

**Show Me The Money:
A Study of Real Estate Development Returns**

by

Matthew S. Flowers

B.S., Mathematics, 2002
University of Florida

M.S., Management, 2004
University of Florida

Master of Business Administration, 2005
University of Florida

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Signature of Author: _____
Department of Urban Studies and Planning
July 31, 2008

Certified by: _____
David M. Geltner
Professor of Real Estate Finance
Department of Urban Studies and Planning
Thesis Supervisor

Accepted by: _____
Brian A. Ciochetti
Chairman, Interdepartmental Degree Program in Real Estate Development

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ABSTRACT

This paper introduces three new tools for the analysis and replication of real estate development returns. In particular, this paper discusses advanced sensitivity analysis, real estate development return indexes and synthetic real estate development investments. The advanced sensitivity analysis allows us to produce subjective ex ante return distributions. This analysis will allow developers and investors to “see” the shape of their investments return distribution. The benefits of knowing the shape of the subjective ex ante return distributions is that it may help developers and investors make better decisions and negotiate specific terms with each contributor in the capital structure. The ex post analysis allows us to produce development return indexes useful in the benchmarking of real estate development performance and in the creation of synthetic development investments by way of the new real estate derivatives. The development return indexes are created by transforming MIT’s Transaction Based Index (TBI), which tracks stabilized property returns, into development return indexes through the use of a stylized mathematical model.

Thesis Supervisor: David M. Geltner

Title: Professor of Real Estate Finance

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1 INTRODUCTION

The purpose of this thesis is to introduce new tools for the analysis and replication of real estate development investment returns. The methodologies described in this paper may help real estate professionals make better investment decisions, evaluate their past investments and “create” development returns using derivatives. In particular, we will examine five development return metrics, each of which has its own unique meaning and interpretation. We will then examine these return metrics from a forward- and backward-looking vantage point, and finally, we will see how to create these returns synthetically.

Chapter 2 introduces the characteristics of real estate development investments and their returns. In this chapter we introduce five return metrics, each of which provides additional information and clarity as to the risks and fundamentals of a specific development investment.

Chapter 3 is devoted to the topic of advanced sensitivity analysis which provides a way to “visualize” the potential distribution of a real estate development investment’s return. This analysis is important because the return distribution gives us insight into how a specific investment might perform in the future. The forecasted return distributions provide value to investors and developers by allowing them to compare alternatives and subjectively judge the risks in and across competing investments. Additionally, it gives the decision-maker the ability to better negotiate the capital structure terms to better match his risk/return preferences.

Finally, Chapter 4 describes the methodologies for creating historic development return indexes and synthetic development investments. The development return indexes are important because they provide a benchmark, or a way of measuring the performance of a specific development investment. Benchmarking investor and developer performance is important as it allows for a system to be established for the payment of bonuses or incentives. The indexes may also act as a diagnostic tool for dissecting actual development investment performance. The indexes have additional value by providing a platform to develop an investment product that mimics the returns earned by real estate developments. These “synthetic” development investments have many benefits that direct investment in real estate development lack, such as a quick means of exit and entry into a diverse pool of assets, lower financing and transaction costs and giving investors the ability to short sell real estate development exposure for the first time.

2 REAL ESTATE DEVELOPMENT INVESTMENTS & RETURNS

This chapter outlines the fundamentals of real estate development investments, leverage and development returns. We will begin with an examination of the specific characteristics of real estate development investments. In particular, there are two characteristics of development projects that make them unique from stabilized property investments. These characteristics are that development projects take time to build and that they have a phased risk regime.¹

1) Development projects take time to build, and therefore the cash outflows to pay for the land and the construction costs do not all occur at the same time and they do not all occur up front. This characteristic causes development projects to have “operational leverage” (this topic will be discussed extensively in the next section).

2) The phased risk regime means that the opportunity cost of capital (OCC) is not stable during the development period or between the development and stabilized phases. This characteristic makes it difficult to value a development investment in the traditional way, in which one discounts every cash flow at the same OCC. Instead, it is easier to value the construction cost cash flows, the lease-up cash flows, the terminal sales value cash flow and the land separately and then treat the development investment as a portfolio or series of these investments. Of course, if one were able to observe a single correct OCC for the development in the market place, which is often difficult, then these values *should* be equal (Geltner, Miller).²

Throughout this chapter we will carefully scrutinize how these characteristics shape and influence real estate development investments and returns, and how these characteristics make development investments different from investments in stabilized assets.

2.1 Net Present Value of a Real Estate Development Investment

Throughout the course of this paper it will be assumed that all development investments are made at a zero net present value (NPV). This assumption is consistent with the view that the private real estate market is competitive and non-zero NPV deals are rare. Since we are assuming zero NPV investments the price of land will be determined by the following formula.³

$$(1) \quad PV[V] - PV[K] = Land$$

¹ A third characteristic is that the use of construction loans in development projects is almost universal.

² We say “should” here because equilibrium should exist between the markets for stabilized assets, construction costs and land; therefore the two valuation techniques should yield the same answer. The portfolio view of real estate development investments is normative, i.e. it tells us what should occur.

³ The NPV of a development investment is defined as $NPV = PV[V] - PV[K] - Land$, this formula reiterates the point that a development investment is like a portfolio, or series of investments in a stabilized property, construction costs and land.

Where the $PV[V]$ is the present value of the expected value of the asset to be constructed and the $PV[K]$ is the present value of the construction costs.⁴

2.2 Leveraged Forward Commitment

A real estate development investment is a levered forward purchase commitment on the underlying stabilized property to be built. In this forward purchase commitment the investor will typically make two sets of payments. The first payment will be made up-front (time 0) and will cover the purchase the land, as well as to pay for any up-front fees of the development. The cost of the land will be at its current fair market value, or equivalently its opportunity cost (i.e. the land is purchased for a zero NPV).⁵ The second set of payments occurs throughout the construction period and covers the construction costs. The construction lender usually funds 100% of the construction costs. However, the use of a construction loan or any other specific financial arrangement is not necessary to carry out the investment analysis of a development project. Upon completion of construction the investor will make the final construction payment and receive the completed asset (Fisher, Geltner).

To sum up, the investor pays for the land, up-front fees and the construction costs and receives a stabilized asset upon completion. This “portfolio” of investments includes a long position in the underlying real estate asset (the forward commitment) and a short position in the construction costs (the leverage). The combination of short and long cash flows is inherently levered because the cash outflows do not occur at the same time and because the construction costs are not perfectly and positively correlated with the value of the underlying asset. The inherent leverage that exists in real estate development investments is an important point because it exists even if no financial leverage is employed.

2.3 Leverage & Leverage Ratios

2.31 Financial Leverage

Financial leverage is created by the use of fixed payment sources of capital in the financial structure.⁶ The fixed payment capital is usually debt, but mezzanine debt and preferred equity also levers up the residual equity position in the same way. The reason why financial leverage occurs is because debt capital earns a fixed rate of return while the underlying asset’s return is volatile. By definition, the equity investor receives all of the residual cash flows of the asset after

⁴ Throughout this analysis it is assumed that it is the optimal time to develop, that is, the development option is being “exercised” and holding the land vacant for speculation would no longer be “highest & best use.”

⁵ The historic, or book value, of the land is irrelevant for this particular analysis.

⁶ Actually, the use of financial capital that does not earn a fixed rates of return still adds leverage if the return is not perfectly and positively correlated with the underlying asset. Additionally, if a capital provider’s return is floating has negative correlation, moves inversely, with the underlying assets return then the amount of leverage increases compared with fixed rate sources of capital.

the debt holder receives his fixed sum. Therefore, any fluctuation in the income earned by the property is passed through directly to the equity holder. Therefore, on a dollar basis any change in the income at the property level is mirrored at the equity level. Since debt is used to finance a portion of the purchase price then the percentage change earned at the equity level is magnified, or levered, when compared to the property level. Conversely, if the capital used was not fixed rate but instead varied perfectly and positively with the cash flow of the asset then the equity return would not be levered, as with the use of joint venture equity partner.

To make this idea more concrete let's assume that an investor purchases a building for \$100 by borrowing \$75 in debt and investing \$25 in equity and this building produces constant income in perpetuity. If the property is expected to produce \$8 per year and the debt earns \$4.50 per year, then the equity investor can expect to earn \$3.50 per year forever. However, if the property actually earns \$9 per year forever, then the debt holder still receives his \$4.50 and the entire \$1 extra flows through to the equity investor, who now earns \$4.50. So on a dollar basis, any change in the income of the property flows through to the equity investors. However, on a percentage basis the return to the equity investor is levered up because the dollar change in cash flows is earned over a smaller amount of capital. For example, in the previous example the debt holder will earn 6% (calculated as: $\$4.50/\75) regardless of how much the property earns (ignoring the probability of financial distress). When the property earns \$8, or an 8% return the equity holder earns a 14% return (calculated as: $\$3.50/\25). However, when the income increases by \$1 the property now earns 9% (calculated as: $\$9/\100) and the equity return is magnified to 18% (calculated as: $\$4.50/\25), an increase of 4% or four times the 1% increase at the property level.

2.32 Leverage Ratio (LR)

To understand why the equity position earned four times the additional return than the property we need to introduce the concept of the leverage ratio. In the context of investment in a stabilized property the leverage ratio is defined as the value of the property divided by the value of the equity used to purchase the property. In our example the investment has a leverage ratio of 4 (calculated as: $\$100/\25), therefore any change in the return at the property level would be experienced four times greater at the equity level.

The leverage ratio concept may be extended from stabilized property investments to development investments using the following analogy: the purchase price for the stabilized property is equivalent to the present value of the expected asset value in the development project, and the amount of equity in the stabilized asset is equivalent to the value of the land in the development case ($LR = PV[V]/Land$) (Geltner, Miller).⁷

⁷ The development leverage ratio will be discussed in greater detail later in this chapter.

2.33 Operational Leverage

In every real estate development investment leverage exists regardless of how the investment is financed. We briefly touched upon this point when we mentioned that a development investment is a levered forward commitment to purchase the underlying asset. The leverage that is inherent in real estate development investments is called operational leverage and it exists for the same fundamental mathematical reasons as financial leverage. Operational leverage exists because the up front commitment of the land buys a net asset, specifically the difference between the terminal asset value and the construction costs. This net asset can be viewed as a long position in the underlying risky asset and a short position in the uncorrelated construction costs; much like how financial leverage is a long position in the underlying asset and a short position in fixed payment debt. This means that the volatility and return of the equity/land value is a magnification, or levered derivative of the underlying asset.

Operational leverage exhibits several traits. For instance, operational leverage increases the further out in time the construction costs occur, the more risky the underlying asset and the less correlated the construction costs are to the underlying asset (all else equal). Additionally, operational leverage decreases as the value of the land increases given constant construction costs, or equivalently operational leverage decreases as the development leverage ratio decreases. An extension of this last trait is that development projects located in cities that have high land prices as a percentage of the total development budget have lower operational leverage than projects in cities where land prices are relatively low (all else equal). Therefore, if the same development project could be construction in both Boston, MA and in Gainesville, FL then the Gainesville project would have more operational leverage, because land values in Gainesville are lower than in Boston, given that each project had the same construction costs.⁸

For a more concrete feel for the concept of operational leverage we will turn to a numerical example. The fundamental concepts of this numerical example will stay with us throughout the course of this research and is the basis for the determination of the values in the real estate development indexes that will be developed in later chapters.

⁸ This point reflects merely mathematical consequences of operational leverage; it does not imply that Gainesville will have a greater volatility in development returns. Some research suggests that cities with higher land prices also have higher volatility in the underlying asset prices. This is because the land supply may be constrained and relatively inelastic which causes the returns to be more sensitive to movements in asset prices. Additionally, large cities may have a more constrained supply of construction which causes demand shocks to cause higher volatility in returns. Therefore, even though land prices in Boston are higher than in Gainesville will cause higher operational leverage, the total volatility of returns may be higher or lower in Boston. However, when comparing two similar sites in Boston or in Gainesville, or when comparing two sites in different cities with the same underlying asset volatility, the operational leverage quantity does help explain the amount of volatility in each project.

Consider that we have just purchased some developable land. This land can support a building that is similar to properties that we currently observe in the market to be worth \$106.93. Assume that it will take one year to construct this building and that the market view is that the value of these similar properties will grow 1% next year. Therefore, we project that the value of our building will be \$108 next year when we complete construction. If the opportunity cost of an existing stabilized asset, that is comparable to our project when complete, is 8% or 400 bps over the current risk free rate of 4%,⁹ then we would be willing to pay \$100 (calculated as: $\$108/1.08$) today to receive the building in one year.¹⁰ This is the price if the forward purchase commitment that was mentioned in Section 2.2, we would be willing to pay \$100 today to receive the building in one year.¹¹ However, to obtain the building in one year we first need to build it. Therefore, we need to factor in the cost to construct our property. If we assume a leverage ratio of 4,¹² then the present value of the construction costs will be \$75 (calculated as: $(1-1/5)*\$100$). Therefore, on a 0-NPV basis we would be willing to pay \$25 (calculated as: $\$100 - \75) for the land.

Next let's look at the returns to the investment in the developable land under three different construction payment scenarios. The first scenario has only one construction payment that is made at the completion of construction; we will call this the "Annual Construction Payment" (ACP) scenario. The second scenario has four equal quarterly construction payments; we will call this the "Quarterly Construction Payment" (MCP) scenario. And the third has twelve equal monthly construction payments; we will call this the "Monthly Construction Payment" (MCP). Each scenario has the same PV[V] and PV[K] and, therefore, they all have the same land value (see Figure 1). But because they have different construction payment schedules they have different amounts of operational leverage. Please note that it is the net present value calculation that determines the price of the land and not the return calculations shown below. The return calculations below give us an alternate method for computing the correct value of the land. Unfortunately, we can only determine the proper return *after* we have computed the net present value. But the return calculations are interesting in their own right because they give us a way to quantify the amount of operational leverage in a development project.

⁹ Our building must be 100% preleased for it to share the same OCC as a stabilized project during its construction period. This is because if it were not preleased, then the development and lease-up period would be exposed to higher volatility and therefore the correct "speculative" OCC during this period would be higher than the stabilized OCC, say by 100-300 bps. The higher volatility is because the project will be exposed to changes in both the capital markets and the property markets.

¹⁰ Note that this is less than \$106.93, which is the price one would pay for a currently constructed and occupied building; this is because the development investment would not generate any income for one year until the property is completed.

¹¹ This is the PV[V] that was mentioned in Section 2.1, this is the present value of the expected asset value at completion.

¹² The leverage ratio can be observed reliably from the market place. Any good developer should be able to tell you off hand what percentage the land cost is to the total development costs. However, most developers would quote the leverage ratio as $(FV[K]+Land)/Land$. To change this value to the correct beginning LR the developer could simply subtract $(FV[K]-PV[K])/Land$ from the way they typically quote the leverage ratio, where the land value is the opportunity cost of the land as we mentioned earlier.

Figure 1

Expected Scenario

Annual Construction Payments													
Month	PV t=0	1	2	3	4	5	6	7	8	9	10	11	12
Asset Value	100.00	-	-	-	-	-	-	-	-	-	-	-	108.00
Construction Costs	(75.00)	-	-	-	-	-	-	-	-	-	-	-	(78.00)
Land/Equity	(25.00)	-	-	-	-	-	-	-	-	-	-	-	30.00
NPV	-												
Unlev Dev IRR	20.00%												
Canonical OCC	20.00%												

Quarterly Construction Payments

Month	PV t=0	1	2	3	4	5	6	7	8	9	10	11	12
Asset Value	100.00	-	-	-	-	-	-	-	-	-	-	-	108.00
Construction Costs	(75.00)	-	-	(19.21)	-	-	(19.21)	-	-	(19.21)	-	-	(19.21)
Land/Equity	(25.00)	-	-	(19.21)	-	-	(19.21)	-	-	(19.21)	-	-	88.79
NPV	-												
Unlev Dev IRR	11.56%												

Monthly Construction Payments

Month	PV t=0	1	2	3	4	5	6	7	8	9	10	11	12
Asset Value	100.00	-	-	-	-	-	-	-	-	-	-	-	108.00
Construction Costs	(75.00)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)
Land/Equity	(25.00)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	(6.38)	101.62
NPV	-												
Unlev Dev IRR	10.75%												

As we can see the ACP scenario has a 20.00% return, the QCP scenario has a 11.56% return and the MCP scenario has a 10.75% return.¹³ This would lead many to assume that the ACP scenario was the most attractive and that the other two scenarios were inferior. However, the ACP scenario has the highest return ex ante because it has the largest amount of operational leverage and is therefore the riskiest of the three scenarios. The ACP must have the highest return in order to compensate investors for the greater risk they expect ex ante. In fact, each of these scenarios is fairly priced, meaning that the investors are exactly compensated for the amount of risk they are exposing themselves to, ex ante.

To see why the ACP scenario has the highest risk we will see what happens when the terminal asset price differs from the \$108 expected value. Figure 2 shows the returns for the three scenarios under the three possible terminal values, the expected scenario, a 15% fall in expected asset prices and a 15% increase in expected asset prices.¹⁴

¹³ We will discuss what we mean by return in the following section.

¹⁴ It will be apparent later why we selected a 15% variation in asset prices over the one year period.

Figure 2

Operational Leverage

Return Summary	Downside	Expected	Upside
Underlying Property	-8.20%	8.00%	24.20%
Annual Constr Draw	-44.80%	20.00%	84.80%
Quarterly Constr Draws	-18.27%	11.56%	43.24%
Monthly Constr Draws	-16.02%	10.75%	38.94%

Deviation from E[IRR]	Downside	Expected	Upside
Underlying Property	-16.20%	0.00%	16.20%
Annual Constr Draw	-64.80%	0.00%	64.80%
Quarterly Constr Draws	-29.83%	0.00%	31.69%
Monthly Constr Draws	-26.77%	0.00%	28.18%

Figure 2 should make us feel warm and tingly inside, because the scenario that earned the highest return given the expected outcome also experiences the highest spread given movements in the underlying asset prices. Therefore, the investors are not earning the higher return for nothing; they are earning it for accepting the additional risk. This leads us back to some of the facts that we know about operational leverage, specifically, that the further out in the future the construction costs the higher the operational leverage, and hence the higher the risk (spread). It is interesting to note that the deviation in returns from the expected value is symmetrical only in the underlying property as well as the ACP scenario. This point will be explained in greater detail later.

By taking the information from the analysis above it is possible to compute two additional metrics (see Figure 3). The first is the ex ante expected risk premium, or $E[RP]$. The risk premium for an investment is simply the expected total return less the risk free rate. This metric allows us to quantify the amount of risk across the various scenarios. As shown below, by using the stabilized property as a base the amount of risk for the three scenarios can be quantified. Here we see that the ACP scenario has four times more risk than an investment in a similar stabilized property, notice that this is the same as the leverage ratio used in the example ($\$100/\25). The amount of risk in the QCP and MCP scenarios drops to 1.9 and 1.7 times, respectively.¹⁵

¹⁵ Notice that the ACP, QCP and MCP scenarios all have a leverage ratio of 4 ($\$100/\25), but only the ACP scenario has four times the risk as the stabilized property. The canonical methodology that will be explained in the next section will fill in the gaps as why this is so.

Figure 3

E[Risk Premium]	RP	Multiple
Underlying Property	4.00%	1.0
Annual Constr Draw	16.00%	4.0
Quarterly Constr Draws	7.56%	1.9
Monthly Constr Draws	6.75%	1.7

Return Range	Spread	Multiple
Underlying Property	32.40%	1.0
Annual Constr Draw	129.60%	4.0
Quarterly Constr Draws	61.52%	1.9
Monthly Constr Draws	54.95%	1.7

Another useful and equivalent method for determining the risk in a development investment is by looking at the spread in the investment returns and computing the ratio of this to the spread of the return in the underlying stabilized property. As we can see in Figure 3 the multiples computed give the same answer as those of Figure 2. However, these metrics for the quarterly and monthly scenarios are only equal to one decimal place due to their asymmetric spreads around the expected return, which is caused by the intermediate cash flows and the compounding effect of the IRR calculation.

The important point to remember is that real estate development investments are riskier than those in the stabilized assets underlying them even in the absence of lease-up risk because development investments are inherently levered (this example above employed no financial leverage). This point leads us to a discussion of the many ways to quantify the risk/return of a particular development investment and what each return means.

2.4 A Multitude of Development Return Metrics:

As seen in Section 2.3 real estate development investments have operational leverage which makes them riskier than investments in stabilized assets. However, there is some ambiguity as to how to measure development returns because there are several correct ways to measure them. Additionally, some returns may have several correct values. This is because a real estate development can often have multiple correct cash flow forecasts. For instance, a multi-phased project could be forecasted such that each phase is sold off immediately upon completion, or each phase could be leased-up to provide income until the final phase is completed and then the entire project is sold, or any combination that may be realistically projected depending on the constraints, strategy and requirements of the owner. Additionally, development projects are usually financed so we need to consider the difference between unlevered and levered return metrics. We will now examine two development returns which depend on and change with the various correct methods of forecasting cash flows.

2.41 Unlevered Development Internal Rate of Return (UDIRR),

The first measure of investment performance that we will examine is the UDIRR. This is the return that we used in our examination of operational leverage in the previous section. The UDIRR is calculated based on the projected actual cash inflows and outflows assuming no financial leverage is used, i.e. no construction loan is used so the construction costs are paid when due with equity. This methodology is straightforward, but based on one of possibly many correct cash flow scenarios. Therefore, one development investment may have several correct UDIRRs.

2.42 Levered Development Internal Rate of Return (LDIRR)

The LDIRR is similar to the UDIRR in that multiple correct values are possible, but the LDIRR differs from the UDIRR in that it adds the effect of financing. The LDIRR is a return metric for the development's total equity investment, and as such is calculated by projecting the equity cash flows.¹⁶ To project the equity cash flows for this metric the contractual yield on the debt is used. This subtlety between the contractual versus the expected yield for the debt will be discussed in more detail later in this chapter. The equity returns may be further divided depending on how the equity is structured amongst the various partners. To simplify the equity breakdown we will assume that the total equity contribution is funded by two parties, as is typical of many development investments. The two partners are a money partner (MP), such as a private equity fund, and a development partner (DP) (see appendix for definitions of terms and variables).¹⁷

$$(2) \quad LDIRR = \left[\frac{V_T - C_T}{V_0 - K_0} \right]^{(1/T)} - 1$$

2.43 Equity Partners' Return (MPIRR & DPIRR)

The total equity invested is the sum of the contributions from the Money Partner and the Development Partner.¹⁸ The Money Partner's return (MPIRR) and the Development Partner's return (DPIRR) are partitions of the LDIRR, and as such multiple correct returns are possible for these returns as well. The IRR experienced by either partner depends on the specified preferred and promoted tier structure upon which they have agreed. Typically, the MPIRR will be very close to, but less than, the LDIRR, and the DPIRR will be greater than the MPIRR and the LDIRR, ex ante. This subject is a topic of discussion in Chapters 3 & 4. As a rule, if one partner's return is

¹⁶ In the bulk of this paper the equity will be assumed to equal the purchase price of the land and any up-front fees. However, it is important to note the LDIRR depends on the actual amount of equity invested in the deal.

¹⁷ In reality, there may be any number of equity participants, as well as, several layers of debt and mezzanine financing.

¹⁸ The Development Partner's equity contribution can come by the way of cash, deferred fees, land equity or some other contribution of value to the project. The DP's contribution should be considered at its opportunity cost, or said in another way, the market value of his contribution.

greater than the LDIRR (which can be thought of as the average return earned on each and every dollar of equity) then the other partner's return will be less than the LDIRR.

2.44 Canonical Return ($E[r_c]$)

The final return metric that we will discuss provides a consistent methodology for computing expected return to the land, and as such this return can only be measured in one way. This metric is called the canonical return (Geltner, Miller). The canonical methodology is built upon the ubiquitous use of construction loans in real estate development projects. The canonical formula uses the construction loan framework to provide a stylized methodology for determining the returns on a real estate development project. This stylized methodology essentially turns every project into the ACP scenario described above in section 2.3. In short, the canonical methodology simplifies the development pro forma down to two cash flows. There is a cash outflow at time 0 which is equal to the land value plus any up-front fees of the development. And the second cash flow is the difference between the expected asset value at time T and the future value of the construction costs, or $FV[K]$.

We will now take some time to get into the details of how to calculate the canonical OCC. The present value of the expected asset value at time T and the present value of the construction costs are:¹⁹

$$(3) \quad V_0 = \frac{V_T}{(1 + E[r_V])^T}$$

$$(4) \quad K_0 = \frac{K_T}{(1 + E[r_D])^T}$$

Using equations 3 and 4 we can now formally define the canonical OCC as:

$$(5) \quad E[r_C] = \left(\frac{Land_T}{Land_0} \right)^{(1/T)} - 1 = \left[\frac{V_T - K_T}{V_0 - K_0} \right]^{(1/T)} - 1 = \left[\frac{(V_T - K_T)(1 + E[r_V])^T (1 + E[r_D])^T}{(1 + E[r_D])^T V_T - (1 + E[r_V])^T K_T} \right]^{(1/T)} - 1$$

Or equivalently, the canonical OCC may be determined using the leverage ratio (LR).

¹⁹ To understand how this works we must first introduce the correct opportunity costs of capital for the various types of cash flows, as well as the cash flows that are typically encountered on a development project. Where the OCC is defined as "the prevailing interest rates and opportunities for earning return in other forms of investments in the capital markets (e.g., stocks, bonds, money markets instruments) are a major determinant of how much investors are willing to pay for any property per dollar of its current income (Geltner, Miller)."

$$(6) \quad E[r_C] = \left[(1 + E[r_D])^T + LR \left((1 + E[r_V])^T - (1 + E[r_D])^T \right) \right]^{1/T} - 1$$

The leverage ratio version of determining the canonical OCC is an extension of the widely used weighted average cost of capital, or WACC methodology commonly seen in corporate finance texts. However, the WACC formula in equation 6 has been modified so that the result is accurate for values of T not equal to one. The WACC methodology has simply been converted from a simple to a compound return metric. However, when T equals one the leverage ratio formula converts back to the simple WACC formula of:

$$(7) \quad E[r_C] = E[r_D] + LR(E[r_V] - E[r_D])$$

Where the LR is defined as:²⁰

$$(8) \quad LR = \frac{V_0}{V_0 - K_0}$$

The canonical OCC is important because it is the expected ex ante return to the land, which underlies all development investments.²¹

Since the canonical OCC gives a unique and consistent way for determining the returns to the land investments, then the ACP, QCP and MCP scenarios from Section 2.3 have the same canonical OCC.²² Therefore, using the canonical OCC metric each project would appear to have the same amount of return, and therefore the same risk. However, this contradicts what we learned earlier, specifically that the ACP scenario had a higher return and more operational leverage (risk) than the QCP and MCP scenarios.²³ So how can it be that the canonical methodology gives the same return to each of these scenarios? The answer is that the canonical methodology assumes that the construction costs are financed until completion, and therefore includes both operational leverage and financial leverage. So the canonical form of the ACP, QCP and MCP scenarios are identical and have the same risk/return when the construction costs are financed until completion. This means that the financing adds just enough financial leverage to

²⁰ This approach gives the same answer as the risk premium multiple and return spread multiple that was seen in Section 2.3 and answers the question about why the leverage ratio formula only works for the canonical methodology and not the QCP or MCP scenarios.

²¹ Notice that the canonical return is the only return in which the NPV of the investment does not need to be determined first to calculate.

²² Since each scenario has the same PV[V] and PV[K] and the same OCC then the FV(V) and the FV(K) are all the same as well. Therefore, from either formula 5 or 6 we see that they have the same 20.00% canonical OCC.

²³ The canonical OCC will always be larger than or equal to the UDIRR ex ante. This is because the canonical OCC has implied financial leverage, and investors must be compensated for this with higher returns.

the QCP and MCP scenarios to give them the same risk as the ACP scenario which has no financial leverage.²⁴

An intuitive way to think about the canonical OCC is that it is the expected return on a development project's equity if the investor purchased the land with all equity capital for a zero NPV and used a riskless financing for all of the construction costs whose only repayment occurred at the end of the development period.

2.45 What's the difference between the Canonical OCC and the LDIRR?

Warning: The content of this Section is very technical and not necessary to understand most of the application of the remainder of the thesis. However, for those interested in learning more about "returnology," as put by my Thesis Advisor, then read on and embrace your inner real estate nerd!

So the attentive reader is now in the position to ask, "When the amount of equity actually invested equals the value of the land and up-front fees are the LDIRR and canonical OCC equal?" The answer is no, they are not, unless the contractual interest rate for the lender is equal to the risk-free rate, which almost never is the case.

To see why these returns are different and what is going on we will reexamine the QCP example used in Section 2.3. In this example we have already seen that the canonical OCC is 20.00% and is calculated as follows (see equation 5).

$$E[r_C] = \frac{100 * 1.08 - 75 * 1.04}{100 - 75} - 1 = 20.00\%$$

To determine the LDIRR for the QCP investment we must first determine the contractual interest rate on our construction loan. If we assume a 200 bps spread over the risk free rate in the construction loan, which is within the current realistic range, then the contractual interest rate (r_k) is 600 bps. We also need to determine the present value of the construction payments using the contractual interest rate, which when grown at r_k for T years gives us the terminal value of the construction loan. The PV of the construction cost using the 6% contractual interest rate as the discount rate is \$74.12.²⁵ We can now calculate the LDIRR as follows (see equation 2).

²⁴ The LR quantifies the amount of total leverage, both operational and financial, in a development investment, each of these scenarios has a leverage ratio of 4.

²⁵ Given the stylized assumptions in our example this C_0 can be calculated as $C_0 = \frac{K_0 * E[r_D]}{1 - 1/(1 + E[r_D])^{T*4}} * \frac{1 - (1/1 + r_k)^{T*4}}{r_k}$, where the rates are expressed in quarterly terms, i.e. $(1+r)^{25} - 1$.

$$LDIRR = \frac{100 * 1.08 - 74.12 * 1.06}{100 - 75} - 1 = 17.74\% \text{ }^{26}$$

OK, so now we see that the canonical OCC does not equal the LDIRR, but why? The reason is because they measure two different things. The canonical OCC is the expected return²⁷ (or average return) on the land, while the LDIRR is the most-likely return (or return of highest probability) to the equity (for a visual see graph 3.2 in the appendix).²⁸ The reason why these two metrics are different is because the contractual interest rate of the construction loan is larger than the expected return on the construction costs.²⁹

The probability of loss due to default requires the construction lender to set the contractual rate higher than his expected return. This leads to a subtle difference between the canonical OCC and the LDIRR; the canonical return assumes that it is possible for the land to receive returns below -100%.³⁰ On the other hand, in the LDIRR case the amount the equity holder can often lose is capped at 100% of the capital invested.³¹ Of course this caveat is a negotiating point between the lender and the borrower (equity investor), but throughout this analysis we will assume that the loans are non-recourse to the borrower and hence the LDIRR cannot drop below -100%. The limit on the equity investor's loss shows us why the lender requires the 200 bps spread over the risk free rate to compensate them for the potential loss due to default from the borrower. However, if the borrower had a full recourse loan and a huge balance sheet that would surely guarantee the lender in the case of default, and if the borrower would pay the lender immediately if default occurred (i.e. there would be no loss due to the postponement of

²⁶ Note that the leverage ratio methodology for computing returns does not work for determining the LDIRR. For example, the return based on the leverage ratio methodology would be $6\% + 4 * (8\% - 6\%) = 14\%$, which does not equal the LDIRR of 17.74%. The reason for this is that the denominator of the equation is the land value as determined by a zero NPV value based on the OCCs used in the canonical methodology, not the LDIRR methodology.

²⁷ Another way of defining the canonical return is that it would tend to equal the average ex post return (see Chapter 4 for definition of ex post returns) over the long run, given that investors are making rational decisions ex ante including investing based on our zero-NPV fair market land valuation that was previously-noted.

²⁸ All of the analyses in this part assume that the equity invested in the deal equals the value of the land, which is $PV[V] - PV[K]$, if this is not the case then these two metrics have less in common.

²⁹ The expected yield on the construction costs is different from the expected yield on the construction loan. This is because the construction loan has some risk, as the capital markets perceives risk, so there is risk premium (usually fairly small) in the construction loans expected return. This is because the construction loan's payoff depends, or has some correlation with the broader economy. Specifically, when the economy has a downturn there is a higher probability that the construction loan will default, and vice versa. Additionally, the contractual interest rate on the construction loan is larger than its expected return due to the probability of loss through default (See appendix for a visual explanation).

³⁰ This is formally due to the computation of the canonical OCC which does not assume the non-recourse (i.e. limited liability) use of debt for the landholder (equity investor see equation 5 or 6). However, there is some debate if the land value could ever really drop below zero. (Could a landholder ever be stopped from just walking away?)

³¹ Since the LDIRR cannot drop below -100% (due to limited liability, i.e. our assumed non-recourse construction loan) then the equity investors can be thought of as owning a put option on the development. If the development investment turns out to perform very poorly, the equity investors can simply put the development to the construction lender and forfeit their investment. Of course, this put option has a price and it is equal to the spread between the contractual interest rate and the expected return, which is less than the 200 bps in this example. The result is that the *most-likely* return ("mode" of the return distribution) to the equity investor is less than the canonical return (due to the loan contract interest rate being above the loan expected return, reflecting the cost of the put option), even while the *mean* (or "expected") equity return is higher (reflecting the value of the put option, the truncation of the lower-end of the ex post return distribution tail). In other words, the ex post distribution of the canonical return is a complete distribution, while that of the equity return is truncated at the lower end (see appendix).

payments) then the contractual rate on the construction loan would shrink to something very close to the risk free rate and the canonical return would very closely match the LDIRR. Another subtlety is that if the construction loan is priced without a risk premium then the expected return for the LDIRR should closely approximate the canonical OCC. Generally however, a spread exists in the construction loan's expected return over the risk free rate so the LDIRR will be less than the canonical OCC (see appendix graph 3.2).³²

In short the difference between the ex ante LDIRR and the canonical IRR is that the LDIRR is a most-likely return, whereas the canonical IRR is an expected return.³³ This chapter discussed five return metrics that are important to real estate development investment. The returns discussed can be separated into two categories: expected returns and most-likely returns. The expected return is "the mean of the probability distribution of the future return (Geltner, Miller)." The most-likely return is simply the return of the highest probability (the "mode" of the probability distribution). It is important to note that when a return distribution is symmetric and has one maximum then the expected return equals the most-likely return. In this particular analysis the canonical IRR is the only expected return while the UDIRR, LDIRR, MPIRR and the DPIRR are all most-likely returns and the expected values of these returns will be discussed in the next chapter, and denoted with $E[\cdot]$.

³² When the construction loan is priced in a competitive market the $E[\text{LDIRR}]$ will be close to the canonical IRR because the value of the put option is included in the expected value computation, meaning the left hand tail of the LDIRR distribution stops at -100% (see appendix). For instance, the $E[\text{LDIRR}]$ used in the example in Chapter 3 is 18.6%, which is greater than the most-likely LDIRR of 17.7%. The $E[\text{LDIRR}]$ does not exactly equal the canonical IRR for two reasons, the first is that the construction loan is probably slightly overpriced in this example ($E[r_k] = 5.2\%$ giving the lender a 120 bps risk premium ex ante which seems high), and the second reason is that the $E[\text{LDIRR}]$ will always be less than the canonical IRR when there is a positive risk premium built into the construction loan. This is because the expected return the construction lender is higher than the risk free rate. However, the equity holder is not giving up his return for nothing (in the $E[\text{LDIRR}] < \text{canonical}$), because the equity capital is in a safer position than the position in the land, because the lender is assuming some downside risk (hence the positive risk premium on the construction loan).

³³ This discussion is for ex ante returns only, because they are forecasted returns. Ex post returns have no uncertainty because the results have already occurred. See the introductions to Chapters 3 and 4 for a more thorough description of ex ante and ex post returns.

3 EX ANTE ANALYSIS OF REAL ESTATE DEVELOPMENT RETURNS

This chapter describes a methodology for computing the ex ante return distributions for the various return metrics discussed in Chapter 2. Before we begin with the analysis let's take a minute to discuss what we mean by ex ante returns. An ex ante return is the return that one *expects or anticipates*³⁴ to earn on an investment over its lifetime. Therefore, ex ante returns are always projections, and as such cannot be known for certain. This chapter describes a technique that will allow us to get a feeling for what the return distributions for our five return metrics may look like ex ante.³⁵ It is important to note that the ex ante return distributions we are creating are exact given our specific assumptions about the underlying stabilized property distribution, but we do not know if the stochastic process that underlies these distributions is the "true" process that is occurring in the real world. But, given what we know about the price movements and distribution of stabilized real estate returns our development return distribution forecast should point us in the right direction.

So why should we care about the shape of the various return's distributions? We should care because this information can help developers and investment professionals make decisions and negotiate the terms between the various classes of investors.³⁶ This analysis gives us a way to see how the future returns may behave. Decision-makers can then apply this information to their own preferences ("utility functions" as economists would call them), to assist in making valuation decisions. For many people, "seeing" the ex ante "shape" of the possible return outcomes can help them make decisions and negotiate terms of the capital structure and project finance.³⁷

Most developers and investors probably do not think about ex ante return distributions when negotiating the terms of their partnership agreement. However, they most-likely have an intuitive feel for how the different terms affect the likely payoff and change the risks of the various pieces of the deal. However, if the developer or investor was armed with a spreadsheet that could easily determine the shapes of the various subjective return distributions, as well as the various return statistics then he would be better equipped during the negotiations and

³⁴ Note that this does not mean that all ex ante returns are expected returns. The LDIRR, MPIRR and DPIRR we will calculate are most-likely returns, not expected returns. However, we will also calculate the E[LDIRR], E[MPIRR] and E[DPIRR] which are expected ex ante returns.

³⁵ The forecasted return distributions are sometimes referred to as "subjective" probability distributions (as opposed to "objective" historical frequency distributions of ex post returns). We will be making assumptions about the nature of the stochastic process governing the future realizations of real estate asset market returns. The exact assumptions will be spelled out later in this chapter.

³⁶ We use the phrase partnership terms here to generally refer to the profit split arrangement between the MP and DP. It has nothing to do with the legal structure of the investment.

³⁷ This analysis is not capable of fully determining the values (or NPVs) of the individual classes of investment within the capital structure. This is because no real market exists for the unique capital structure investment class(es) created in the typical real estate development investment capital structure. Therefore, we do not have a rigorous way to compute the NPV of a specific class because a comparable OCC cannot be observed directly (indeed, simple DCF as a methodology is not adequate to handle the truncated payoff distributions of contingent claims). However, these classes could be valued using options theory as the claims controlled by the classes are derivatives (perfectly and positively correlated) with the value of the development investment.

decision making process. This analysis is especially useful in making decisions amongst several alternatives by giving the decision maker the ability to actually see how the returns spread out.

We can now combine the theory we just learned in the previous chapter, the QCP example used in Section 2.3 and what we will call advanced sensitivity analysis to see what the distributions of our various return metrics look like given a return distribution for the underlying stabilized asset. This analysis will also provide us with additional quantitative measures, such as the expected returns for our most-likely return metrics. To complete this exercise we must first review the basics of the ex ante analysis, as well as cover the details of the advanced sensitivity analysis.

3.1 Basic Ex Ante Analysis for Real Estate Development Projects

The first step in any ex ante analysis is to create a pro forma that projects the magnitudes and timing of the various cash flows during the investment period. However, for real estate development investments it is commonplace for analysts to muddy the waters and combine the development period with the operating (stabilized) period. The result is a mixing of two very different investments into the same analysis. To avoid apples-to-oranges comparisons it is useful to separate the development investment from the subsequent investment in the stabilized asset. This does not mean that an investor cannot build *and* hold (B&H) a building for investment if that is indeed his strategy. But to determine whether the development investment is wealth maximizing it is best if the analyst assumes that the owner will build *and* sell (B&S).³⁸ However, to determine the value of the asset at completion of construction an analysis of the stabilized period is often advisable. In order to correctly value the development investment we need to determine what the project will be worth upon completion. Usually, a projected 10 year DCF on the stabilized asset is performed. Once the asset value is determined the investment is analyzed during the development period only, which essentially assumes the project will be sold at completion, or thought of another way, that the value of the project will be recognized upon completion.

Even though the development and stabilized holding periods should not be mixed for the investment decision criteria (i.e. whether or not to do the deal), it is still very interesting to look at the returns for the entire investment holding period for the equity investors. The investment holding period return for the B&H scenario is also very important for determining the proper

³⁸ In principle, the any contributor of capital can choose to cash out or continue holding at the end of the development phase, and investors can choose to invest in stabilized assets that are already built instead of buying into a development project. Hence, the development decision is separate from the stabilized phase investment decision. Fusing the two together unnecessarily obscures the decision analysis.

preferred and promoted profit split structure between the MP and the DP as some games may be played if the holding period is sufficiently different than the development period.³⁹

Additionally, we do not need to complicate the investment analysis with regard to the financial structure, if all financing is obtained at market rates. This is the case in a majority of development investments, and hence all capital providers price their capital at zero NPV returns. Then the financing decisions will not change the NPV of the development. However, if non-zero financing is used, such as subsidized debt, TIF financing, etc. then recognition of this non-zero-NPV needs to occur and the commonly used adjusted present value (APV) analysis is very helpful in this regard. Theoretically, if the project makes sense from the unlevered NPV standpoint then it is possible to structure the deal with one or several participants such that each investor earns a fair market rate of return ex ante. However, if we assume that one partner is presented with an array of fair (0-NPV) terms then financial structure can come into play, not from a NPV standpoint, but from a comparative standpoint. The advanced sensitivity analysis will help investors to decide which partnership structure fits their needs best by comparing the results from the analysis across the various alternatives.

3.2 Advanced Sensitivity Analysis

The advanced sensitivity analysis gives us a deeper and intuitive feel for the risk involved in the layers of our development investment. The advanced sensitivity analysis is similar to the popular Monte Carlo analysis that is typically used to determine the variability of investment outcome in other branches of finance. In a Monte Carlo analysis the user must specify the means, standard deviations, and correlations between all of the variables, then the sensitivity is run many times (usually over 1,000). The computer randomly chooses values for each of the variables conforming to the statistical inputs specified by the user. The result is a sample distribution of the investment returns. The sample distribution gives additional information regarding the risk characteristics of the investment as well as the variables that cause the most variation in the investment returns. The important thing to take away from the Monte Carlo analysis is that the investments sample return distribution is determined so the investor can get a deeper understanding of the risks associated with the investment. Monte Carlo works well for investments in assets with inefficient markets, such as the production of a new electrical gadget.

However, when the underlying investment is commercial real estate the Monte Carlo analysis is overkill. Much analysis and research has already been performed to determine the typical distribution of stabilized real estate returns. Since we already know the typical distribution of stabilized commercial real estate assets there is no need to perform a Monte Carlo analysis.

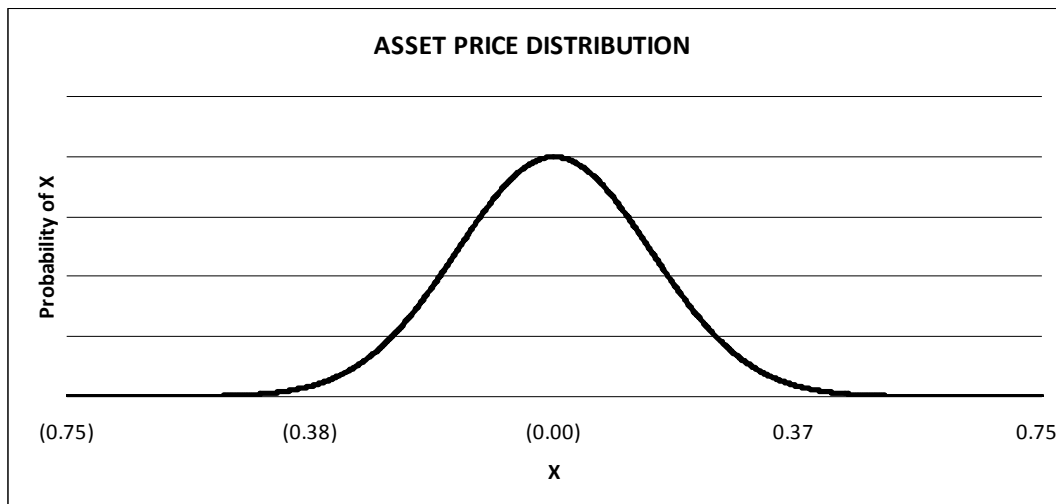
³⁹ This is the topic of Section 3.4.

Therefore, we turn to the advanced sensitivity analysis, which is easier to perform, does not require the multitude of inputs (the means, standard deviations and correlations of many variables) and is more intuitive to most end users.

In order to perform the advanced sensitivity analysis we need to understand how development returns change given changes in the underlying terminal asset value.⁴⁰ If we know that asset prices historically follow a normal distribution and have a standard deviation of around 15% per year then we are all set.⁴¹ We do not, for this analysis, need to determine what is causing the changes nor do we have to estimate statistical variables for several hard-to-measure cash flows.

To perform the advanced sensitivity analysis one simply runs the operational property-level cash flows in the pro forma through the predefined real estate distribution. This gives the effect of both changing the terminal asset value at time T for the B&S timeframe, as well as changing the stabilized cash flows and time T+10 terminal asset value in the B&H timeframe. In this example the distribution is assumed to be the normal distribution with a mean of 0% and a standard deviation of 15%/year (see Figure 4). For this analysis we do run into a problem by using the normal distribution because the normal distribution does not fit into a specified range, say -75% and 75%,⁴² therefore we make the simplifying assumption that the distribution stops at plus and minus five standard deviations from the mean.⁴³

Figure 4



⁴⁰ Note that we are not interested in what is causing the underlying asset's price movements, as this is not the focus of this research.

⁴¹ Actually what we observe is the standard deviation for indexes that track stabilized properties, such as the TBI. The standard deviation for this index over the past 23 years has been roughly 10% per annum. However, we are interested in the standard deviation of individual property returns, not a very large portfolio of properties. Therefore, 15% is a more reasonable figure.

⁴² This range encompasses five standard deviations from the mean on either side. This range encompasses roughly 99.8% of all possible returns. We must use a bounded range because the sensitivity analysis is also bounded.

⁴³ The remaining .2% is simply divided by 1999 and added to the probability of each of the 1999 trials. The result is a distribution that ends at the points -75% and 75% and is shifted vertically by .2%/1999 over the original unadjusted normal curve.

In this analysis 1999 values from this distribution are run systematically (not randomly) through the pro forma model and the results recorded. From this analysis we can then graph the distributions of the canonical OCC, UDIRR, LDIRR, MPIRR and the DPIRR for both the B&S and B&H investment holding periods to see the return distributions of these metrics.

To make this analysis more concrete we will turn to an example of how this analysis is performed. In this example we will use the same methodology and “base” numbers that were seen in the QCP scenario in Section 2.3. However, we will complicate the analysis slightly by showing how we determine the \$108 terminal asset value at the completion of the project. This will allow us to do two things. First, this shows us how to separate the development period from the stabilized period, which is imperative for an unbiased evaluation of the two distinct investments. And secondly, it will allow us to view the various returns in the B&S and B&H scenarios. The ability to view their returns in these two very different timelines will give us some insight to how the deal should be structured depending on the anticipated holding period.

Note that it is possible to graph the NPV of the development over this same distribution (see appendix). However, this does not add much to our insight. This is because the NPV of the investment is not as intuitive a measure as the return percentages when graphed. We will therefore stick to graphing the development return metrics for the remainder of this analysis.⁴⁴ Additionally, this analysis is meant as a means to compare slices of the capital structure, not the feasibility of the entire project.

3.3 Deal Structures

To give an example of how this works let’s further define the QCP scenario. We will assume that a construction loan in the amount of \$75 is used and therefore we need an additional \$25 in capital, which is exactly equal to the amount of land and up-front fees.⁴⁵ To gain a deeper feeling for this project and to gain a sense for the type of returns we are expecting for this development we observe the following:

⁴⁴ To being the analysis the project must have an expected non-zero NPV ex ante to begin with otherwise this analysis is meaningless because the investment should not be undertaken from the start and no further analysis is needed, unless the NPV can be increased.

⁴⁵ The \$75 construction loan is the loan amount excluding the interest reserve. The interest reserve is expected to be \$1.71 and will be funded by the construction lender, so the total loan amount to be repaid at completion of construction is \$76.71.

Figure 5

QCP - EX ANTE PERFORMANCE SUMMARY	
NPV Development	\$0.00
OCC - Construction (risk-free)	4.0%
OCC - Stabilized Property	8.0%
Construction Loan Rate, r_K	6.0%
Leverage Ratio	4.00
UDIRR	11.6%
LDIRR	17.7%
Canonical OCC	20.0%

Therefore, the most-likely return to the \$25 of additional capital needed is 17.7% (LDIRR). We will assume that the \$25 in additional capital is divided evenly between a MP and the DP with the following three sets of partnership terms:

Developer Side Note: Many of you in the development world are probably wondering about a few additional metrics in this development, specifically what is the return on cost and current cap rates. The unlevered return on cost for this investment is 7.6%, as defined as the first stabilized years NOI divided by the total budget exclusive of interest reserves. Current cap rates of properties currently trading in the same market are 7.0%, defined as the projected future 12 months of stabilized NOI of a property that recently sold divided by its sales price. Therefore, this development has an unlevered spread over the cap rate of 0.6%. Great, this is good . . . right? Or should the spread be 0.7% or 0.5%? Well in this case 0.6% is good; actually in this case 0.6% is exactly the correct spread we should expect. This is because we have already determined that this project has zero NPV, and hence the project is priced correctly. Had we not known the NPV of this development before computing the yield on cost, or the spread over the cap rate, would we still think it was a good project? One would have to use subjective judgment, or some rule of thumb to decide whether or not to proceed with the project, which is hardly rigorous. Also, what if the next development we want to invest in has a .6% spread, but a different amount of operational leverage or different construction duration?

The NPV methodology is so great because it allows us to use the forces of supply and demand in the markets for stabilized assets and bonds to determine the price for the land. If the land was priced any differently then trading with super-normal profits would be take place until the prices converge back to market equilibrium values.

*Mezzanine Terms*⁴⁶⁴⁷

- The MP (mezzanine lender) contributes \$12.50 and the DP contributes the remaining \$12.50 of capital.
- The MP's capital earns a preferred 16% IRR to be paid out first of operating cash flow and/or sales proceeds.
- Upon sale the balance of the MP's capital and accrued interest is paid out before the DP receives his first dollar.
- The MP receives nothing after his 16% return.
- The MP will not contribute any additional capital to fund shortfalls from operations.

Preferred Equity Terms

- The MP and the DP contribute \$12.50 of capital.
- Operational cash flows will be made first to the MP until he has received his preferred return, and then pari passu to the MP and DP in the ratio of 14.94% (calculated as 13%/87%) to the MP and the remainder to the DP.
- Upon sale the MP's capital is returned first, followed by the return of the DP's capital.
- The MP is then paid his preferred return of 12%.
- After the preferred return is paid in full the MP will receive 13% and the DP will receive 87% of the additional profits.
- The MP will not contribute any additional capital to fund shortfalls from operations.

JV Equity Terms

- The MP and the DP contribute \$12.50 of capital.
- Both Partners earn a 12% return which is paid out pari passu.
- Operating cash flows will be paid out pari passu between the MP and the DP, with any short falls being paid in pari passu as well.
- Upon sale the MP and DP's capital is also returned on a pari passu.
- After the preferred return is paid in full the MP will receive 45% of the profits and the DP will receive 55% until the MP has received an 18% IRR.
- After an 18% IRR has been reached the remaining profits will be divided 30% to the MP and 70% to the DP.

⁴⁶ See appendix for an exhibit showing the order in which the cash flows are partitioned.

⁴⁷ Right about now most folks in the real estate development and investment world are saying to themselves that these partnership structures and the amounts of capital contributed by the parties are not realistic. This example is not meant to describe an actual deal nor is it supposed to detail realistic terms. Instead, this example is meant to describe the process and application of the advanced sensitivity analysis and how the results may be interpreted. The example is admittedly different from reality, but by keeping the capital contributions fixed we are better able to see how the changes in the partnership terms change the return distributions. Additionally, the names of the scenarios may not exactly fit the deal terms or capital structure, but the terms are close enough to make the names relevant. The goal of this analysis is to compare how the returns behave under different partnership terms. And by holding the amount of capital invested under each scenario constant we are better able to observe the effects of the terms, rather than muddy those changes with different amounts of capital.

We are now ready to review our findings and to see how the different partnership terms affect the return distribution to our two partners.

3.4 Examining the Results

The advanced sensitivity analysis has given us the data we need to examine the return distributions for the UDIRR, canonical IRR, LDIRR, MPIRR and the DPIRR. Additionally, we will double our analysis by examining the distributions for both the B&S (buy and sell) and B&H (buy and hold) investment periods.⁴⁸

Figure 6

EX ANTE SUMMARY	MEZZANINE	PREFERRED EQUITY	JV EQUITY
LDIRR - Pro Forma	17.7%	17.7%	17.7%
MPIRR - Pro Forma	16.0%	16.7%	17.1%
DPIRR - Pro Forma	19.4%	18.7%	18.3%
LDIRR - Average	18.6%	18.6%	18.6%
MPIRR - Average	5.2%	8.0%	8.1%
DPIRR - Average	31.9%	29.2%	29.1%
Construction Loan - Contractual	6.0%	6.0%	6.0%
Construction Loan - Average	5.2%	5.2%	5.2%

By reviewing the numbers in Figure 6 as well as the graphs in appendix (graphs 3.1-3.10)⁴⁹ we can draw the following conclusions about the various partnership terms and their effect on the expected returns, average returns and the shape of the return distributions.

For instance, suppose we are a developer who is negotiating terms with a potential MP. After several sessions of negotiating the MP has given us the option of choosing between the Preferred Equity and the JV Equity terms. Let's say we believe that the two scenarios are fairly priced, such that no one deal is superior to the other on a risk/return basis. So the only thing we need to decide is how much downside protection we need to feel comfortable and how much upside potential do we require. After taking a few minutes to complete the analysis we view the figures in the appendix (graph 3.10) to see what the subjective return distributions look like for the DP and our MP for both the B&S and B&H investment horizons. For the B&S investment

⁴⁸ The three partnership structures have fairly large preferred returns and are admittedly much better suited for short term projects, such as the development period only, rather than longer term holding periods. But it is still interesting to see how the partners' return distributions change given the investment time period.

⁴⁹ A tip for reading the return distribution graphs in appendix graphs 3.1-3.10: The probability of the returns, the vertical axis, is not important as this is simply a function of the number of trials used in the sensitivity analysis, this is because we are dealing with a continuous function, and therefore the probability is only meaningful over a range, not an individual point. What is important is the shape of the distribution, as well as, the values assigned to the vertical bars that give the probability that an event will occur, such as losing 100% of the invested capital, or the return of all of the invested capital plus accrued interest (such as the MP graph in the Mezzanine scenario, or the graph of the construction loans return).

horizon, the MP has a 3.5% chance of losing all of his money given either set of terms. However, there is a significantly higher chance of him losing some money, or not receiving his preferred return, under the JV terms than under the Preferred Equity terms. Additionally, we can see that the MP has a much larger upside under the JV terms. For us, the DP, we see that the JV terms give us significantly more downside protection as the MP shares equally in our losses. However, we can also see that we are giving up some upside potential to receive this protection.

The results are the same for the B&H investment horizon for the DP, except the left tail is much lower and longer. However, we find something very interesting for the MP in the B&H horizon. It appears that the Preferred Equity scenario dominates the JV Equity scenario, meaning that the Preferred Equity scenario always has a lower chance of loss or a higher chance of gain. So it appears that the MP did not do his homework when he decided to give us the choice for the partnership terms, or the MP controls the sales date and he knows he will sell early, so that the distribution looks more like the B&S distribution than the B&H.

Ultimately, the decision over which terms to choose is a subjective choice by the developer, as usual. However, this tool does give the developer more information so that he can make a more informed decision.

3.41 Downside Protection & Upside Potential:

The three scenarios show structures that have different levels of downside protection and upside potential. The Mezzanine scenario has quite a bit of downside protection with only a 3.5% chance of losing 100% of the invested capital and an 87.8% chance of receiving their full 16% contractual return. However, the Mezzanine scenario has no upside, meaning that even when the deal does extremely well the MP will still only earn their 16% return.

The JV Equity scenario is in stark contrast to the Mezzanine scenario in that it provides no downside protection to the MP, but the MP shares greatly in the upside potential. We can see that in this case the MP and DP are acting as partners, that is, their returns are much more similar than in either of the two cases. In this case they have identical returns for LDIRR returns less than or equal to the preferred return, and their return distributions are similar for returns greater than the preferred return with the only caveat being that the DP earns more than the MP.⁵⁰

⁵⁰ The DP typically earns a large promote because the MP wants to incentivize him to make the MP as much money as possible. Therefore, the MP is willing to give up some of the upside to align the interests of the DP with their own. Additionally, let's say that the DP brings into the partnership a parcel of land that he has created value on through either earning entitlements or through the some other use of his expertise. The MP may prefer for the DP to not realize all of this profit up-front as either as profit from the transfer of land to the partnership, or additional land equity contribution or as an upfront fee. Instead, the MP may want to have the value created by the DP during the predevelopment stage to be realized upon sale as a promoted interest. This can help further align the interests of the MP and DP.

The Preferred Equity scenario is a mix of the Mezzanine and the JV Equity scenario in that the MP has some downside protection, but also shares in the upside.

3.42 Risk and Return:

As we can see from Figure 6 each scenario is dividing the same amount of returns between the two partners. Therefore, any gain to one party is a loss to the other. So as we shift the risk in the LDIRR between the parties we can see how the returns to each party changes. As the partnership terms add more risk to the MP (risk increases to the MP as we move to the right in Figure 6) the larger are his pro forma and average return.⁵¹ Conversely, the more risk the MP adds the lower the risk for the DP and therefore his returns decrease from left to right.

3.43 Debt vs. Equity Characteristics:

A particular case that is interesting is the MP's terms in the Mezzanine scenario. In this case the MP has terms very similar to the construction loan. That is, the MP preferred return is much like the contractual return of the construction loan. So while the 16% return is the most-likely return to the MP this is not his expected return. For example, the construction lender's contractual return is 6%, however the average return given the probability and loss due to default is only 5.2%. This is very much like the MP in the Mezzanine scenario where his contractual return is 16%, yet his average return is also 5.2%. The average returns are similar because the MP in the Mezzanine scenario has a much larger probability of default (12.2%) as well as a much larger expected loss given default than the construction lender. The construction lender's probability of default is only 3.5% (see appendix graph 3.1).

The Preferred Equity scenario is like a mix of debt and equity. As mentioned before this scenario has downside protection, like debt, but also shares in the upside, like equity. We can see from the graph of the MP's return distribution in appendix that the return has two kinks, one at the 0% return point, and another after the MP has received his preferred return. This means that the probability of losing capital decreases sharply as compared to the DP along with the share of the upside received after his preferred return.

⁵¹ The pro forma and average returns have the same parity as the canonical IRR and the LDIRR, that is the pro forma return is the most-likely return (i.e. the return with the highest probability of occurring), while the average return is much like the canonical IRR (i.e. the expected return, which is the same thing as average return). When we use the contractual returns in the pro forma (such as the construction loans contractual return) instead of the expected return we end up calculating pro forma, or most-likely, returns, such as the LDIRR, MPIRR and DPIRR instead of expected/average returns, such as the canonical IRR, E[LDIRR], E[MPIRR] and the E[DPIRR]. See Section 2.4 for a more formal discussion of the difference between the LDIRR and the canonical IRR.

3.44 Inverse Relationship between the MP and the DP:

The conclusions drawn above were mostly from the viewpoint of the MP. When the view is switched to the DP position the statements above become reversed. Meaning that any upside potential gained by the MP is lost by the DP, and any downside protection gained by the MP is lost by the DP. As we mentioned the MP has only a 3.5% chance of losing all of their capital in the Mezzanine scenario, while the DP has a 17.9% chance of losing all of his money, therefore the DP is providing the downside protection to the MP in this case.

3.45 Build & Sell vs. Build & Hold:

The return distributions are examined from a B&S and a B&H investment timeframe and shown in the appendix. As we can see the shape of the distributions changes greatly between the two timeframes. What is interesting to note is that probability of loss is reduced due to the longer timeframe, but also to probability of hitting a home run is also diminished due to the compounding nature of the returns. The shape of the return distributions for the B&H timeframe has some similarities with that of the B&S timeframe. In particular, the areas of greatest probability in the B&H timeframe look very similar to the B&S timeframe with the only caveat that the left tail is much lower and longer, which means that this area has a lower probability of occurrence in the B&H timeframe. It is also important to note that the B&H scenario has lower expected and average returns to the investors as we are mixing the one year high risk development period with the ten year low risk stabilized period.

It is important to note that this analysis does not yield a single metric that may be used to judge which partnership term sheet is better.⁵² Instead, this analysis is able to give a few numerical clues as well as the visual return distribution to give an intuitive and comparative feel for the risks involved in the underlying investment.

⁵² Several metrics exist for this purpose. Specifically the Sharpe ratio, however this ratio may not give correct results when the return distributions have different shapes. Option theory based models would be required to give a complete integration of ex ante return and risk to arrive at an economically rigorous valuation.

4 EX POST ANALYSIS OF REAL ESTATE DEVELOPMENT RETURNS

We will now switch the focus of our attention from the ex ante analysis in which we were interested in forecasting subjective distributions for our various returns to an analysis of ex post returns. In particular we will examine how to create ex post development return indexes from a stabilized property index, as well as the uses for such indexes. But before we begin this discussion we will first define what we mean by ex post returns. Ex post returns are an after-the-fact measure of how an investment actually performed. To put it another way, we are switching from the total range of what might happen in the future, to an analysis of the one thing that actually did happen in the past. In this study we are focusing on the completed or round-trip project IRR. Therefore, one can only calculate this type of ex post return when the investment is wrapped-up, because then and only then will all of the project's cash flows be known with certainty.⁵³

It is again time to ask "Why do we care about all of this?" We should care because the methodology used for computing the ex post returns and the indexes that are the byproduct lend themselves to some rather interesting uses. For example, the ex post development return indexes can be used to benchmark past investments to evaluate performance.⁵⁴ This is useful because there is currently no index that tracks development returns.⁵⁵ Also, benchmarking an investment may help in diagnosing why a certain investment performed the way it did. This allows an investment manager to learn from his past experience and to improve his subsequent investments. Additionally, it could provide a way to calculate bonuses or other incentives for investment managers or developers who are actively placing money under their discretion. Also, note that the development return indexes could be coupled with derivative contracts, like those currently trading for stabilized assets, to create a market for real estate development derivatives. Conversely, the current derivatives traded on stabilized return indexes could be combined with Treasury bonds to create development returns synthetically using a similar methodology that is used to compute the development return indexes. Finally, the development return indexes may simply be published each quarter to provide more information to the real estate market.

⁵³ To be more exact we should have said "only one cash-flow result is possible." However, if the cash flows change signs from positive to negative more than once then the IRR may have more than one value. However, it is usually fairly obvious that only one of the multiple returns makes any sense. However this is a technically not directly related to this topic and one of the beauties of the canonical methodology in that only two cash flows occur and therefore a unique IRR exists.

⁵⁴ A quick clarification of language: Ex ante returns cannot be used for benchmarking because they are forward-looking, while benchmarks, by definition are ex post, or backward-looking. Additionally, ex ante returns will always be positive whereas ex post spreads can be positive, negative or zero (Fisher, Geltner).

⁵⁵ NCREIF is poised to deliver its NFI closed end opportunity fund index that would be the closest match to our development indexes in 2009. However, the opportunity fund does not track development projects exclusively, and the amount of leverage and the development horizons are not all equivalent. However, the NFI will track actual projects instead of being a stylized development index, such as ours.

In our ex post analysis we will create eighteen different real estate development indexes.⁵⁶ With these indexes in hand we will be able to perform additional analysis that can be used to benchmark returns for the equity investors in real estate development projects, as well as benchmark returns for the land component. Specifically, we are creating indexes that track the ex post LDIRR and canonical returns. It is important to note that the indexes created in this analysis are 100% customizable to track the returns of a specific project or given specific partnership terms amongst the various equity investors.⁵⁷ Actually, the customizing of the index is essential, as we would expect to lose quite a bit of reliability of the benchmark if the index is not tailor made to fit the actual investment as closely as possible.

We will now turn to an overview of the real estate development return indexes created for this analysis.

4.1 Development Return Indexes

In this analysis we will create two types of real estate development indexes. The first will track the ex post canonical IRR and the second will track the LDIRR. We will create nine indexes under each type of index so we can track how the development horizon and leverage ratio influence ex post returns. The development indexes will be created for one, two and three year development horizons, and for leverage ratios equal to 2.50, 3.33 and 5.00.⁵⁸ In practice, only one user-customized return indexes would be needed, in fact only one data point from a return index is needed to benchmark a single project.

The first type of index will track the ex post canonical IRR. This return measures the actual return earned to the land over the given investment period. It also will be a measure of the ex post return on a synthetic development investment that we will discuss in Section 4.6.⁵⁹

The second type of index will track the ex post LDIRR. To keep this analysis consistent with the previous chapters we will assume, again, that the total equity contributed to the development is equal to the price of the land and any up-front fees. Of course, if we were benchmarking an

⁵⁶ Note that we have to create these indexes because no organization currently tracks the returns to real estate developments. This may be due to the difficulties in obtaining accurate return information from the developers or their investors. This may also be because most developers or equity partners are private companies and keep their return data as trade secret. This is unlike the market for stabilized properties that has many return indexes, such as NCREIF's NPI index and MIT's TBI index amongst others.

⁵⁷ To reiterate the analysis can be performed to accommodate any financial structure or investment scenario. In fact, the indexes created by this analysis are more useful when custom tailored to compare against an actual investment ex post.

⁵⁸ These leverage ratios correspond to loan-to-values (LTVs) of 60%, 70% and 80%, respectively.

⁵⁹ At first blush the canonical index may not look like it provides much additional value. However, the canonical indexes also provides us with a bit of a "check" on the LDIRR ex post returns (when the equity equals the cost of the land and up-front fees), in that, in principle on average LDIRR should less than, but close to the average canonical, ex post. However, this will not happen exactly because the capital structure terms and parameters have not been calibrated to provide that equality. Additionally, we have not necessarily assumed real world terms for our capital structure. But tracking the ex post canonical provides a bit of a cross-check as to how far off we might be off those considerations. Of course, even the real world won't get it right always, and the assumption of "rational expectations" doesn't tell us how long a time-frame we need for the ex post to average out to equal the ex ante.

actual development investment we would want to set the equity amount equal to the actual amount of equity invested, as well as specify the terms of the other capital contributors, such as a mezzanine lender and the construction lender. The LDIRR index is further divided to track the ex post returns to the MP and the DP given a user-specified set of profit tiers. The LDIRR, MPIRR and DPIRR index is the benchmark of interest to private equity and opportunity funds and developers who want to compare their project's actual return against a benchmark. In our analysis we will assume a somewhat simple, but hopefully realistic set of partnership terms. Of course, when benchmarking an actual project the partnership terms should be specified.

Our development return indexes are created by transforming a stabilized property index. Therefore, in order to create our development return indexes we need to first choose a stabilized return index. There are several stabilized property indexes to choose from, including NCREIF's NPI index, Moody's/REAL's Commercial Property Price Index (CPPI) and MIT/CRE's Transaction Based Index (TBI). For this analysis we will be using MIT's TBI because it is a transaction based index (hedonic methodology) and the underlying properties are institutional quality. We did not choose the NPI because this index is based on appraisals and therefore has quite a bit of lag and smoothing. We did not choose the CPPI index because it does not fit our needs as it tracks both institutional and non-institutional quality properties that are part of the RCA database, even though it is a transaction based index (repeat sales methodology). Additionally, the CPPI only has historic return from 2000 to the present. We feel the users of our indexes are more interested in the benchmarking and/or derivative opportunities of institutional quality real estate only. Therefore, the TBI is the best match (see appendix).

4.2 Transaction Based Index (TBI)

MIT/CRE's definition of the TBI is as follows:

"The MIT/CRE CREDL Initiative has developed a Transactions-Based Index (TBI) of Institutional Commercial Property Investment Performance. The purpose of this index is to measure market movements and returns on investment based on transaction prices of properties sold from the NCREIF Index database. This is a new type of index that offers advantages for some purposes over the median-price or appraisal-based indexes previously available for commercial real estate in the U.S. Median price indexes are not true price-change indexes because the properties that transact in one period are different from those that transacted in the previous period. Appraisal-based indexes are based on appraisal estimates rather than actual prices of actual transactions.

The type of transactions-based index being provided by MIT/CRE can often provide a more up-to-date or precise picture of movements in the real estate market than these other types of indexes, and is being provided for research purposes by the MIT Center for Real Estate as a service to the industry and academic research communities. However, it should be noted that transactions-based indexes are statistical products

that can contain estimation error. MIT makes no warranty or claim regarding the usefulness or implications of the index.

Using econometric techniques, the TBI estimates quarterly market price changes based on the verifiable sales prices of all and only properties sold from the NPI database each quarter. The TBI controls for differences in the properties that are sold each period, for transaction sample selection bias, and for estimation error noise. The details of the index methodology are described in Fisher, Geltner & Pollakowski. The TBI is a hedonic price index that uses the recent appraised values of the properties as a composite hedonic variable.

TBI returns are comparable to NPI equal-weighted cash-flow based returns, with appreciation including capital expenditures. All indexes are updated quarterly, with postings generally within six weeks or less of the end of the quarter. Please note that TBI returns will occasionally exhibit backward adjustments in the past historical data. These will normally be very minor, as the TBI is not a "repeat-sales" index, but a "hedonic" index based on a "representative property" that mirrors the average characteristics of the NCREIF properties."

4.3 Methodology

The methodology used for creating the two types of development return indexes are pulled from theory discussed in Chapter 2. The following assumptions are included in the canonical and LDIRR return indexes.

General Index Assumptions:

1. The land value at time 0 is equal to the present value of the forecasted expected asset value at completion less the present value of the construction costs, i.e. we are assuming a zero-NPV contribution of the land to the development at time 0.
2. The *expected* value of the completed asset at time T is equal to the current asset value, as determined by the TBI index, grown forward T years using the average annual past three year CPI growth.
3. The present value of the construction costs is simply a function of the present value of the expected terminal asset value and the user-specified leverage ratio.⁶⁰
4. The OCC for the asset is equal to the Treasury bond rate for the proper duration, one, two or three year, plus a 400 bps risk premium.⁶¹
5. The OCC for the construction costs is equal to the Treasury bond rate for the proper duration.
6. The future value of the construction costs is simply its present value grown to time T at the Treasury bond rate for the proper duration, i.e. the T year Treasury bond rate.⁶²
7. The construction costs are divided into four payments occurring at times T/4, T/2, 3T/4 and T.
8. In the LDIRR indexes it is assume that the amount of equity invested is equal to the cost of the land.
9. In the LDIRR, MPIRR and DPIRR indexes it is assumed that the construction loan is non-recourse and as such these returns cannot drop below -100%.
10. The contractual rate on the construction loan is 200 bps above the Treasury bond yield for the proper duration.

Using these assumptions to create the canonical return index is actually quite simple. We will first go through the steps of creating such indexes and then we will show an example of how one sample from the index can be calculated.

⁶⁰ $PV(K) = PV(V) * (1 - 1/LR)$

⁶¹ The 400 bps risk premium is comprised of a 300 bps risk premium for a stabilized asset plus another 100 bps for the asset being speculative. Clearly if the property to be benchmarked is not speculative the additional 100 bps would not be included. Also, the risk premiums are not stable through time; however this is a simplifying assumption of the index.

⁶² This assumption further reinforces our view that the construction costs are riskless since their repayment is “ensured” in our assumptions, that is the construction costs will be repaid with certainty. Additionally, this reinforces our view that the subjective ex ante return distributions and the ex post canonical returns can dip below -100% and that the time T land value can drop below \$0.

Canonical Index Creation Process:

1. Determine the time 0 land value; $Land_0 = PV(V) - PV(K)$.
2. Determine the future value of the construction costs; $FV(K) = PV(K) * (1+r_f)^T$.
3. Determine the time T land value; $Land_T = (V_a - FV(K)) / Land_0$.⁶³ The $FV(K)$ is determined by using the OCC for the construction costs, i.e. the risk-free rate.
4. Determine the ex post canonical IRR; $r_C = (Land_T / Land_0)^{(1/T)} - 1$

To get a feel for how this works let's turn back to our favorite example, the QCP scenario. The first step is to calculate the time 0 value of the land. The time 0 value of the land is an ex ante figure which is calculated by forecasting the expected terminal asset value and assuming a leverage ratio. The correct time 0 value of the land can never be known in advance for certain, otherwise it would be a risk-free investment and should yield the same return as a similar duration zero-coupon Treasury bond.

In this example let's assume the TBI's current value is \$106.93, and over the past three years the CPI has grown 1% per annum on average. Therefore, our *expected* terminal value at completion is \$108, remember in this example construction takes exactly one year. The one year Treasury bond yield is 4.0% and the risk premium for speculative assets like this one 4.0% for a total OCC of 8.0% for the asset. Therefore, the present value of the *expected* terminal value is \$100. With a user-specified leverage ratio of 4 the present value of construction costs is \$75 (calculated as: $\$100 * (1 - 1/4)$). Therefore, the time zero value of the land is \$25 (calculated as: $\$100 - \75).

Next we determine the *actual* value for the land at completion. This value is easy to calculate because it is simply the *actual* value of the index at time T less the future, or grown, value of the construction costs. If the terminal value of the index turns out to be only \$107.46 that is the actual growth in asset prices was only 0.5% instead of the 1.0% projected, then the ex post canonical return is:

$$r_C = (107.46 - 75 * 1.04) / 25 - 1 = 17.9\%$$

Therefore, the ex post canonical return is 2.1% lower than our ex ante canonical return of 20.0%. Notice that the sole reason this occurred was because our forecast of the terminal asset value was incorrect⁶⁴ because the terminal value of the construction was known with certainty.⁶⁵

⁶³ Where V_a is equal to the actual terminal asset value. This is simply the value of the TBI at the time of completion.

⁶⁴ Maybe our assumption that the TBI will grow with the average three years of CPI was a little too myopic, or maybe this is simply an effect of the risk inherent in real estate.

⁶⁵ This is not a bad thing. As long as our forecast was unbiased at the time it was made then the fact that it was not accurate is simply a result of the underlying asset having risk.

We will now turn to the process used for creating the LDIRR indexes, which includes the tracking of the MPIRRs and DPIRRs.

*LDIRR Index Creation Process:*⁶⁶

1. Determine the time 0 equity value (which we are assuming equals the time 0 land value); $Equity_0 = Land_0 = PV(V) - PV(K)$.
2. Determine the future value of the construction loan; $C_T = C_0 * (1+r_D)^T$.
3. Determine the time T equity value; $Equity_T = (V_a - C_T)$.
4. Determine the ex post LDIRR; $LDIRR = (Equity_T / Equity_0)^{(1/T)} - 1$

Using this methodology we can calculate the ex post LDIRR for the same example. If we assume that the contractual interest rate on the construction loan is 6.0%, i.e. the construction loan has a 200 bps risk premium over the 4.0% risk-free rate. The first step in determining the ex post LDIRR is to determine the time 0 equity value, which equals the time 0 value of the land, or \$25. The future value of the construction loan using the contractual rate of interest is \$78.56, which is also the balance of the construction loan if all of the construction interest is funded by the construction lender using an interest reserve.⁶⁷ Therefore, the ex post LDIRR for this period is:

$$LDIRR = (107.46 - 78.56) / 25 - 1 = 15.6\%$$

The ex post LDIRR is 2.1% less than the ex ante LDIRR of 17.7% as calculated in Chapter 3. In our return indexes we further divide the LDIRR to determine the MPIRR and the DPIRR over the same period and using the following partnership terms.

*Ex Post Partnership Terms:*⁶⁸

- The MP contributes 90% of the total equity and the DP contributes the remaining 10%.
- Upon sale the MP's and DP's capital will be return first, pari passu as proceeds exist.
- Next, the MP and DP will be paid an 8% IRR preferred return to be paid out pari passu.
- Followed by, the MP receiving 80% of the total profits and the DP receiving 20% of the total profits until the MP receives a 15% IRR.

⁶⁶ It is important to note that regardless of which return metric one is interested in calculating the correct land value at time 0 is always the \$25, which was calculated using the NPV methodology with an unbiased projection of the terminal asset value, a proper OCC for the asset, as well as a proper OCC for the construction costs.

⁶⁷ This is where assumption 7 comes into play from the "General Index Assumptions." One must know or assume a payment schedule in order to determine either C_0 or C_T . In this example, the $PV(K)$ is determined through the use of a leverage ratio, from here we can back out what the four equal construction costs must be which occur at times $T/4$, $T/2$, $3T/4$ and T . Once we know the dollar value of these construction outflows it is elementary to determine C_0 and C_T .

⁶⁸ These terms should look a little more realistic to real estate professionals than the terms in our three ex ante scenarios. The point here is not to show how the different terms change the subjective projected return distributions as was the case in Chapter 3, instead the point here is to determine the ex post returns earned by the MP and DP. So a more realistic set of terms was appropriate.

- Finally, if proceeds exist, the MP will receive 65% of the remaining profits and the DP receives the remaining 35%.

4.4 Results

We will now take a look at the results of our analysis. It is important to note that these return indexes are computed for our generic or stylized developments, so details from this analysis should not be used for comparison against a specific investment. However, these stylized indexes do provide a wealth of information about how development returns have, or should have, behaved,⁶⁹ which may provide some insight about how future returns will unfold. We will take a look at the results for both the canonical return indexes as well as the LDIRR indexes.

Interesting Findings: Canonical Return Indexes

There are several interesting conclusions that we can draw from our analysis of the ex post canonical returns. The appendix shows the graphs for the nine canonical ex post indexes, as well as the ex ante canonical returns (graphs 4.3-4.4). One of the salient features of these indexes is that the shorter the development period the higher the ex ante canonical return *and* the greater the return volatility ex post. The research is telling us that shorter development projects typically have more risk than longer development projects.⁷⁰

Another interesting result of the analysis is that the ex ante returns are much more stable across time. However, this makes sense because ex post returns include the random component of realized risk. The ex ante returns are fairly stable because they only depend on underlying expected returns and a leverage ratio, which usually do not change much over time. In general we would expect the average ex post return to be near the average of the corresponding average going-in returns over the long run. That is, across the entire cycle, the ex post returns should cycle around the ex ante returns. This is clearly the result as we can see in the appendix, which graphs the difference between the ex ante and ex post canonical returns. To double check our figures we computed the average ex ante and ex post returns over the 22 year period and

⁶⁹ Since the development return indexes are created, that is inferred using “fancy” mathematical models and not observed empirically, our results can only be thought of as normative results.

⁷⁰ We should be very happy that the more volatile investment ex post also requires a higher going-in (ex ante) return. Our calculations and methodology are therefore consistent with the logic that higher risk investments should yield higher returns, both ex ante and on average ex post. But why is this happening? One theory for why this is happening as explained by David Geltner is that in a random walk mean return magnitudes are direct linear functions of the period interval, and periodic volatility is a linear function of the square root of the period interval. Basically, he is saying that returns increase linearly, while the volatility of returns decreases over time, when measured on a per annum basis. Therefore, the longer the development return the lower the volatility, but also the lower the return because the IRR is a compounded return and the return moves linearly, not exponentially. This point can be illustrated well by example. With a random walk suppose a one year return volatility (standard deviation) of 10%, then the one year variance is .01% (calculated as: $.1^2$), then the two year variance is .02% (calculated as: $.01\% * 2$), so the two year volatility is $\sqrt{.02\%} = 14.14\%$, but the two year IRR is measured per annum, so the volatility of the two year IRR is 6.8% (calculated as: $(1 + 14.14\%)^{1/2} - 1$). Thus, underlying series with 10% per annum volatility has 6.8% volatility in the two year IRR. The result is similar for longer durations as well.

saw that the difference in these two metrics falls within a fairly tight band. This is a good check to make sure that the theory is holding up in reality and that our figures make sense.

We can also see that the higher the leverage ratio the higher the volatility in returns. This is also another intuitive point and meshes with the theory we presented in Chapter 2. We will now move on to discuss the interesting findings in the LDIRR indexes.

Interesting Findings: LDIRR, MPIRR & DPIRR Return Indexes

Now we will look at how the returns to the various equity partners may have performed historically (see appendix).⁷¹ Based on the partnership terms that we specified we can see that given good outcomes, meaning that the actual terminal value was greater than the expected terminal value, and hence the LDIRR is high, the development partner's return far exceeds the return to the money partner. This is a byproduct of the incentive structure set up in the partnership terms. That is, when the development performs well the development partner receives a greater than proportional share of the profits, or a promoted interest. However, the terms of this investment are structure so that when the property performs poorly (the LDIRR is less than or equal to the preferred return) then the money partner and the development partner have the same return (this is similar to the JV Equity scenario described in Chapter 3).

Additionally, we can see that there are not many instances where the equity partners decided to exercise their put options and walk away from the deal forfeiting 100% of their equity investments. This event does happen in a few cases, for example a three year development project with a leverage ratio of five that started development in the fourth quarter of 1989, amongst a few others. Surprisingly, even though the one year development investments have the highest volatility in the canonical indexes only the two and three year development indexes report any instances of the equity partner's exercising their put options to the construction lender.⁷² Unfortunately, there is not enough data on hand to determine how the current real estate downturn is affecting the returns on equity development investments.

We will now turn to see how these indexes can be used to effectively benchmark development investment returns.

⁷¹ Again, these returns are based on the stylized assumptions for our model as these indexes.

⁷² This is because the largest one year loss in the TBI is only 11.30% which is significantly less than the 20% equity implied by a leverage ratio of 5. The two and three year development horizon investments experienced a loss of 100% of the equity value in periods of multiple years of deterioration of real estate values.

4.5 Benchmarking

Again it is important to point out that the ex ante spreads described in Chapter 3 are “forward-looking, normative expectations. Benchmarks are backward-looking, empirical indicators of historic performance results within a peer universe. The purpose of benchmarking is generally to assist with the evaluation of the performance of investment agents and the diagnosis of the performance of investment assets or portfolios (Fisher, Geltner).”

For opportunity funds, private equity funds and developers the index that matters most for benchmarking is the LDIRR index, more specifically the MPIRR and DPIRR components of this index. This is because the LDIRR index tracks what the returns should have been for the equity given the assumptions and restrictions of our model.

A good index for benchmarking will be style-pure and match the underlying investment as closely as possible in terms of location, property type, and quality (i.e. institutional or non-institutional). The “style” in style-purity refers to matching the specific type of investment being benchmarked with the assets tracked by the index. For instance, core stabilized apartment investments in the southeast are one type of style and value-add office in the northwest is a different style. “Style-purity is important for indexes to be useful as benchmarks, because it is not appropriate to compare the performance of one style of investment against that of another style for purposes of evaluating a manager who is specialized in (and hired for the purpose of) investing in one particular style (Fisher, Geltner).”⁷³

We now know enough about benchmarking to ask ourselves “are our ex post indexes good for benchmarking?” The answer is “yes . . . but.” Yes, the indexes provide a good indication for what the returns should have been had investors acted according to the assumptions used in construction our indexes, but the indexes could be improved upon. For instance, the indexes would be improved if we were better able to match the location of the target development, say the southeast, northwest or even by MSA, and if we were able to match the product type of the development. So if we had a development project that we wanted to benchmark in Gainesville, Florida it would be better to use the TBI index for stabilized apartment buildings in the southeast as the base for our development index. However, while the TBI does segment by property type it does not segment by location. So the best we could do in this instance is use the TBI apartment index as our base. Another important aspect of style-purity is the importance of

⁷³ Additionally, it is important to choose the correct type of return to benchmark. In all of our previous analysis we used dollar-weighted rates of return over time-weighted rates of return. Dollar-weighted rates of return are also appropriate for benchmarking development investment returns as well. We choose dollar-weighted rates or return (IRR) over time-weighted rates or return for two reasons, First, “most development projects are not regularly appraised and marked-to-market during the construction phase of the project . . . [Second] Development projects often require, and give, greater discretion over capital flow timing to the project manager than is typically the case for core property investments.” “These features make real estate development projects more comparable to such private investment asset classes as venture capital, for which IRR-based benchmarking is the standard procedure (Fisher, Geltner).”

separating the development period returns from the stabilized returns. If one intended on holding the development property for several years after the construction and lease-up period he should benchmark the two investments separately.

The next section will show us how to create synthetic real estate development returns using a portfolio of stabilized property derivatives, risk-free bonds and put options.⁷⁴

4.6 Creating Synthetic Development Returns

All of the theory we have learned up until this point will help us understand how we can use risk-free bonds and forward contracts traded on a stabilized property index to create a synthetic investment in real estate development.⁷⁵ For the purpose of illustration, let's suppose that we own a private equity fund and we recently decided to use forward contracts traded on NCREIF's price appreciation index and U.S. Treasury bonds to create synthetic development returns. How would we accomplish this feat?

*Strategy:*⁷⁶

- 1) Long a forward contract to purchase the value of the index T years in the future for a price (F_T) equal to $F_T = E[\text{Index}_T] * [(1+r_f)/(1+r_f+RP)]^T$, where T is the amount of years left on the forward contract, $E[\text{Index}_T]$ is the expected value of the index at time T, r_f is the risk-free rate, RP is the risk premium for stabilized properties.
- 2) Choose a leverage ratio (LR), based on the strategy of the fund.
- 3) Long zero-coupon Treasury bonds (B_0) in an amount equal to $B_0 = E(\text{Index}_T) / (LR * (1+r_f+RP)^T)$.⁷⁷

To see how this works let's borrow some numbers from our now infamous QCP example. If we assume that the stabilized property index is currently \$106.93 and we expect that the index will have a value of \$108 in one year. Additionally, we decide that we would like to custom tailor this investment to perform like a development project with a one year horizon and a leverage ratio of 4. We also know that the risk-free rate and risk premium for stabilized assets are both currently 4% per annum. Given these facts and assumptions we determine that the forward

⁷⁴ Actually, the put options are optional (no pun intended). The use of the put option depends on whether one wants to replicate the canonical or the LDIRR returns.

⁷⁵ One could ask why not just create new derivatives on one, or many of our new real estate development indexes that we just finished discussing. The reason is that the use of the stabilized property derivatives simplifies the market and would increase trading volume for the stabilized index and not create additional unneeded indexes that all compete for the same capital. Essentially, it would be easy to create a bundled "product" that would mimic the derivatives on the development indexes, so it would not be as efficient to create the new derivative contracts as it is to simply find a new use for the existing contracts.

⁷⁶ Notice that this reinforces our analogy that real estate development investments are like levered forward commitments on a stabilized asset.

⁷⁷ This is the portfolio for one forward contract. Clearly, this portfolio could be purchased on a larger scale by purchasing N times the quantity of each piece of the portfolio.

price for delivery in one year is \$104 (calculated as: $\$108 * 1.04 / 1.08$) and that we should long \$25 worth of one year zero coupon bonds (calculated as: $\$108 / (4 * 1.08)$). If everything turns out as expected the index value in one year will be \$108 and our forward contract will produce a gain of \$4.00 (calculated as $\$108 - \104) and the risk-free bonds will be worth \$26 (calculated as: $\$25 * 1.04$) for a total return on the synthetic development investment of 20.0% (calculated as: $(\$26 + \$4) / \$25$). Therefore, the synthetic development investment yields the same ex ante return as similar development investment.

Now let's see what happens to the synthetic development's return if the actual value of the index at time T is either \$91.80 or \$124.20. When the index value at time T is \$91.80 we lose \$12.20 on the forward contract (calculated as: $\$91.80 - \104), and our bonds are worth \$26. Therefore, the total return on our synthetic development is -44.8% (calculated as: $(\$26 - \$12.20) / \$25$). If the actual index value at time T is \$124.20 then we gain \$20.20 on the forward contract (calculated as: $\$124.20 - \104) and our bonds are worth \$26. Therefore, the total return on our synthetic development is 84.8% (calculated as: $(\$26 + \$20.20) / \$25$). If these returns look familiar its because these are the same returns we calculated in Chapter 2 for our operational leverage example, specifically the ACP scenario⁷⁸ when we varied the terminal value by plus or minus 15% from its expected value (see Figure I in Chapter 2 and Figure 7 below).

Figure 7

<i>Ex Ante = Ex Post</i>		<i>Ex Ante >> Ex Post</i>		<i>Ex Ante >> Ex Post</i>	
Canonical Example		Canonical Example		Canonical Example	
V_0	106.93	V_0	106.93	V_0	106.93
$E[V_T]$	108.00	$E[V_T]$	108.00	$E[V_T]$	108.00
$rf + RP$	8.00%	$rf + RP$	8.00%	$rf + RP$	8.00%
rf	4.00%	rf	4.00%	rf	4.00%
Leverage Ratio	4.00	Leverage Ratio	4.00	Leverage Ratio	4.00
$PV(E[V_T])$	100.00	$PV(E[V_T])$	100.00	$PV(E[V_T])$	100.00
$PV[V] - PV[K]$	25.00	$PV[V] - PV[K]$	25.00	$PV[V] - PV[K]$	25.00
V_t	108.00	V_t	91.80	V_t	124.20
Ex Post $E[r_C]$	20.00%	Ex Post $E[r_C]$	-44.80%	Ex Post $E[r_C]$	84.80%
Derivative Example		Derivative Example		Derivative Example	
$Index_0$	106.93	$Index_0$	106.93	$Index_0$	106.93
$E[Index_T]$	108.00	$E[Index_T]$	108.00	$E[Index_T]$	108.00
RP	4.00%	RP	4.00%	RP	4.00%
rf	4.00%	rf	4.00%	rf	4.00%
Leverage Ratio	4.00	Leverage Ratio	4.00	Leverage Ratio	4.00
$PV(E[Index_T])$	104.00	$PV(E[Index_T])$	104.00	$PV(E[Index_T])$	104.00
Bond Investmt ₀	25.00	Bond Investmt ₀	25.00	Bond Investmt ₀	25.00
V_t	108.00	V_t	91.80	V_t	124.20
Ex Post Return	20.00%	Ex Post Return	-44.80%	Ex Post Return	84.80%

⁷⁸ Actually, this will happen to the canonical returns in the ACP, QCP and MCP scenarios, which is what the index tracks and what the synthetic development investment mirrors.

So we now know how to create synthetic development returns, but why would we invest in a synthetic development product instead of simply investing in a development project? We might choose the synthetic investments because of one or more of the following benefits:

- 1) Lower transaction costs.
- 2) Lower management fees.
- 3) No promoted interest paid to the DP.
- 4) Lower interest rate on our “synthetic construction loan,” i.e. the risk-free rate.
- 5) Increased liquidity⁷⁹ and the ability to divest early and quickly.
- 6) Earn positive alpha in the real estate derivative or bond market.
- 7) Similar to investing in a portfolio of real estate development projects, therefore reducing the unsystematic risk in the investment.
- 8) Give investors the ability to short sell real estate development exposure.

However, the synthetic development investment is not without its downsides. The following lists some of the negatives involved in the synthetic development investment:

- 1) No positive alpha from superior real estate development management.
- 2) Basis risk; that is the index may not track exactly the investment desired.
- 3) Basis risk; the index may not track the actual movements in the properties perfectly.
- 4) Currently, the real estate derivatives market is not very efficient, and as such finding a suitable counterparty may be difficult and expensive.
- 5) The index could exhibit some lag. “[T]he lag refers to a systematic tendency of the index to lag behind the actual property market prices, to only reflect the true current return in any given period (Geltner, Fisher).” However, if the derivative markets are efficient then this lag should be correctly priced.

It is interesting to note that the ex post canonical returns calculated earlier in this chapter are the actual ex post returns that would have been experienced under our synthetic development investment. Therefore, the synthetic development investment gives one the ability to experience the same return that was earned on the land in a development project.

Note that we could make the synthetic development investment track the LDIRR return instead of the canonical return by adding a put option to the portfolio. The put option would have a strike price equal to the forward price less the future value of the bond investment. This would

⁷⁹ The Treasury bond market is one of the most liquid markets in the world, however the market in which the forward contract would be purchased is currently illiquid, least compared to the real estate property market. However, when the real estate derivatives market picks up the liquidity of that market will also increase.

limit the total loss to the investor to 100% of his equity, just like with the LDIRR return with a non-recourse construction loan. If the markets are in equilibrium then one would expect the price of the put to equate to the spread in a construction loan on a development that has similar characteristics as our synthetic development (such as development horizon and leverage ratio).

5 CONCLUSION

Throughout this paper we discussed the various types of real estate development returns. We defined these return metrics and shown how they should be used both ex ante and ex post. Hopefully you have gotten a feel for the applications and limitations⁸⁰ of these returns, and you have become expert at reading footnotes along the way.⁸¹

Chapter 2 described the characteristics of real estate developments and how these characteristics affect their returns. We also covered the five different types of real estate returns and their uses, including the UDIRR, LDIRR, MPIRR, DPIRR and the canonical OCC (see the appendix for a summary of these returns). These returns provided the foundation for the ex ante and ex post analyses which followed.

Chapter 3 defined ex ante returns and introduced the advanced sensitivity analysis. The advanced sensitivity analysis was performed by running a user-specified stabilized property distribution through our development pro forma. This analysis is a useful tool for determining the shape of the ex ante subjective return distributions for our five development return metrics. This analysis focused on the MPIRR and DPIRR because the outcomes of this analysis are especially relevant for helping decision-makers choose and negotiate partnership terms. We then walked through an example showing how the various terms for our three different “partnerships” affected the two partners’ ex ante subjective return distributions. In particular we saw how this analysis, when combined with artful negotiations, can help limit an investor’s downside or provide upside potential to his investment.

Chapter 4 switched our attention to ex post returns. In this chapter we created return indexes by transforming the TBI, a stabilized property index, into two types of development return indexes. These indexes tracked the ex post canonical and LDIRR returns. The canonical index measures the return to the land and to synthetic development investments; while the LDIRR index tracks the returns to the equity (the LDIRR may be partitioned to track the returns for each equity provider). These indexes allow for the benchmarking of completed development projects, as well as providing a foundation upon which to create synthetic development investments. From our analysis of the historic canonical and LDIRR returns we found that shorter-duration real estate development investments typically have more volatility than longer development investments. We also found that projects with a higher leverage ratio have more volatility, all else equal.

⁸⁰ The biggest limitation on the use of real estate development returns is that a return alone is not sufficient as an investment decision criterion. We have already seen that the NPV rule is the proper way to choose an investment.

⁸¹ What did you expect? I couldn’t help myself.

Additionally, this paper introduced a new and innovative route for investors to gain real estate development exposure through the use of real estate derivatives. Particularly, funds could be created to synthetically invest in development. With these funds it would be possible for portfolio managers to quickly react to news in the real estate market and increase or decrease development exposure. It would also allow the fund managers to customize and change the leverage ratio and the development horizon of the fund almost instantaneously. This strategy would allow the fund to provide its investors with returns that more closely match the underlying real estate development investment because the management fees, transaction costs and the implied financing is obtained at a lower rate (the risk-free rate).

Another innovative use for the LDIRR index is that it could be incorporated into the partnership terms to set the profit hurdles between the DP and the MP. For instance, the partnership terms could be set such that the DP only receives his promoted interest if the project beats its development return benchmark. This would imply that only developers who create positive alpha receive additional profits.

In summary, the analyses described in this paper have hopefully brought additional insight and clarity into the world of real estate development returns. This paper has shown ways to help investors make better decisions, as well as judge the performance of their past decisions. Finally, an investment product has been described that has the potential to change the way investors gain exposure to real estate development returns.

APPENDIX

CHAPTER 2

2.1 - Variable Symbols and Definitions

$E[r_V]$: The expected OCC for a core stabilized asset. This rate is usually between 200 to 400 bps over the risk free rate.

$E[r_S]$: The expected OCC for a speculative asset. This rate is usually between 100 to 300 bps over the $E[r_V]$. A speculative asset is one that is not fully leased-up or stabilized, and hence still retains its lease-up or market risk.

$E[r_D]$: The expected OCC of construction cost (which is not the same as the expected return on the construction loan). This rate is closely approximated by the risk free rate of a similar duration.⁸²

$E[r_C]$: The canonical OCC for the development.

r_K : The contractual yield on the construction loan.

V_0 : The time 0 present value (PV) of the expected stabilized asset at time T.

V_T : The expected stabilized asset value at time T.

K_0 : The PV of the construction costs at time 0.

K_T : the FV of the construction costs at time T.

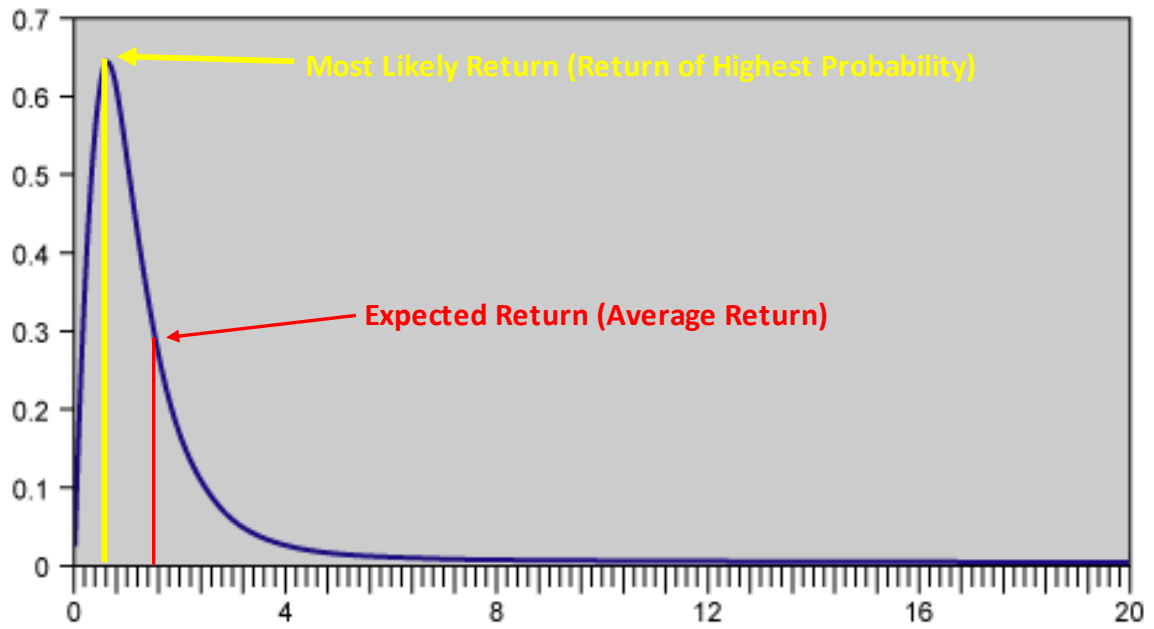
C_0 : The value of the construction loan at time 0.

C_T : The value of the construction loan at time T.

Where time 0 is the time when the land is purchased and time T is upon completion of construction and lease-up.

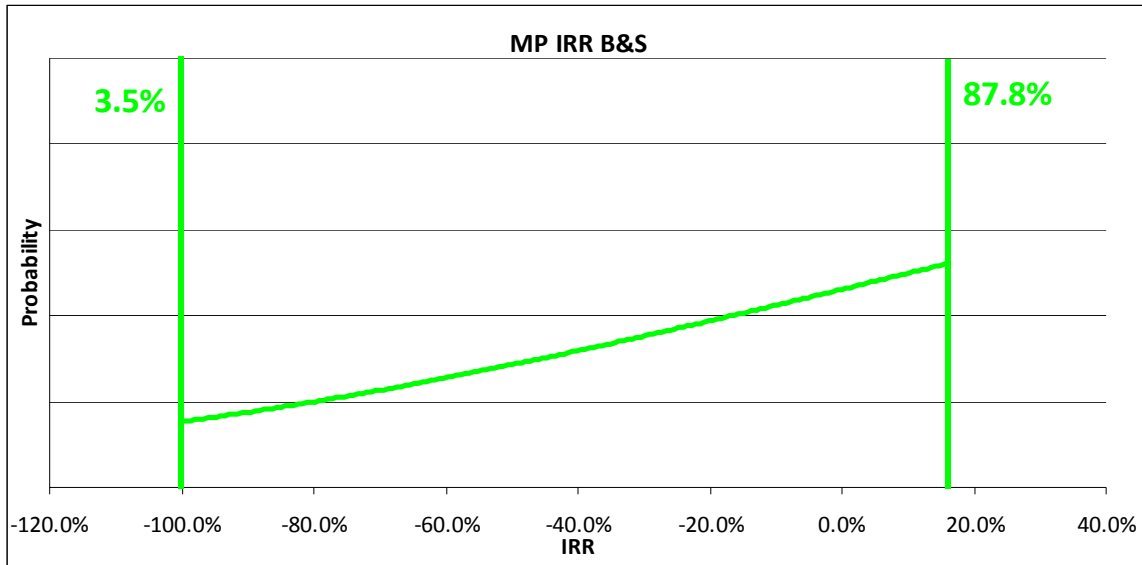
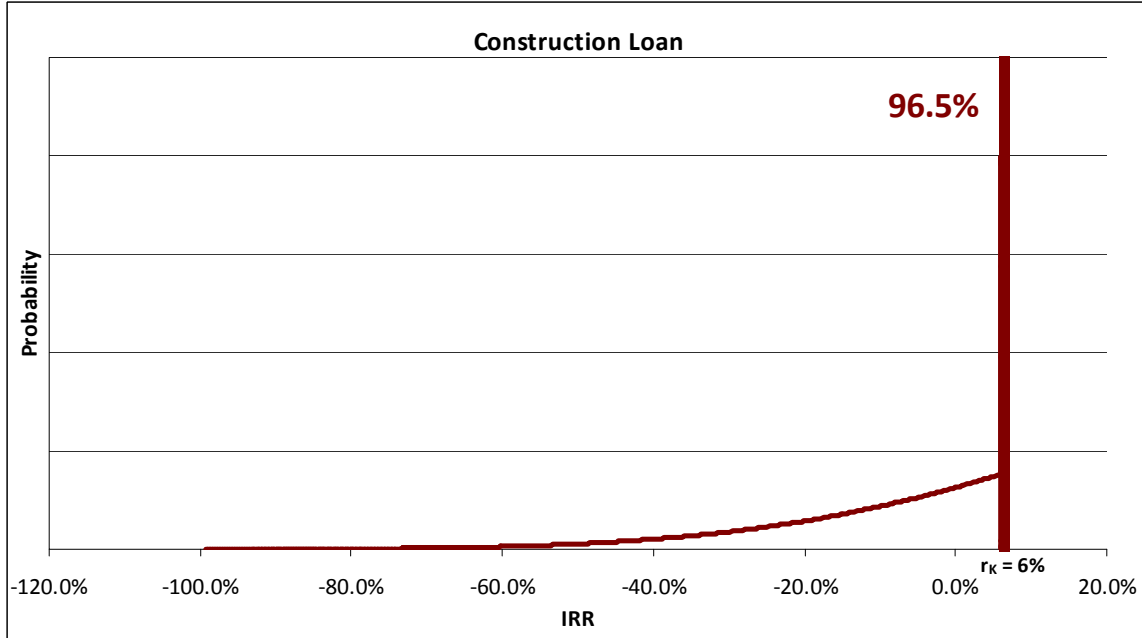
⁸² This may seem strange at first, that a cash flow that is viewed as very risky by some has what is essentially the lowest discount rate possible. But there are several reasons why this is so. The first is that by using the risk free rate we are making the present value of the construction costs as large as possible, and hence giving them much respect. Secondly, the construction costs will vary from their original estimate (or perhaps the value agreed upon in the gross maximum price (GMP) contract) due to architectural or engineering errors or miscalculations. The increase in construction costs for these reasons have very little risk, as calculated from how the capital markets view risk (Geltner, Miller).

2.2 - Expected Return vs. Most-likely Return for a Asymmetric Return Distribution

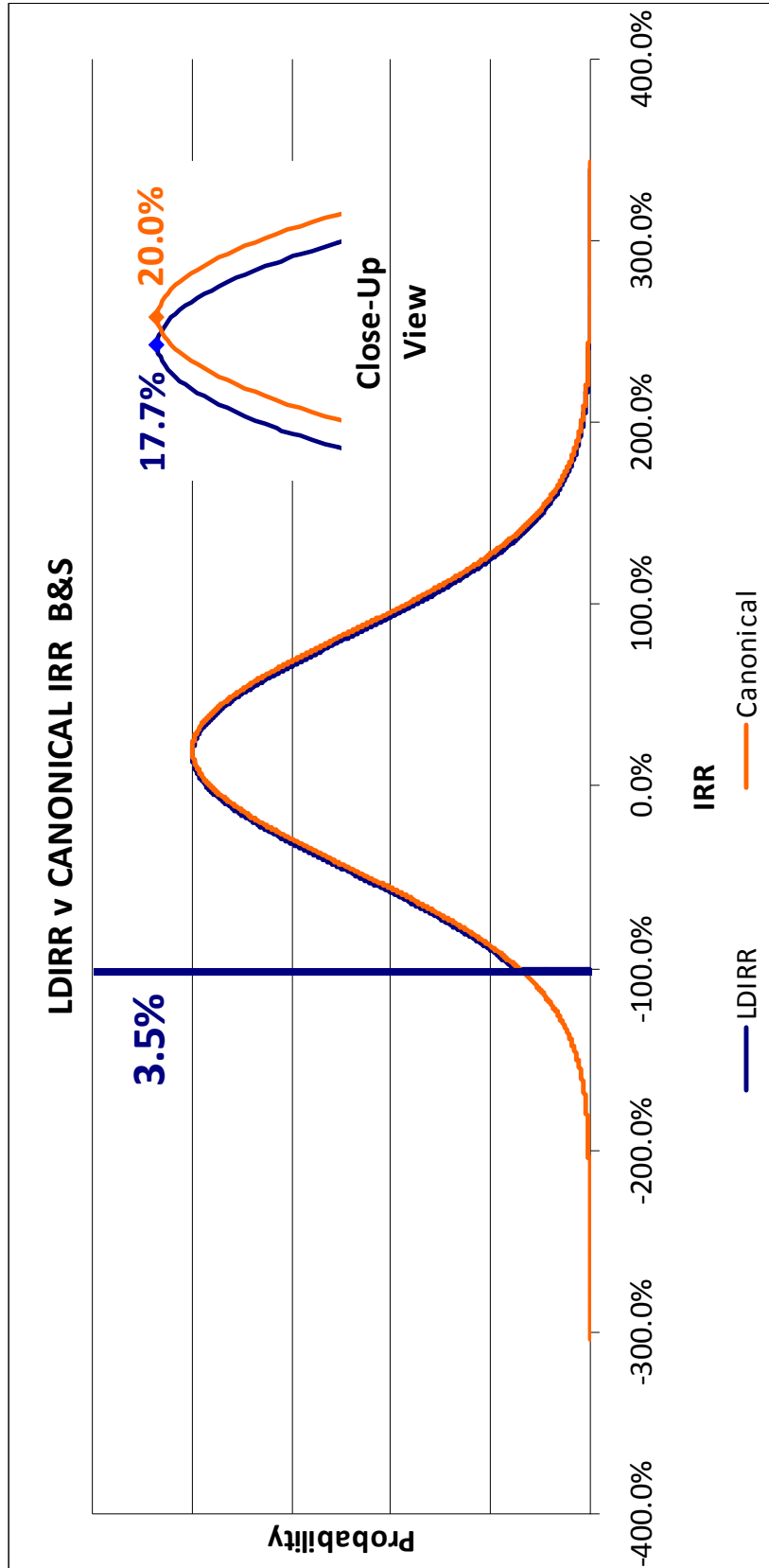


CHAPTER 3

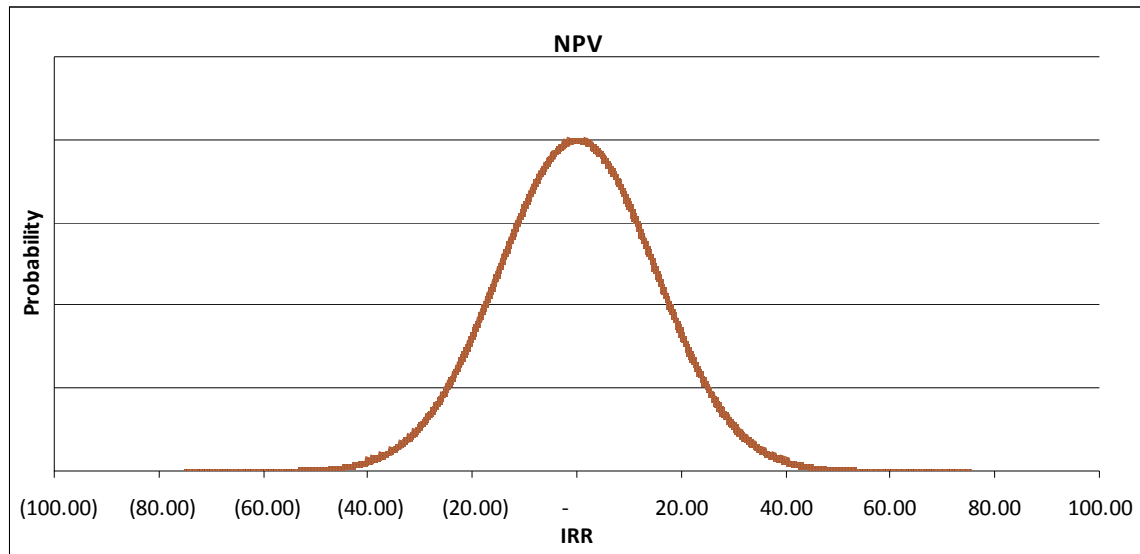
3.1 - Construction Loan and Mezzanine Loan Return Distributions



3.2 - Canonical vs. Levered Development Return



3.3 - Net Present Value Ex Ante Distribution



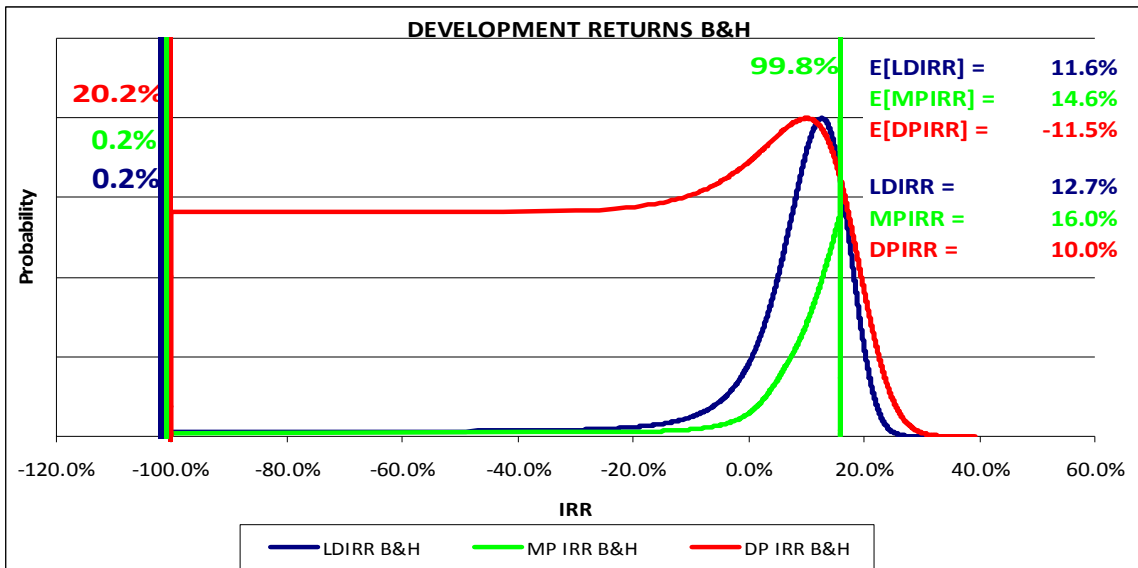
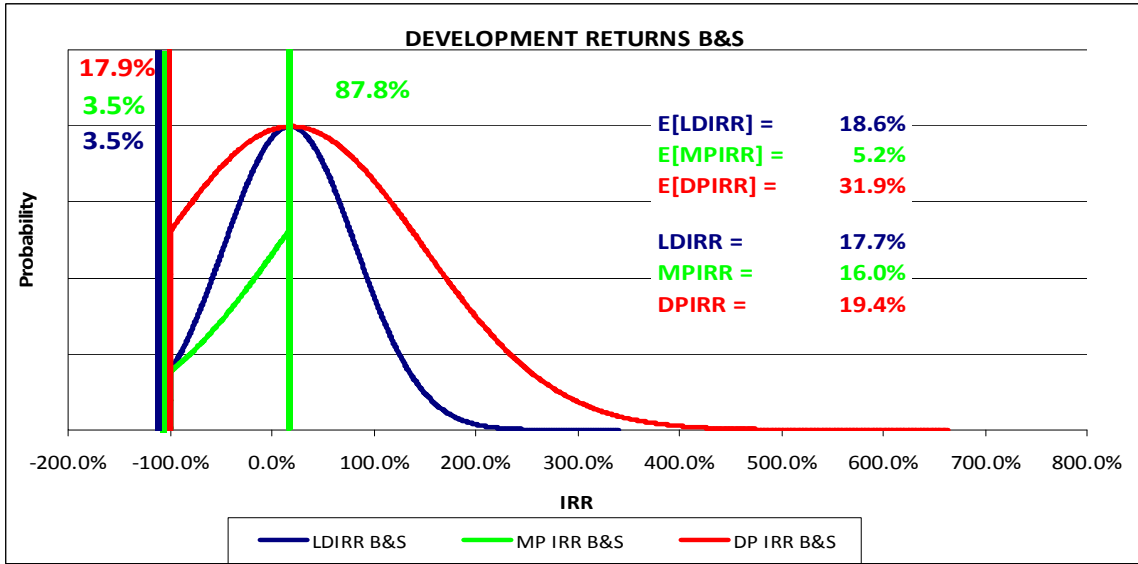
3.4 - Partnership Structure Exhibits

DEAL STRUCTURE SUMMARY		MEZZANINE SCENARIO	
OPERATIONS		CASH PAID IN	CASH PAID OUT
1)		DP - Pays Shortfalls	MP - Pref Payments
2)			DP - Excess Profits
SALE/CONTRIBUTIONS		CASH PAID IN	CASH PAID OUT
1)		DP Equity Contribution	MP - Return Capital
2)		MP Equity Contribution	MP - Preferred Return
3)			DP - Return Equity
4)			DP - Excess Profits

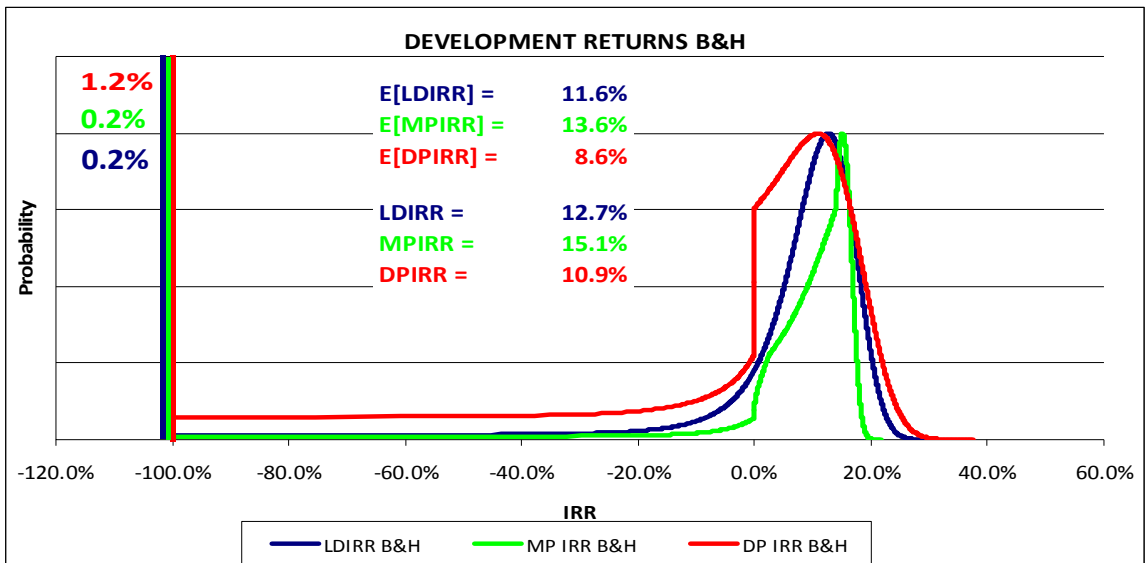
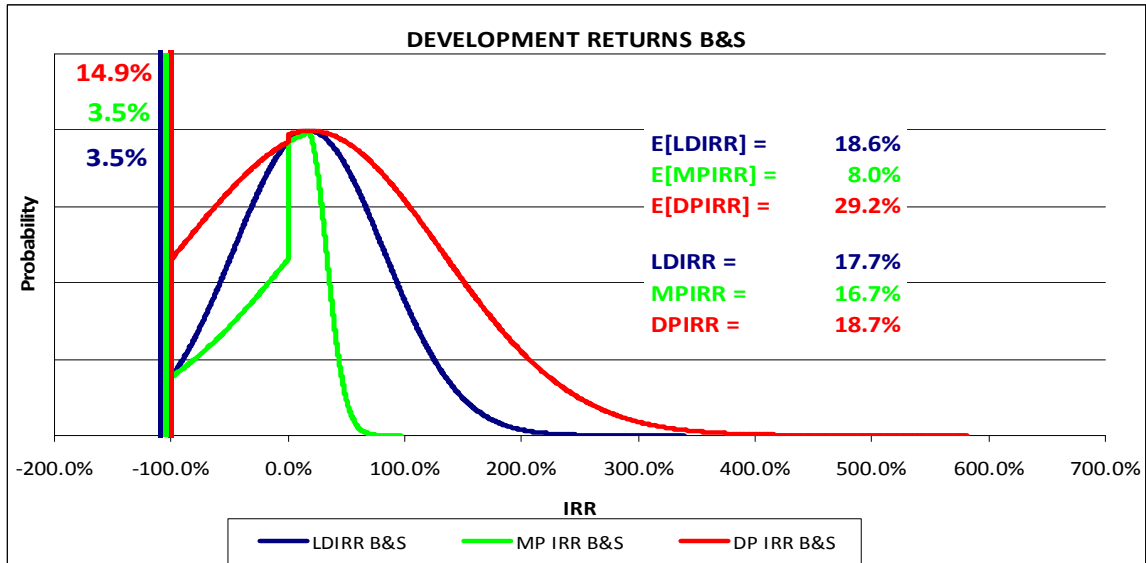
DEAL STRUCTURE SUMMARY		PREFERRED EQUITY SCENARIO	
OPERATIONS		CASH PAID IN	CASH PAID OUT
1)		DP - Pays Shortfalls	MP - Pref Payments
2)			MP&DP - Excess Profits
3)			
4)			
SALE/CONTRIBUTIONS		CASH PAID IN	CASH PAID OUT
1)		DP Equity Contribution	MP - Return Capital
2)		MP Equity Contribution	DP - Return Equity
3)			MP - Preferred Return
4)			MP&DP- Excess Profits

DEAL STRUCTURE SUMMARY		JV EQUITY SCENARIO	
OPERATIONS		CASH PAID IN	CASH PAID OUT
1)		MP&DP - Pays Shortfalls	MP&DP - Pref Payments
2)			MP&DP - Excess Profits
SALE/CONTRIBUTIONS		CASH PAID IN	CASH PAID OUT
1)		MP&DP Equity Contribution	MP&DP - Return Capital
2)			MP&DP - Preferred Return
3)			MP&DP - Return Equity

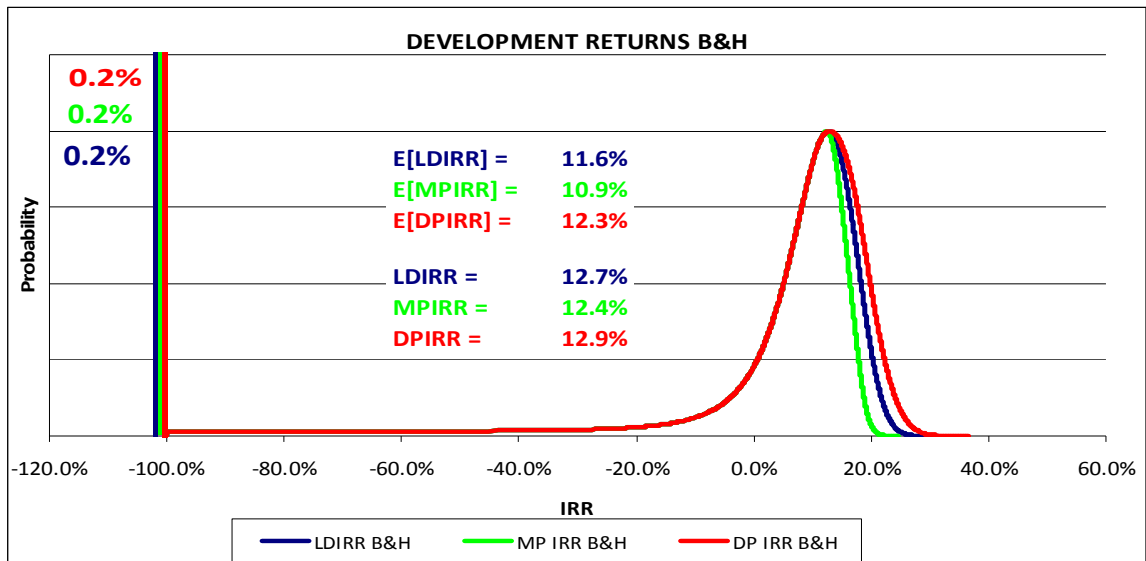
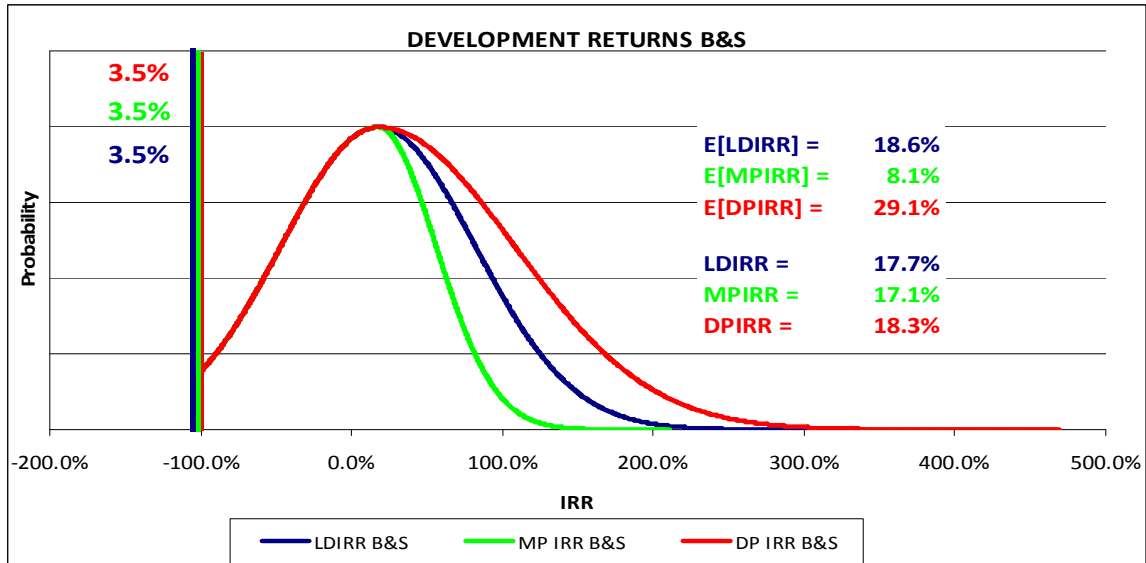
3.5 - Mezzanine Scenario - Build & Sell and Build & Hold Return Distributions



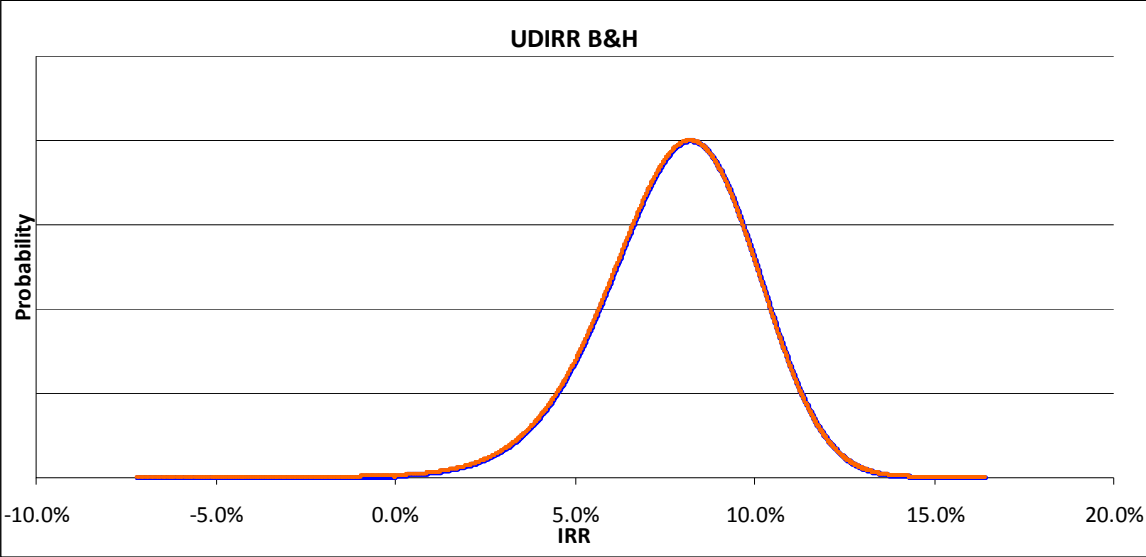
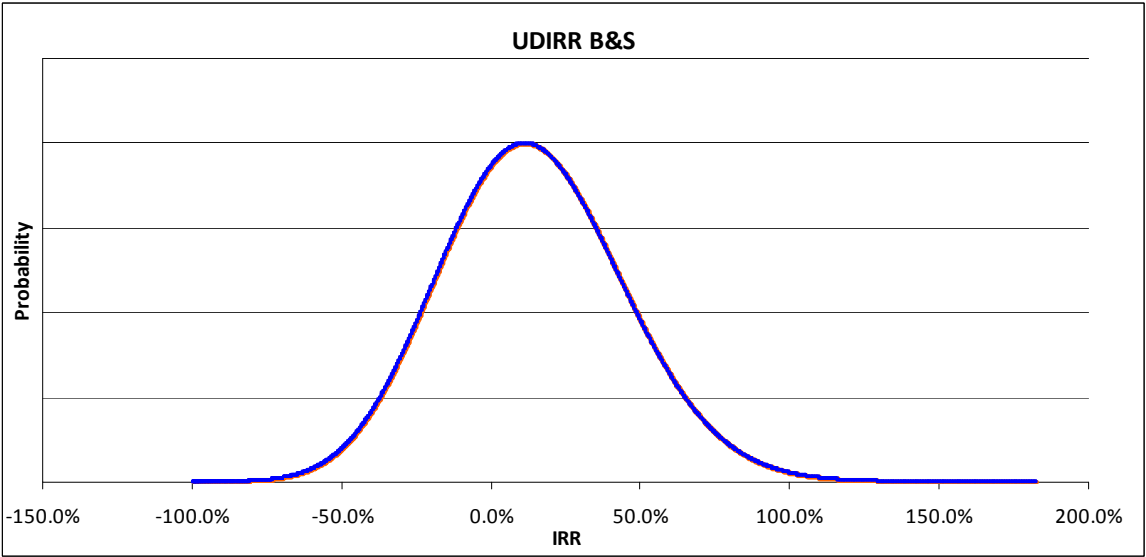
3.6 - Preferred Equity Scenario - Build & Sell and Build & Hold Return Distributions



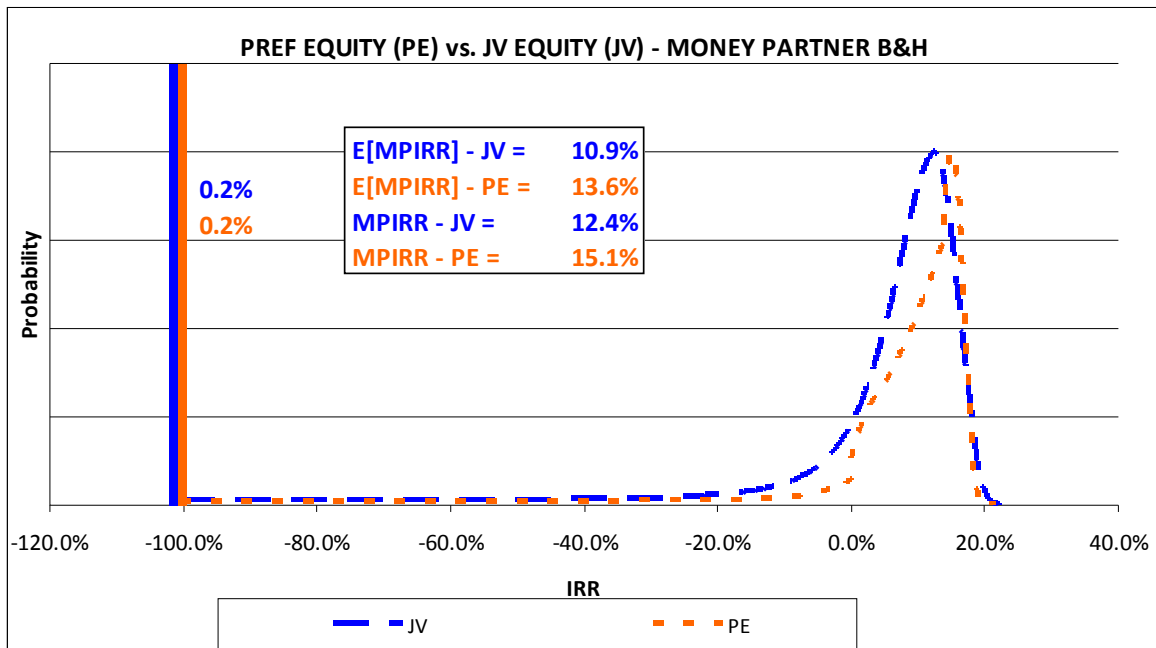
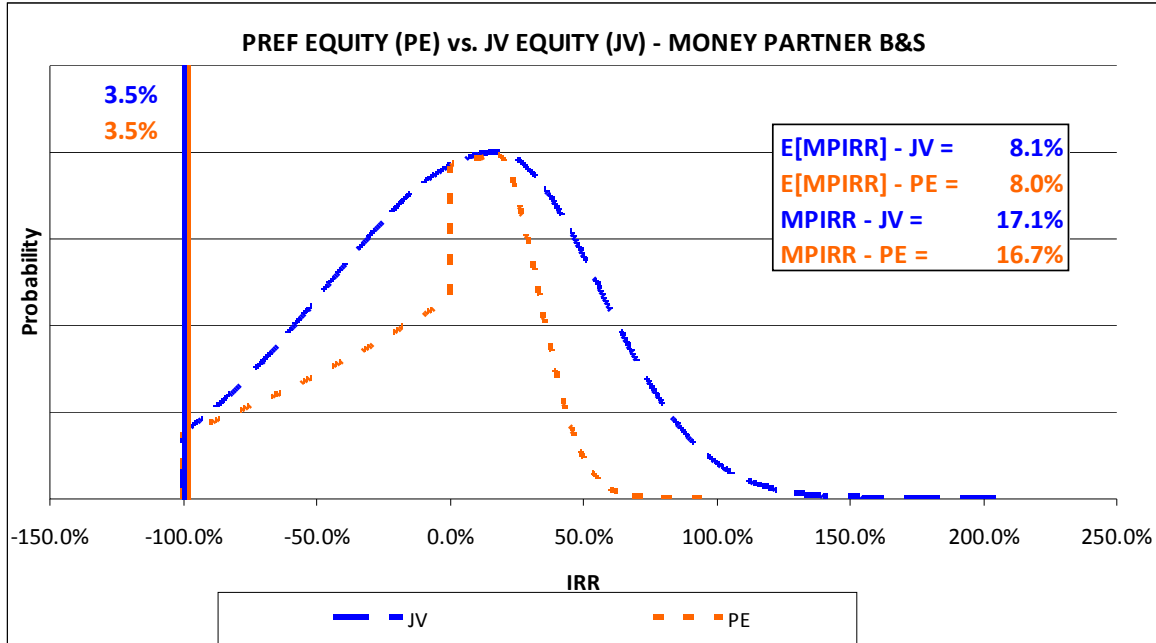
3.7 - JV Equity Scenario - Build & Sell and Build & Hold Return Distributions



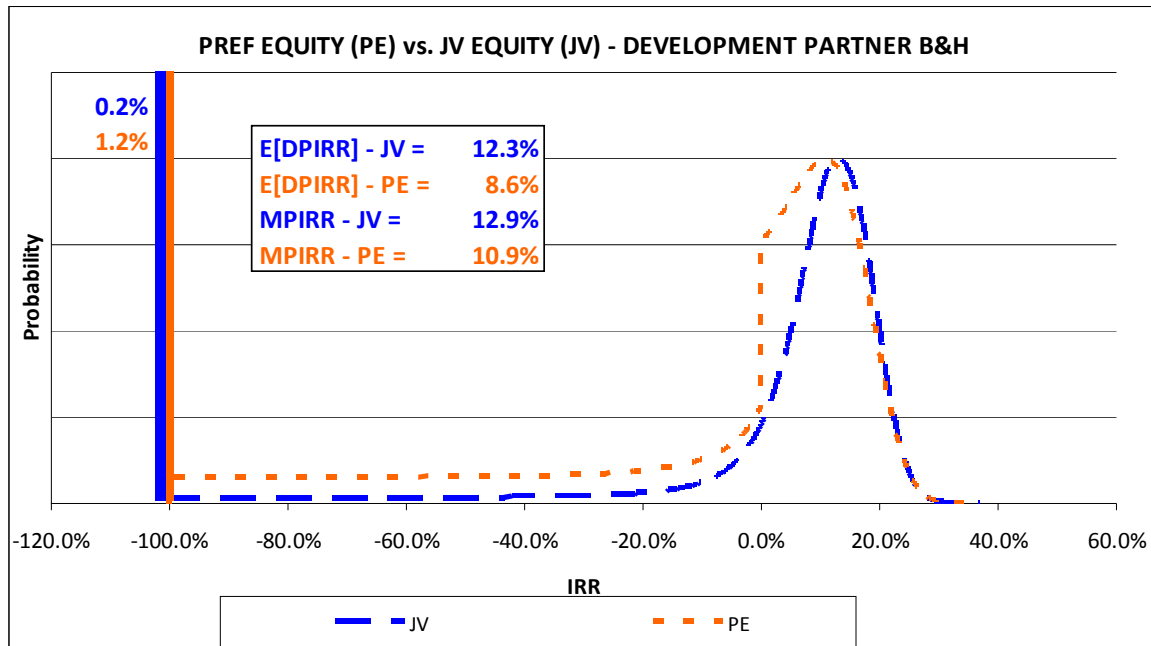
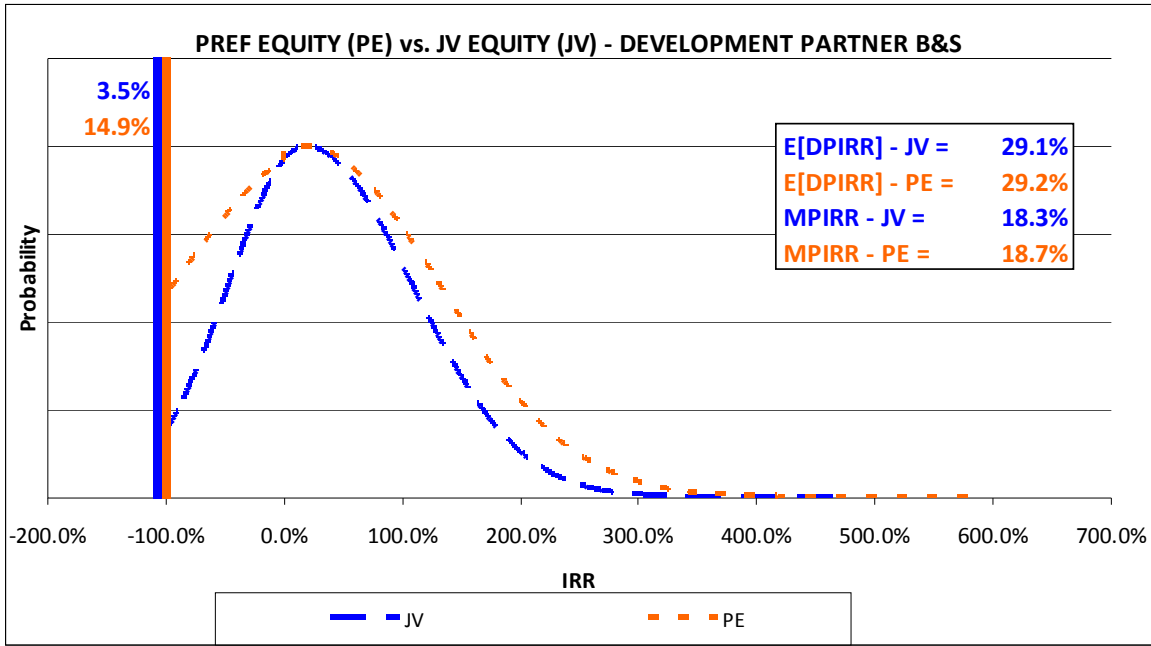
3.8 - Unlevered Development Returns Build & Sell and Build & Hold



3.9 - Money Partner (MP) Forecasted Return Distributions: JV vs. PE Terms

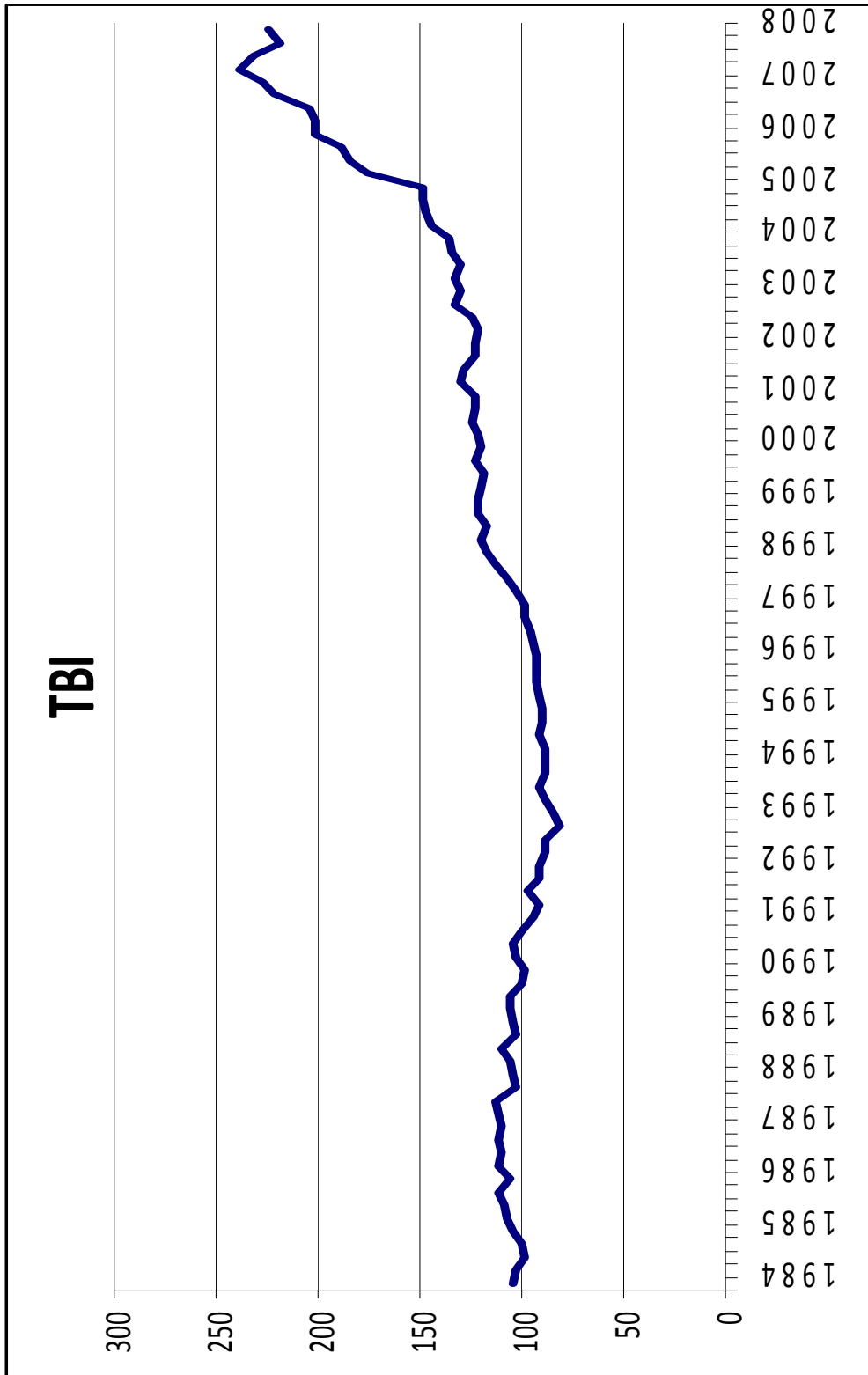


3.10 - Development Partner (DP) Forecasted Return Distributions: JV vs. PE Terms

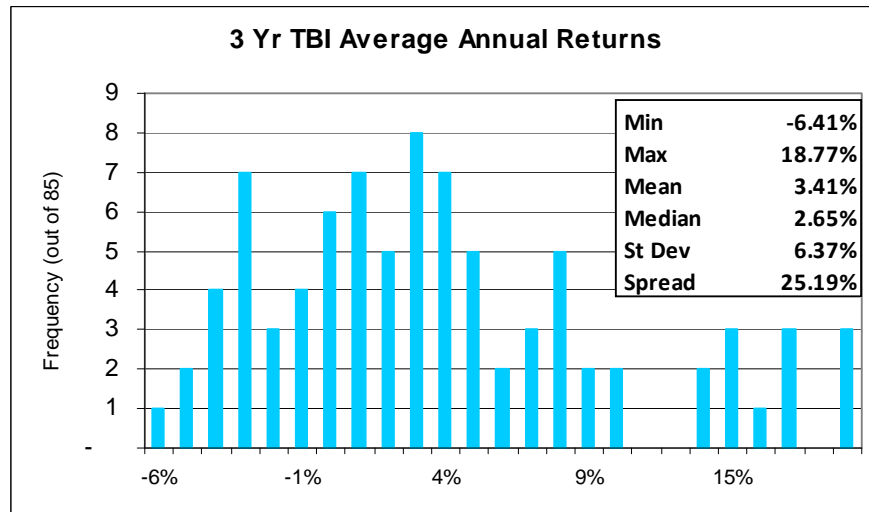
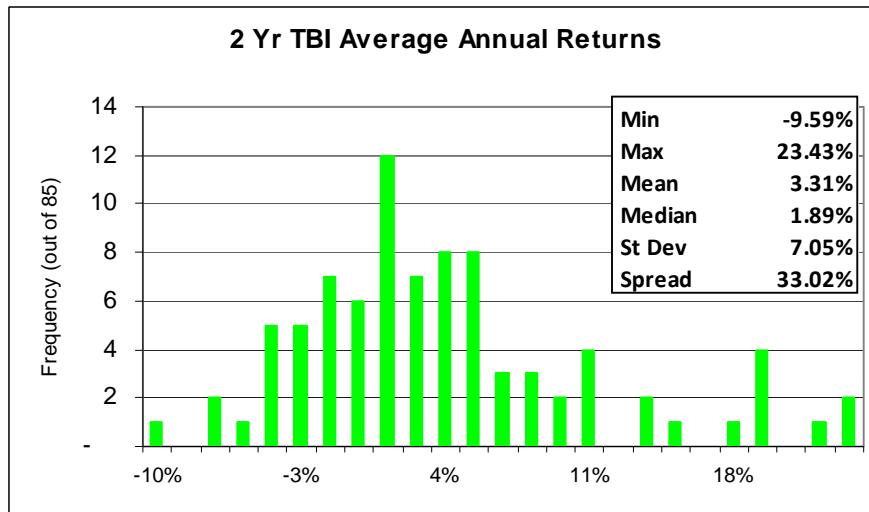
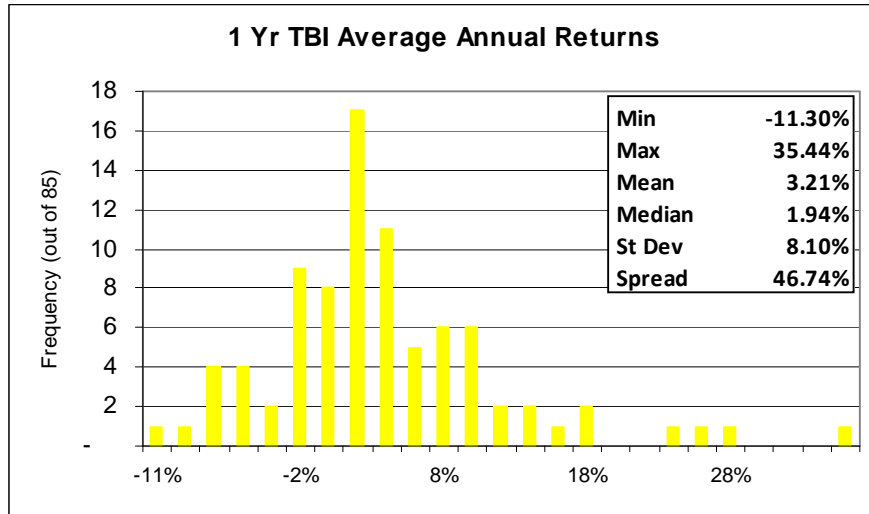


CHAPTER 4

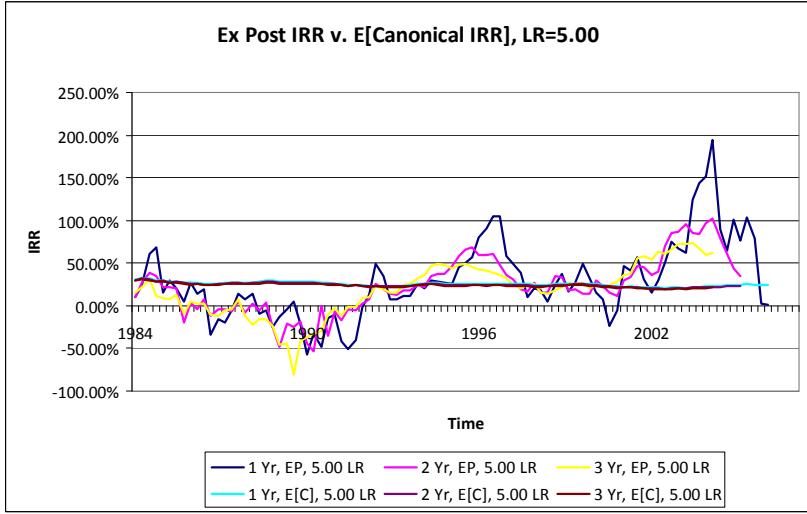
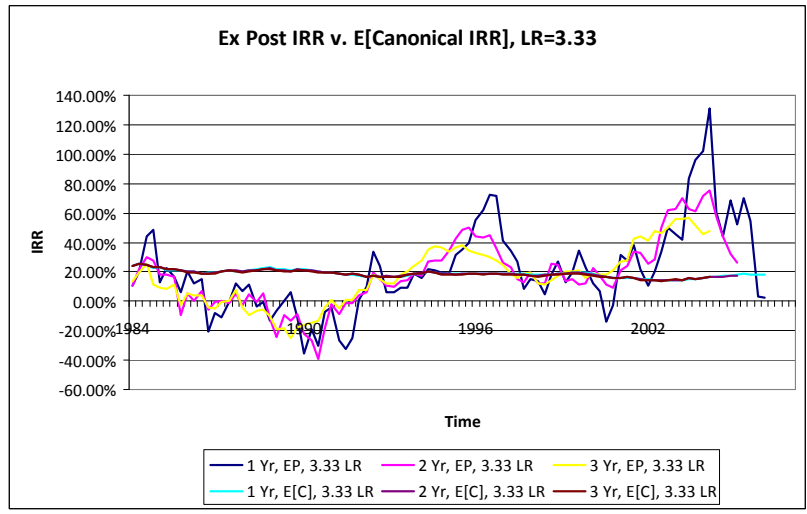
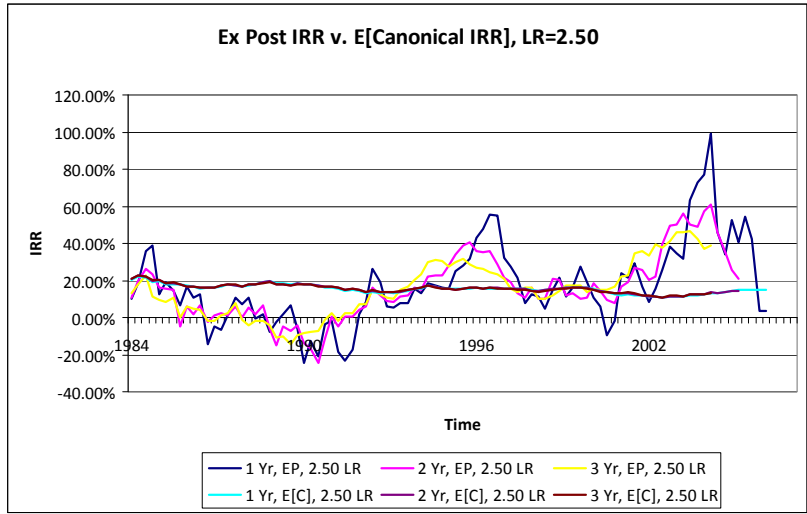
4.1- Transaction Based Index (TBI)



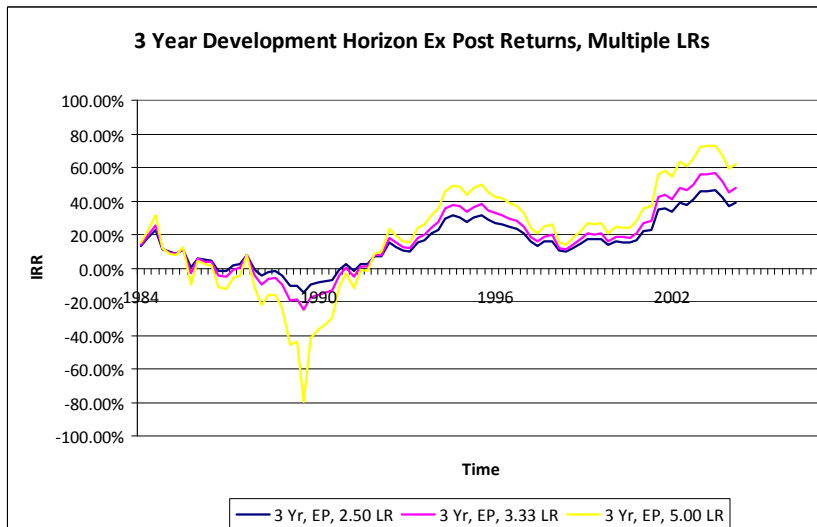
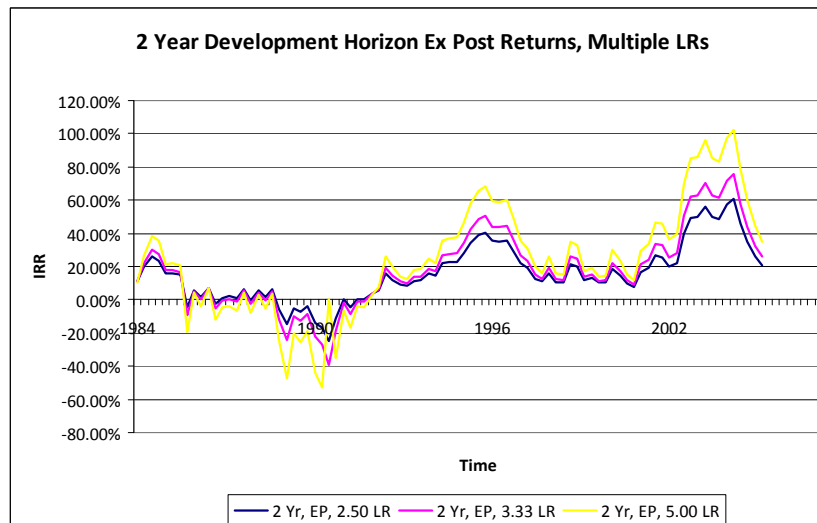
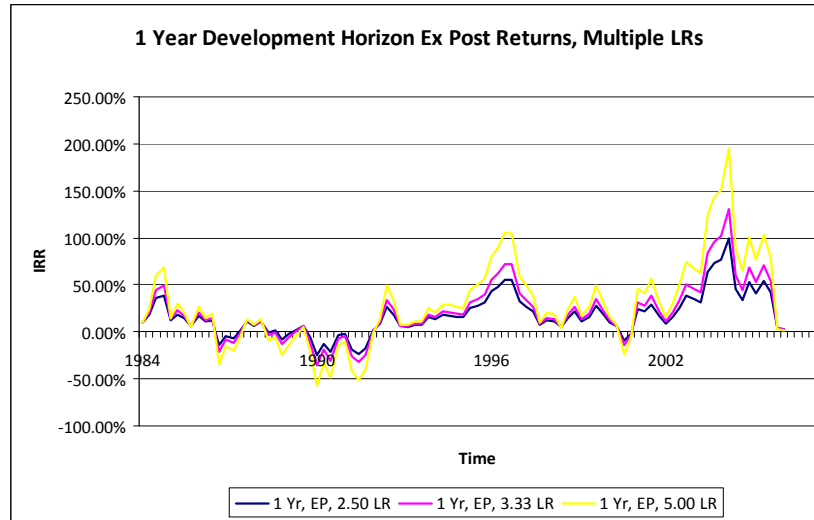
4.2- 1, 2 & 3 Average Annual Returns



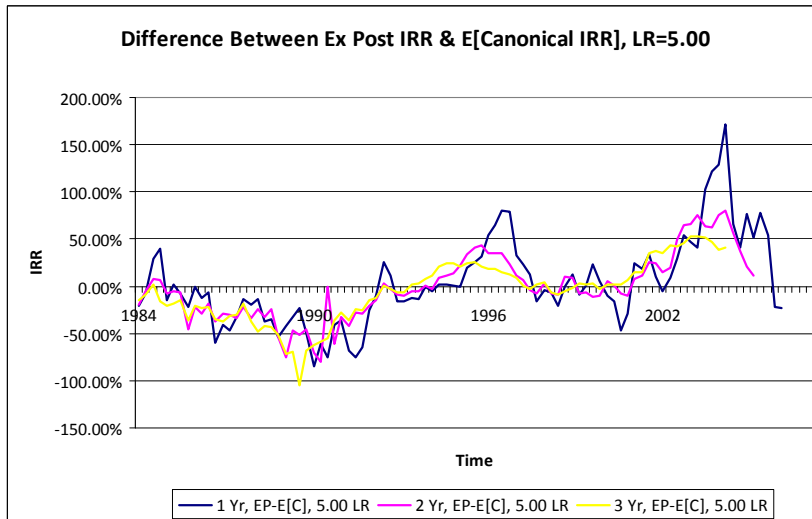
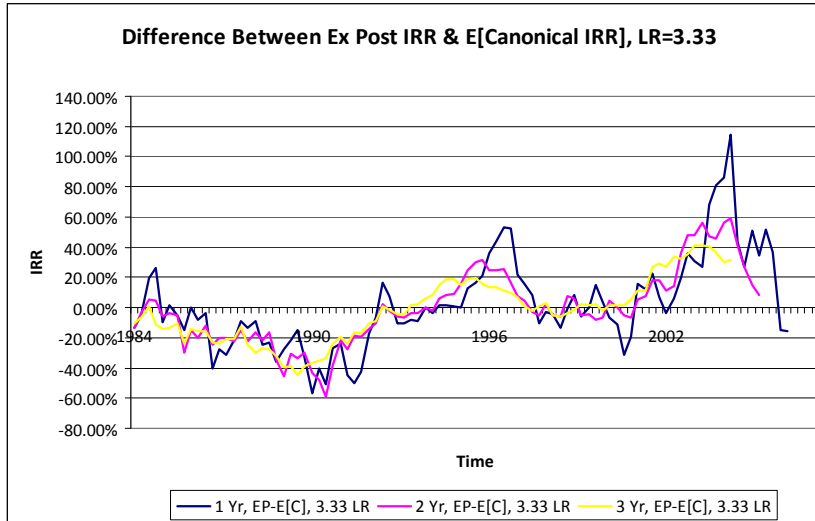
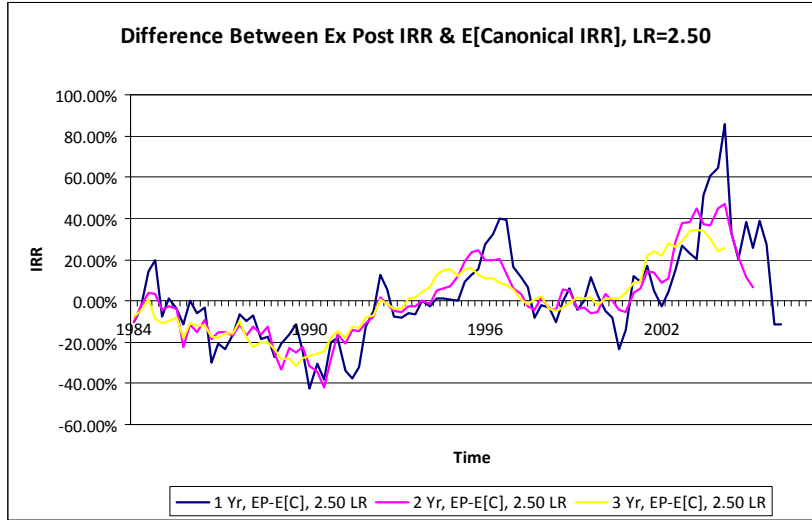
4.3 - Ex Post & Ex Ante Canonical Return Indexes



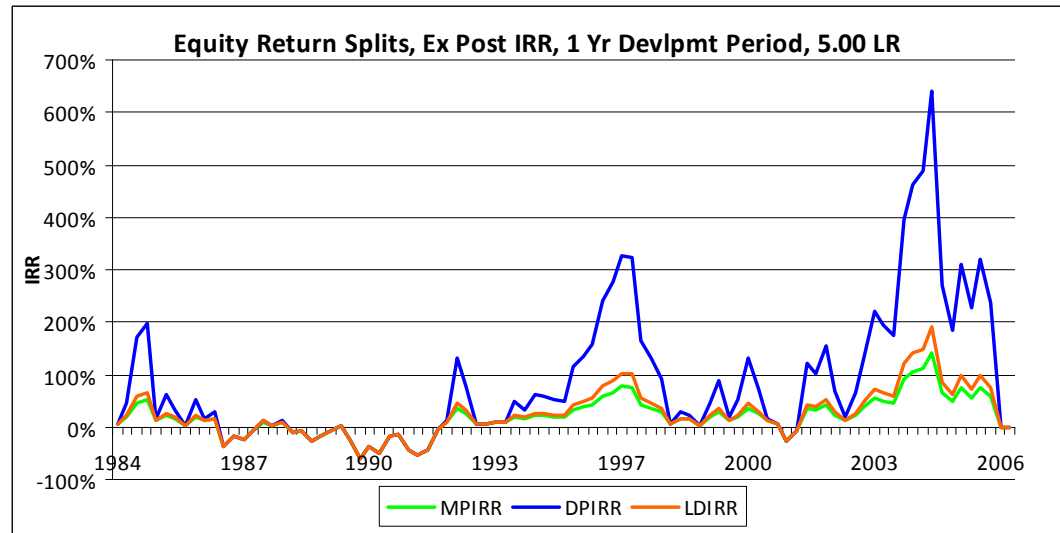
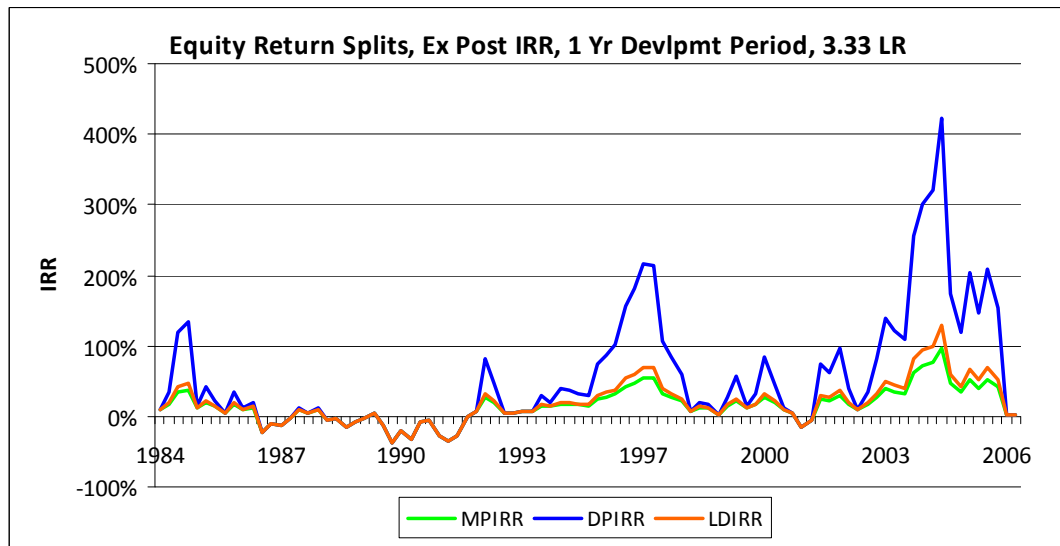
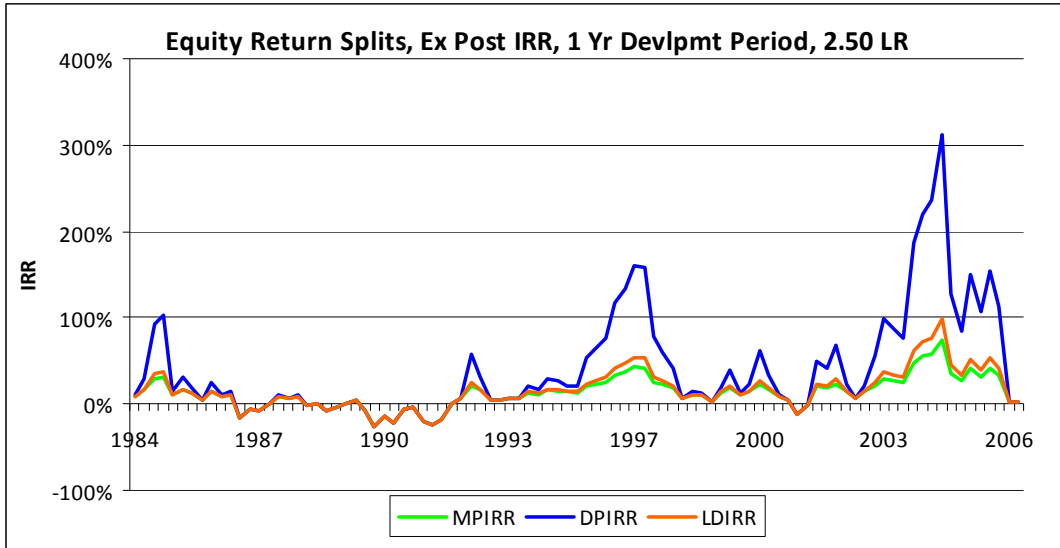
4.4 - Ex Post Canonical Return Indexes by Holding Period



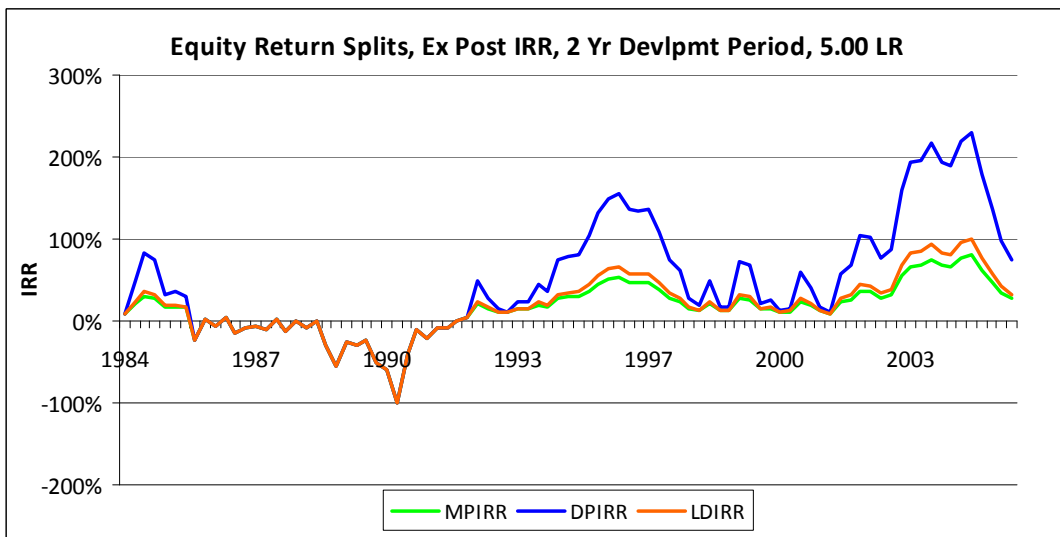
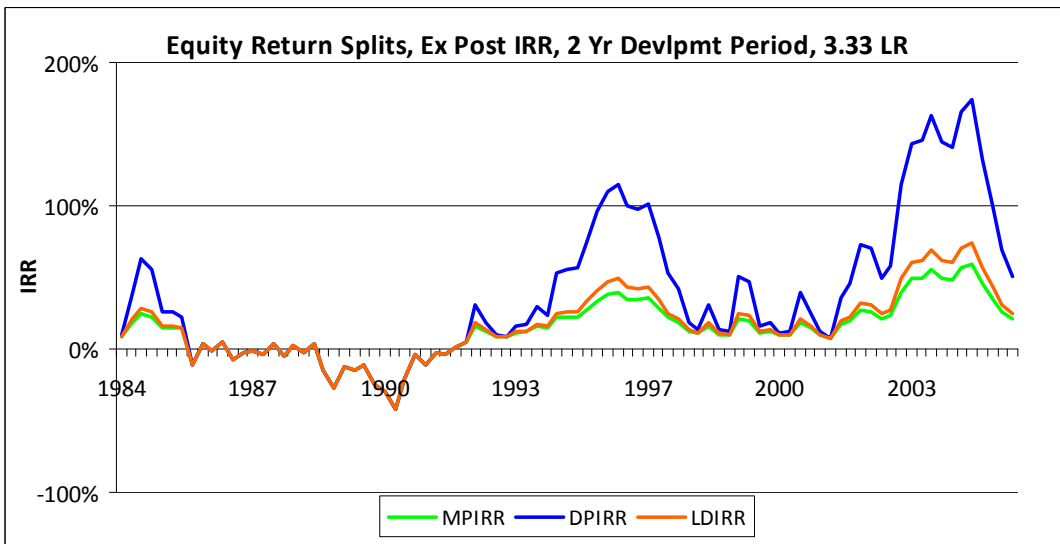
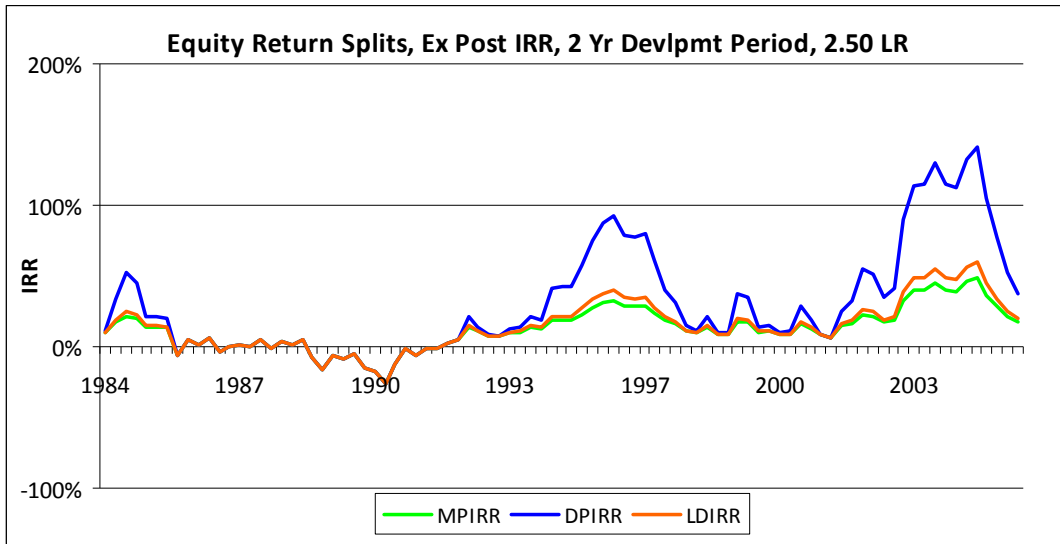
4.5 - Difference between Ex Post & Ex Ante Canonical Returns



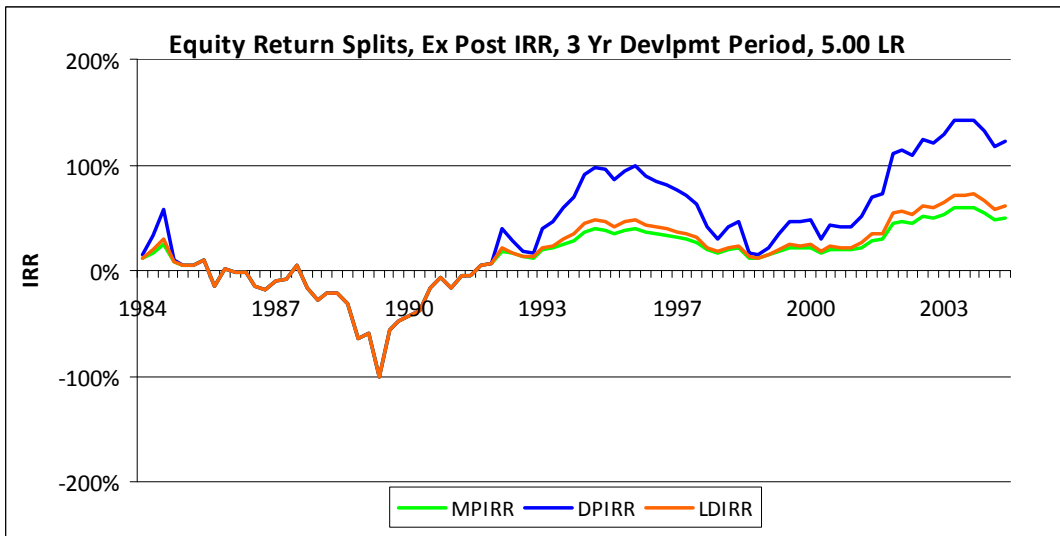
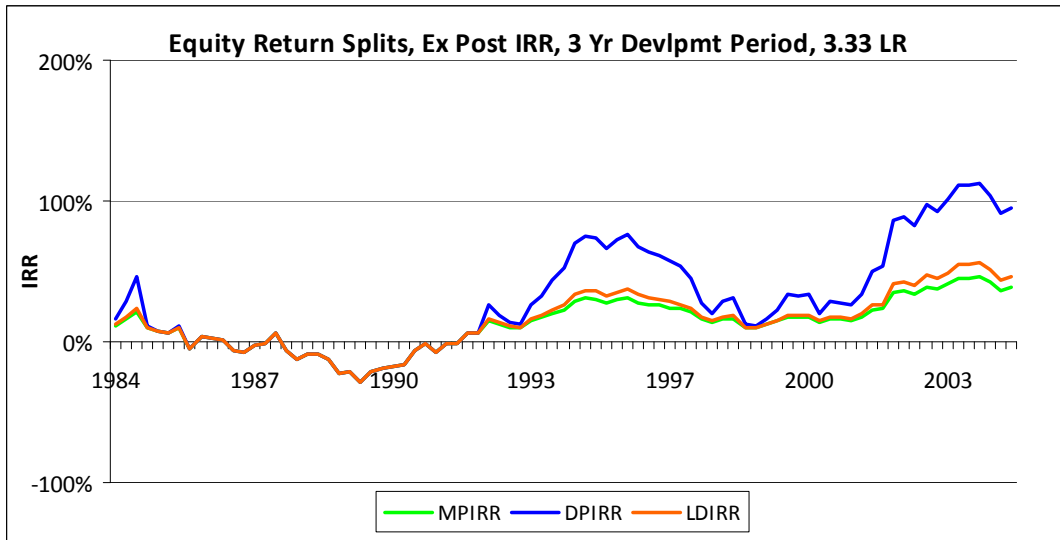
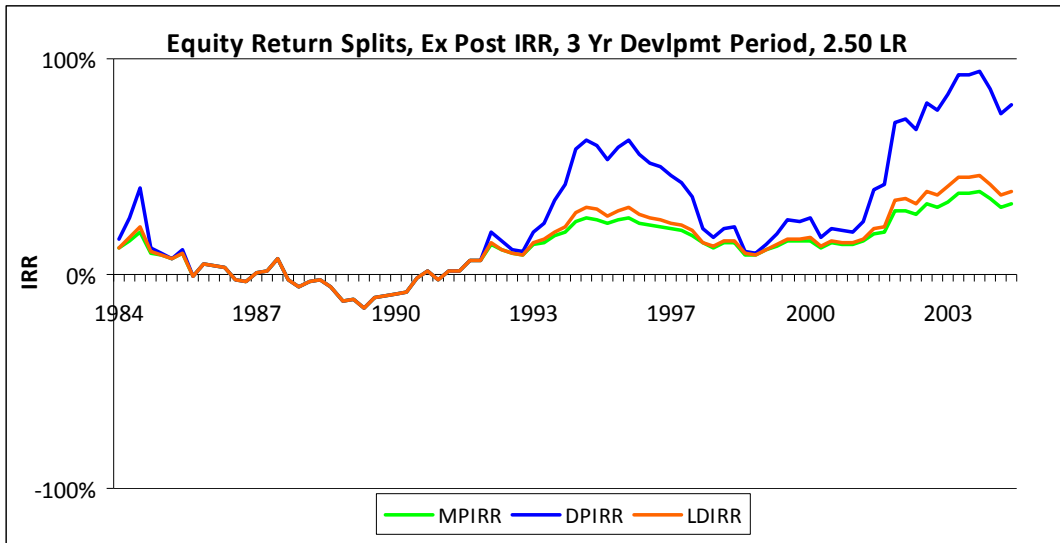
4.6 - Ex Post LDIRR, MPIRR & DPIRR Returns for 1 Year Development Horizons



4.7 - Ex Post LDIRR, MPIRR & DPIRR Returns for 2 Year Development Horizons



4.8 - Ex Post LDIRR, MPIRR & DPIRR Returns for 3 Year Development Horizons



CONCLUSION

5.1 – Summary of Development Return Metrics

Unlevered Development IRR (UDIRR) – This return gives us a way to measure the amount of operational leverage inherent in a development investment, as well as quantifying the return to the landholder if he funded the entire project with equity. The UDIRR is a non-unique return metric.⁸³

Levered Development IRR (LDIRR) – This is the return across every dollar of equity. The LDIRR is a non-unique return metric.

Money Partner IRR (MPIRR) – This is the return to the money partner in a joint venture development investment. The MPIRR is a non-unique return metric.

Development Partner IRR (DPIRR) – This is the return to the development partner in a joint venture development investment. The DPIRR is a non-unique return metric.

Canonical OCC – This is the expected return to the land over the development period. The canonical OCC is a unique return metric.

⁸³ Remember non-unique returns may have multiple values depending on how the cash flows are forecasted. See Chapter 2 for more detail.

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