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# Appraising Value and Risk of Commercial Assets: Stratifying the Modified Internal Rate of Return in an American and European Put Option Analysis

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*In comparative project valuations, there is an assumption of equality of risk across investments. Two commercial metro office buildings are valued according to both a European and American Put Option, broadening the number of acceptable actions for investors. This paper presents a technique that enhances the final investment decision process. Specifically, this paper posits that, superior to the Internal Rate of Return (IRR), stratifying the Modified Internal Rate of Return (MIRR) provides another layer of risk analysis that facilitates project comparisons even where other techniques have led to conflicting results.*

In making commercial real estate valuation decisions, the process of analyzing competitive locations is based upon the unique real estate properties themselves, other available investment opportunities, the expected rates of return, and the degree of risk associated with each of the capital projects. This paper posits that with the appraisal of the value of commercial assets, real options exist for an investor. It compares the existence of a European Put Option where reversion value (gross selling price) can occur only at the end of the lease term and an American Put Option where reversion can happen at any time during the holding period. Specifically, it's the presence of both the European and American Put Options that gives the investor the right but not the obligation to make a sell decision. Just like with financial options, the value of the real option is contingent on future event(s) such as net lease revenue receipts and the expected future re-sale value.

The value of real estate projects are likely to fluctuate stochastically and the investor will choose to exercise the option, there is no obligation, when it is perceived to be 'in-the-money' (Dixit and Pindyck, 1994). This paper recognizes and supports prior works which state that investors have the choice to make net capital expenditures with or without the ability to abandon or sell-off the project. It focuses, based on actual real estate data, on a specific mutually exclusive case between two similar office buildings in metro downtown Chicago.

In the traditional Discounted Cash Flow (DCF) process, the Internal Rate of Return (IRR) is normally used to rank the desirability of projects. In order to determine the relative weights and timing of the various components of the return, the IRR can be partitioned (Brueggeman and Fisher, 2008). However, the IRR is subject to weaknesses such as producing multiple rates of return depending on the sign of the cash flows, and the rate itself is used as the reinvestment rate of return for the project. This paper advocates the use of the Modified Internal Rate of Return (MIRR) as an alternative because it will not produce multiple rates of return and uses the cost of capital and not itself as the reinvestment rate of return and offers a more conservative return. In an extension of the literature, the stratifying of the MIRR adds another layer to the risk analysis aspect that goes beyond that of the IRR and its partitioning. This paper looks at the related real option literature and the source of the data for the analysis, the methodology section and the empirical results, and the analysis of the empirical results and the conclusion end the paper.

## RELATED LITERATURE

The impact of risk and uncertainty on rational decision rules used in the selection of projects to include in a corporate capital budget has been a major finance topic for discussion and research. Lintner (1965) found that the expected return in a capital budgeting case was an increasing function of the risk-free rate of return, the market price of dollar risk, the project's variance of returns, the aggregate present value of the project and its co-variance with existing assets of the firm, and the co-variance of the project with other projects included in the capital budget. A situation of certainty exists when the investor knows for sure (100% probability) what his future returns will look like (Levy and Sarnat, 1984).

Looking at capital budgeting under uncertainty (Huang and Litzemberger, 1988) and (Lucas and Prescott, 1971), using the Sharpe-Lintner-Black model of capital market equilibrium, Fama (1977) found that the present value of expected future cash flows depends on the risk-adjusted discount rates for each of the periods until the flow of funds is realized. The discount rate experienced adjustments for risk over the time period due to the possible reassessment of the future cash flows. Even though the traditional Discounted Cash Flow (DCF) method takes into account the time value of money, systematic cash flows, and the ultimate resale of the property, it has a weakness in that it tends to be passive and does not capture the ability of the investor to adapt or revise their decisions in response to market

developments. It is generally accepted that investors will follow a set of rigid rules and will not alter a project at any specific stage of its useful operating life (Trigeorgis, 1993), (Trigeorgis and Mason, 1987).

Real options allow investors to take a more strategic approach to decision making as they have the right but not the obligation to make an investment decision. Just as financial options derive their value from the underlying asset, the value of real options is contingent on future events (Xie, 2009). In a recent work by Stout, Xie, and Qi (2008), they create a hypothetical example where the managers of a rental car company are faced with the problem of trying to decide whether to buy a fleet of gasoline-powered cars or hybrid vehicles in light of pending new government regulation. They claim that within this situation is an embedded abandonment option. There is an option to sell the gas-powered vehicle in any one year at a specific salvage value.

The question becomes how much value is added from the abandonment option (Bonini, 1977). The abandonment option is analogous to an American Put option on a dividend paying security. Berger, Ofek, and Swary (1995) predict that market value is positively related to liquidation value after controlling for the relation between a firm's market value and its expected future cash flows. Concerned with valuing projects that had several options available and then quantifying their interactions, Trigeogis (1993) found that the value of real options may not be additive. Valuing two options in a toll-road project in Australia, Rose (1998) found that at least one of the options displayed a significant value. The interaction between the options influenced the one significant option value. Ignoring embedded options could result in underestimating the value of a project. The findings of these latter two works imply that the flexibility that accrued to management through the recognition of a real option could be as economically significant as the expected future cash flows of the project.

**Data Review**

The data for the comparison of alternative real estate investments is obtained from REIS, Inc. The company is a provider of commercial real estate performance data and analysis. It specifically focuses on the metro (city), submarket (neighborhood), and property level. Their internet site is www.reis.com. The site offers coverage of 80 U.S. metropolitan areas and over 2,300 submarkets for the office, apartment, retail, and industrial sectors.

This paper analyzes a mutually exclusive situation that specifically compares two downtown Chicago office building investments, Projects Riverside and LaSalle. Their valuations will follow a traditional discounted cash flow (DCF) process. The physical characteristics for Projects Riverside and LaSalle are presented in Table I while the pertinent dollar per square foot data, used in the DCF model, for each property, is reported in Table II. The initial outlay for Project LaSalle was approximately $108.7 million and the initial outlay for Project Riverside was approximately $144.1 million. These are historical purchase prices from 2008 based on data from REIS, Inc.

**Table I: Physical Characteristics for Projects Riverside and LaSalle**

| Project Name | Project Riverside | Project LaSalle |
|---|---|---|
| City | Chicago | Chicago |
| Property Type | Multi-Tenant | Multi-Tenant |
| Building Area (sf) | 702,439 | 621,428 |
| Buildings/Floors | 1/22 | 1/30 |
| Year Built/Renovated | 1965/1994 | 1984/not yet |

**Table II: Dollar per Square Foot (psf) Data for Projects Riverside and LaSalle**

| Property Address | Project Riverside | Project LaSalle |
|---|---|---|
| Net Rentable Area (psf) | 702,439 | 621,428 |
| Sale Price (psf) | $205.00 | $175.00 |
| Average Asking Rent (psf) | $27.51 | $26.36 |
| Vacancy Loss Rate (%) | 14.40% | 9.20% |
| Expense Stop (psf) | $12.89 | $10.91 |
| Free Rent Concessions (psf) | $0.23 | $0.25 |
| Credit Loss (%) | 1.00% | 1.00% |
| Operating Expenses (psf) | $14.12 | $11.89 |
| Capital Reserves (psf) | $0.10 | $0.11 |
| Going-In-Cap-Rate (%) | 5.20% | 7.50% |

Notes for Table Two's line items:

- All per square foot (psf) figures are on an annual basis.
- Net Rentable Area (NRA) of a building included in the transaction, expressed in square feet, is an approximation based on verified public records.

- The potential rent revenue is the product of the building rentable area estimate and the average asking rent which is the market rent paid by a potential tenant.
- Sale Price (psf) is the purchase price of the property per square foot of net rentable area (NRA).
- Asking Rent for office properties is a weighted average quoted as annual gross rent per square foot.
- Vacancy losses are estimated rent losses from unoccupied space and unpaid rents.
- The Expense Stop creates an upper limit on the amount of operating expenses that the owner will be responsible for.
- Expense Reimbursement Recovery is the difference between the operating expense psf and the expense stop psf. The excess must be paid by the tenant. The recoverable operating expenses are property taxes, insurance, and maintenance.
- Free Rent Concession, to induce the lease signing, is the offer of a free rent period during which no rent is required to be paid. It is the total dollar amount or number of months free rent granted per lease terms.
- Credit Loss is the total amount of rent due that the landlord is unable to collect due to tenant default.
- Operating Expenses are the average annual costs, per square foot, of operating buildings that include property taxes, energy, janitorial service, insurance, common area maintenance, and management and leasing fees.
- Capital Reserves is an allowance that provides the periodic replacement of building components that wear out more rapidly than the building itself. They must be replaced during the economic life of the building.
- The reported estimated Going-in Capitalization Rate (Cap Rate) can be compared to the Reis Indexed Metro Office Cap Rate of 7.4%. The REIS Indexed Metro Office Cap Rate is modeled as a function of risk-free interest rates, metro rent growth expectations, current construction activity, and by running measures of volatility in rents. These measures are proxies for capital conditions, income expectations, and risk.

REIS, Inc. also compiles aggregate metro property data through Metro Analysis, Rent Comparables and Sales Comparables reports. The metro or metropolitan area is a geographical division of the United States that includes a major city, for example, Chicago, and its surrounding communities and counties. These Metro Analysis reports offer reasonable property benchmarks for the time frame of the paper's study. Relevant facts from their analyses are presented in Table III below.

**Table III: Relevant Data from Metro Area Analysis conducted by REIS, Inc.**

| | |
|---|---|
| Annualized 5-year Rent Growth | 2.1% |
| Annualized 5-year Vacancy Rate | 17.6% |
| Average Lease Term (years) | 5.5 |
| Average Leasing Commissions | 4.1% |
| Annualized 5-year Construction/Absorption | 1.9 |
| Inflation Rate per www.InflationData.Com | 3.85% |
| Stabilization Rate* | 68.18% |

Notes:
- Vacancy Rate is the amount of available space expressed as a percentage of total inventory.
- Lease term is the average term currently being quoted for new leases, in years.
- Leasing Commission is an amount paid to a real estate broker in exchange for bringing together the parties of the lease agreement.
- Usually it's paid in the form of a percentage of the yearly rent.
- Construction/Absorption is the construction or completions during the time period divided by absorption during the same time period.
- *Stabilization is achieved when the average vacancy rate of the properties built in any given year equals or is less than the Metro's average overall vacancy rate for the last five years.

These commercial assets are acquired subject to existing leases as noted by the lease terms and leasing commissions in Table III. Even if this were a new development project, the property lease would be based on typical leases in the marketplace. The lease and its terms, such as rent and expense reimbursements, must be accounted for in the calculation of the property's relevant future net operating income (NOI) and future reversion (RV) or sale price. The length of the property lease, this study uses an average five year period, plus its other specific terms affect the risk and return of the respective projects and cannot be ignored in the determination of the expected future property cash flows.

## METHODOLOGY

In order to consider the choice between Project Riverside and Project LaSalle, this paper presents a financial analysis that enables an investor to assess whether the risk associated with these projects is commensurate with their expected returns. The concept of due diligence is critical and is extended by this paper by reviewing the risk-return tradeoff within an American and European Put Option framework. Within these two real option strategies, a discounted cash flow (DCF) method is followed along with the comparison of both the IRR and MIRR. This comparison is further enhanced by contrasting the partitioning of the IRR with the stratifying of the MIRR. The relevancy of the latter accrues from the overall strengths of the MIRR over the IRR and the ability of an investor to determine how much of the return is associated with the annual future operating cash flows of the project and the timing of the estimated future cash flow from the resale of the property. It's the weights associated with these two specific cash flow components that allows the incorporation of relative risk which enables an investor to compare projects even where other techniques have led to conflicting results (Plath and Kennedy, 1994).

Regarding the two commercial projects, the appeal of the properties is not for the use or occupancy of the owner, they are considered to be income producing assets. Income properties are bought and sold on their ability to generate future income streams. This income stream is a cash flow. Using the discounted cash flow method (DCF), an investor will capitalize the expected future net operating income associated with the property and determine the asset's estimated net present value (Gallinelli 2009). The DCF analysis helps to determine if a proposed project can generate strong enough risk-adjusted returns. It is a standard framework for multi-period real estate investment analysis. For Projects Riverside and LaSalle, both present changing rent rolls and lease renewals and lease variables (inflation) that can change the level of gross operating income. Also impacted are the operating expenses and expense reimbursements which affect both the net operating income (NOI) for each year and the net terminal value or reversion (RV) (DeLisle, 2009). The basic DCF model to evaluate the property's net present value (NPV) is:

$$\text{NPV Office Building} = \sum NOI_t / (1 + capr)^t + RVt / (1+capr)^t - IO_0$$

The NPV is equal to the present value of future cash inflows – initial investment, where:

NOI = expected net operating income (cash flows) for the office building
RV = reversion (resale) value of the property; net terminal value
IO = initial investment outlay
capr = Capitalization Rate for the office building
t = unique time period for each of the expected future cash flows

**Table IV: Projected Net Cash Flow from Operations: Project Riverside**

| Year | | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Rentable Area Assumption (sf) | 702,439 | | | | | | |
| Average Asking Rate | 3.85% | $ 27.51 | $ 28.57 | $ 29.67 | $ 30.82 | $ 32.00 | $ 33.23 |
| Potential Rent Revenue | 3.85% | $ 19,327,015 | $ 20,071,105 | $ 20,843,843 | $ 21,646,331 | $ 22,479,714 | $ 23,345,183 |
| Vacancy Loss | 14.40% | 2,783,090 | 2,890,239 | 3,001,513 | 3,117,072 | 3,237,079 | 3,361,706 |
| Effective Rent Revenue | | $ 16,543,925 | $ 17,180,866 | $ 17,842,329 | $ 18,529,259 | $ 19,242,635 | $ 19,983,477 |
| Operating Expense psf | 3.85% | $ 14.12 | $ 14.66 | $ 15.23 | $ 15.81 | $ 16.42 | $ 17.06 |
| Expense stop psf | 3.85% | 12.89 | 13.39 | 13.90 | 14.44 | 14.99 | 15.57 |
| Expense Reimbursement psf | | $ 1.23 | $ 1.28 | $ 1.33 | $ 1.38 | $ 1.43 | $ 1.49 |
| Expense Reimbursement | | $ 864,00 | $ 897,264 | $ 931,809 | $ 967,683 | $ 1,004,939 | $ 1,043,629 |
| Free Rent Concessions | $ 0.23 | 161,561 | 161,561 | 161,561 | 161,561 | 161,561 | 161,561 |
| Credit Loss | 1.00% | 193,270 | 200,711 | 208,438 | 216,463 | 224,797 | 233,452 |
| Effective Gross Revenue | | $ 17,053,094 | $ 17,715,858 | $ 18,404,139 | $ 19,118,918 | $ 19,861,216 | $ 20,632,093 |
| Total Operating Expenses | | $ 9,918,439 | $ 10,300,299 | $ 10,696,860 | $ 11,108,689 | $ 11,536,374 | $ 11,980,524 |
| Capital Reserves | $ 0.10 | 70,244 | 70,244 | 70,244 | 70,244 | 70,244 | 70,244 |
| Total Expenses | | $ 9,988,683 | $ 10,370,542 | $ 10,767,104 | $ 11,178,933 | $ 11,606,618 | $ 12,050,768 |
| Net Operating Income (NOI) or Net Cash Flow | | $ 7,064,411 | $ 7,345,315 | $ 7,637,035 | $ 7,939,985 | $ 8,254,599 | $ 8,581,325 |

*Expected inflation rate is 3.85%
**Other variable % and $ from Table II

**Table V: Projected Net Cash Flow from Operations: Project LaSalle**

| Year | | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Rentable Area Assumption (sf) | 621,428 | | | | | | |
| Average Asking Rate | 3.85% | $ 26.36 | $ 27.37 | $ 28.43 | $ 29.52 | $ 30.66 | $ 31.84 |
| Potential Rent Revenue | | $ 16,380,033 | $ 17,010,664 | $ 17,665,575 | $ 18,345,699 | $ 19,052,009 | $ 19,785,511 |
| Vacancy Loss | 9.20% | 1,506,963 | 1,564,981 | 1,625,233 | 1,687,804 | 1,752,785 | 1,820,267 |
| Effective Rent Revenue | | $ 14,873,070 | $ 15,445,683 | $ 16,040,342 | $ 16,657,895 | $ 17,299,224 | $ 17,965,244 |
| Operating Expense psf | 3.85% | $ 11.89 | $ 12.35 | $ 12.82 | $ 13.32 | $ 13.83 | $ 14.36 |
| Expense stop psf | 3.85% | 10.91 | 11.33 | 11.77 | 12.22 | 12.69 | 13.18 |
| Expense Reimbursement psf | | $ 0.98 | $ 1.02 | $ 1.06 | $ 1.10 | $ 1.14 | $ 1.18 |
| Expense Reimbursement | | $ 608,999 | $ 622,276 | $ 635,807 | $ 649,595 | $ 663,644 | $ 677,956 |
| Free Rent Concessions | $ 0.26 | 161,571 | 161,571 | 161,571 | 161,571 | 161,571 | 161,571 |
| Credit Loss | 1.00% | 163,800 | 170,107 | 176,656 | 183,457 | 190,520 | 197,855 |
| Effective Gross Revenue | | $ 15,156,698 | $ 15,736,281 | $ 16,337,922 | $ 16,962,462 | $ 17,610,776 | $ 18,283,773 |
| Total Operating Expenses | | $ 7,388,779 | $ 7,673,247 | $ 7,968,667 | $ 8,275,461 | $ 8,594,066 | $ 8,924,937 |
| Capital Reserves | $ 0.11 | 68,357 | 68,357 | 68,357 | 68,357 | 68,357 | 68,357 |
| Total Expenses | | $ 7,457,136 | $ 7,741,604 | $ 8,037,024 | $ 8,343,818 | $ 8,662,423 | $ 8,993,294 |
| Net Operating Income (NOI) or Net Cash Flow | | $ 7,699,562 | $ 7,994,677 | $ 8,300,898 | $ 8,618,644 | $ 8,948,353 | $ 9,290,479 |

*Expected inflation rate is 3.85%
**Other variable % and $ from Table II

Notes for Tables IV and V:

- The estimated average annual inflation rate adjustment is 3.85%. The NOI increases each year even if leases are not renewed.
- Vacancy losses are estimated rent losses from unoccupied space and unpaid rents.
- Expense Stop creates an upper limit on the amount of operating expenses that the owner will be responsible for.
- Expense Reimbursement Recovery is the difference between the operating expense psf and the expense stop psf. The excess must be paid by the tenant. The recoverable operating expenses are property taxes, insurance, and maintenance.
- Free Rent Concession, to induce the lease signing, is the offer of a free rent period during which no rent is required to be paid. It is the total dollar amount or number of months free rent granted per lease terms.
- Credit Loss is the total amount of rent due that the landlord is unable to collect due to tenant default.
- Effective Gross Revenue is determined as the effective rent income plus the operating expense recoveries less the provisions for the free rent period and potential credit losses.
- Operating Expenses are the average annual costs, per square foot, of operating buildings that include property taxes, energy, janitorial service, insurance, common area maintenance, and management and leasing fees.
- Capital Reserves is an allowance that provides the periodic replacement of building components that wear out more rapidly than the building itself. They must be replaced during the economic life of the building.
- Net operating income (NOI) is calculated as the net of the effective gross revenue and both the operating expenses and the provision for future capital outlays.

Even though the worksheet calculates the NOI, the measure is not income as described under generally accepted accounting principles (GAAP) but is cash flow. The term NOI is interchangeable with the net cash flow from operations.

If the appraised value of the project is a function of the income stream and the NOI results from the income stream that is generated from the operations of the property, the real estate investment is independent of external factors such as taxes or financing. The investor is deciding upon a property's income potential not the property itself. The before-tax NOI serves as an objective means of measuring the potential income stream from the property while the going-in capitalization rate acts as an investor's subjective estimate of how well the capital is required to perform (Gallinelli, 2004). Tax benefits are not ignored, rather, the implication is that an investor will consider the before tax cash flows, understanding that a tax benefit will be realized (Brueggeman and Fisher, 2008).

The existing financing terms are assumed to be similar for both properties and as such, the expected returns for any particular group of investors should not be impacted by the financing of the project. It's not that interest rates or access to debt markets don't impact value, but under any economic climate, an investor will choose the equity-debt allocation based on the degree of risk that they are most comfortable with (Fisher 2008).

The net present value (NPV) and the Internal Rate of Return (IRR) are two accepted measures of analyzing the attractiveness of real estate investments. The IRR builds on the NPV framework attempting to find a discount rate which equates the NPV to zero. It is similar to a breakeven point. While it considers both the magnitude and timing of each cash flow, it assumes a cash flow reinvestment rate at the IRR, which can give an unrealistic view of a project's potential value. A project with positive and negative cash flows delivers multiple IRRs. A conflict between the decision rules of each technique can occur making comparisons between alternative projects, especially mutually exclusive ones, difficult. An investor can partition the IRR (Brueggeman and Fisher, 2008) with the objective of finding out what portion of the return is from the annual operating cash flows and what portion comes from the resale.

There generally is more certainty associated with the funds that occur earlier than later in the investment holding period. Hence, the greater the proportion of resale cash flow, the greater the risk an investor must face. However, even partitioning the IRR, its weaknesses are not addressed. The use of the modified internal rate of return (MIRR) gives the investor a potentially stronger technique to analyze the cash flows of a project. It results in a more conservative return than the IRR; negative cash flows are cancelled out by positive ones, and compounds the cash flows forward at a more realistic reinvestment rate based on the project's cost of capital. It then discounts this future cash flow back to the initial outlay date at a rate that more fairly represents the investment risk of the project. The basic model to find the MIRR is presented below.

$$\text{Zero} = FVNOI_t / (1 + MIRR)^t + RV_t / (1 + MIRR)^t - IO_0$$

The MIRR is the rate which equates the NPV to Zero
Future value of the sum of each NOI @ capr
$\sum NOI_t (1+ capr)^t$ = FVNOI at the end of the lease term
RV = the reversion (sale) value at the end of the lease term
NOI = the net operating income or net cash flow for each year in the investment horizon
Capr = the capitalization rate used to determine the future value of net cash flows
FVNOI = the future value of the sum of each periodic NOI by the end of the lease term
RV = the Reversion value for the office building at the end of the lease term
MIRR = the modified internal rate of return for each office building
IO = the Initial investment outlay
T = the time period as of the end of the lease term.

This paper puts forth that the relative proportions of the MIRR, represented by the two cash flow sources, can provide another layer of analysis that reveals that the risk differences between the income properties are strong enough to challenge, specifically in the case of the mutually exclusive Riverside and LaSalle projects, the traditional decision rules of the NPV, IRR, and it's partitioning. The process of the stratifying of the modified internal rate of return is presented below.

**The Stratifying of the Modified Internal Rate of Return**

Step 1: Calculate the MIRR as described above.
Step 2: Use the MIRR to discount back the NOI cash flows and the RV cash flow
Step 3: Formulate the weight or strata of the MIRR
[a] $PVNOI_t + PVRV_t = TPVCF_t$
[b] $PVNOI_t / TPVCF_t$ = relative proportion of MIRR from the discounted total future NOI
[c] $PVREV_t / TPVCF_t$ = relative proportion of MIRR from the discounted future RV, where
$PVNOI_t$ = present value of future net operating income from the end of lease term
$PVRV_t$ = present value of future reversion value from the end of lease term
$TPVCF_t$ = Total present value of both operating and reversion cash flows at time period zero

Note: European Put Option - future reversion or sale of the office building can only occur at the end of the holding term. American Put Option - future reversion or sale of the office building can occur at any time during the holding term.

The stratification of the modified internal rate of return is strengthened, in this paper, by the fact that all the anticipated future cash flows are partially determined by existing leases, mitigating some of the uncertainty typically associated with estimating these future cash flows.

## EMPIRICAL ANALYSIS

This study posits that an investor can approach the income property valuation process either adhering to the European Put Option strategy where each property will be sold at the end of the fifth year (2012) or following an American Put Option strategy that offers the flexibility of choosing to sell the property during any year of the investment holding period. In order to determine the reversion value (RV) for both project Riverside and LaSalle, their net operating income (NOI) for the sixth year (2013), (Tables IV and V) is divided by each property's estimated going-in capitalization rate (Cap Rate) (Table II). The given cap rate represents the return required for the particular property investment based on its risk when compared to returns earned from competing investments. When direct capitalization is used, the properties being reviewed need to be comparable. The two office buildings appear to be similar in terms of their construction, size, age, location, and functionality. When making estimates of the future property value, the handling of capital outlays is important, too. Here, each property reflects an actual 'Capital Reserve' provision (Table II) in determining the net operating income (NOI). Further, consistency is maintained through the use of Table III's relevant data from the metro area analysis conducted by REIS, Inc on important items as the average lease term and inflation rent escalator. The expected future cash flows from the resale of each property under both the European Put Option and American Put Option are presented in Table VI below.

**Table VI: Cash Flow from Resale (Reversion Value) for Project Riverside and Project LaSalle Under the European and American Put Option Strategies**

| **European Put Option** | **Project Riverside** | **Project LaSalle** |
|---|---|---|
| NOI period 6 (2013) | $8,581,325 | $9,290,479 |
| Cap Rate | 5.20% | 7.50% |
| Cash Flow from Reversion | $165,025,487 | $123,873,052 |
| **American Put Option** | | |
| Lease term | **Reversion Value** | **Reversion Value** |
| Year 1 | $134,737,369 | $92,756,207 |
| Year 2 | 141,743,712 | 99,712,923 |
| Year 3 | 149,114,386 | 107,191,392 |
| Year 4 | 156,868,334 | 115,230,746 |
| Year 5 | 165,025,487 | 123,873,052 |

Note: European Put Option – Reversion value only at the end of the holding term. American Put Option – Reversion value calculated at the end of each year in holding period.

The NPVs of each project under the European and American Put Option strategies is presented next in Table VII:

**Table VII: Net Present Value (NPV) for Project Riverside and Project LaSalle Under the European and American Put Option Strategies**

| **European Put Option** | **Project Riverside** | **Project LaSalle** |
|---|---|---|
| Initial Outlay | $143,999,995 | $108,749,900 |
| Cap Rate | 5.20% | 7.50% |
| Net Present Value | $16,878,443 | $10,983,976 |
| **American Put Option** | | |
| Lease term | **NPV** | **NPV** |
| Year 1 | ($9,207,428) | ($15,302,673) |
| Year 2 | (2,570,319) | (8,384,618) |
| Year 3 | 3,989,284 | (1,702,722) |
| Year 4 | 10,471,996 | 4,750,923 |
| Year 5 | 16,878,443 | 10,983,976 |

Note: European Put Option – NPV based on reversion only at the end of the holding term. American Put Option – NPV is calculated as if reversion can occur at the end of any year in the holding period.

The next step in the DCF process is the determination of both the internal rate of return and the modified internal rate of return. The results for Projects Riverside and LaSalle, under the European and American Put Option strategies, are presented below in Table VIII.

**Table VIII: Internal Rate of Return (IRR) and Modified Internal Rate of Return (MIRR) For Projects Riverside and LaSalle Under the European and American Put Option Strategies**

| **European Put Option** | **Project Riverside** | | **Project LaSalle** | |
|---|---|---|---|---|
| Capitalization Rate | 5.20% | | 7.50% | |
| Internal Rate of Return (IRR) | 7.78% | | 9.87% | |
| Modified Internal Rate of Return (MIRR) | 7.56% | | 9.59% | |
| Excess of MIRR over Cap Rate | 2.36% | | 2.09% | |
| Excess of IRR over Cap Rate | 2.58% | | 2.37% | |
| **American Put Option** | | | | |
| Lease Term | **IRR** | **MIRR** | **IRR** | **MIRR** |
| Year 1 | na | na | na | na |
| Year 2 | na | na | na | na |
| Year 3 | 6.21% | 6.16% | na | na |
| Excess of internal return over capr | 1.01% | 0.96% | na | na |
| Year 4 | 7.20% | 7.06% | 8.78% | 8.66% |
| Excess of internal return over capr | 2.00% | 1.86% | 1.28% | 1.16% |
| Year 5 | 7.78% | 7.56% | 9.87% | 9.59% |
| Excess of internal return over capr | 2.58% | 2.36% | 2.37% | 2.09% |

Note: na is "not applicable" as the NPV < 0. This fact guarantees the MIRR to be < the Cap Rate, capr = going-in cap rate, European Put Option – IRR and MIRR based on reversion only at the end of the holding term, American Put Option – IRR and MIRR are calculated as if reversion can occur at the end of any year in the holding period.

**Table IX: Contrasting of the Stratifying of the Modified Internal Rate of Return with the Partitioning of the Internal Rate of Return for Projects Riverside and LaSalle Under the European and American Put Options**

| **European Put Option** | **Project Riverside** | **Project LaSalle** |
|---|---|---|
| **Relative Proportions of the MIRR** | | |
| From operational (NOI) cash flows | 20.39% | 27.94% |
| From reversion (RV) cash flow | 79.61% | 72.06% |
| **Relative Proportions of the IRR** | | |
| From operational (NOI) cash flows | 21.21% | 28.86% |
| From reversion (RV) cash flow | 78.79% | 71.14% |
| **American Put Option** | **Stratifying of the MIRR** | |
| **Lease Term** | | |
| Year 1 | na | na |
| Year 2 | na | na |
| Year 3: From Operational cash flows | 13.37% | na |
| From Reversion cash flows | 86.63% | na |
| Year 4: From Operational cash flows | 17.09% | 23.98% |
| From Reversion cash flows | 82.91% | 76.02% |
| Year 5: From Operational cash flows | 20.39% | 27.94% |
| From Reversion cash flows | 79.61% | 72.06% |
| | **Partitioning of the IRR** | |
| **Lease Term** | | |
| Year 1 | na | na |
| Year 2 | na | na |
| Year 3: From Operational cash flows | 13.57% | na |
| From Reversion cash flows | 86.43% | na |
| Year 4: From Operational cash flows | 17.50% | 24.31% |
| From Reversion cash flows | 82.50% | 75.69% |
| Year 5: From Operational cash flows | 20.21% | 28.86% |
| From Reversion cash flows | 78.79% | 71.14% |

Note: na is "not applicable" as the NPV < 0. This fact guarantees the MIRR and IRR to be < the Cap Rate, European Put Option – based on reversion only at the end of the holding term, American Put Option – based on reversion occurring at the end of any year in the holding period, Partitioning the IRR under-estimates the risk associated with the reversion cash flows under both the European and American Put Options.

## ANALYSIS OF EMPIRICAL RESULTS

The decision regarding investing in Project Riverside and Project LaSalle is being made under a mutually exclusive investment situation. In the DCF framework, an accepted rule is to accept the project with the comparative greater positive NPV. Table VII, under the European Put section, reports that Projects Riverside and LaSalle reflect positive net cash flows of $16,878,773 and $10,983,976 respectively. Project Riverside would be favored over Project LaSalle. Under the American Put Option, within the five year holding period, Project Riverside offers a viable positive NPV in each of years three, four, and five in the amounts of $3,989,284, $10,471,996, and $16,878,443 respectively. During the first two years, for both properties, there is an estimated negative net present value, making the choice to sell within that period not a prudent one. For Project LaSalle, under the American Put Option, the investor would realize an opportunity in years four and five as year three was met with negative net cash flows. Its positive NPV in year four was $4,750,923 and in year five was $10,983,976. Investors have more flexibility with Project Riverside.

To corroborate the actions dictated by the NPV rule, the internal returns on both investments need to be compared. The expectation is that the respective internal rates of return will be greater than the project's going-in capitalization rate and be consistent with the NPV ruling. Under the European Put Option, the Riverside property reflects an IRR of 7.78% (Table VIII) while Property LaSalle generated an IRR of 9.87%. Here, Project LaSalle is favored as its IRR exceeds not only its own cost of capital of 7.5% but is greater than that of the Riverside property. A conflict between the NPV and IRR exists. When considering the American Put Option, there is still no resolution, as Table VIII reports that the IRRs of Project LaSalle exceed that of Project Riverside in years four and five. Recognizing that the weaknesses associated with the internal rate of return can be avoided with the use of the modified internal rate of return, Table VIII also reports the MIRR findings as well. Under the European Option, Project Riverside had a MIRR of 7.56% which exceeded its cap rate of 5.2% by a margin of 2.36% (the IRR exceeded the cap rate by 2.58%). The MIRR associated with Project LaSalle was 9.59% and exceeded its cap rate of 7.5% by a margin of 2.09% (the IRR was greater than the cap rate by 2.37%).

Project LaSalle is favored by its MIRR but not by its NPV. Within the American Put Option strategy, there is no conflict in year three as Project LaSalle's MIRR is less that its cap rate while Project Riverside has a MIRR that exceeds its going-in cap rate making it a preferred project. Both properties reflect MIRR values which exceed their cap rates in years four and five. In year 4, Project LaSalle's MIRR of 8.66% exceeded its cap rate by 1.16% while its IRR of 8.78% had a spread of 1.28%. Project Riverside's MIRR of 7.06% exceeded its cap rate by 1.86% while its IRR of 7.20% had a spread of 2.0%. During year five, Project LaSalle's MIRR of 9.59% was larger than its cap rate by a margin of 2.09% while its IRR of 9.87% had a spread of 2.37%. For Project Riverside, its MIRR of 7.56% exceeded its cap rate by a spread of 2.36% while its IRR of 7.78% was associated with a spread of 2.58%. The MIRR delivers a more conservative return measurement as evidenced by the relatively larger cap rate spreads associated with the IRR calculations. The IRR consistently overstates the return associated with each project.

Within this environment of conflicting investment decision rules, the property investor needs to be able to further measure a project's expected future cash flow risk. One method to help address the latter is the partitioning of the internal rate of return. Its objective is to gain some sense of the relative proportion of the components of the return and to view the timing and/or magnitude of a project's cash flows. This paper extends the literature through the introduction of the stratifying of the modified internal rate of return. Aware of the strengths of the MIRR over the IRR and viewing it in conjunction with other risk factors (such as office building construction exceeds market absorption or there is an expected increase in vacancy rates), it offers an insightful measure of the risk associated with expected operational and reversion cash flows.

Within Table IX, the European Put Option reports interesting results. It has been established that both the MIRR and IRR favor Project LaSalle over Project Riverside. Yet, traditional DCF analysis would have the investor defer to the net present value rule to make a final decision and choose Project Riverside. Before making that decision, however, the stratifying of the MIRR and the partitioning of the IRR reveal that approximately 80% and 79% of Riverside's respective cash flows are associated with the reversion value of the project. On the other hand, for Project LaSalle, the relative proportions of the MIRR and IRR coming from its reversion cash flow are approximately 72% and 71%. A relative greater risk is associated with the future cash flows beyond the holding period for Project Riverside.

Within the American Put Option, Project Riverside had the only viable positive cash flow option in year three. The respective stratifying of the MIRR and partitioning of the IRR show relative proportions from the resale of the property to be approximately 87% and 86% respectively. Project Riverside's relative proportions of the MIRR associated with the expected resale cash flow over years four and five are approximately 83% and 80%. The IRR partitioned according to its reversion value during the same time period was approximately 83% and 79%. Project LaSalle generated relative proportions of its MIRR from the future sales price over years four and five that were approximately 76% and 72%. Regarding the proportions of the IRR over the same time frame, Project LaSalle showed approximate weights of 76% and 71%.

The investor-buyer must be aware of the relative greater risk associated with the key reversion cash flow. The results of the stratifying of the MIRR over years four and five reveal a consistent pattern where the expected reversion cash flow risk of Project Riverside is greater than that of Project LaSalle's. Under both the European and American Put Option strategies, taking into account this assessment of cash flow risk from the stratifying of the MIRR needs to be performed in recognition of other specific risk factors. From Table II, reporting relevant data from the metro area, REIS, Inc. reported that the annualized 5-year vacancy rate was 17.6%. Project LaSalle is well below this figure with a rate of 9.2% while Project Riverside stands at 14.4%. The annualized 5-year rent growth rate is only 2.1%. The region shows an approximate 2:1 ratio of the construction of office buildings relative to their absorption. This could lead to a future downward pressure on rent revenue as well as an increase in vacancy rates.

The area shows a stability rate of approximately 68%. Stabilization is achieved when the average vacancy rates of the properties built in any given year (here, it is 2008) are equal to or less than the metro's average overall vacancy rate for the last five years. The inflation factor for the period was 3.85% which impacts most of the cash flow estimates in Tables IV and V. The stratifying of the MIRR together with these risk factors, and an investor's unique aversion to risk, the NPV default rule may not be followed by the investor. The acceptance decision could be directed back towards Project LaSalle and not the Riverside property.

## CONCLUSION

Even though the traditional Discounted Cash Flow (DCF) method takes into account the time value of money, systematic cash flows, and the ultimate resale of the property, it has a weakness in that it tends to be passive and does not capture the ability of the investor to adapt or revise their decisions in response to market developments. With this backdrop, this paper looks at the DCF analysis within the framework of an American and European Put Option strategy. It puts forth the notion that these real options give the property investor the flexibility to make choices at multiple points during the investment holding period. Traditional DCF analysis settles project acceptance conflicts by comparing the NPV with the internal rate of return (IRR). The case is made that the modified internal rate of return (MIRR) is a better technique than the latter. The MIRR delivers a return that is more conservative, can handle a sequence of positive and negative cash flows, and specifies the project's cap rate as the reinvestment rate.

This paper extends the literature with the stratifying of the modified internal rate of return which breaks out the proportion of the MIRR that comes from both the operational and reversion cash flows. It implies that the investor faces more risk the greater the proportion of the MIRR that is comprised of the future resale value. Under conditions of uncertainty the need to have accurate measures of risk is essential. In this study, the IRR consistently overstates the return, as compared with the MIRR, in each of the years in the holding period. The partitioning of the IRR understates the most volatile of the NPV cash flow components facing the investor, as compared with the stratifying of the MIRR, in every year of the holding period, under both the European and American Put Option strategies. The stratifying of the MIRR provides a practical improvement over the IRR partitioning and offers another layer of risk analysis that facilitates project comparisons even where other techniques lead to conflicting results.

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