



Fundamentals of Financial Modeling

October 28, 2014



What is Financial Modeling?

The task of building an abstract representation (a model) of a financial decision making situation.

The process of using a model for financial decision making and analysis.

Both looking back and looking forward



Simple example:

Lemonade Sales

Cost of Ingredients

Gross Profit = Lemonade Sales – Cost of Ingredients

Advertising

Other Operating Expenses

Pretax Income = Gross Profit – Advertising – Other Operating Expenses

Return on Sales = Pretax Income / Lemonade Sales * 100

Assumptions

Accounting Identities

Performance Indicators



A brief History Financial Modeling

First enabled by Computer Timesharing in the 1970s

Financial Modeling languages appear mid-decade

Main users: financial analysts, controllers, CFO's in large companies

Ongoing battle with IT

[My Introduction to Financial Modeling in 1977](#)



My Introduction to Financial Modeling

Comshare – 1977

- Marriott
- First American Bank of Maryland
- Fairchild Industries



Ferox – 1979 - 2002

- Federal Express
- Texaco
- The World Bank



Explosion of usage with the PC Revolution

Visicalc – 1979 – first electronic spreadsheet

RCS – 1980 – first PC based financial modeling language

Lotus 123 – 1982 – took the market by storm

ENCORE! for Windows -1995 – niche market for financial modeling languages

Microsoft Excel – Mac version in 1985, Version 5.0 in 1993 – now the gold standard of spreadsheet software. What most people use for financial modeling today.



The 4 main types of Financial Models

1. Transaction Based Models
2. Discounted Cash Flow Models
3. Financial Statement Models
4. Consolidation Models



1. Transaction Based Models

Beginning Cash = Last period's ending cash

Receipts: tabulated from the transactions

Disbursements: tabulated from the transactions

Ending Cash = Beginning Cash + Receipts – Disbursements

A transaction consists of a date, a description, a type (receipt or disbursement), and an amount.

For example:

1/3/2012; Sale of lemonade to Uncle Joe, Receipt, 0.50

1/3/2012, Sale of lemonade to Aunt Peggy, Receipt, 0.50

1/6/2012, Payment to Mom for lemonade ingredients, Disbursement, 15.00



Transaction Models, cont.

1. Good for short-term detailed cash planning
2. Not practical for forecasting complete financial statements (you'd need to create thousands of debits and credits)



2. Discounted Cash Flow Models

- Used for capital budget and project finance
- Objective is to compute an Internal Rate of Return based on an investment and future cash flows
- Can also express the result as a Net Present Value of the stream of cash flows



Discounted Cash Flow Sample – ENCORE! Language

"Investment"

"Sales"

"Gross Margin %"

"Gross Profit" = "Sales" * "Gross Margin %" / 100.0

"Depreciation"

"Other Operating Expenses"

"Pretax Income" = "Gross Profit" - "Depreciation" - "Other Operating Expenses"

"Income Tax Rate (%)"

"Income Taxes" = "Income Tax Rate (%)" * "Pretax Income" / 100.0

"Income After Tax" = "Pretax Income" - "Income Taxes"

"Net Cash Flow" = "Income After Tax" + "Depreciation" - "Investment"

"NPV @ 8%" = "Net Cash Flow" NPV 8.0

"IRR Params"

"Internal Rate of Return" = "Net Cash Flow" IRR "IRR Params"



Discounted Cash Flow Sample - Excel

	A	B	C	D	E	F	G
		2011	2012	2013	2014	2015	2016
1							
2	Investment	100,000					
3							
4	Sales		20,000	40,000	40,000	40,000	40,000
5	Gross Margin %		60%	60%	60%	60%	60%
6	Gross Profit		12,000	24,000	24,000	24,000	24,000
7	Depreciation		10,000	10,000	10,000	10,000	10,000
8	Other Operating Expenses		2,000	2,000	2,000	2,000	2,000
9	Pretax Income		0	12,000	12,000	12,000	12,000
10							
11	Income Tax Rate (%)		40%	40%	40%	40%	40%
12	Income Taxes		0	4,800	4,800	4,800	4,800
13	Income After Tax		0	7,200	7,200	7,200	7,200
14							
15	Net Cash Flow	(100,000)	10,000	17,200	17,200	17,200	17,200
16							
17	NPV @ 8%	27,402					
18							
19	Internal Rate of Return	13.2%					



3. Financial Statement Models

- Objective is to forecast a complete Income Statement, Balance Sheet, and Cash Flow statement for a startup or a going concern
- Also known as a ***Cash Flow Projection Model***
- If for a going concern, you have to have an accurate starting point



4. Consolidation Models

- Aggregation or analysis of multiple DCF models or multiple financial statement models
- There may be global assumptions that apply to all models
- If there is interaction among models (e.g. Intercompany Sales, Investments in Subsidiaries) it can get really hairy



Financial Statement Model Historical Income Statement

Sales

Cost of Sales

Gross Profit = Sales – Cost of Sales

Gross Profit Margin % = Gross Profit / Sales * 100

Operating Expenses

Operating Income = Gross Profit – Operating Expenses

Other Income (Expense)

Interest Expense

Pretax Income = Operating Income + Other Income (Expense) –
Interest Expense

Income Taxes

Net Income = Pretax Income – Income Taxes

Return on Sales = Net Income / Sales * 100



Financial Statement Model Historical Balance Sheet - Assets

Cash

Accounts Receivable

Inventory

Other Current Assets

Total Current Assets = Cash SUM Other Current Assets

Fixed Assets – Net

Other Assets

Total Assets = Total Current Assets + Fixed Assets – Net + Other Assets



Financial Statement Model Historical Balance Sheet – Liabilities and Equity

Accounts Payable

Credit Line Balance

Other Current Liabilities

Total Current Liabilities = Accounts Payable + Credit Line Balance + Other Current Liabilities

Long Term Debt

Other Liabilities

Total Liabilities = Total Current Liabilities + Long Term Debt + Other Liabilities

Opening Balance Equity

Retained Earnings

Total Equity = Opening Balance Equity + Retained Earnings

Total Liabilities and Equity = Total Liabilities + Total Equity

Current Ratio = Total Current Assets / Total Current Liabilities

Total Debt = Credit Line Balance + Long Term Debt

Debt to Equity Ratio = Total Debt / Total Equity



Historical Financial Statement Model in Excel

	A	B	C	D
1				
2	Historical Income Statement			
3		2010		
4	Sales	29,321		
5	Cost of Sales	10,417		
6	Gross Profit	18,904		
7	Gross Profit Margin %	64.5%		
8	Operating Expenses	8,523		
9	Operating Income	10,381		
10				
11	Other Income (Expense)	415		
12	Interest Expense	0		
13	Pretax Income	10,796		
14				
15	Income Taxes	2,291		
16	Net Income	8,505		
17	Return on Sales	29.0%		
18				
19	Historical Balance Sheet			
20				
21	Cash	34,975		
22	Accounts Receivable	5,261		
23	Inventory	0		
24	Other Current Assets	1,326		
25	Total Current Assets	41,562		



Financial Statement Model Projected Income Statement

Sales

Gross Profit Margin %

$$\text{Gross Profit} = \text{Sales} * \text{Gross Profit Margin \%} / 100$$

$$\text{Cost of Sales} = \text{Sales} - \text{Gross Profit}$$

Operating Expenses

$$\text{Operating Income} = \text{Gross Profit} - \text{Operating Expenses}$$

Other Income (Expense)

Interest Rate %

$$\text{Interest Expense} = \text{Interest Rate \%} * \text{Credit Line Balance} / 100.0$$

$$\text{Pretax Income} = \text{Operating Income} + \text{Other Income (Expense)} - \text{Interest Expense}$$

Income Tax Rate %

$$\text{Income Taxes} = \text{Income Tax Rate \%} * \text{Pretax Income} / 100.0$$

$$\text{Net Income} = \text{Pretax Income} - \text{Income Taxes}$$

$$\text{Return on Sales} = \text{Net Income} / \text{Sales} * 100$$



Financial Statement Model Projected Balance Sheet

- **The balance sheet has to balance: Total Assets must equal Total Liabilities and Equity**
- **Retained Earnings must roll forward based on Net Income from the Income Statement**
- **Working Capital is special**
 - **Accounts Receivable: Days of Sales**
 - **Inventory: Days of Inventory on Hand**
 - **Accounts Payable: Days of Payables**
- **Other projected balances can be input, or calculated based on the expected change from the previous period**
- **Cash is the end result of everything else in the model**



Financial Statement Model Projected Balance Sheet - Assets

Cash – to be calculated last

A/R Days of Sales

Accounts Receivable = A/R Days of Sales * Sales / 365

Days of Inventory on Hand

Inventory = Days of Inventory on Hand * Cost of Sales / 365

Other Current Assets

Total Current Assets = Cash SUM Other Current Assets

Fixed Assets – Net

Other Assets

Total Assets = Total Current Assets + Fixed Assets – Net + Other Assets



Financial Statement Model Projected Balance Sheet – Liabilities and Equity

Days of Payables

Accounts Payable = Days of Payables * Operating Expenses / 365

(Repayments- Credit Line)

Credit Line Balance = Credit Line Balance LAG 1 + (Repayments – Credit Line)

Other Current Liabilities

Total Current Liabilities = Accounts Payable SUM Other Current Liabilities

Long Term Debt

Other Liabilities

Total Liabilities = Total Current Liabilities + Long Term Debt + Other Liabilities

Opening Balance Equity

Retained Earnings = Retained Earnings LAG 1 + Net Income

Total Equity = Opening Balance Equity + Retained Earnings

Total Liabilities and Equity = Total Liabilities + Total Equity



Financial Statement Model Projected Balance Sheet – Final Calculations

1. Plug cash

All Assets except Cash = Accounts Receivable + Inventory + Other Current Assets + Fixed Assets – Net + Other Assets

Cash = Total Liabilities and Equity – All Assets except Cash

2. Recalculate subtotals dependent on cash

Total Current Assets = Cash SUM Other Current Assets

Total Assets = Total Current Assets + Fixed Assets – Net + Other Assets

3. Calculate ratios

Current Ratio = Total Current Assets / Total Current Liabilities

Total Debt = Credit Line Balance + Long Term Debt

Debt to Equity Ratio = Total Debt / Total Equity



Projected Financial Statement Model in Excel

	A	B	C	D	E
1		Calculated cells in orange background			
2	Projected Income Statement				
3		History	Projections		
4			2010	2011	2012
5	Sales	29,321		32,000	2013
6	Cost of Sales	10,417		11,200	
7	Gross Profit	18,904		20,800	
8	Gross Profit Margin %	64.5%		65.0%	
9	Operating Expenses	8,523		10,000	
10	Operating Income	10,381		10,800	
11					
12	Other Income (Expense)	415		500	
13	Interest Rate %			8%	
14	Interest Expense	0		277.2	
15	Pretax Income	10,796		11,023	
16	Income Tax Rate %			40%	
17	Income Taxes	2,291		4,409	
18	Net Income	8,505		6,614	
19	Return on Sales	29.0%		20.7%	
20					
21	Projected Balance Sheet				
22					
23	Cash	34,975			
24	AVR Days of Sales			30	
25	Accounts Receivable	5,261		2,630	