	1
Gamma (per $ per $):	1.3625E-14
Vega (per %):	2.59E-07
Theta (per day):	-0.0020864
Rho (per %):	0.56134861

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.8659
Time step, dt = 1.6000 years, 584.00 days
Growth factor per step, a = 1.1549
Probability of up move, p = 0.9999
Up step size, u = 1.1549
Down step size, d = 0.8659

					56.81155
				49.1913	41.81155
			42.59318	36.20299	
		36.88007	31.34675		42.59318
	31.93327	27.14193		36.88007	27.59318
27.65	23.50114		31.93327	23.89175	
20.34872		27.65	20.68685		31.93327
	23.94125	17.91186		27.65	16.93327
	15.50911		23.94125	14.66168	
		20.72996	12.69483		23.94125
		10.99182		20.72996	8.941251
			17.94941	7.741648	
			6.702989		17.94941
				15.54182	2.949413
				2.553628	
					13.45717
					0

Node Time:

0.0000	1.6000	3.2000	4.8000	6.4000	8.0000

Retail Centre 1 - Northern Suburbs Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	31.05
Volatility (% per year):	12.08%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	9.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

Price:	24.377129
Delta (per $):	1
Gamma (per $ per $):	1.0463E-14
Vega (per %):	1.737E-07
Theta (per day):	-0.0019432
Rho (per %):	0.57432551

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.8504
Time step, dt = 1.8000 years, 657.00 days
Growth factor per step, a = 1.1759
Probability of up move, p = 0.9999
Up step size, u = 1.1759
Down step size, d = 0.8504

Node Time: 0.0000	1.8000	3.6000	5.4000	7.2000	9.0000
31.05	36.51155	42.93377	50.48563	59.36582	69.808
24.37713	28.66519	33.70754	39.63687	46.6092	54.808
	26.40541	31.05	36.51155	42.93377	50.48563
	18.55904	21.82377	25.6628	30.17715	35.48563
		22.45557	26.40541	31.05	36.51155
		13.22935	15.55665	18.29338	21.51155
			19.09657	22.45557	26.40541
			8.24782	9.698956	11.40541
				16.24003	19.09657
				3.483518	4.096574
					13.81077
					0

Retail Centre 1 - Northern Suburbs Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	34.53
Volatility (% per year):	12.73%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	10.0000
Exercise Price:	15.00
Tree Steps:	5

○ Put ◉ Call

Price:	28.4314551
Delta (per $):	1
Gamma (per $ per $):	3.8367E-15
Vega (per %):	1.2486E-07
Theta (per day):	-0.0018101
Rho (per %):	0.58035281

Retail Centre 1 - Northern Suburbs Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15
Discount factor per step = 0.8353
Time step, dt = 2.0000 years, 730.00 days
Growth factor per step, a = 1.1972
Probability of up move, p = 0.9999
Up step size, u = 1.1973
Down step size, d = 0.8352

Node Time:					
0.0000	2.0000	4.0000	6.0000	8.0000	10.0000
34.53	41.34113	49.49577	59.25894	70.94792	84.94258
28.43146	34.03985	40.75455	48.7938	58.41886	69.94258
	28.84103	34.53	41.34113	49.49577	59.25894
	21.53975	25.78878	30.87599	36.96672	44.25894
		24.08935	28.84103	34.53	41.34113
		15.34812	18.37589	22.00095	26.34113
			20.12052	24.08935	28.84103
			9.655378	11.56029	13.84103
				16.80558	20.12052
				4.276605	5.120523
					14.03679
					0

APPENDIX 2

CASE STUDY 2

Retail Centre 2 - North East Johannesburg

Current GLA Valuation

Transaction Date	December 2003	**Initial yield (DCM)**	**8.7%**
Corporate tax tate	30%	GLA (m^2)	25000
Rode 'hurdle rate' for relevant quarter	19.3%	Average Annual Rent per m^2	R 584
Annual rent escalation (10%)	1.1	Average Monthly Rent per m^2	R 49
Annual expenses escalation (inflation target 6%)	1.06	Depreciation of capex over 20 years	R 6,000,000
Vacancy factor	5%	After tax cost of interest	7.0%
Actual Transaction price (Va)	**R 120,000,000**	**Theoretical DCM value (NOI / Rode hurdle rate) (Vt)**	**R 54,275,389**
		Difference (Premium paid) >>>	**R 65,724,611**

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
POTENTIAL GROSS INCOME (PGI)	14,604,000	16,064,400	17,670,840	19,437,924	21,381,716
Less vacancy factor of 5%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)	*13,873,800*	15,261,180	16,787,298	18,466,028	20,312,631
-TOTAL OPERATING EXPENSES	**-3,398,650**	-3,738,515	-4,112,367	-4,523,603	-4,975,963
NET OPERATING INCOME (NOI)	**10,475,150**	**11,522,665**	**12,674,932**	**13,942,425**	**15,336,667**

Option to Expand GLA ***Assume 1 year to build extension if exercised at transaction date***

Additional GLA (m2)	8500	Additional GLA as % of current GLA	34%
Additional GLA monthly rent (R/m^2)	150	Additional GLA expenses at Year 1	-1,155,541
Additional Annual PGI	15,300,000	Depreciation of capex over 20 years	3,825,000
Building cost to extend (R/m^2)	9,000		
Capital expenditure to extend	76,500,000		

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**
POTENTIAL GROSS INCOME (PGI)		15,300,000	16,830,000	18,513,000	20,364,300	22,400,730	24,640,803	27,104,883	29,815,372	32,796,909	36,076,600
Less vacancy factor of 5%		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)		14,535,000	15,988,500	17,587,350	19,346,085	21,280,694	23,408,763	25,749,639	28,324,603	31,157,063	34,272,770
-TOTAL OPERATING EXPENSES		-1,224,873	-1,298,366	-1,376,268	-1,458,844	-1,546,375	-1,639,157	-1,737,506	-1,841,757	-1,952,262	-2,069,398
NET OPERATING INCOME (NOI)		**13,310,127**	**14,690,134**	**16,211,082**	**17,887,241**	**19,734,319**	**21,769,606**	**24,012,133**	**26,482,846**	**29,204,801**	**32,203,372**

Retail Centre 2 - North East Johannesburg

Benefits Forecast

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CAPEX	-76,500,000	<<<<<<<<<	**X VALUE FOR DERIVAGEM**									
Terminal value	0	0	0	0	0	159,623,666	183,052,020	208,814,602	237,148,022	268,312,780	302,595,676	
PV OF TERMINAL VALUE						**113,809,468**	**121,975,290**	**130,039,239**	**138,022,308**	**145,944,375**	**153,824,298**	
EGI		0	14,535,000	15,988,500	17,587,350	19,346,085	21,280,694	23,408,763	25,749,639	28,324,603	31,157,063	34,272,770
-Total operating expenses		0	-1,224,873	-1,298,366	-1,376,268	-1,458,844	-1,546,375	-1,639,157	-1,737,506	-1,841,757	-1,952,262	-2,069,398
NOI		0	13,310,127	14,690,134	16,211,082	17,887,241	19,734,319	21,769,606	24,012,133	26,482,846	29,204,801	32,203,372
-Interest on loan		-7,593,024	-7,460,470	-7,314,036	-7,152,269	-6,973,563	-6,776,143	-6,558,052	-6,317,123	-6,050,966	-5,756,939	
PBT		**-7,593,024**	**5,849,656**	**7,376,098**	**9,058,813**	**10,913,678**	**12,958,176**	**15,211,554**	**17,695,010**	**20,431,880**	**23,447,863**	
-Corporate Tax		0	-1,754,897	-2,212,829	-2,717,644	-3,274,104	-3,887,453	-4,563,466	-5,308,503	-6,129,564	-7,034,359	
-Principal repaid on loan		-1,238,118	-1,398,429	-1,544,862	-1,706,630	-1,885,336	-2,082,755	-2,300,847	-2,541,776	-2,807,933	-3,101,960	
BENEFITS	**-76,500,000**	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**6,987,968**	**8,347,241**	**9,844,731**	**11,494,383**	**13,311,544**	
Benefits + Terminal value	**-76,500,000**	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**165,377,905**						
	-76,500,000	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**190,039,987**					
	-76,500,000	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**6,987,968**	**217,161,843**				
	-76,500,000	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**6,987,968**	**8,347,241**	**246,992,753**			
	-76,500,000	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**6,987,968**	**8,347,241**	**9,844,731**	**279,807,164**		
	-76,500,000	**-8,831,142**	**2,696,331**	**3,618,406**	**4,634,540**	**5,754,239**	**6,987,968**	**8,347,241**	**9,844,731**	**11,494,383**	**315,907,220**	
PV OF BENEFITS	-76,500,000	-8,253,404	2,355,080	2,953,697	3,535,668	4,102,693	4,656,378	5,198,242	5,729,723	6,252,183	6,766,914	
ATCI for PV of CF	**7.0%**	**<<assumption: 100% debt-funded.**				42,003,202						
Required Return	**8.3%**	**<<Risk-Free Rate (yield of 5 year RSA Retail Bond matched to transaction month)**								**<<Used Jan 2004 as Dec '03 unavailable**		
PV OF BENEFITS + TERMINAL VALUE (S VALUE FOR DERIVAGEM)	**>>>>>>>>>**					42,003,202	54,825,402	68,087,594	81,800,385	95,974,635	110,621,472	
IRR of Benefits	**>>>>>>>>>**					**16.4%**	**16.8%**	**17.1%**	**17.2%**	**17.3%**	**17.3%**	

Terminal value of extended section						
Est. resale (NOI for Next Year/WACC)	239,203,866	263,874,010	291,056,154	321,004,197	353,997,590	390,343,900
-Balance owing on loan (capital only)	-68,726,626	-66,643,870	-64,343,023	-61,801,248	-58,993,315	-55,891,354
Subtotal	**170,477,241**	**197,230,140**	**226,713,131**	**259,202,949**	**295,004,275**	**334,452,546**
-Cumulative depreciation	-19,125,000	-22,950,000	-26,775,000	-30,600,000	-34,425,000	-38,250,000
-Initial CAPEX	*-76,500,000*	*-76,500,000*	*-76,500,000*	*-76,500,000*	*-76,500,000*	*-76,500,000*
Taxable Capital Gain	*74,852,241*	*97,780,140*	*123,438,131*	*152,102,949*	*184,079,275*	*219,702,546*
-Capital gains tax for companies at 14.5%	-10,853,575	-14,178,120	-17,898,529	-22,054,928	-26,691,495	-31,856,869
After-tax Terminal Value	**159,623,666**	**183,052,020**	**208,814,602**	**237,148,022**	**268,312,780**	**302,595,676**

Retail Centre 2 - North East Johannesburg

Loan Repayment Schedule

Loan principal	76,500,000
Loan interest	10%
Loan Term (years)	20
Monthly payment	**R 738,242**

Assume 2% below prime lending rate

Month	Principal at beginning of month	Payment at end of month	Interest portion	Cumulative interest	Principal portion	Cumulative principal
1	76,500,000	738,242	637,500	637,500	100,742	100,742
2	76,399,258	738,242	636,660	1,274,160	73,824	174,566
3	76,325,434	738,242	635,814	1,909,974	102,428	276,993
4	76,223,007	738,242	634,960	2,544,935	103,281	380,274
5	76,119,726	738,242	634,100	3,179,035	104,142	484,416
6	76,015,584	738,242	633,232	3,812,267	105,010	589,426
7	75,910,574	738,242	632,357	4,444,623	105,885	695,311
8	75,804,689	738,242	631,474	5,076,098	106,767	802,078
9	75,697,922	738,242	630,585	5,706,682	107,657	909,735
10	75,590,265	738,242	629,688	6,336,370	108,554	1,018,289
11	75,481,711	738,242	628,783	6,965,153	109,459	1,127,747
12	75,372,253	738,242	627,871	7,593,024	110,371	1,238,118
13	75,261,882	738,242	626,951	8,219,975	111,291	1,349,409
14	75,150,591	738,242	626,024	8,845,998	112,218	1,461,626
15	75,038,374	738,242	625,088	9,471,087	113,153	1,574,780
16	74,925,220	738,242	624,146	10,095,232	114,096	1,688,876
17	74,811,124	738,242	623,195	10,718,427	115,047	1,803,922
18	74,696,078	738,242	622,236	11,340,663	116,006	1,919,928
19	74,580,072	738,242	621,269	11,961,932	116,972	2,036,900
20	74,463,100	738,242	620,295	12,582,227	117,947	2,154,847
21	74,345,153	738,242	619,312	13,201,539	118,930	2,273,777
22	74,226,223	738,242	618,321	13,819,859	119,921	2,393,698
23	74,106,302	738,242	617,321	14,437,180	120,920	2,514,619
24	73,985,381	738,242	616,314	15,053,494	121,928	2,636,547
25	73,863,453	738,242	615,297	15,668,791	122,944	2,759,491
26	73,740,509	738,242	614,273	16,283,064	123,969	2,883,459
27	73,616,541	738,242	613,240	16,896,304	125,002	3,008,461
28	73,491,539	738,242	612,198	17,508,502	126,043	3,134,504
29	73,365,496	738,242	611,148	18,119,650	127,094	3,261,598
30	73,238,402	738,242	610,089	18,729,739	128,153	3,389,751
31	73,110,249	738,242	609,021	19,338,760	129,221	3,518,972
32	72,981,028	738,242	607,944	19,946,704	130,298	3,649,269
33	72,850,731	738,242	606,858	20,553,562	131,383	3,780,653
34	72,719,347	738,242	605,763	21,159,325	132,478	3,913,131
35	72,586,869	738,242	604,659	21,763,984	133,582	4,046,713
36	72,453,287	738,242	603,546	22,367,530	134,695	4,181,409
240	759,897	738,242	6,101	100,677,974	732,140	76,472,243

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Stock Price:	42.00
Volatility (% per year):	9.01%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	5.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

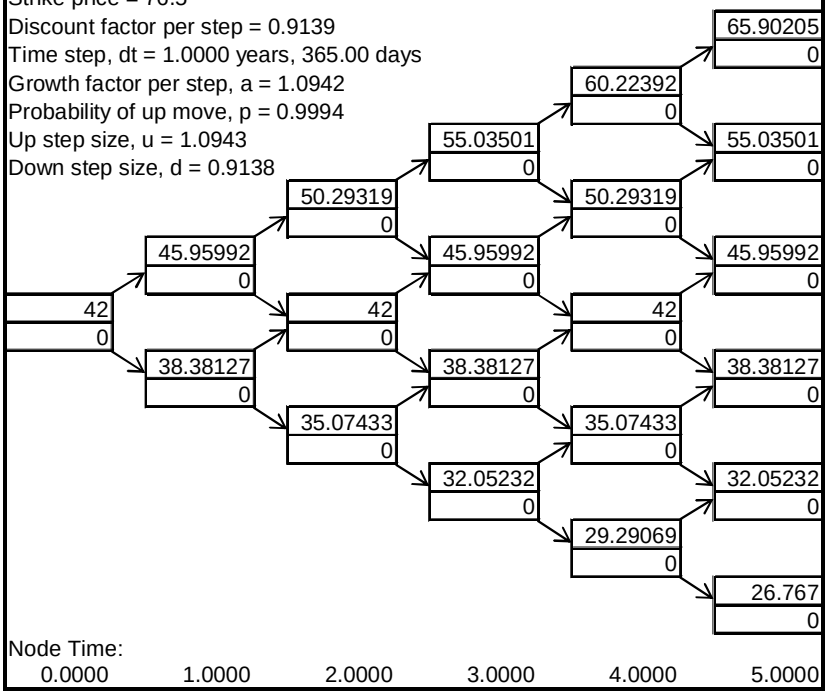
Price:	0
Delta (per $):	0
Gamma (per $ per $):	0
Vega (per %):	0
Theta (per day):	0
Rho (per %):	0

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.9139
Time step, dt = 1.0000 years, 365.00 days
Growth factor per step, a = 1.0942
Probability of up move, p = 0.9994
Up step size, u = 1.0943
Down step size, d = 0.9138



Node Time:
0.0000 1.0000 2.0000 3.0000 4.0000 5.0000

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	54.82
Volatility (% per year):	9.86%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	6.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

Price:	10.2399885
Delta (per $):	0.96145111
Gamma (per $ per $):	0.08055875
Vega (per %):	0.21544478
Theta (per day):	-0.0116895
Rho (per %):	2.79606925

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.8976
Time step, dt = 1.2000 years, 438.00 days
Growth factor per step, a = 1.1140
Probability of up move, p = 0.9999
Up step size, u = 1.1141
Down step size, d = 0.8976

Node Time: 0.0000	1.2000	2.4000	3.6000	4.8000	6.0000
54.82	61.07343	68.0402	75.80169	84.44855	94.08177
10.23999	11.40912	12.71173	14.16307	15.78011	17.58177
	54.82	61.07343	68.0402	75.80169	84.44855
	0	0	0	0	15.78011
	49.20687	54.82	61.07343	68.0402	75.80169
	0	0	0	0	0
		44.16848	49.20687	54.82	61.07343
		0	0	0	0
			39.64598	44.16848	49.20687
			0	0	0
				35.58655	39.64598
				0	0
					31.94277
					0

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Stock Price:	68.08
Volatility (% per year):	10.65%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	7.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

Price:	27.3367272
Delta (per $):	0.99999996
Gamma (per $ per $):	1.4064E-05
Vega (per %):	0.01015225
Theta (per day):	-0.0114255
Rho (per %):	2.73241259

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.8816
Time step, dt = 1.4000 years, 511.00 days
Growth factor per step, a = 1.1343
Probability of up move, p = 0.9999
Up step size, u = 1.1343
Down step size, d = 0.8816

0.0000	1.4000	2.8000	4.2000	5.6000	7.0000
					127.8433
					51.34328
				112.7058	
				45.26226	
			99.36068		99.36068
			39.90146		22.86068
		87.59572		87.59572	
		35.17559		20.15219	
	77.22381		77.22381		77.22381
	31.00944		17.76459		0.723809
68.08		68.08		68.08	
27.33673		15.65987		0.638051	
	60.01888		60.01888		60.01888
	13.80451		0.562454		0
		52.91225		52.91225	
		0.495814		0	
			46.64709		46.64709
			0		0
				41.12376	
				0	
					36.25444
					0

Node Time:

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	81.80
Volatility (% per year):	11.39%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	8.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

Price:	44.5634524
Delta (per $):	0.99999999
Gamma (per $ per $):	2.0554E-06
Vega (per %):	0.00326361
Theta (per day):	-0.0106404
Rho (per %):	2.85612906

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.8659
Time step, dt = 1.6000 years, 584.00 days
Growth factor per step, a = 1.1549
Probability of up move, p = 0.9999
Up step size, u = 1.1549
Down step size, d = 0.8659

					168.0718
					91.57177
				145.528	
				79.28756	
			126.008		126.008
			68.65126		49.50802
		109.1063		109.1063	
		59.4418		42.8659	
	94.47167		94.47167		94.47167
	51.46777		37.11491		17.97167
81.8		81.8		81.8	
44.56345		32.13548		15.56003	
	70.828		70.828		70.828
	27.82411		13.47202		0
		61.3277		61.3277	
		11.66419		0	
			53.1017		53.1017
			0		0
				45.97906	
				0	
					39.8118
					0

Node Time:

0.0000	1.6000	3.2000	4.8000	6.4000	8.0000

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	95.97
Volatility (% per year):	12.08%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	9.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

Price:	61.9383579
Delta (per $):	1
Gamma (per $ per $):	4.4928E-10
Vega (per %):	0.00017756
Theta (per day):	-0.0099103
Rho (per %):	2.92974363

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.8504
Time step, dt = 1.8000 years, 657.00 days
Growth factor per step, a = 1.1759
Probability of up move, p = 0.9999
Up step size, u = 1.1759
Down step size, d = 0.8504

					215.764
					139.264
				183.4891	
				118.4304	
			156.042		156.042
			100.7134		79.54205
		132.7006		132.7006	
		85.64685		67.64186	
	112.8507		112.8507		112.8507
	72.83423		57.52204		36.35069
95.97		95.97		95.97	
61.93836		48.91624		30.91125	
	81.6144		81.6144		81.6144
	41.59794		26.28575		5.114397
		69.40617		69.40617	
		22.35241		4.349024	
			59.0241		59.0241
			3.698189		0
				50.19502	
				0	
					42.68663
					0

Node Time:

0.0000	1.8000	3.6000	5.4000	7.2000	9.0000

Retail Centre 2 - North East Johannesburg

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	110.62
Volatility (% per year):	12.73%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	10.0000
Exercise Price:	76.50
Tree Steps:	5

○ Put ◉ Call

Price:	79.517421
Delta (per $):	1
Gamma (per $ per $):	1.4608E-10
Vega (per %):	0.00010684
Theta (per day):	-0.0092313
Rho (per %):	2.96025439

Retail Centre 2 - North East Johannesburg

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 76.5
Discount factor per step = 0.8353
Time step, dt = 2.0000 years, 730.00 days
Growth factor per step, a = 1.1972
Probability of up move, p = 0.9999
Up step size, u = 1.1973
Down step size, d = 0.8352

					272.1213
				227.2881	195.6213
			189.8414	163.3899	
			136.4692		189.8414
		158.5642		158.5642	113.3414
		113.984	132.4401	94.66605	
	132.4401		79.06784		132.4401
	95.20353	110.62		110.62	55.94008
110.62		66.03976	92.39488	46.72183	
79.51742	92.39488		39.02264		92.39488
	55.15833	77.17242		77.17242	15.89488
		32.59218	64.45793	13.27523	
			11.08732		64.45793
				53.83821	0
				0	
					44.96813
					0

Node Time:
0.0000 2.0000 4.0000 6.0000 8.0000 10.0000

APPENDIX 3

CASE STUDY 3

Retail Centre 3 - Sandton

Current GLA Valuation					
Transaction Date	November 2006	**Initial yield (DCM)**			**4.7%**
Corporate tax tate	29%	GLA (m^2)			2050
Rode 'hurdle rate' for relevant quarter	15.0%	Average Annual Rent per m^2			R 1,469
Annual rent escalation (10%)	1.1	Average Monthly Rent per m^2			R 122
Annual expenses escalation (inflation target 6%)	1.06	Depreciation of capex over 20 years			R 2,800,000
Vacancy factor	5%	After tax cost of interest			7.1%
Actual Transaction price (Va)	**R 56,000,000**	**Theoretical DCM value (NOI / Rode hurdle rate) (Vt)**			**R 17,662,667**
				Difference (Premium paid) >>>	**R 38,337,333**

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
POTENTIAL GROSS INCOME (PGI)	3,012,000	3,313,200	3,644,520	4,008,972	4,409,869
Less vacancy factor of 5%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)	*2,861,400*	3,147,540	3,462,294	3,808,523	4,189,376
-TOTAL OPERATING EXPENSES	**-212,000**	-233,200	-256,520	-282,172	-310,389
NET OPERATING INCOME (NOI)	**2,649,400**	**2,914,340**	**3,205,774**	**3,526,351**	**3,878,987**

Option to Expand GLA	***Assume 1 year to build extension if exercised at transaction date***		
Additional GLA (m2)	8000	Additional GLA as % of current GLA	390%
Additional GLA monthly rent (R/m^2)	205	Additional GLA expenses at Year 1	-827,317
Additional Annual PGI	19,680,000	Depreciation of capex over 20 years	3,000,000
Building cost to extend (R/m^2)	7,500		
Capital expenditure to extend	60,000,000		

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**
POTENTIAL GROSS INCOME (PGI)		19,680,000	21,648,000	23,812,800	26,194,080	28,813,488	31,694,837	34,864,320	38,350,753	42,185,828	46,404,411
Less vacancy factor of 5%		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)		18,696,000	20,565,600	22,622,160	24,884,376	27,372,814	30,110,095	33,121,104	36,433,215	40,076,536	44,084,190
-TOTAL OPERATING EXPENSES		-876,956	-929,573	-985,348	-1,044,469	-1,107,137	-1,173,565	-1,243,979	-1,318,618	-1,397,735	-1,481,599
NET OPERATING INCOME (NOI)		**17,819,044**	**19,636,027**	**21,636,812**	**23,839,907**	**26,265,677**	**28,936,530**	**31,877,125**	**35,114,597**	**38,678,802**	**42,602,591**

Retail Centre 3 - Sandton												
Benefits Forecast												
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CAPEX	-60,000,000	**<<<<<<<<<**	**X VALUE FOR DERIVAGEM**									
Terminal value	0	0	0	0	0	214,311,662	241,516,438	271,430,018	304,325,484	340,503,392	380,294,531	
PV OF TERMINAL VALUE						**152,089,226**	**160,033,119**	**167,931,273**	**175,801,491**	**183,660,688**	**191,524,956**	
EGI		0	18,696,000	20,565,600	22,622,160	24,884,376	27,372,814	30,110,095	33,121,104	36,433,215	40,076,536	44,084,190
-Total operating expenses		0	-876,956	-929,573	-985,348	-1,044,469	-1,107,137	-1,173,565	-1,243,979	-1,318,618	-1,397,735	-1,481,599
NOI		**0**	**17,819,044**	**19,636,027**	**21,636,812**	**23,839,907**	**26,265,677**	**28,936,530**	**31,877,125**	**35,114,597**	**38,678,802**	**42,602,591**
-Interest on loan		-5,955,313	-5,851,349	-5,736,499	-5,609,623	-5,469,461	-5,314,622	-5,143,570	-4,954,606	-4,745,856	-4,515,246	
PBT		**-5,955,313**	**11,967,695**	**13,899,527**	**16,027,189**	**18,370,446**	**20,951,054**	**23,792,960**	**26,922,519**	**30,368,742**	**34,163,556**	
-Corporate Tax		0	-3,470,631	-4,030,863	-4,647,885	-5,327,429	-6,075,806	-6,899,958	-7,807,531	-8,806,935	-9,907,431	
-Principal repaid on loan		-971,073	-1,096,807	-1,211,657	-1,338,533	-1,478,695	-1,633,534	-1,804,586	-1,993,550	-2,202,300	-2,432,910	
BENEFITS	**-60,000,000**	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**13,241,715**	**15,088,416**	**17,121,439**	**19,359,506**	**21,823,215**	
Benefits + Terminal value	**-60,000,000**	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**225,875,984**						
	-60,000,000	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**254,758,154**					
	-60,000,000	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**13,241,715**	**286,518,433**				
	-60,000,000	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**13,241,715**	**15,088,416**	**321,446,923**			
	-60,000,000	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**13,241,715**	**15,088,416**	**17,121,439**	**359,862,899**		
	-60,000,000	**-6,926,386**	**7,400,257**	**8,657,008**	**10,040,771**	**11,564,322**	**13,241,715**	**15,088,416**	**17,121,439**	**19,359,506**	**402,117,746**	
PV OF BENEFITS	-60,000,000	-6,467,214	6,451,606	7,046,921	7,631,487	8,206,781	8,774,198	9,335,065	9,890,642	10,442,129	10,990,666	
ATCI for PV of Benefits	**7.1%**	**<<assumption: 100% debt-funded.**				114,958,808	131,676,898	148,910,116	166,670,977	184,972,302	203,827,237	
Required Return	**9.0%**	**<<Risk-Free Rate (yield of 5 year RSA Retail Bond matched to transaction month)**										
PV OF BENEFITS + TERMINAL VALUE (S VALUE FOR DERIVAGEM)					**>>>>>>>>>**	114,958,808	131,676,898	148,910,116	166,670,977	184,972,302	203,827,237	
IRR of Benefits					**>>>>>>>>>**	**33.1%**	**30.9%**	**29.3%**	**28.2%**	**27.3%**	**26.6%**	

Terminal value of extended section						
Est. resale (NOI for Next Year/WACC)	291,840,853	321,516,999	354,190,283	390,162,191	429,764,462	473,362,124
-Balance owing on loan (capital only)	-53,903,236	-52,269,702	-50,465,116	-48,471,567	-46,269,266	-43,836,356
Subtotal	**237,937,617**	**269,247,296**	**303,725,167**	**341,690,624**	**383,495,196**	**429,525,767**
-Cumulative depreciation	-15,000,000	-18,000,000	-21,000,000	-24,000,000	-27,000,000	-30,000,000
-Initial CAPEX	*-60,000,000*	*-60,000,000*	*-60,000,000*	*-60,000,000*	*-60,000,000*	*-60,000,000*
Taxable Capital Gain	*162,937,617*	*191,247,296*	*222,725,167*	*257,690,624*	*296,495,196*	*339,525,767*
-Capital gains tax for companies at 14.5%	-23,625,954	-27,730,858	-32,295,149	-37,365,141	-42,991,803	-49,231,236
After-tax Terminal Value	**214,311,662**	**241,516,438**	**271,430,018**	**304,325,484**	**340,503,392**	**380,294,531**

Retail Centre 3 - Sandton

Loan Repayment Schedule

Loan principal	60,000,000
Loan interest	10%
Loan Term (years)	20
Monthly payment	**R 579,013**

Assume 2% below prime lending rate

Month	Principal at beginning of month	Payment at end of month	Interest portion	Cumulative interest	Principal portion	Cumulative principal
1	60,000,000	579,013	500,000	500,000	79,013	79,013
2	59,920,987	579,013	499,342	999,342	57,901	136,914
3	59,863,086	579,013	498,678	1,498,019	80,335	217,250
4	59,782,750	579,013	498,008	1,996,027	81,005	298,254
5	59,701,746	579,013	497,333	2,493,360	81,680	379,934
6	59,620,066	579,013	496,652	2,990,013	82,361	462,295
7	59,537,705	579,013	495,966	3,485,979	83,047	545,342
8	59,454,658	579,013	495,274	3,981,253	83,739	629,081
9	59,370,919	579,013	494,576	4,475,829	84,437	713,517
10	59,286,483	579,013	493,873	4,969,702	85,140	798,658
11	59,201,342	579,013	493,163	5,462,865	85,850	884,508
12	59,115,492	579,013	492,448	5,955,313	86,565	971,073
13	59,028,927	579,013	491,726	6,447,039	87,287	1,058,360
14	58,941,640	579,013	490,999	6,938,038	88,014	1,146,374
15	58,853,626	579,013	490,265	7,428,303	88,748	1,235,121
16	58,764,879	579,013	489,526	7,917,829	89,487	1,324,608
17	58,675,392	579,013	488,780	8,406,610	90,233	1,414,841
18	58,585,159	579,013	488,028	8,894,638	90,985	1,505,826
19	58,494,174	579,013	487,270	9,381,908	91,743	1,597,569
20	58,402,431	579,013	486,506	9,868,413	92,507	1,690,076
21	58,309,924	579,013	485,735	10,354,148	93,278	1,783,355
22	58,216,645	579,013	484,957	10,839,105	94,056	1,877,410
23	58,122,590	579,013	484,173	11,323,279	94,839	1,972,250
24	58,027,750	579,013	483,383	11,806,662	95,630	2,067,880
25	57,932,120	579,013	482,586	12,289,248	96,427	2,164,306
26	57,835,694	579,013	481,783	12,771,031	97,230	2,261,537
27	57,738,463	579,013	480,972	13,252,003	98,041	2,359,577
28	57,640,423	579,013	480,155	13,732,159	98,858	2,458,435
29	57,541,565	579,013	479,332	14,211,490	99,681	2,558,116
30	57,441,884	579,013	478,501	14,689,991	100,512	2,658,628
31	57,341,372	579,013	477,663	15,167,655	101,350	2,759,978
32	57,240,022	579,013	476,819	15,644,473	102,194	2,862,172
33	57,137,828	579,013	475,967	16,120,441	103,046	2,965,218
34	57,034,782	579,013	475,108	16,595,549	103,905	3,069,122
35	56,930,878	579,013	474,243	17,069,792	104,770	3,173,893
36	56,826,107	579,013	473,369	17,543,161	105,644	3,279,536
240	595,998	579,013	4,785	78,963,117	574,228	59,978,230

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	114.96
Volatility (% per year):	9.01%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	5.0000
Exercise Price:	60.00
Tree Steps:	5

○ Put ◉ Call

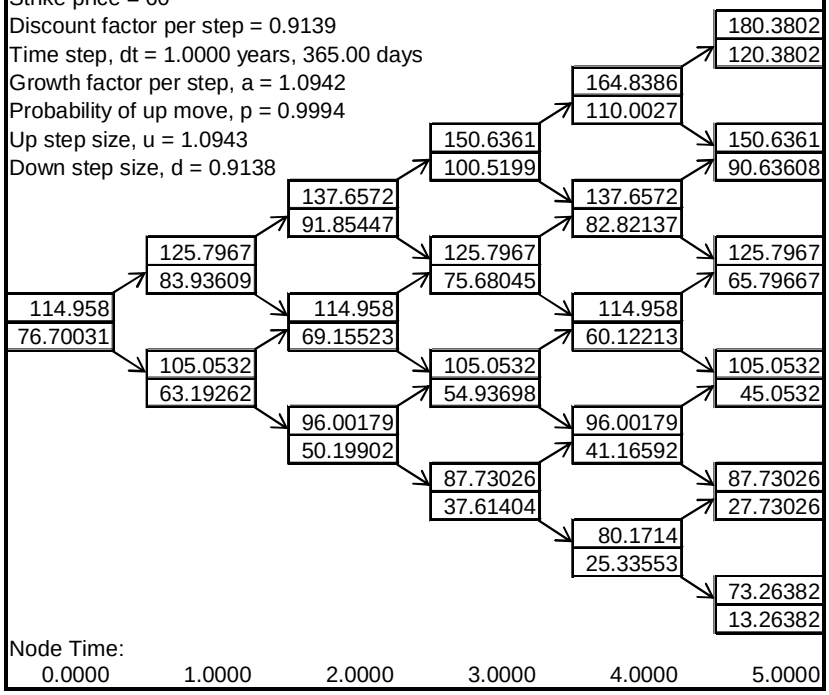
Price:	76.7003109
Delta (per $):	1
Gamma (per $ per $):	-1.119E-16
Vega (per %):	2.8422E-14
Theta (per day):	-0.0103357
Rho (per %):	1.86584951

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.9139
Time step, dt = 1.0000 years, 365.00 days
Growth factor per step, a = 1.0942
Probability of up move, p = 0.9994
Up step size, u = 1.0943
Down step size, d = 0.9138



Node Time:
0.0000 1.0000 2.0000 3.0000 4.0000 5.0000

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Stock Price:	131.68
Volatility (% per year):	9.86%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	6.0000
Exercise Price:	60.00
Tree Steps:	5

○ Put ◉ Call

Price:	96.7111049
Delta (per $):	1
Gamma (per $ per $):	0
Vega (per %):	2.8422E-14
Theta (per day):	-0.0096234
Rho (per %):	2.03619698

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.8976
Time step, dt = 1.2000 years, 438.00 days
Growth factor per step, a = 1.1140
Probability of up move, p = 0.9999
Up step size, u = 1.1141
Down step size, d = 0.8976

Node Time: 0.0000	1.2000	2.4000	3.6000	4.8000	6.0000
131.676					
96.7111					
	146.6966				
	107.744				
		163.4305			
		120.0355			
	118.1934		182.0734		
	79.24087		133.7293		
		131.676		202.8429	
		88.28099	146.6966	148.9852	
			98.35244	163.4305	225.9816
		106.0914		109.5729	165.9816
		62.69635	118.1934	131.676	182.0734
			69.84931	77.81834	122.0734
		95.22846		106.0914	146.6966
		46.88434		52.23371	86.69656
				85.47783	118.1934
				31.62017	58.19343
					95.22846
					35.22846
					76.72558
					16.72558

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	148.91
Volatility (% per year):	10.65%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	7.0000	○ Put
Exercise Price:	60.00	◉ Call
Tree Steps:	5	

Price:	116.954492
Delta (per $):	1
Gamma (per $ per $):	1.1708E-17
Vega (per %):	-7.105E-14
Theta (per day):	-0.0089612
Rho (per %):	2.16038983

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.8816
Time step, dt = 1.4000 years, 511.00 days
Growth factor per step, a = 1.1343
Probability of up move, p = 0.9999
Up step size, u = 1.1343
Down step size, d = 0.8816

Node Time: 0.0000	1.4000	2.8000	4.2000	5.6000	7.0000
148.91	168.9101	191.5963	217.3296	246.5191	279.629
116.9545	132.6635	150.4825	170.6949	193.6222	219.629
	131.2781	148.91	168.9101	191.5963	217.3296
	95.03151	107.7962	122.2754	138.6994	157.3296
		115.7339	131.2781	148.91	168.9101
		74.62005	84.64339	96.01311	108.9101
			102.0302	115.7339	131.2781
			55.39554	62.83699	71.27807
				89.94917	102.0302
				37.05228	42.03023
					79.2986
					19.2986

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	166.67
Volatility (% per year):	11.39%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	8.0000
Exercise Price:	60.00
Tree Steps:	5

○ Put ◉ Call

Price:	137.464865
Delta (per $):	1
Gamma (per $ per $):	2.2809E-18
Vega (per %):	5.6843E-14
Theta (per day):	-0.0083454
Rho (per %):	2.24539751

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.8659
Time step, dt = 1.6000 years, 584.00 days
Growth factor per step, a = 1.1549
Probability of up move, p = 0.9999
Up step size, u = 1.1549
Down step size, d = 0.8659

Node Time: 0.0000	1.6000	3.2000	4.8000	6.4000	8.0000
166.67	192.4889	222.3075	256.7452	296.5177	342.4514
137.4649	158.7604	183.3549	211.7595	244.5644	282.4514
	144.3142	166.67	192.4889	222.3075	256.7452
	110.5857	127.7174	147.5032	170.3542	196.7452
		124.9571	144.3142	166.67	192.4889
		86.00451	99.32853	114.7167	132.4889
			108.1963	124.9571	144.3142
			63.21064	73.00381	84.31422
				93.68375	108.1963
				41.73048	48.19633
					81.11776
					21.11776

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Stock Price:	184.97
Volatility (% per year):	12.08%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	9.0000
Exercise Price:	60.00
Tree Steps:	5

○ Put ◉ Call

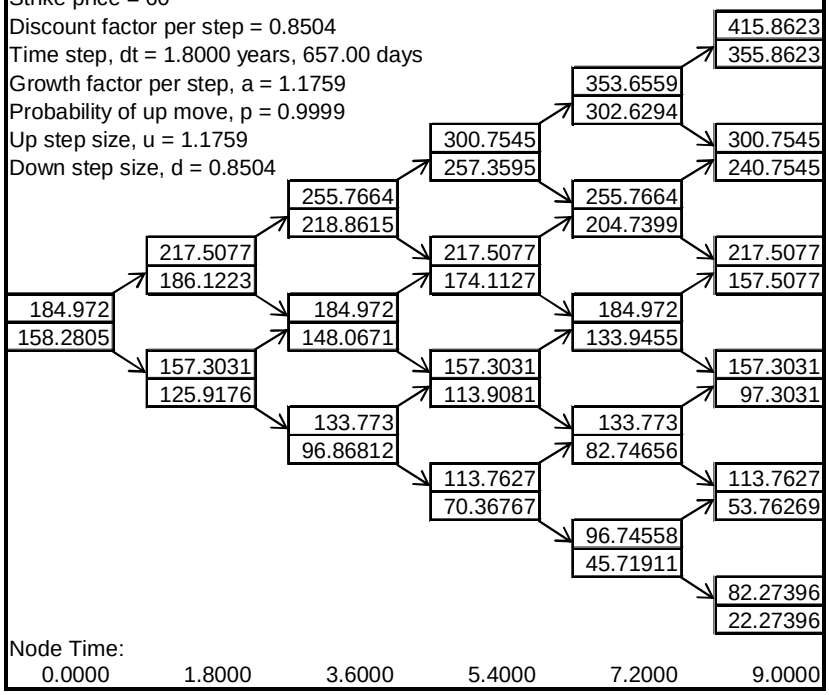
Price:	158.280516
Delta (per $):	1
Gamma (per $ per $):	-3.64E-18
Vega (per %):	-2.842E-14
Theta (per day):	-0.0077728
Rho (per %):	2.29730439

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.8504
Time step, dt = 1.8000 years, 657.00 days
Growth factor per step, a = 1.1759
Probability of up move, p = 0.9999
Up step size, u = 1.1759
Down step size, d = 0.8504



Node Time:

0.0000	1.8000	3.6000	5.4000	7.2000	9.0000

Retail Centre 3 - Sandton

Derivagem Valuation

Underlying Type: Equity

Stock Price:	203.83
Volatility (% per year):	12.73%
Risk-Free Rate (% per year):	9.00%

Time	Dividend

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	10.0000
Exercise Price:	60.00
Tree Steps:	5

○ Put ◉ Call

Price:	179.43282
Delta (per $):	1
Gamma (per $ per $):	4.4417E-18
Vega (per %):	-2.842E-14
Theta (per day):	-0.0072402
Rho (per %):	2.32141311

Retail Centre 3 - Sandton

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 60
Discount factor per step = 0.8353
Time step, dt = 2.0000 years, 730.00 days
Growth factor per step, a = 1.1972
Probability of up move, p = 0.9999
Up step size, u = 1.1973
Down step size, d = 0.8352

					501.4072
				418.7982	441.4072
			349.7994	368.682	
		292.1684	307.9388		349.7994
	244.0324	257.2035		292.1684	289.7994
203.827	214.8273		244.0324	242.0522	
179.4328		203.827	202.1718		244.0324
	170.2456	168.8621		203.827	184.0324
	141.0405		170.2456	153.7108	
		142.1969	128.385		170.2456
		107.232		142.1969	110.2456
			118.7694	92.0807	
			76.90878		118.7694
				99.20159	58.76936
				49.08538	
					82.8577
					22.8577

Node Time:

0.0000	2.0000	4.0000	6.0000	8.0000	10.0000

APPENDIX 4

CASE STUDY 4

Retail Centre 4 - Centurion

Current GLA Valuation

Transaction Date	December 2003	**Initial yield (DCM)**	**13.5%**
Corporate tax tate	30%	GLA (m^2)	9313
Rode 'hurdle rate' for relevant quarter	19.3%	Average Annual Rent per m^2	R 453
Annual rent escalation (10%)	1.1	Average Monthly Rent per m^2	R 38
Annual expenses escalation (inflation target 6%)	1.06	Depreciation of capex over 20 years	R 750,000
Vacancy factor	5%	After tax cost of interest	7.0%
Actual Transaction price (Va)	**R 15,000,000**	**Theoretical DCM value (NOI / Rode hurdle rate) (Vt)**	**R 10,521,168**
		Difference (Premium paid) >>>	**R 4,478,832**

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
POTENTIAL GROSS INCOME (PGI)	4,220,772	4,642,849	5,107,134	5,617,848	6,179,632
Less vacancy factor of 5%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)	*4,009,733*	4,410,707	4,851,777	5,336,955	5,870,651
-TOTAL OPERATING EXPENSES	**-1,979,148**	-2,177,063	-2,394,769	-2,634,246	-2,897,671
NET OPERATING INCOME (NOI)	**2,030,585**	**2,233,644**	**2,457,008**	**2,702,709**	**2,972,980**

Option to Expand GLA ***Assume 1 year to build extension if exercised at transaction date***

Additional GLA (m2)	5000	Additional GLA as % of current GLA	54%
Additional GLA monthly rent (R/m^2)	54	Additional GLA expenses at Year 1	-1,062,573
Additional Annual PGI	3,240,000	Depreciation of capex over 20 years	775,000
Building cost to extend (R/m^2)	3,100		
Capital expenditure to extend	15,500,000		

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**
POTENTIAL GROSS INCOME (PGI)		3,240,000	3,564,000	3,920,400	4,312,440	4,743,684	5,218,052	5,739,858	6,313,843	6,945,228	7,639,751
Less vacancy factor of 5%		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
EFFECTIVE GROSS INCOME (EGI)		3,078,000	3,385,800	3,724,380	4,096,818	4,506,500	4,957,150	5,452,865	5,998,151	6,597,966	7,257,763
-TOTAL OPERATING EXPENSES		-1,126,327	-1,193,907	-1,265,541	-1,341,474	-1,421,962	-1,507,280	-1,597,717	-1,693,580	-1,795,194	-1,902,906
NET OPERATING INCOME (NOI)		**1,951,673**	**2,191,893**	**2,458,839**	**2,755,344**	**3,084,538**	**3,449,870**	**3,855,148**	**4,304,572**	**4,802,772**	**5,354,857**

Retail Centre 4 - Centurion												
Benefits Forecast												
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CAPEX	-15,500,000	<<<<<<<<<	**X VALUE FOR DERIVAGEM**									
Terminal value	0	0	0	0	0	22,870,526	27,129,878	31,840,997	37,051,359	42,813,334	49,184,686	
PV OF TERMINAL VALUE						**16,306,369**	**18,077,783**	**19,828,973**	**21,564,228**	**23,287,617**	**25,003,000**	
EGI		0	3,078,000	3,385,800	3,724,380	4,096,818	4,506,500	4,957,150	5,452,865	5,998,151	6,597,966	7,257,763
-Total operating expenses		0	-1,126,327	-1,193,907	-1,265,541	-1,341,474	-1,421,962	-1,507,280	-1,597,717	-1,693,580	-1,795,194	-1,902,906
NOI		0	1,951,673	2,191,893	2,458,839	2,755,344	3,084,538	3,449,870	3,855,148	4,304,572	4,802,772	5,354,857
-Interest on loan		-1,538,456	-1,511,599	-1,481,929	-1,449,153	-1,412,944	-1,372,944	-1,328,756	-1,279,940	-1,226,013	-1,166,439	
PBT		**-1,538,456**	**440,074**	**709,964**	**1,009,686**	**1,342,400**	**1,711,594**	**2,121,114**	**2,575,208**	**3,078,559**	**3,636,334**	
-Corporate Tax		0	-132,022	-212,989	-302,906	-402,720	-513,478	-636,334	-772,562	-923,568	-1,090,900	
-Principal repaid on loan		-250,861	-283,342	-313,011	-345,788	-381,996	-421,996	-466,185	-515,000	-568,928	-628,502	
BENEFITS	**-15,500,000**	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**776,119**	**1,018,595**	**1,287,645**	**1,586,064**	**1,916,932**	
Benefits + Terminal value	**-15,500,000**	**-1,789,316**	**24,710**	**183,964**	**360,993**	**23,428,210**						
	-15,500,000	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**27,905,997**					
	-15,500,000	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**776,119**	**32,859,592**				
	-15,500,000	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**776,119**	**1,018,595**	**38,339,004**			
	-15,500,000	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**776,119**	**1,018,595**	**1,287,645**	**44,399,398**		
	-15,500,000	**-1,789,316**	**24,710**	**183,964**	**360,993**	**557,684**	**776,119**	**1,018,595**	**1,287,645**	**1,586,064**	**51,101,618**	
PV OF BENEFITS	-15,500,000	-1,672,258	21,583	150,169	275,400	397,621	517,161	634,330	749,421	862,714	974,471	
ATCI for PV of CF	**7.0%**	**<<assumption: 100% debt-funded.**				-21,117						
Required Return	**8.3%**	**<<Risk-Free Rate (yield of 5 year RSA Retail Bond matched to transaction month)**								**<<Used Jan 2004 as Dec '03 unavailable**		
PV OF BENEFITS + TERMINAL VALUE (S VALUE FOR DERIVAGEM)					**>>>>>>>>>**	-21,117	2,267,459	4,652,978	7,137,655	9,723,758	12,413,612	
IRR of Benefits					**>>>>>>>>>**	**7.0%**	**9.3%**	**10.9%**	**11.9%**	**12.7%**	**13.3%**	

Terminal value of extended section						
Est. resale (NOI for Next Year/WACC)	37,388,337	41,816,606	46,729,069	52,176,627	58,215,419	64,907,358
-Balance owing on loan (capital only)	-13,925,003	-13,503,006	-13,036,822	-12,521,821	-11,952,894	-11,324,392
Subtotal	**23,463,334**	**28,313,600**	**33,692,248**	**39,654,805**	**46,262,525**	**53,582,966**
-Cumulative depreciation	-3,875,000	-4,650,000	-5,425,000	-6,200,000	-6,975,000	-7,750,000
-Initial CAPEX	*-15,500,000*	*-15,500,000*	*-15,500,000*	*-15,500,000*	*-15,500,000*	*-15,500,000*
Taxable Capital Gain	*4,088,334*	*8,163,600*	*12,767,248*	*17,954,805*	*23,787,525*	*30,332,966*
-Capital gains tax for companies at 14.5%	-592,808	-1,183,722	-1,851,251	-2,603,447	-3,449,191	-4,398,280
After-tax Terminal Value	**22,870,526**	**27,129,878**	**31,840,997**	**37,051,359**	**42,813,334**	**49,184,686**

Retail Centre 4 - Centurion

Loan Repayment Schedule

Loan principal	15,500,000
Loan interest	10%
Loan Term (years)	20
Monthly payment	**R 149,578**

Assume 2% below prime lending rate

Month	Principal at beginning of month	Payment at end of month	Interest portion	Cumulative interest	Principal portion	Cumulative principal
1	15,500,000	149,578	129,167	129,167	20,412	20,412
2	15,479,588	149,578	128,997	258,163	14,958	35,370
3	15,464,630	149,578	128,825	386,988	20,753	56,123
4	15,443,877	149,578	128,652	515,640	20,926	77,049
5	15,422,951	149,578	128,478	644,118	21,101	98,150
6	15,401,850	149,578	128,302	772,420	21,276	119,426
7	15,380,574	149,578	128,125	900,545	21,454	140,880
8	15,359,120	149,578	127,946	1,028,490	21,633	162,512
9	15,337,488	149,578	127,766	1,156,256	21,813	184,325
10	15,315,675	149,578	127,584	1,283,840	21,995	206,320
11	15,293,680	149,578	127,400	1,411,240	22,178	228,498
12	15,271,502	149,578	127,216	1,538,456	22,363	250,861
13	15,249,139	149,578	127,029	1,665,485	22,549	273,410
14	15,226,590	149,578	126,841	1,792,326	22,737	296,147
15	15,203,853	149,578	126,652	1,918,978	22,926	319,073
16	15,180,927	149,578	126,461	2,045,439	23,117	342,190
17	15,157,810	149,578	126,268	2,171,707	23,310	365,501
18	15,134,499	149,578	126,074	2,297,781	23,504	389,005
19	15,110,995	149,578	125,878	2,423,660	23,700	412,705
20	15,087,295	149,578	125,681	2,549,340	23,898	436,603
21	15,063,397	149,578	125,481	2,674,822	24,097	460,700
22	15,039,300	149,578	125,281	2,800,102	24,298	484,998
23	15,015,002	149,578	125,078	2,925,180	24,500	509,498
24	14,990,502	149,578	124,874	3,050,054	24,704	534,202
25	14,965,798	149,578	124,668	3,174,722	24,910	559,112
26	14,940,888	149,578	124,461	3,299,183	25,118	584,230
27	14,915,770	149,578	124,251	3,423,434	25,327	609,557
28	14,890,443	149,578	124,040	3,547,474	25,538	635,096
29	14,864,904	149,578	123,827	3,671,302	25,751	660,847
30	14,839,153	149,578	123,613	3,794,914	25,966	686,812
31	14,813,188	149,578	123,396	3,918,311	26,182	712,994
32	14,787,006	149,578	123,178	4,041,489	26,400	739,394
33	14,760,606	149,578	122,958	4,164,447	26,620	766,015
34	14,733,985	149,578	122,736	4,287,183	26,842	792,857
35	14,707,143	149,578	122,513	4,409,696	27,066	819,922
36	14,680,078	149,578	122,287	4,531,983	27,291	847,214
240	153,966	149,578	1,236	20,398,805	148,342	15,494,376

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	0.02
Volatility (% per year):	9.01%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	5.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

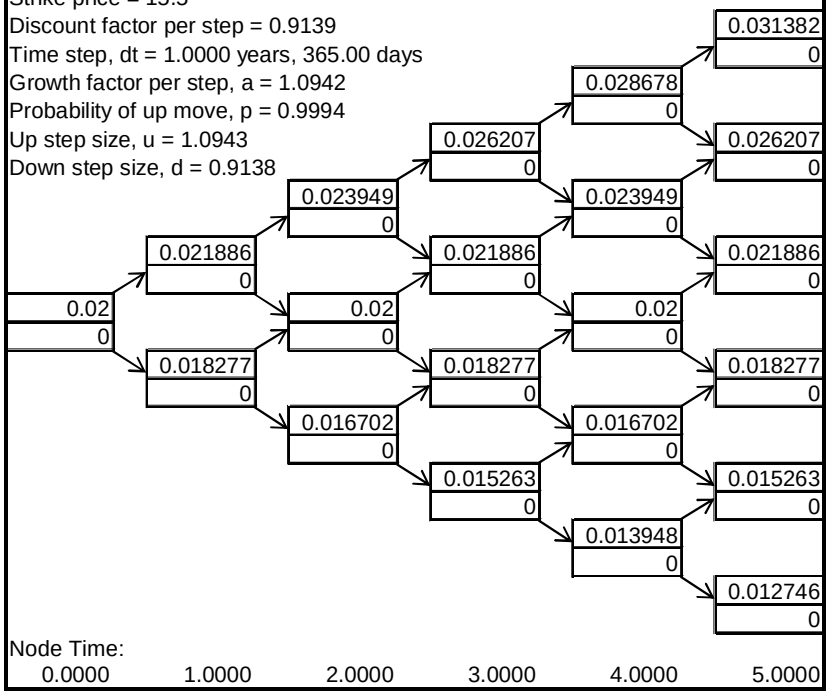
Price:	0
Delta (per $):	0
Gamma (per $ per $):	0
Vega (per %):	0
Theta (per day):	0
Rho (per %):	0

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.9139
Time step, dt = 1.0000 years, 365.00 days
Growth factor per step, a = 1.0942
Probability of up move, p = 0.9994
Up step size, u = 1.0943
Down step size, d = 0.9138



Node Time:
0.0000 1.0000 2.0000 3.0000 4.0000 5.0000

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	2.27
Volatility (% per year):	9.86%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	6.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

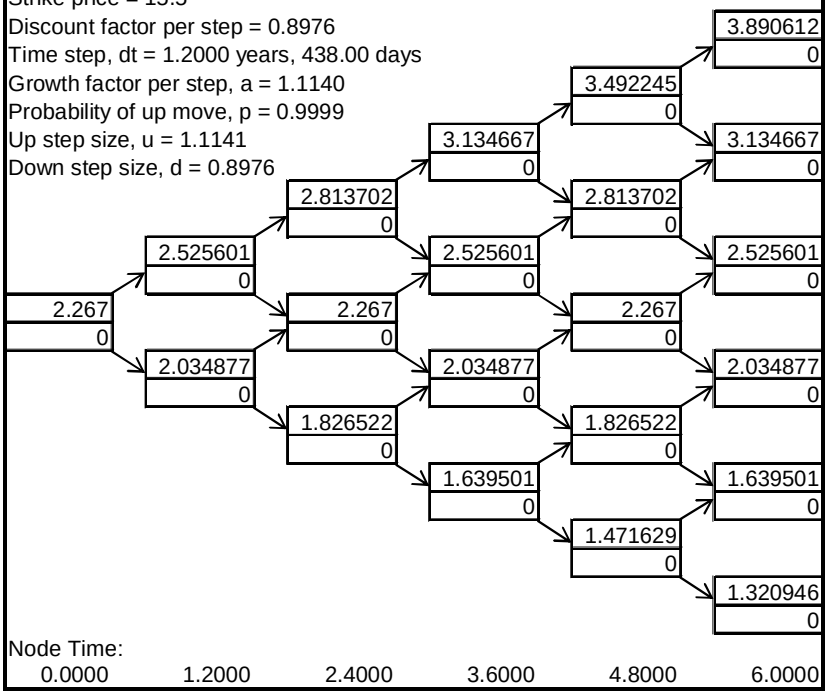
Price:	0
Delta (per $):	0
Gamma (per $ per $):	0
Vega (per %):	0
Theta (per day):	0
Rho (per %):	0

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.8976
Time step, dt = 1.2000 years, 438.00 days
Growth factor per step, a = 1.1140
Probability of up move, p = 0.9999
Up step size, u = 1.1141
Down step size, d = 0.8976



Node Time:

0.0000	1.2000	2.4000	3.6000	4.8000	6.0000

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	4.65
Volatility (% per year):	10.65%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	7.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

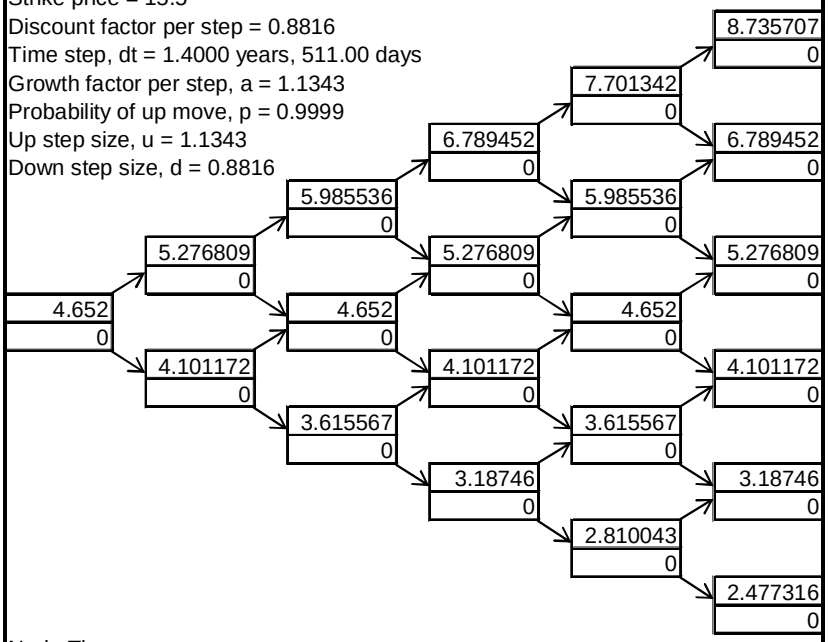
Price:	0
Delta (per $):	0
Gamma (per $ per $):	0
Vega (per %):	0
Theta (per day):	0
Rho (per %):	0

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.8816
Time step, dt = 1.4000 years, 511.00 days
Growth factor per step, a = 1.1343
Probability of up move, p = 0.9999
Up step size, u = 1.1343
Down step size, d = 0.8816



Node Time:

0.0000	1.4000	2.8000	4.2000	5.6000	7.0000

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	7.14
Volatility (% per year):	11.39%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	8.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

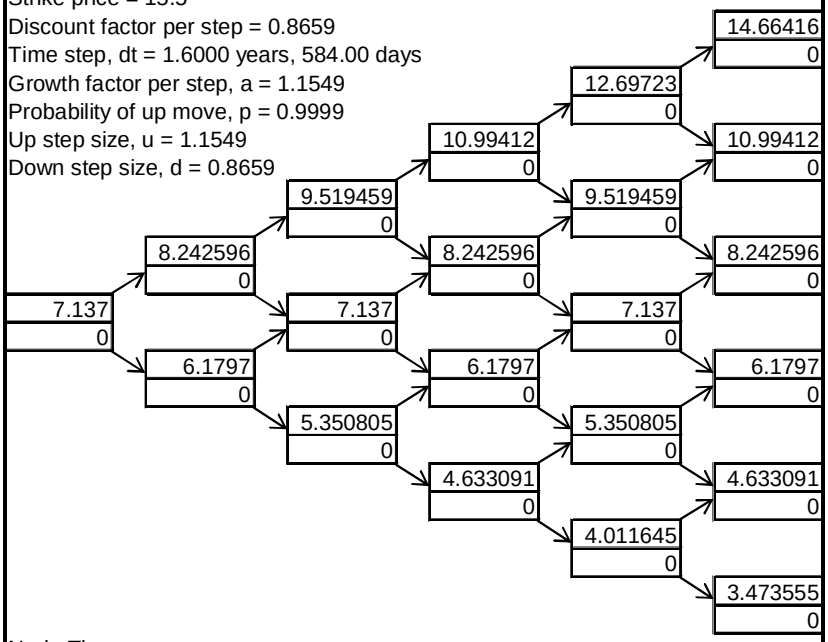
Price:	0
Delta (per $):	0
Gamma (per $ per $):	0
Vega (per %):	0.04655779
Theta (per day):	0
Rho (per %):	0

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.8659
Time step, dt = 1.6000 years, 584.00 days
Growth factor per step, a = 1.1549
Probability of up move, p = 0.9999
Up step size, u = 1.1549
Down step size, d = 0.8659



Node Time:
0.0000 1.6000 3.2000 4.8000 6.4000 8.0000

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	9.72
Volatility (% per year):	12.08%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	9.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

Price:	2.82770019
Delta (per $):	0.99970905
Gamma (per $ per $):	0.28979649
Vega (per %):	0.03368843
Theta (per day):	-0.0020073
Rho (per %):	0.67029464

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.8504
Time step, dt = 1.8000 years, 657.00 days
Growth factor per step, a = 1.1759
Probability of up move, p = 0.9999
Up step size, u = 1.1759
Down step size, d = 0.8504

					21.85968
					6.359683
				18.58982	
				5.40798	
			15.80907		15.80907
			4.598695		0.309074
		13.44429		13.44429	
		3.910517		0.262821	
	11.43323		11.43323		11.43323
	3.325323		0.22349		0
9.723		9.723		9.723	
2.8277		0.190044		0	
	8.268592		8.268592		8.268592
	0.161604		0		0
		7.031741		7.031741	
		0		0	
			5.979903		5.979903
			0		0
				5.085404	
				0	
					4.324707
					0

Node Time:

0.0000	1.8000	3.6000	5.4000	7.2000	9.0000

Retail Centre 4 - Centurion

Derivagem Valuation

Underlying Type: Equity

Time	Dividend

Stock Price:	12.41
Volatility (% per year):	12.73%
Risk-Free Rate (% per year):	9.00%

Option Data

Option Type: Binomial: American ☐ Imply Volatility

Time to Expiration:	10.0000
Exercise Price:	15.50
Tree Steps:	5

○ Put ◉ Call

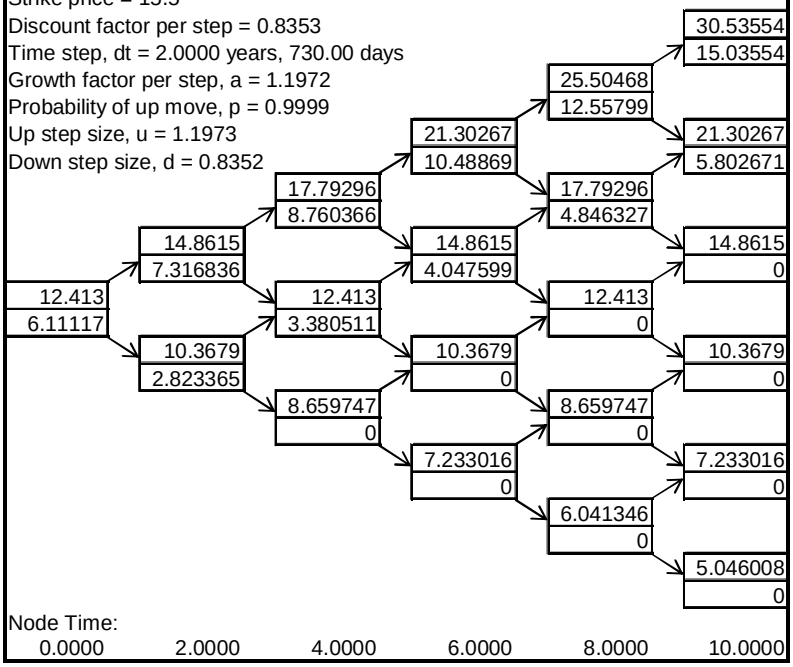
Price:	6.1111703
Delta (per $):	0.99997309
Gamma (per $ per $):	0.02174296
Vega (per %):	0.00460327
Theta (per day):	-0.0018703
Rho (per %):	0.60632499

Retail Centre 4 - Centurion

Binomial Tree

At each node:
Upper value = Underlying Asset Price
Lower value = Option Price
Values in red are a result of early exercise.

Strike price = 15.5
Discount factor per step = 0.8353
Time step, dt = 2.0000 years, 730.00 days
Growth factor per step, a = 1.1972
Probability of up move, p = 0.9999
Up step size, u = 1.1973
Down step size, d = 0.8352



Node Time:
0.0000 2.0000 4.0000 6.0000 8.0000 10.0000

APPENDIX 5

PROXY VOLATILITY CALCULATION USING JSE-LISTED SHARES PRIMARILY INVOLVED IN COMMERCIAL PROPERTY IN SOUTH AFRICA

Volatility based on listed property stocks

Shortname	Name	Volatility	Portfolio
ACUCAP	Acucap Properties Ltd.	5.49	Holding co.
AMBIT	Ambit Properties Ltd.	8.03	Retail, commercial & industrial
APEXHI-A	ApexHi Properties Ltd.	5.1	Retail, commercial & industrial
APEXHI-B	ApexHi Properties Ltd.	6.54	Retail, commercial & industrial
DIVERSIFIED	Divrsified Property Fund Ltd.	5.16	Retail & industrial
FAIRVEST	Fairvest Property Holdings Ltd.	23.33	Retail, commercial & industrial
FREESTONE	Freestone Property holdings Ltd.	8.45	Retail, commercial & industrial
IFOUR	iFour Properties Ltd.	7.07	Rentals - unspecified
OCTODEC	Octodec Investments Ltd.	9.14	Retail, commercial & industrial
PANPROP	Pangbourne Properties Ltd.	5.88	Retail, commercial & industrial
PARAPROP	Paramount Poperty fund Ltd.	6.39	Retail, commercial & industrial
PREMIUM	Premium Properties Ltd.	8.84	Retail, commercial, industrial & residential
SARETAIL	SA Retail Properties Ltd.	5.84	Retail
SIYAPROP	Siyathenga Property Fund Ltd.	11.17	Retail
SPEARHEAD	Spearhead Property Holdings Ltd	7.73	Retail, commercial & industrial
VUKILE	Vukile Property Fund Ltd.	8.13	Investments properties
Average		**8.27**	

Source: Oldert (February 2007 – May 2007).