

Mortgage-Equity Appraisal Software With Refinancing

Version 3.0

Operating and Use Guide

by Steve Rushmore, MAI

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Introduction to the Mortgage-Equity Appraisal Software with Refinancing

The Mortgage-Equity Appraisal Software with Refinancing has been designed specifically to assist in the preparation of real estate appraisals using a Mortgage-Equity Discounted Cash Flow technique. The software provides a mathematical framework to perform mortgage-equity appraisals for all types of commercial real estate including properties with projected irregular income flows. It also allows for a refinance event sometime during the projection period. This is particularly important these days when the initial cost of financing is very expensive but after the recovery most buyers will refinance.

The tool consists of a software program written as Microsoft Excel® workbook and a software manual. **The Mortgage-Equity Appraisal Software with Refinance can only run on the Windows® operating system. It will not run on OSX® operating systems**

All output is formatted for a standard laser printer using 8½ by 11-inch or A4 paper.

Mortgage Equity Valuation Model with Refinancing

A discounted cash flow valuation model utilizing the mortgage-equity technique forms the basis for this software which values commercial real estate using two different loan underwriting criteria:

- **Loan-to-Value Ratio:** Assumes a specific ratio between the size of the loan and the value of the property.
- **Debt Coverage Ratio:** Assumes a specified ratio of Net Income divided by the Debt Service as of a specific projection year.

By inputting the terms of typical financing, along with a projection of net income, the program determines the value that provides the stated returns to the mortgage and equity components.

The software also allows for a refinance event sometime during the projection period.

Acknowledgement

The Mortgage-Equity Appraisal Software with Refinancing was developed by Steve Rushmore, MAI with assistance from Professor Jan A, deRoos, PhD. of Cornell University and Suzanne Mellen, CRE, MAI of HVS.

Operating and Use Guide

The purpose of this Operating and Use Guide is to provide a complete description of the Mortgage-Equity Appraisal Software with Refinancing: how it works (the calculations) and how it is used- (inputting the data and interpreting the results).

The author strongly recommends reading this manual thoroughly prior to attempting to use the software. Try entering the data set forth in the Case Study so you can understand the logic of the software, and the various analytical features it offers.

The Software is Not Supported

The Mortgage-Equity Appraisal Software with Refinancing and the Operating and Use Guide are provided “as is” without warranty of any kind, either express or implied, respecting the contents of this guide and software, including but not limited to implied warranties for the guide’s and software’s quality, performance, merchantability, or fitness for any particular purpose. The author shall not be liable to any person or entity with respect to any liability, loss, or damage caused or alleged to be caused directly or indirectly by this guide and software. In accordance with the software license, neither the author, nor any entity affiliated with the author (including Hospitality Consulting Services, LLC) will provide any type of software support as part of the distribution of the Software and the Use Guide.

About the Author

Steve Rushmore, MAI is the Founder of HVS. Steve has provided consultation services for more than 15,000 properties throughout the world during his 40-year career and specializes in complex issues involving feasibility, valuation and financing.

As a leading authority and prolific author on the topic of hotel feasibility studies and appraisals, Steve Rushmore has written five textbooks and two seminars for the Appraisal Institute covering this subject. He has also authored three reference books on investing and has published more than 300 articles. He is also a frequent lecturer at major universities around the world including Cornell, Lausanne, Glion, Florida International University, Hong Kong Polytechnic, Michigan State, Houston, NYU and the Harvard Business School. Steve Rushmore has degrees from Cornell University and University of Buffalo.

Commercial Real Estate Valuation

When valuing commercial real estate, the analyst applies the classic “three approaches” appraisal methodology, using the Income Capitalization approach, the Sales Comparison approach, and Cost approach. Although all three valuation methods are generally given consideration, the inherent strength of each approach and the nature of the subject property must be evaluated to determine which will provide supportable estimates of market value.

For the purpose of this Operating & Use Guide, only the Income Capitalization approach using Mortgage-Equity Technique will be discussed.

Mortgage-Equity Appraisal Software with Refinancing

The Mortgage-Equity Appraisal Software with Refinancing estimates the value of commercial real estate using a Mortgage-Equity Appraisal Model which allows for 10-year holding period and a refinancing event during the holding period. The projected property cash flows are allocated to the mortgage and equity components based on current lending terms and market rates of returns to each component. The value of the property equals the sum of the mortgage component plus the equity component.

The process of estimating the value of the mortgage and equity components is summarized in the following Eight steps:

1. The terms of typical financing are set forth including: interest rate, amortization term, loan-to-value ratio and the debt coverage ratio.

2. An equity yield and terminal capitalization rate are also established. The equity yield takes into account the benefits of ownership; it is typical for buyers to base their equity yield on a ten-year holding period. The yield explicitly includes annual cash flow distributions and the equity residual. The equity yield implicitly includes refinancing distributions that return any property appreciation and mortgage amortization, income tax benefits, and non-financial considerations such as status and prestige.

3. The terminal capitalization rate is established as that rate appropriate for the property to be sold at the end of the assumed 10-year holding period.

4. The year for the refinancing event is established. The terms of the new financing are set forth, including: interest rate, amortization term, loan-to-value ratio and the debt coverage ratio.

5. The software performs three valuations using a 10-year Mortgage-Equity Discounted Cash Flow technique. 1) The initial value of the property to form the basis of the size of the initial mortgage. 2) The value of the property as of the refinance year to form the basis of the size of

the refinanced mortgage. 3) The value of the property based on the assumed refinancing during the 10-Year term.

The Mortgage-Equity Discounted Cash Flow technique values the equity component by first deducting the yearly debt service from the forecasted Net Income, leaving the net income to equity for each forecast year. To this is added any additional proceeds to equity from the refinancing as of the year the refinancing takes place. The Net Income forecast for the 11th year is capitalized into a reversionary value. From this figure, the remaining mortgage balance is deducted along with normal selling expenses; the resulting equity residual is discounted back to the date of value at the equity yield rate. The net income to equity for each of the ten projection years also undergoes a similar discounting process. The sum of these discounted values equates to the value of the equity component. Adding the equity component to the initial mortgage balance yields the overall property value.

6. The mortgage amount, the annual debt service, and the remaining mortgage balance all depend on the value to be calculated. Thus, the preceding calculation must be solved through an algebraic equation that computes the total property value. This software uses the algebraic solution developed by Suzanne Mellen in "Simultaneous Valuation: A New Technique" Appraisal Journal, April 1983.

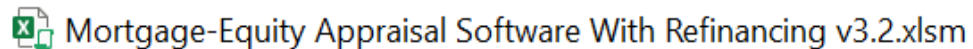
7. In addition to estimating value using a specified loan-to-value ratio, the software also estimates value using a debt coverage ratio.

8. The proof of value is performed by allocating the total property value between mortgage and equity components and verifying that the rates of returns set forth in Steps #1 and #2 can be precisely met from the forecasted net income.

Getting Started Using the Mortgage-Equity Appraisal Software with Refinancing

The best way to learn how to use the Mortgage-Equity Appraisal Software with Refinancing is to actually work with the software while following the instructions in this Guide.

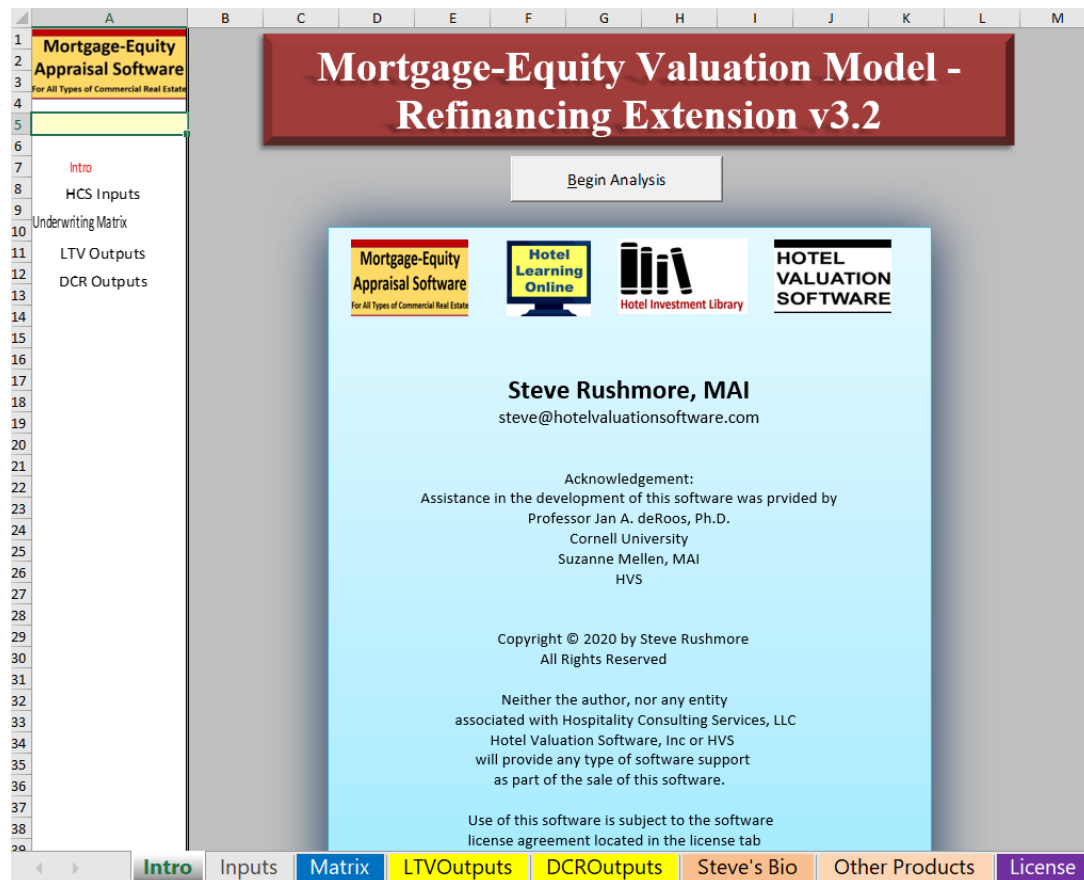
The Excel file for the Mortgage-Equity Appraisal Software with Refinancing looks like this:



The version number (v3.2) will change with any software updates.

Open the Excel file and before using the software do a “Save As” and save the file under a different name so each time the original file is used it starts with a fresh spreadsheet.

The software opens with the “Intro” page which contains information about the author and contributors to the development of the mortgage-equity technique. It also has contact information- web and e-mail as well as the owner of the copyright.



The Mortgage-Equity Appraisal Software with Refinancing Excel workbook employs a common look and feel that includes:

- An opening screen with a black colored tab
- Navigation is via a set of tabs along the bottom of the screen.

The software uses the following protocol for cell color:

Color Input Legend	
Mandatory Input:	White
Optional Input:	Orange
Output Only:	Green
No User Input:	Grey
No User Input:	Light Blue
Information/Instructionals:	Dark Blue

Case Study

The Mortgage-Equity Appraisal Software with Refinancing will be demonstrated through the use of a case study.

What occurred during the early part of 2020 with COVID-19 is a perfect example of why the Mortgage-Equity Appraisal Software with Refinancing is the best appraisal model to handle a commercial property valuation at the bottom of a major down-cycle.

Looking at the current situation: Net income has plummeted, the cost of capital is through the roof, but most people believe commercial real estate will be back to “normal”- two to three years from now. No matter what technique is used to value the cash flow- it is not fair to penalize the property’s value by discounting the 10-year net income projection using a discount rate based on the current high cost of capital.

The solution, as always, comes down to- “look at the market.” How will a typical buyer analyze a potential commercial real estate investment at this point in time- i.e. what is the projection of net income, where will the initial acquisition capital come from and what will it cost? Based on previous cycles- this is what often happens:

-The projection of net income starts with the current NOI and models a recovery. Depending on the market, the type of asset and other factors- the recovery back to 2019 net income levels will probably be 1 to 3 years from now.

-The initial acquisition capital will probably come from a variety of sources which also depend on the local market and type of asset.

-Debt capital (interest rates) will cost significantly more than it did at the end of 2019. Loan-to-value ratios will be much lower. Amortization rates will be much shorter.

-Equity capital might also cost more because of the reduced leverage. In some cases, the initial acquisition might be all-cash.

-Terminal capitalization rates will probably be the same since they are not a factor for 10-years when everything has probably recovered.

-The big change to the acquisition analysis is the addition of a Refinancing Event. Most investors buying commercial real estate today, with the high cost of capital, will structure their investment to include a refinancing (of both debt and maybe equity) that will take place after the market returns to normal. Again, depending on the local market and type of asset- this will probably occur 2 to 3 years from now. If appraisers do not factor such a refinancing into their calculations, they will be significantly undervalued the property.

The only way to accurately include such a refinancing is to use the Mortgage-Equity Appraisal Software with Refinancing model. The following Case Study demonstrates how this software works

A commercial piece of real estate was heavily impacted by COVID-19. During 2019, its Net Operating Income was \$1,000,000, but today it is much lower. A typical investor looking to acquire this property today would project the NOI to slowly recover over the next four years reaching its 2019 level in 2023. An NOI recovery might look like this:

2020-	\$250,000
2021-	\$500,000
2022-	\$750,000
2023-	\$1,000,000

After reaching the 2023 stabilized level of \$1,000,000 the NOI is projected to increase at a 3% annual inflation rate.

Based on the current Debt and Equity markets, where financing is very expensive and difficult to obtain- the following is the cost of capital for these two components:

Mortgage:

-Interest	10%
-Loan-to-Value	50%
-Debt Coverage Ratio	1.7 in 2022
-Amortization	20 years
-Payments Per Year	12

Equity:

-Equity Yield 18%

Terminal Rate:

-Capitalization 8%

-Sales Expenses 2%

As you can see, the high cost of debt is shown by the high interest rate, low loan-to-value, the high debt coverage ratio and the short amortization.

Once the property reaches the \$1,000,000 stabilized NOI in 2023, the buyer would refinance the mortgage which by this point in time should be less expensive than the initial mortgage. The following mortgage terms were assumed for the refinancing:

Mortgage:

-Interest 5%
-Loan-to-Value 70%
-Debt Coverage Ratio 1.6 in 2025
-Amortization 25 years
-Payments Per Year 12

Refinancing Costs:

-Costs Associated with the Refinancing: 1% of Gross Refinancing Proceeds

Using the Software

Open the Mortgage-Equity Appraisal Software with Refinancing model and do a “Save As” to another file name. Click on the Input Tab at the bottom of the page to open the Input Page shown below.

The screenshot shows the 'Inputs' page of the Mortgage-Equity Appraisal Software. The page is titled 'Mortgage-Equity With Refinancing Inputs' and is divided into four main sections for data entry:

- Project Information:** Includes fields for Job Title, Prepared By, Prepared For, Job ID, and Number of Rooms.
- Valuation Inputs:** Includes fields for First Projection Year, Stabilized Year, Equity Yield, Terminal Cap Rate, Selling Expenses, Mortgage Interest Rate (Initial), Mortgage Amortization (Initial), and Mortgage Payments Per Year (Initial).
- Refinancing Inputs:** Includes fields for Refinance Year, Mortgage Interest Rate (Refi), Mortgage Amortization (Refi), Mortgage Payments Per Year (Refi), and Refi Costs (As a % of Gross Refi Proceeds).
- Net Income Inputs:** Includes a table for inputting data and an 'Auto Fill Inflation' button.

A 'Color Input Legend' on the right side defines the input types: Mandatory Input (white), Optional Input (orange), Output Only (green), No User Input (grey), and Information/Instructions (blue). The bottom navigation bar includes tabs for Intro, Inputs, Matrix, LTVOutputs, DCROutputs, Steve's Bio, Other Products, and License.

There are four Sections of the Input Page:

- Project Information
- Valuation Inputs
- Refinancing Inputs
- Net Income Inputs

Project Information Section

Enter the project information for this analysis below.

Job Title:	
Prepared By:	
Prepared For:	
Job ID:	
Number of Rooms:	

The Project Information Section contains input areas identifying the project. Nothing entered into this area affects the valuation calculations. The Number of Rooms is used to calculate the value per room. You can also enter the number of square feet onto this line to get the value per square foot.

The Project Information Section with data entered. The Commercial Building has 65,000 square feet of space.

Enter the project information for this analysis below.

Job Title:	Commercial Building
Prepared By:	Steve Rushmore
Prepared For:	First County Bank
Job ID:	1276
Number of Rooms:	65000

Valuation Inputs Section

Valuation Inputs	
First Projection Year:	<input type="text"/>
Stabilized Year:	<input type="text"/>
Equity Yield:	<input type="text"/>
Terminal Cap Rate:	<input type="text"/>
Selling Expenses:	<input type="text"/>
Mortgage Interest Rate (Initial):	<input type="text"/>
Mortgage Amortization (Initial):	<input type="text"/>
Mortgage Payments Per Year (Initial):	<input type="text"/>

The Valuation Inputs Section is the area where information pertaining to the mortgage-equity valuation parameters are entered.

- First Projection Year: Date of Value and the first year of the Net Income Projection
- Stabilized Year: Year the Net Income stabilizes after which the Net Income increases at the assumed rate of inflation
- Equity Yield: Equity IRR (enter as a whole number)
- Terminal Cap Rate: Capitalization rate applied to the 11th year's Net Income to calculate the Sales Price (Terminal Value) at the end of the 10-year projection period (enter as a whole number)
- Selling Expenses: Expenses associated with the sale of the property- usually broker and legal costs (enter as a percentage of the sales price)
- Mortgage Interest Rate (Initial): Annual interest rate of the initial mortgage obtained as of the date of value (enter as a whole number)
- Mortgage Amortization (Initial): Number of years to fully amortize the initial mortgage
- Mortgage Payments Per Year (Initial): Number of payments per year for the initial mortgage (usually 12)

Using the data from the Case Study the following shows the Valuation Input Section with the information inputted:

Valuation Inputs	
First Projection Year:	2020
Stabilized Year:	2023
Equity Yield:	18.00%
Terminal Cap Rate:	8.00%
Selling Expenses:	2.00%
Mortgage Interest Rate (Initial):	10.00%
Mortgage Amortization (Initial):	20
Mortgage Payments Per Year (Initial):	12

Refinancing Inputs Section

Refinancing Inputs	
Refinance Year:	
Mortgage Interest Rate (Refi):	
Mortgage Amortization (Refi):	
Mortgage Payments Per Year (Refi):	
Refi Costs (As a % of Gross Refi Proceeds):	

The Refinancing Inputs Section is the area where information pertaining to the assumed refinancing is entered.

- Refinance Year: Year the refinancing takes place
- Mortgage Interest Rate (Refi): Annual interest rate of the initial mortgage obtained as of the date of value (enter as a whole number)
- Mortgage Amortization (Refi): Number of years to fully amortize the initial mortgage
- Mortgage Payments Per Year (Refi): Number of payments per year for the initial mortgage (usually 12)
- Refi Costs (As a % of Gross Refi Proceeds): Costs associated with refinancing the mortgage such as commissions, points, etc.

Using the data from the Case Study, the following shows the Refinancing Inputs Section with the information inputted:

Refinancing Inputs	
Refinance Year:	2023
Mortgage Interest Rate (Refi):	5.00%
Mortgage Amortization (Refi):	25
Mortgage Payments Per Year (Refi):	12
Refi Costs (As a % of Gross Refi Proceeds):	1.00%

Net Income Inputs Section

Net Income Inputs	
Auto Fill Inflation	2020:
	2021:
	2022:
	2023:
	2024:
	2025:
	2026:
	2027:
	2028:
	2029:
	2030:
Inflation Rate After NOI Stabilizes:	

[Go Back](#)

The Net Income Inputs Section is where the projected annual Net Income is entered. As you can see the software has prepopulated the Years.

Enter the Net Income up to the year it Stabilizes. Then at the bottom of this table is a section: Inflation Rate After NOI Stabilizes- Enter the annual Inflation Rate (as a whole number) that will be applied to the projected NOI after it stabilizes for the remaining term.

Click on the Auto Fill Inflation button and the inflation rate will be applied to the Net Income for the remaining term.

Using the data from the Case Study, the following shows the Net Income Inputs Section with the Net Income up to the Stabilized Year inputted:

Net Income Inputs	
2020:	\$ 250
2021:	\$ 500
2022:	\$ 750
2023:	\$ 1,000
2024:	
2025:	
2026:	
2027:	
2028:	
2029:	
2030:	
Inflation Rate After NOI Stabilizes: <input type="text"/>	

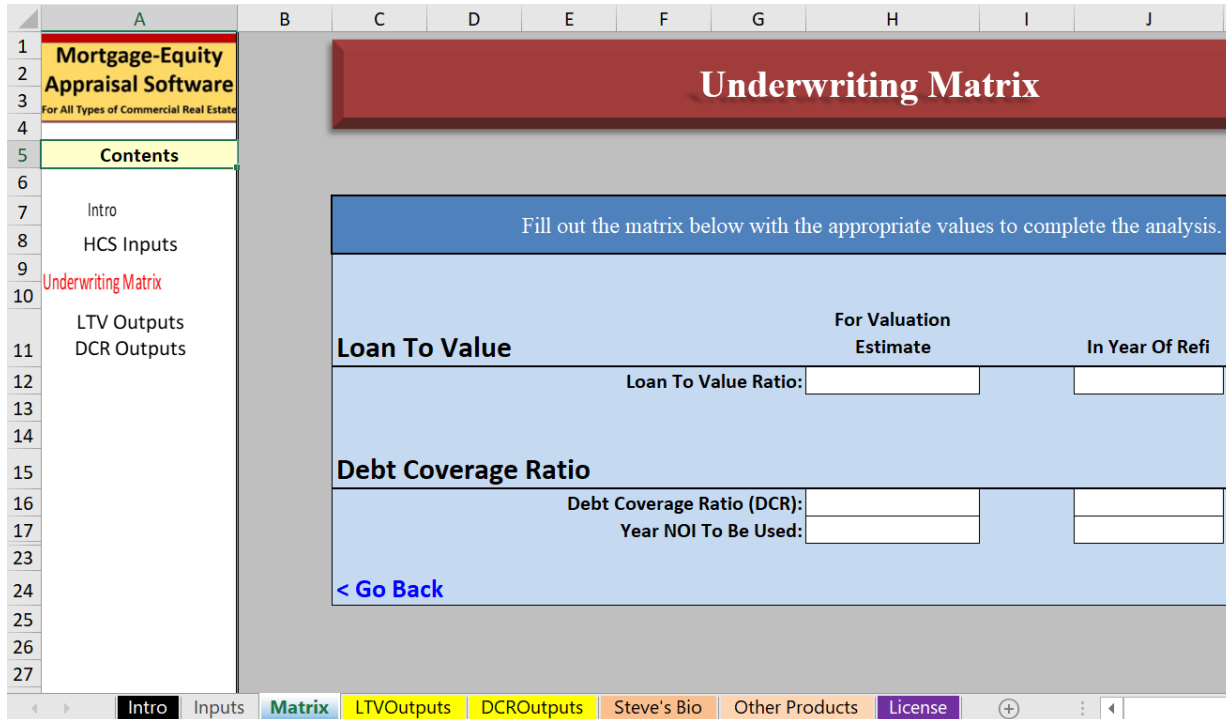
Auto Fill Inflation

The following shows the Net Income Section with the Net Income populated based on the 3% annual inflation rate by clicking on the Auto Fill Inflation button.

Net Income Inputs	
2020:	\$ 250
2021:	\$ 500
2022:	\$ 750
2023:	\$ 1,000
2024:	\$ 1,030
2025:	\$ 1,061
2026:	\$ 1,093
2027:	\$ 1,126
2028:	\$ 1,159
2029:	\$ 1,194
2030:	\$ 1,230
Inflation Rate After NOI Stabilizes: <input type="text" value="3.00%"/>	

Auto Fill Inflation

Underwriting Matrix Tab



The Underwriting Matrix Tab is where mortgage underwriting information is entered. The Mortgage-Equity Appraisal Model with Refinancing values the property based on both a Loan-to-Value Ratio or a Debt Coverage Ratio.

Loan-to-Value Ratio: Entered as percentages for both the Initial Financing and the Refinancing.

Debt Coverage Ratio: Entered as a ratio- Net Income/Debt Service (such as 1.7) and the Year that ratio needs to be achieved. The Debt Coverage Ratio is entered for both the Initial Financing and the Refinancing.

Using the data from the Case Study, the following shows the Underwriting Matrix Tab with the information inputted:

Fill out the matrix below with the appropriate values to complete the analysis.		
	For Valuation Estimate	In Year Of Refi
Loan To Value		
Loan To Value Ratio:	50.00%	70.00%
Debt Coverage Ratio		
Debt Coverage Ratio (DCR):	1.70	1.60
Year NOI To Be Used:	2022	2025
< Go Back		

Mortgage-Equity Appraisal Software

For All Types of Commercial Real Estate

Output Tabs

At this point, all the information has been entered. The next two tabs are Output Tabs; one for the valuation based on the Loan-to-Value Ratios and the other for the valuation based on a Debt Coverage Ratios. The Output Tabs details the valuation, shows the cash flow and IRR for each component, along with a number of metrics to evaluate the results.

The following is the Output Tab for the valuation based on the Loan-to-Value Ratios:

Loan To Value Outputs											
Job Title: Commercial Building Job ID: 1276											
Value Based On Currently Available Parameters						Value Based On Refinancing Year Cash Flows					
Valuation Input			Valuation Output			Valuation Input			Valuation Output		
Inflation	3.00%		Value	\$	7,707,423	Year of Value	2023	Value	\$	13,466,657	
Loan to Value Ratio	50.00%		Value Per Room	\$	119	Inflation	3.00%	Value Per Room	\$	207	
Amortization	20		Overall Discount Rate		15.10%	Loan to Value Ratio	70.00%	Overall Discount Rate		10.18%	
Loan Term	10		Cap Rate - 1st Year NOI		3.24%	Amortization	25	Cap Rate - 1st Year NOI		7.65%	
Interest Rate	10.00%		Mortgage @ 50% LTV	\$	3,853,711	Loan Term	10	Mortgage @ 70% LTV	\$	9,426,660	
Terminal Cap Rate	8.00%		Mortgage Per Room	\$	59	Interest Rate	5.00%	Mortgage Per Room	\$	145	
Transaction Costs	2.00%		Annual Debt Service	\$	446,270	Terminal Cap Rate	8.00%	Annual Debt Service	\$	661,288	
Equity Yield	18.00%		Debt Coverage Ratio - Year 1		0.56	Transaction Costs	2.00%	Debt Coverage Ratio - Refi Year		1.56	
						Equity Yield	18.00%				
LTV Model											
	\$ (000)	IRR	Value Per Room	Metrics							
Value of the Property	\$ 9,289	12.35%	\$ 143	Total Appreciation	65.50%						
Value of the Mortgage Component	\$ 3,854	6.31%	\$ 59	Annual Appreciation	5.17%						
Value of the Equity Component	\$ 5,435	18.00%	\$ 84	Cash Flow Return	68.38%						
				Appreciation Return	31.62%						
				Total Property Yield	12.35%						
				Stabilized Going In Rate	6.76%						
Cash Flows for IRR Calcs											
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total Property	\$ (9,289)	\$ 250	\$ 500	\$ 750	\$ 1,000	\$ 1,030	\$ 1,061	\$ 1,093	\$ 1,126	\$ 1,159	\$ 16,260
Mortgage	\$ (3,854)	\$ 446	\$ 446	\$ 446	\$ (5,425)	\$ 661	\$ 661	\$ 661	\$ 661	\$ 661	\$ 8,762
Equity	\$ (5,435)	\$ (196)	\$ 54	\$ 304	\$ 6,330	\$ 369	\$ 400	\$ 431	\$ 464	\$ 498	\$ 7,498
Ratios											
Debt Coverage Ratio		0.56	1.12	1.68	1.51	1.56	1.60	1.65	1.70	1.75	24.59
Debt Yield		6.49%	12.97%	19.46%	25.95%	26.73%	27.53%	28.36%	29.21%	30.08%	30.98%
Equity Dividend Rate		-3.61%	0.99%	5.59%	116.47%	6.78%	-7.35%	7.94%	8.54%	9.16%	9.80%
Proof of Value											
Year	Total Property Present Value			Mortgage Component Present Value			Equity Component Present Value				
	Net Income Before D. S.	PV Factor @ 12.35%	Discounted Cash Flow	Net Income Before D. S.	PV Factor @ 6.31%	Discounted Cash Flow	Net Income Before D. S.	PV Factor @ 18%	Discounted Cash Flow		
2020	\$ 250	0.8901	\$ 223	\$ 446	0.9406	\$ 420	\$ (196)	0.8475	\$ (166)		
2021	\$ 500	0.7923	\$ 396	\$ 446	0.8848	\$ 395	\$ 54	0.7182	\$ 39		
2022	\$ 750	0.7052	\$ 529	\$ 446	0.8323	\$ 371	\$ 304	0.6086	\$ 185		
2023	\$ 1,000	0.6277	\$ 628	\$ (5,425)	0.7829	\$ (4,247)	\$ 6,330	0.5158	\$ 3,265		
2024	\$ 1,030	0.5588	\$ 576	\$ 661	0.7364	\$ 487	\$ 369	0.4371	\$ 161		
2025	\$ 1,061	0.4974	\$ 528	\$ 661	0.6927	\$ 458	\$ 400	0.3704	\$ 148		
2026	\$ 1,093	0.4427	\$ 484	\$ 661	0.6516	\$ 431	\$ 431	0.3139	\$ 135		
2027	\$ 1,126	0.3941	\$ 444	\$ 661	0.6129	\$ 405	\$ 464	0.2660	\$ 124		
2028	\$ 1,159	0.3508	\$ 407	\$ 661	0.5766	\$ 381	\$ 498	0.2255	\$ 112		
2029	\$ 16,260	0.3122	\$ 5,077	\$ 8,762	0.5423	\$ 4,752	\$ 7,498	0.1911	\$ 1,433		
			\$ 9,289			\$ 3,854			\$ 5,435		
Refinancing Year Calculations											
Refinancing Year Value	\$ 13,467			Refi Year Net Income to Equity	\$ 554						
New Loan to Value Ratio	70.00%			plus the Gross Refi Proceeds	\$ 5,871						
New Mortgage Amount	\$ 9,427			less the Refinancing Costs	\$ 94						
Rem. Balance on Initial Mortgage	\$ 3,556			Net Income to Equity	\$ 6,330						
Gross Refinancing Proceeds	\$ 5,871										
Less: DS on Initial Mortgage	\$ 446										
Net Mortgage Flow	\$ 5,425										
Reversion Cash Flow Calculations											
Year 10 Net Income of	\$ 1,194			Year 10 mort. Payment of	\$ 661			Year 10 Net Inc. to Equity of	\$ 533		
+ reversion of	\$ 15,066			+ the RMB of	\$ 8,101			+ the equity residual of	\$ 6,965		
	\$ 16,260				\$ 8,762				\$ 7,498		
Reversion Calculations for Proof											
Year 11 Net Income of \$1,230				Net Sales Price	\$ 15,066						

Each section of the Output Tab will be described separately:

The following table is located on the top of the Loan-to-Value Output Tab showing various Valuation Inputs and Valuation Outputs for two points in time: Current Date of Value (2020) and the Date of Refinancing (2023).

Value Based On Currently Available Parameters				Value Based On Refinancing Year Cash Flows			
Valuation Input		Valuation Output		Valuation Input		Valuation Output	
Inflation	3.00%	Value	\$ 7,707,423	Year of Value	2023	Value	\$ 13,466,657
Loan to Value Ratio	50.00%	Value Per Room	\$ 119	Inflation	3.00%	Value Per Room	\$ 207
Amortization	20	Overall Discount Rate	15.10%	Loan to Value Ratio	70.00%	Overall Discount Rate	10.18%
Loan Term	10	Cap Rate - 1st Year NOI	3.24%	Amortization	25	Cap Rate - 1st Year NOI	7.65%
Interest Rate	10.00%	Mortgage @ 50% LTV	\$ 3,853,711	Loan Term	10	Mortgage @ 70% LTV	\$ 9,426,660
Terminal Cap Rate	8.00%	Mortgage Per Room	\$ 59	Interest Rate	5.00%	Mortgage Per Room	\$ 145
Transaction Costs	2.00%	Annual Debt Service	\$ 446,270	Terminal Cap Rate	8.00%	Annual Debt Service	\$ 661,288
Equity Yield	18.00%	Debt Coverage Ratio - Year 1	0.56	Transaction Costs	2.00%	Debt Coverage Ratio - Refi Year	1.56
				Equity Yield	18.00%		

The Valuation Input section on the left side of the table contains initial the mortgage, capitalization rates and yield information that has been previously entered into the model.

The Valuation Output section on the left side of the table contains the results of the initial valuation detailed as follows:

Value: \$7,707,423- the initial value based on the 10-year Net Income projection using the initial mortgage and equity inputs. This represents the value of the property assuming the use of the high cost of capital during the entire 10-year projection period (i.e. no refinancing).

Value Per Room: \$119- value per square foot.

Overall Discount Rate: 15.10%- implied overall discount rate that would result in the same value if used in a discounted cash flow technique.

Cap Rate 1st Year NOI: 3.24%- comes from Year-1 NOI/Value

Mortgage @ 50% LTV: \$3,853,711- amount of the initial mortgage which is 50% of the initial value.

Mortgage Per Room: \$50- per square foot

Annual Debt Service: \$466,270- the debt service based on the size of the mortgage and the debt service constant.

Debt Coverage Ratio- Year 1- .56- the ratio of Net Income/Debt Service for the first year.

The Valuation Input section on the right side of the table contains refinancing data for the mortgage, capitalization rates and yield information that has been previously entered into the model.

The Valuation Output section on the right side of the table contains the results of the refinancing valuation.

Value: \$13,466,657- the value as of the date of refinancing (2023) based on the 10-year Net Income projection starting in 2024 and continuing for 10-years. This Net Income projection goes beyond the initial Net Income projection and, in this example, at this point in time, the Net Income is increasing at the 3% inflation rate. This valuation utilizes the mortgage terms of the refinancing plus the equity yield inputs. This represents the value of the property as of 2023, assuming the use of the lower cost, refinanced mortgage.

Purpose of the Two Valuations

The purpose of performing two valuations- the first valuation, as of the date of value, using the current high cost of capital and the second valuation, as of the date of refinancing, using the less expensive refinanced mortgage terms, is to determine the debt service over the 10-year projection that will be used in calculating the equity return which requires an 18% IRR. Since the loan-to-value ratio for the initial mortgage is 50% and 70% for the refinanced mortgage, the valuations are used to size each of the mortgages and the interest and amortization produces the mortgage constants which calculates the amount of debt service for each mortgage.

Knowing the yearly Net Income and the yearly Debt Service, you can calculate the cash flow to equity. The following table shows the cash flow to the total property, mortgage and equity components during the 10-year projection period.

Cash Flows for IRR Calcs	Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total Property		\$ (9,289)	\$ 250	\$ 500	\$ 750	\$ 1,000	\$ 1,030	\$ 1,061	\$ 1,093	\$ 1,126	\$ 1,159	\$ 16,260
Mortgage		\$ (3,854)	\$ 446	\$ 446	\$ 446	\$ (5,425)	\$ 661	\$ 661	\$ 661	\$ 661	\$ 661	\$ 8,762
Equity		\$ (5,435)	\$ (196)	\$ 54	\$ 304	\$ 6,330	\$ 369	\$ 400	\$ 431	\$ 464	\$ 498	\$ 7,498
Ratios												
Debt Coverage Ratio			0.56	1.12	1.68	1.51	1.56	1.60	1.65	1.70	1.75	24.59
Debt Yield			6.49%	12.97%	19.46%	25.95%	26.73%	27.53%	28.36%	29.21%	30.08%	30.98%
Equity Dividend Rate			-3.61%	0.99%	5.59%	116.47%	6.78%	7.35%	7.94%	8.54%	9.16%	9.80%

The amounts in the column for 2019 shows the value of each component. We already calculated the size of the initial mortgage- \$3,854,000. The \$5,435,000 value of the equity component is determined by a discounted cash flow calculation using the 18% equity yield- which will be shown later. Adding the value of the initial mortgage and the value of the equity component produces the value of the Total Property- \$9,289,000.

The table also shows the net income projection for each year. The debt service for each year which changes in 2023 with the refinancing. Deducting the debt service from the net income produces the cash flow to equity.

The details of the refinancing in 2023 and the sale of the property in 2029 are shown in other tables.

At the bottom of the table is a line of data containing the Debt Coverage Ratio, Debt Yield and the Equity Dividend Rate. These are calculated as follows:

- Debt Coverage Ratio- Net Income/Debt Service
- Debt Yield- Net Income/Amount of the Mortgage
- Equity Dividend Rate- Cash Flow to Equity/Value of Equity Component

Refinancing Calculations

The following table shows the calculations of the mortgage refinancing that takes place in 2023:

Refinancing Year Value	\$13,467,000
New Loan to Value Ratio	70%
New Mortgage Amount	\$9,427,000
Remaining Balance on Initial Mortgage	\$3,556,000
Gross Refinancing Proceeds	\$5,871,000
Less: Debt Service on Initial Mortgage	\$446,000
Net Mortgage Flow	\$5,425,000

The first step is to determine the amount of the New Mortgage which is the Total Property Value as of 2023- \$13,467,000 multiplied by the 70% Loan to Value Ratio producing a New Mortgage amount of \$9,427,000. From this amount the Remaining Mortgage Balance of the Initial Mortgage- \$3,556,000 is deducted leaving Gross Refinancing Proceeds of \$5,871,000. This represents the additional amount the lender is lending to the property owner. The lender also received Debt Service in 2023 of \$446,000 which produces a Net Mortgage Flow from the lender of \$5,425,000. This is the amount on the Mortgage line in the Cash Flow Table for 2023.

The following table shows the calculations of the Net Income to Equity that takes place as of 2023 as a result of the refinancing:

Year 2023- Net Income to Equity	\$554,000
Plus: Gross Refinance Proceeds	\$5,871,000
Less: Refinancing Costs	-\$94,000
Year 2023- Net Income to Equity	\$6,330,000

The Refinance Year Net Income to Equity is the Net Income of \$1,000,000 as of 2023 less the Debt Service of \$446,000 or \$554,000.

The Gross Refinance Proceeds comes from the previous table. The Refinancing Costs is 1% of the new mortgage amount of \$9,427,000 or \$94,000 is deducted leaving Year 2023- Net Income to Equity of \$6,330,000 which is shown on the Equity line in the Cash Flow Table for 2023.

Reversion Calculations

The assumed sale at the end of the 10-year hold is called the Reversion. The sale is calculated by capitalizing the 11th Year's Net Income at the Terminal Capitalization Rate. From the sales proceeds is deducted the Selling Expenses leaving the Net Sales Price. The following table shows this calculation:

Year 11 Net Income	\$1,230,000
Terminal Capitalization Rate	8%
Reversion Sales Price	\$15,373,000
Less: Selling Expenses	\$307,000
Net Sales Price	\$15,066,000
Plus: Year 10 Net Income	\$1,194,000
Total Property Reversion	\$16,260,000

To the Net Sales Price is added Year 10 Net Income of \$1,194,000 producing a Total Property Reversion of \$16,260,000

The Proceeds to the Lender at the Reversion is the Year 10 Debt Service of \$661,000 plus the Remaining Mortgage Balance of \$8,101,000 resulting in an amount of \$8,762,000 going to the Lender.

Year 10 Debt Service	\$661,000
Remaining Mortgage Balance	\$8,101,000
Year 10 Proceeds to Lender	\$8,762,000

The Cash Flow to Equity is calculated as follows:

Net Sale Price	\$15,066,000
Less: Remaining Mortgage Balance	\$8,101,000
Equity Residual	\$6,965,000
Plus: Year 10 Net Income to Equity	\$533,000
Year 10 Cash Flow to Equity	\$7,498,000

The Remaining Mortgage Balance is deducted from the Net Sales Price leaving the Equity Residual. To that amount is added the Year 10 Net Income to Equity producing the Year 10 Cash Flow to Equity of \$7,498,000.

Valuation of the Equity Component and the Total Property

Now that we have the annual Cash Flow to Equity Plus the Equity Residual, we can perform a discounted cash flow using the 18% Equity Yield to Value the Equity Component. The following table shows this DCF calculation:

Equity Component Present Value			
Net Income Before D. S.	PV Factor @ 18%	Discounted Cash Flow	
\$ (196)	0.8475	\$ (166)	
\$ 54	0.7182	\$ 39	
\$ 304	0.6086	\$ 185	
\$ 6,330	0.5158	\$ 3,265	
\$ 369	0.4371	\$ 161	
\$ 400	0.3704	\$ 148	
\$ 431	0.3139	\$ 135	
\$ 464	0.2660	\$ 124	
\$ 498	0.2255	\$ 112	
\$ 7,498	0.1911	\$ 1,433	
		\$ 5,435	

This DCF results in a Value of the Equity Component of \$5,435,000.

To obtain the value of the Total Property, the Value of the Equity Component of \$5,435,000 is added to the Initial Mortgage of \$3,854,000 producing a Total Property Value of: \$9,289,000.

Summary of Values and IRR's

The following table is the summary of the values of each component and the resulting IRR's

LTV Model			
		\$(000)	IRR
Value of the Property	\$	9,289	12.35%
Value of the Mortgage Component	\$	3,854	6.31%
Value of the Equity Component	\$	5,435	18.00%

The Value of the Property as of 2020 assuming the refinancing that takes place in 2023 is \$9,289,000. The IRR is 12.35%. The IRR for the Property is the same as the Overall Discount Rate if you should do a discounted cash flow valuation using an overall rate. The 12.35% is a derived

rate meaning that it was calculated from the results of the mortgage-equity analysis rather than an estimated rate made by an appraiser.

The Value of the Mortgage Component as of 2020 assuming the refinancing that takes place in 2023 is \$3,854,000. The IRR is 6.31%. The 6.31% is the blended interest rate of 10% for Years 2020 to 2023 and 5% from 2024 to 2029.

The following tables are the proofs showing the derived IRR's for the Total Property Value and the Value of the Mortgage Component.

Total Property Present Value				Mortgage Component Present Value			
Year	Net Income Before D. S.	PV Factor @ 12.35%	Discounted Cash Flow	Year	Net Income Before D. S.	PV Factor @ 6.31%	Discounted Cash Flow
2020	\$ 250	0.8901	\$ 223	2020	\$ 446	0.9406	\$ 420
2021	\$ 500	0.7923	\$ 396	2021	\$ 446	0.8848	\$ 395
2022	\$ 750	0.7052	\$ 529	2022	\$ 446	0.8323	\$ 371
2023	\$ 1,000	0.6277	\$ 628	2023	\$ (5,425)	0.7829	\$ (4,247)
2024	\$ 1,030	0.5588	\$ 576	2024	\$ 661	0.7364	\$ 487
2025	\$ 1,061	0.4974	\$ 528	2025	\$ 661	0.6927	\$ 458
2026	\$ 1,093	0.4427	\$ 484	2026	\$ 661	0.6516	\$ 431
2027	\$ 1,126	0.3941	\$ 444	2027	\$ 661	0.6129	\$ 405
2028	\$ 1,159	0.3508	\$ 407	2028	\$ 661	0.5766	\$ 381
2029	\$ 16,260	0.3122	\$ 5,077	2029	\$ 8,762	0.5423	\$ 4,752
			\$ 9,289				\$ 3,854

Metrics

The Output Tab has a Metrics table containing six metrics that can be used to analyze the results of the valuation.

Metrics	
Total Appreciation	65.50%
Annual Appreciation	5.17%
Cash Flow Return	68.38%
Appreciation Return	31.62%
Total Property Yield	12.35%
Stablized Going In Rate	6.76%

The following is a description of each Metrics:

Total Appreciation- The percentage change in property value over the holding period.

It is calculated using the following formula:

$$((\text{Residual Value}/\text{Current Value}) - 1) = \text{Total Appreciation}$$

Annual Appreciation- The average annual compound property value appreciation rate.

It is calculated using the Excel Rate function:

=Rate(Number of Periods,, Current Value, - Sales Price) = Annual Appreciation

Appreciation Return- The proportion of property value attributable to the reversion at the end of the holding period.

It is calculated using the following formula:

$((\text{Net Sales Price}/(1+\text{Unleveraged IRR})^{10})/\text{Current Value}) = \text{Appreciation Return}$

What this formula does is calculate the present value of the expected reversion using the overall property IRR as the discount rate

Cash Flow Return- The proportion of property value attributable to property cash flows over the holding period.

It is calculated using the following formula:

1 - Appreciation Return = Cash Flow Return

Stabilized Going In Cap Rate- The stabilized year's NOI (adjusted for inflation) divided by property value.

It is calculated using the following formula:

$\text{Stabilized Year's Net Income} * (1/(1 + \text{Inflation Rate After Stabilization}) ^ (\text{Number of Years to Stabilization} - 1))/\text{Current Property Value} = \text{Stabilized Going In Cap Rate}$

What the formula does is deflates the Stabilized Year's Net Income to Year #1 at the Inflation Rate After Stabilization to get the Stabilized Year's Net Income in current dollars. This deflated Net Income is divided by the Current Property Value to get the Stabilized Going-In Cap Rate.

Output Tab for the Valuation based on a Debt Coverage Ratio

The information and layout presented in the Output Tab for the Debt Coverage Ratio is the same as the previously described Output Tab for the Loan-to-Value valuation.

The only difference in the use of the Debt Coverage Ratio Output Tab is the following table which proves the inputted Debt Coverage Ratios were actually obtained:

Cash Flows for IRR Calcs	Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total Property	\$	(9,285)	\$ 250	\$ 500	\$ 750	\$ 1,000	\$ 1,030	\$ 1,061	\$ 1,093	\$ 1,126	\$ 1,159	\$ 16,260
Mortgage	\$	(3,810)	\$ 441	\$ 441	\$ 441	\$ (5,496)	\$ 663	\$ 663	\$ 663	\$ 663	\$ 663	\$ 8,786
Equity	\$	(5,475)	\$ (191)	\$ 59	\$ 309	\$ 6,401	\$ 367	\$ 398	\$ 430	\$ 462	\$ 496	\$ 7,474
Ratios												
Debt Coverage Ratio			0.57	1.13	1.70	-0.18	1.55	1.60	1.65	1.70	1.75	1.80
Debt Yield		6.56%	13.12%	19.69%	26.25%	27.04%	27.85%	28.68%	29.54%	30.43%	31.34%	
Equity Dividend Rate		-3.49%	1.07%	5.64%	116.91%	6.70%	7.27%	7.85%	8.45%	9.06%	9.70%	

The Debt Coverage Ratio line on the table above shows that the Debt Coverage Ratios entered in the model- 1.70 in 2022 and 1.60 in 2025 were actually achieved.

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The Math Behind the Mortgage-Equity Technique

For those who want to understand the math behind the Mortgage-Equity Appraisal Technique, the remainder of this Operating and Use Guide will be devoted to explaining how the formulas actually derive the value based on a Discounted Cash Flow Analysis using the Mortgage-Equity Technique. Formulas for the two different loan underwriting criteria will be described:

- **Loan-to-Value Ratio:** Assumes a specific ratio between the size of the loan and the value of the property.
- **Debt Coverage Ratio:** Assumes a specified ratio of Net Income divided by the Debt Service as of a specific projection year.
- **Debt Yield:** Assumes a specified ratio of Net Income divided by the amount of the Mortgage as of a specific projection year.

Mortgage-Equity Technique Using a Loan-to-Value Ratio

The mortgage-equity technique using a loan-to-value ratio calculates the exact amount of debt and equity that the property will be able to support based on the anticipated cash flow derived from the forecast of net income and the return requirements of the mortgage lender (interest) and the equity investor (equity yield) to produce a specified loan-to-value ratio.

Overall, the valuation process is as follows. To solve for the value of the mortgage and equity components, the yearly debt service is deducted from the forecast of net income before debt service; leaving the net income to equity for each year in the forecast. The net income as of Year

11 is capitalized into a reversionary value using the terminal capitalization rate. The equity residual, which is the total reversionary value minus the mortgage balance at that point in time and any broker and legal cost associated with the sale, is discounted to the date of value at the equity yield rate. The net income to equity for each of the forecast years is also discounted. The sum of these discounted values equates to the value of the equity component. Since the equity component represents a specific percentage of the total value (loan-to-value ratio), the value of the mortgage and the total property value can be easily computed.

The process described above can be expressed in an algebraic equation, which set forth the mathematical relationships between known and unknown variables. The symbols used to represent these variables are listed below.

NI	Net income available for debt service
V	Value
M	Loan-to-value ratio
i	Mortgage interest rate
f	Annual debt service constant
n	Number of years in projection period
d _e	Annual cash available to equity
d _r	Residual equity value
b	Brokerage and legal cost percentage
P*	Fraction of loan paid off in projection period
f _p	Annual constant required to amortize the entire loan during the projection period
R _r	Overall terminal capitalization rate applied to net income to calculate total property reversion (sale price at end of the projection period)
1/S _n	Current worth of 1\$ (discount factor) at the equity yield rate

* $P = (f - i) \div (f_p - i)$ where i = the interest rate of the mortgage

Using these symbols, a series of formulas can be derived to express the components making up this mortgage-equity valuation process.

Debt service. To calculate a property's debt service, the appraiser first determines the amount of the mortgage, which is the total property value (V) multiplied by the loan-to-value ratio (M). Then the amount of the mortgage is multiplied by the annual debt service constant (f) using the following formula:

$$f \times M \times V = \text{debt service}$$

Net income to equity (equity dividend). The net income to equity (d_e) is the property's net income before debt service (NI) minus the debt service. The following formula represents net income to equity:

$$NI - (f \times M \times V) = d_e$$

Reversionary value. The value of the property at the end of Year 10 is calculated by dividing the net income in Year 11 before debt service (NI'') by the terminal capitalization rate (R_r). The following formula calculates the property's reversionary value in Year 10:

$$NI''/R_r = \text{reversionary value}$$

Broker and legal costs. When a property is sold, costs associated with the transaction normally include a broker's commission and attorneys' fees. For a commercial property transaction broker and legal costs typically range from 1% to 4% of the sale price. Because these expenses reduce the proceeds to the seller, they are usually deducted from the reversionary value in mortgage-equity technique. Broker and legal costs (b) expressed as a percentage of the reversionary value (NI''/R_r) can be calculated with the following formula:

$$(b (NI''/ R_r)) = \text{broker and legal costs}$$

Ending mortgage balance. The balance of the mortgage at the end of Year 10 must be deducted from the total reversionary value (debt and equity) to isolate the equity residual. A financial formula is used to calculate the fraction of the loan paid off, which is expressed as a percentage of the original loan balance at a particular point in time. The mortgage interest rate (i) is deducted from the annual debt service constant of the loan over the entire amortization period (f) and the result is divided by the annual constant required to amortize the entire loan over the projection period (sub p) minus the mortgage interest rate. The formula is:

$$(f-i) / (fp-i) = P$$

If the fraction of the loan paid off expressed as a percentage of the initial loan balance is P , then the percentage of the loan remaining can be expressed as $1 - P$. Thus, the ending mortgage balance is the fraction of the loan remaining ($1-P$) multiplied by the amount of the initial loan ($M \times V$). The formula is:

$$(1 - P) \times M \times V = \text{ending mortgage balance}$$

Equity residual value. The value of the equity when the property is sold at the end of the projection period (d_r) is the reversionary value minus broker and legal costs and the ending mortgage balance. The following formula represents the equity residual value:

$$(NI''/ R_r) - (b(NI''/ R_r)) - ((1-P) \times M \times V) = d_r$$

Annual cash flow to equity. The annual cash flow to equity consists of the equity dividend for each of the 10 projection years plus the equity residual at the end of Year 10. The following formulas represent the annual cash flow to equity:

$$\begin{aligned} NI^1 - (f \times M \times V) &= d_e^1 \\ NI^2 - (f \times M \times V) &= d_e^2 \dots \\ NI^{10} - (f \times M \times V) &= d_e^{10} \end{aligned}$$

Value of the equity. If the initial amount of the mortgage is calculated by multiplying the loan-to-value ratio (M) by the value of the property (V), then the equity value will be 1 minus the loan-to-value ratio times the property value. The formula is:

$$(1 - M) V$$

Discounting the cash flow to equity to present value. The cash flow to equity for each of the projection years is discounted to present value at the equity yield rate ($1/S^n$). The sum of all these cash flows is the value of the equity $(1-M)V$. The following formula calculates equity as the sum of the discounted cash flows:

$$\begin{aligned} (d_e^1 \times 1/S^1) + (d_e^2 \times 1/S^2) + \dots + (d_e^{10} \times 1/S^{10}) \\ + (d_r \times 1/S^{10}) = (1 - M)V \end{aligned}$$

Combining equations: annual cash flow to equity and cash flow to equity discounted to present value. The final step in the process is to make one, overall equation that shows that the annual cash flow to equity plus the yearly cash flows discounted to present value equal the value of the equity.

$$\begin{aligned} ((NI^1 - (f \times M \times V)) 1/S^1) + ((NI^2 - (f \times M \times V)) 1/S^2) + \dots \\ \dots + ((NI^{10} - (f \times M \times V)) 1/S^{10}) + \\ \dots + (NI''/ R_r) - (b(NI''/ R_r)) - ((1 - P) \times M \times V) 1/S^{10} = (1-M)V \end{aligned}$$

Since the only unknown is the property value (V), this equation is easy to solve.

Example:

Estimate the market value of a commercial property using the Mortgage-Equity Technique Using a Loan-to-Value Ratio.

A 4-year projection of income and expense was made up to the point where the property is expected to stabilize. After that point the Net Income Before Debt Service is projected to grow at 3% per year.

Year	Net Income Available For Debt Service
1	\$1,000
2	\$1,100
3	\$1,300
4	\$1,500
5	\$1,545
6	\$1,591
7	\$1,639
8	\$1,688
9	\$1,739
10	\$1,791

Mortgage

Based on discussions with lenders and mortgage data from the ACLI the following are the mortgage financing assumptions:

Mortgage Interest Rate (i)	7.0%
Loan-to-Value Ratio (M)	75%
Amortization	25 Years
Constant (f)	.084814
Term	10 Years

Terminal Value

Holding Period	10 Years
Terminal Capitalization Rate (R_r)	10%
Broker and Legal Cost (b)	3%

Equity Requirements

Equity Yield	18%
--------------	-----

The Following Calculations Can be Made with the Available Data

Annual Debt Service

$$f \times M \times V = \text{Debt Service}$$

$$.084181 \times .75 \times V = .06361V$$

Percentage of the Loan Paid Off During Holding Period

$$P = (f - i) \div (fp - i)$$

$$\text{Mortgage Constant 25 Year Term: } .08481$$

$$\text{Mortgage Constant 10 Year Term: } .13933$$

$$P = (.08481 - .07000) / (.13933 - 0.07000) = .21367$$

Reversionary Value

$$NI'' / R_r = \text{reversionary value}$$

$$\$1,845 / .10 = \$18,448$$

Broker and Legal Costs

$$(b (NI'' / R_r)) = \text{broker and legal costs}$$

$$(.03(\$1,845 / .10)) = \$553$$

The Following Calculations Require an Algebraic Equation to Solve for Value (V)

Ending Mortgage Balance

$$(1 - P) \times M \times V = \text{ending mortgage balance}$$

$$(1 - .21367) \times .75 \times V = .83975V$$

Equity Residual Value (d_r)

$$(NI'' / R_r) - (b(NI'' / R_r)) - ((1 - P) \times M \times V) = d_r$$

$$\$18,448 - \$553 - ((1 - .21367) \times .75 \times V) = d_r$$

$$\$17,894 - (.78633 \times .75) = d_r$$

$$\$17,894 - 0.5897V = d_r$$

Annual Cash Flow to Equity

$$NI^1 - (f \times M \times V) = d_e^1$$

$$NI^2 - (f \times M \times V) = d_e^2 \dots$$

$$NI^{10} - (f \times M \times V) = d_e^{10}$$

Year

- 1 (\$1,000 - 0.0636 V) = d_e^1
- 2 (\$1,100 - 0.0636 V) = d_e^2
- 3 (\$1,300 - 0.0636 V) = d_e^3
- 4 (\$1,500 - 0.0636 V) = d_e^4
- 5 (\$1,545 - 0.0636 V) = d_e^5
- 6 (\$1,591 - 0.0636 V) = d_e^6
- 7 (\$1,639 - 0.0636 V) = d_e^7
- 8 (\$1,688 - 0.0636 V) = d_e^8
- 9 (\$1,739 - 0.0636 V) = d_e^9
- 10 (\$1,791 - 0.0636 V) = d_e^{10}

Discounting the Cash Flow and Equity Residual to Present Value

	Discount Factors At 18%
<u>Year</u>	<u>Equity Yield</u>
1	0.84746
2	0.71818
3	0.60863
4	0.51579
5	0.43711
6	0.37043
7	0.31393
8	0.26604
9	0.22546
10	0.19106

$$(d_e^1 \times 1/S^1) + (d_e^2 \times 1/S^2) + \dots + (d_e^{10} \times 1/S^{10}) + (d_r \times 1/S^{10}) = (I - M)V$$

Year

1	(	\$1,000 -	0.06361 V)	x	0.84746 +
2	(	\$1,100 -	0.06361 V)	x	0.71818 +
3	(	\$1,300 -	0.06361 V)	x	0.60863 +
4	(	\$1,500 -	0.06361 V)	x	0.51579 +
5	(	\$1,545 -	0.06361 V)	x	0.43711 +
6	(	\$1,591 -	0.06361 V)	x	0.37043 +
7	(	\$1,639 -	0.06361 V)	x	0.31393 +
8	(	\$1,688 -	0.06361 V)	x	0.26604 +
9	(	\$1,739 -	0.06361 V)	x	0.22546 +
10	(	\$1,791 -	0.06361 V)	x	0.19106 +
Residual	(	\$17,894 -	0.5897 V)	x	0.19106 = (1-M)V

Combine Terms

<u>Year</u>	<u>Total</u>	<u>Total</u>
1	\$847 -	0.05391 V
2	\$790 -	0.04568 V
3	\$791 -	0.03872 V
4	\$774 -	0.03281 V
5	\$675 -	0.02780 V
6	\$589 -	0.02356 V
7	\$515 -	0.01997 V
8	\$449 -	0.01692 V
9	\$392 -	0.01434 V
10	\$342 -	0.01215 V
Residual	<u>\$3,419</u> -	<u>0.11267</u> V
	\$9,584 -	0.39854 V = (1-M)V

Solve for Value (V)

$$\begin{aligned}
 \$9,584 - 0.39854 V &= 0.25 V \\
 \$9,584 &= 0.64854 V \\
 V &= \$14,778
 \end{aligned}$$

Proof

To determine whether all assumptions have been met a proof needs to be performed to determine if the value is actually \$14,778. The following is the proof:

Based on a 75% loan-to-value ratio- the amount of the mortgage component is \$11,083 and the 25% equity component is \$3,694 together equates to \$14,778.

10 Yr LTV Model:	0	Value \$(000)	% of Total Value	IRR
Value of the Property		\$ 14,778	100.0%	10.85%
Value of the Mortgage Component		\$ 11,083	75.0%	7.00%
Value of the Equity Component		\$ 3,694	25.0%	18.00%

Using the debt service constant for a 7%, 25-year mortgage of .08481 results in annual debt service of:

$$\$11,083 \times .08481 = \$940 \text{ (Annual Debt Service)}$$

The annual Cash Flow to the Mortgage and Equity is as follows:

Year	1	2	3	4	5	6	7	8	9	10
Total Property	\$ 1,000	\$ 1,100	\$ 1,300	\$ 1,500	\$ 1,545	\$ 1,591	\$ 1,639	\$ 1,688	\$ 1,739	\$ 1,791
Mortgage	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940	\$ 940
Equity	\$ 60	\$ 160	\$ 360	\$ 560	\$ 605	\$ 651	\$ 699	\$ 748	\$ 799	\$ 851

The Equity Residual is calculated as follows:

$$\begin{aligned} \text{Year 11 Cash Flow of } \$1845 \text{ capitalized at } 10\% &= \$18,448 \\ \text{Less: Selling Expenses} & \quad \quad \quad \$553 \\ \text{Equals: Net sales price} & \quad \quad \quad \$17,895 \end{aligned}$$

The Remaining Mortgage Balance

$$\begin{aligned} \text{Amount Paid Off } (1 - .21367) &= 0.78633 \\ \text{Original Mortgage } \$11,083 \times 0.78633 &= \$8,715 \end{aligned}$$

Net Sales Price	\$17,895
Less: Remaining Mortgage Balance	<u>\$8,715</u>
Equity Residual	\$9,180

Mortgage-Equity Appraisal Software

For All Types of Commercial Real Estate

The following table proves that when the Net Income to Equity plus the Equity Residual is discounted to the present value at the 18% Equity Yield Rate, the resulting value of the Equity Component is \$3,694.

Equity Component Present Value			
Year	Net Income to Equity	PV Factor @ 18.0%	Discounted Cash Flow
1	\$ 60	0.8475	\$ 51
2	\$ 160	0.7182	\$ 115
3	\$ 360	0.6086	\$ 219
4	\$ 560	0.5158	\$ 289
5	\$ 605	0.4371	\$ 264
6	\$ 651	0.3704	\$ 241
7	\$ 699	0.3139	\$ 219
8	\$ 748	0.2660	\$ 199
9	\$ 799	0.2255	\$ 180
10	\$ 10,030	0.1911	\$ 1,916
Equity Component Value			\$ 3,694
Year 10 net inc. to equity of			\$ 851
plus the equity residual of			\$ 9,179
			\$ 10,030
Net Sales Price			\$ 17,895
Less: RMB			\$ 8,715
Equals: Equity Residual			\$ 9,179

The following table proves that when the Annual Debt Service plus the Remaining Mortgage Balance is discounted to the present value at the 7% Mortgage Interest Rate the resulting value of the Mortgage Component is \$11,083.

Mortgage Component Present Value			
Year	Mortgage Payment	PV Factor @ 7%	Discounted Cash Flow
1	\$ 940	0.9352	\$ 879
2	\$ 940	0.8746	\$ 822
3	\$ 940	0.8179	\$ 769
4	\$ 940	0.7649	\$ 719
5	\$ 940	0.7153	\$ 672
6	\$ 940	0.6690	\$ 629
7	\$ 940	0.6256	\$ 588
8	\$ 940	0.5851	\$ 550
9	\$ 940	0.5472	\$ 514
10	\$ 9,655	0.5117	\$ 4,941
Mortgage Component Value			\$ 11,083
Year 10 mort. payment of			\$ 940
plus the RMB of			\$ 8,715
			\$ 9,655
The reversion is the remaining mortgage balance (RMB) of the loan at the end of year 10.			

Combining the Value of the Equity Component of \$3,694 with the Value of the Mortgage Component of \$11,083 proves the Total Value of the Property of \$14,778. Furthermore, the Equity Investor and Mortgage Lender both received their desired rate of return confirming the valuation is correct by this Mortgage-Equity Technique.

If the property were appraised using the Property Yield method- the Property Yield would have to be 10.9% to result in the same \$14,778 Total Property Value as shown in the following table which proves the 10.9% Property Yield.

Total Property Present Value			
Year	EBITDA less Repl. Reserve	PV Factor @ 10.9%	Discounted Cash Flow
1	\$ 1,000	0.9021	\$ 902
2	\$ 1,100	0.8138	\$ 895
3	\$ 1,300	0.7341	\$ 954
4	\$ 1,500	0.6623	\$ 993
5	\$ 1,545	0.5974	\$ 923
6	\$ 1,591	0.5390	\$ 858
7	\$ 1,639	0.4862	\$ 797
8	\$ 1,688	0.4386	\$ 740
9	\$ 1,739	0.3957	\$ 688
10	\$ 19,686	0.3569	\$ 7,027
Total Property Value			\$ 14,778
Year 10 Cash Flow of			\$ 1,791
plus reversion of			\$ 17,895
			\$ 19,686
Year 11 Cash Flow of \$1845			
capitalized at 10% equals			\$ 18,448
Less: Selling Expenses			\$ 553
Equals: Net sales price			\$ 17,895

The question is- doesn't the Mortgage-Equity Technique where the 7% Mortgage Interest Rate amounting to 75% of the discount rate have more support than applying a 10.9% Property Yield?

Mortgage-Equity Technique Using a Debt Coverage Ratio

The mortgage-equity technique using a debt coverage ratio calculates the exact amount of debt and equity that the property will be able to support based on the anticipated cash flow derived from the forecast of net income and the return requirements of the mortgage lender (interest) and the equity investor (equity yield) to produce a specified Debt Coverage Ratio as of a specific projection year.

The algebra for the mortgage-equity technique using a debt coverage ratio is simpler than the loan-to-value ratio because the size of the mortgage can immediately be determined. Using the data from the previous example, the following shows how the amount of the mortgage and debt service is calculated.

Assume the mortgage lender wants a Debt Coverage Ratio of 1.3 based on Year 3 projected Net Income which is \$1,300.

The mortgage constant of .08481 is multiplied by the debt coverage ratio of 1.3 producing a mortgage cap rate:

$$.08481 \times 1.3 = .11026$$

The mortgage amount is calculated by dividing the Year 3 projected Net Income by the mortgage cap rate:

$$\$1,300 / .11026 = \$11,791$$

The debt service can then be calculated:

$$\$11,791 \times .08481 = \$1,000$$

Once the mortgage amount and debt service is determined, the net income to equity plus the equity residual can be calculated and discounted to the present value at the equity yield rate and added to the mortgage amount to produce the total property value.

The overall equation for the Mortgage-Equity Technique Using a Debt Coverage Ratio is as follows:

Terms:

Debt Coverage Ratio:	DCR
Year (N) to Achieve the DCR:	DCR ⁿ
Net Income for DCR ⁿ :	NI ^{DCR}
Initial Mortgage Balance:	B ⁰

Initial Mortgage Balance (Value of the Mortgage Component):

$$NI^{DCR} / (f \times DCR) = B^0$$

Mortgage-Equity Technique Using a Debt Coverage Ratio Equation:

$$B^0 + ((NI^1 - (f \times B^0)) / S^1) + ((NI^2 - (f \times B^0)) / S^2) + \dots \\ \dots + ((NI^{10} - (f \times B^0)) / S^{10}) + \\ \dots + (NI'' / R_r) - (b(NI'' / R_r)) - ((1 - P) \times B^0) / S^{10} = V$$

Example

Using all the Projected Net Income Data and the Mortgage and Equity Data from the previous example the property will be valued using the Mortgage-Equity Technique Using a Debt Coverage Ratio rather than the Loan-to-Value Ratio.

Assume the Mortgage Lender is sizing the loan so a debt coverage ratio of 1.3 is achieved in the third year. The projected 3rd year Net Income is \$1,300.

The initial mortgage balance is:

The mortgage constant of .08481 is multiplied by the debt coverage ratio of 1.3 producing a mortgage cap rate:

$$.08481 \times 1.3 = .11026$$

The initial mortgage balance (or the value of the mortgage component) is calculated by dividing the Year 3 projected Net Income by the mortgage cap rate:

$$\$1,300 / .11026 = \$11,791$$

The debt service can then be calculated by multiplying the initial mortgage balance by the mortgage constant:

$$\$11,791 \times .08481 = \$1,000$$

Discounting the Cash Flow and Equity Residual to Present Value

	<u>Net Income</u>	-	Debt <u>Service</u>	=	<u>NI to Equity</u>	x	<u>Equity Yield</u>	=	
1	\$1,000	-	\$1,000	=	\$0	x	0.84746	=	\$0
2	\$1,100	-	\$1,000	=	\$100	x	0.71818	=	\$72
3	\$1,300	-	\$1,000	=	\$300	x	0.60863	=	\$183
4	\$1,500	-	\$1,000	=	\$500	x	0.51579	=	\$258
5	\$1,545	-	\$1,000	=	\$545	x	0.43711	=	\$238
6	\$1,591	-	\$1,000	=	\$591	x	0.37043	=	\$219
7	\$1,639	-	\$1,000	=	\$639	x	0.31393	=	\$201
8	\$1,688	-	\$1,000	=	\$688	x	0.26604	=	\$183
9	\$1,739	-	\$1,000	=	\$739	x	0.22546	=	\$167
10	\$1,791	-	\$1,000	=	\$791	x	0.19106	=	<u>\$151</u>
					Discounted Net Income to Equity				\$1,671

Value of the Reversion $\$1,845 / .10 =$	\$18,448
Less Broker and Legal: $\$18,448 \times .03$	<u>\$553</u>
	\$17,895
Ending Mortgage Balance	
$(1 - .21367) = .78633 \times \$11,791 =$	\$9,271
Equity Residual	<u>\$8,623</u>
Discounted Value of Equity Residual $(\$8,623 \times .19106) =$	\$1,648
Value of Equity Component $(\$1,671 + \$1,648) =$	\$3,319
Original Mortgage Balance	<u>\$11,791</u>
Total Property Value	\$15,109

Proof:

The following table shows the Net Income, Mortgage Debt Service, Equity Dividend. It also verifies the 1.3 Debt Coverage Ratio in Year 3.

Year	1	2	3	4	5	6	7	8	9	10
Total Property	\$ 1,000	\$ 1,100	\$ 1,300	\$ 1,500	\$ 1,545	\$ 1,591	\$ 1,639	\$ 1,688	\$ 1,739	\$ 1,791
Mortgage	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000
Equity	\$ -	\$ 100	\$ 300	\$ 500	\$ 545	\$ 591	\$ 639	\$ 688	\$ 739	\$ 791
Debt Coverage Ratio	1.00	1.10	1.30	1.50	1.55	1.59	1.64	1.69	1.74	1.79

The following table shows the Total Property Value, the value of the Mortgage and Equity Components. Because the size of the mortgage was determined by the debt coverage ratio rather than the loan-to-value ratio the mortgage is 78% of the total property value. The last column shows the mortgage component having a yield of 7% (which is the assumed interest rate) and the equity receiving an 18% equity yield.

10 Yr DCR Model:	0	Value \$(000)	% of Total Value	IRR
Value of the Property		\$ 15,109	100.0%	10.51%
Value of the Mortgage Component		\$ 11,791	78.0%	7.00%
Value of the Equity Component		\$ 3,319	22.0%	18.00%

The following table shows each component receiving the desired rate of return.

Total Property Present Value				Mortgage Component Present Value				Equity Component Present Value			
Year	EBITDA less Repl. Reserve	PV Factor @ 10.51%	Discounted Cash Flow	Year	Mortgage Payment	PV Factor @ 7%	Discounted Cash Flow	Year	Net Income to Equity	PV Factor @ 18.00%	Discounted Cash Flow
1	\$ 1,000	0.9049	\$ 905	1	\$ 1,000	0.9352	\$ 935	1	\$ -	0.8475	\$ -
2	\$ 1,100	0.8188	\$ 901	2	\$ 1,000	0.8746	\$ 875	2	\$ 100	0.7182	\$ 72
3	\$ 1,300	0.7409	\$ 963	3	\$ 1,000	0.8179	\$ 818	3	\$ 300	0.6086	\$ 183
4	\$ 1,500	0.6704	\$ 1,006	4	\$ 1,000	0.7649	\$ 765	4	\$ 500	0.5158	\$ 258
5	\$ 1,545	0.6066	\$ 937	5	\$ 1,000	0.7153	\$ 715	5	\$ 545	0.4371	\$ 238
6	\$ 1,591	0.5489	\$ 874	6	\$ 1,000	0.6690	\$ 669	6	\$ 591	0.3704	\$ 219
7	\$ 1,639	0.4967	\$ 814	7	\$ 1,000	0.6256	\$ 626	7	\$ 639	0.3139	\$ 201
8	\$ 1,688	0.4494	\$ 759	8	\$ 1,000	0.5851	\$ 585	8	\$ 688	0.2660	\$ 183
9	\$ 1,739	0.4067	\$ 707	9	\$ 1,000	0.5472	\$ 547	9	\$ 739	0.2255	\$ 167
10	\$ 19,686	0.3680	\$ 7,244	10	\$ 10,271	0.5117	\$ 5,256	10	\$ 9,414	0.1911	\$ 1,799
Total Property Value			\$ 15,109	Mortgage Component Value			\$ 11,791	Equity Component Value			\$ 3,319
Year 10 Cash Flow of			\$ 1,791	Year 10 mort. payment of			\$ 1,000	Year 10 net inc. to equity of			\$ 791
plus reversion of			\$ 17,895	plus the RMB of			\$ 9,271	plus the equity residual of			\$ 8,623
			\$ 19,686				\$ 10,271				\$ 9,414
Year 11 Cash Flow of \$1845				The reversion is the remaining mortgage				Net Sales Price			\$ 17,895
capitalized at 10% equals			\$ 18,448	balance (RMB) of the loan at the end				Less: RMB			\$ 9,271
Less: Selling Expenses			\$ 553	of year 10.				Equals: Equity Residual			\$ 8,623
Equals: Net sales price			\$ 17,895								

The mortgage-equity technique using a debt coverage ratio is the method which probably best reflects the actions of typical real estate buyers. When a buyer looks at a potential acquisition of a commercial property the size of the mortgage becomes the critical factor. Once a lender provides guidance as to the debt coverage ratio, the buyer can determine how much can be borrowed and apply the mortgage-equity technique using a debt coverage ratio to determine the price that can be paid. The precision of this analysis cannot be matched by applying a discounted cash flow with a property yield.

Mortgage-Equity Technique Using a Debt Yield

The mortgage-equity technique using a debt yield calculates the exact amount of debt and equity that the property will be able to support based on the anticipated cash flow derived from the forecast of net income and the return requirements of the mortgage lender (interest) and the equity investor (equity yield) to produce a specified Debt Yield as of a specific projection year.

The algebra for the mortgage-equity technique using a debt yield is similar to the mortgage-equity technique using a debt coverage ratio because the size of the mortgage can immediately be determined. Using the data from the previous example, the following shows how the amount of the mortgage and debt service is calculated.

Assume the Mortgage Lender is sizing the loan so a debt yield of 11% is achieved in the third year. The projected 3rd year Net Income is \$1,300.

The initial mortgage balance is:

The 3rd year Net Income of \$1,300 divided by the debt yield of 11%:

$$\$1,300 / .11 = \$11,818$$

The debt service can then be calculated by multiplying the initial mortgage balance by the mortgage constant:

$$\$11,818 \times .08481 = \$1,002$$

The remaining mortgage-equity technique calculations are the same as those used with the debt coverage ratio.

Proof

The following table shows the Net Income, Mortgage Debt Service, Equity Dividend. It also verifies the 11% Debt Yield in Year 3.

Total Property	\$ 1,000	\$ 1,100	\$ 1,300	\$ 1,500	\$ 1,545	\$ 1,591	\$ 1,639	\$ 1,688	\$ 1,739	\$ 1,791
Mortgage	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002	\$ 1,002
Equity	\$ (2)	\$ 98	\$ 298	\$ 498	\$ 543	\$ 589	\$ 637	\$ 686	\$ 737	\$ 789
Debt Coverage Ratio	1.00	1.10	1.30	1.50	1.54	1.59	1.64	1.68	1.73	1.91
Debt Yield	8.46%	9.31%	11.00%	12.69%	13.07%	13.47%	13.87%	14.29%	14.71%	15.15%

The following table shows the Total Property Value, the value of the Mortgage and Equity Components. Because the size of the mortgage was determined by the debt yield rather than the loan-to-value ratio the mortgage is 78.2% of the total property value. The last column shows the mortgage component having a yield of 7% (which is the assumed interest rate) and the equity receiving an 18% equity yield.

10 Yr Debt Yield Model:	0	Value \$(000)	% of Total Value	IRR
Value of the Property		\$ 15,122	100.0%	10.50%
Value of the Mortgage Component		\$ 11,818	78.2%	7.00%
Value of the Equity Component		\$ 3,304	21.8%	18.00%

The following table shows each component receiving the desired rate of return.

Total Property Present Value				Mortgage Component Present Value				Equity Component Present Value			
Year	EBITDA less Repl. Reserve	PV Factor @ 10.50%	Discounted Cash Flow	Year	Mortgage Payment	PV Factor @ 6.93%	Discounted Cash Flow	Year	Net Income to Equity	PV Factor @ 18.00%	Discounted Cash Flow
1	\$ 1,000	0.9050	\$ 905	1	\$ 1,002	0.9352	\$ 937	1	\$ (2)	0.8475	\$ (2)
2	\$ 1,100	0.8190	\$ 901	2	\$ 1,002	0.8746	\$ 877	2	\$ 98	0.7182	\$ 70
3	\$ 1,300	0.7411	\$ 963	3	\$ 1,002	0.8179	\$ 820	3	\$ 298	0.6086	\$ 181
4	\$ 1,500	0.6707	\$ 1,006	4	\$ 1,002	0.7649	\$ 767	4	\$ 498	0.5158	\$ 257
5	\$ 1,545	0.6070	\$ 938	5	\$ 1,002	0.7153	\$ 717	5	\$ 543	0.4371	\$ 237
6	\$ 1,591	0.5493	\$ 874	6	\$ 1,002	0.6690	\$ 671	6	\$ 589	0.3704	\$ 218
7	\$ 1,639	0.4971	\$ 815	7	\$ 1,002	0.6256	\$ 627	7	\$ 637	0.3139	\$ 200
8	\$ 1,688	0.4499	\$ 759	8	\$ 1,002	0.5851	\$ 586	8	\$ 686	0.2660	\$ 182
9	\$ 1,739	0.4071	\$ 708	9	\$ 1,002	0.5472	\$ 548	9	\$ 737	0.2255	\$ 166
10	\$ 19,686	0.3684	\$ 7,253	10	\$ 10,295	0.5117	\$ 5,268	10	\$ 9,390	0.1911	\$ 1,794
Total Property Value			\$ 15,122	Mortgage Component Value			\$ 11,818	Equity Component Value			\$ 3,304
Year 10 Cash Flow of			\$ 1,791	Year 10 mort. payment of			\$ 1,002	Year 10 net inc. to equity of			\$ 789
plus reversion of			\$ 17,895	plus the RMB of			\$ 9,293	plus the equity residual of			\$ 8,602
			\$ 19,686				\$ 10,295				\$ 9,390
Year 11 Cash Flow of \$1845 capitalized at 10% equals			\$ 18,448	The reversion is the remaining mortgage balance (RMB) of the loan at the end of year 10.				Net Sales Price			\$ 17,895
Less: Selling Expenses			\$ 553					Less: RMB			\$ 9,293
Equals: Net sales price			\$ 17,895					Equals: Equity Residual			\$ 8,602

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