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HALLMARKS OF CREATING A GOOD PROJECT FINANCIAL SPREADSHEET: WHERE DESIGN AND SIMPLICITY GO HAND IN HAND

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The emergence of project finance in developing countries has ignited considerable interest in building financial models to assess the financial viability of proposed infrastructure projects. Because these projects would be financed "off-balance sheet" with little or no recourse to the sponsor's existing assets, estimating the future revenues that will secure financing for a project is of paramount importance. Potential lenders and other investors will rely heavily on financial models to determine whether a project is financially feasible by estimating future cash flows, profitability, and the ability to service debt under different financial structures and under a range of downside assumptions. As a project progresses beyond the initial feasibility stage, a financial model will likely become a focal point for negotiating key aspects of the project financing. An audited version of the model may also become part of the loan agreement in financing a project, with the model used to provide periodic checks of loan cover ratios or other target ratios; missing contractual targets could then trigger certain amendments or constraints moving forward during a project's life.

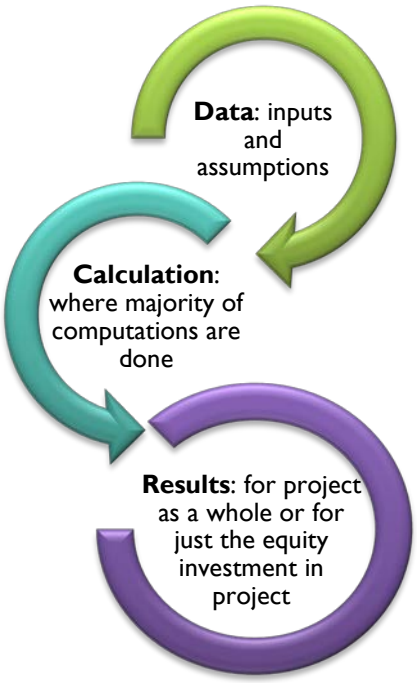
It is not surprising, therefore, that public authorities are placing increased attention on learning to build and use financial models. This paper highlights and discusses some of the important fundamentals of building effective financial models for project financing using Excel spreadsheets. These include an effective design and layout (structure) for the model, simplicity of the model, and building a model with the flexibility and power to conduct sensitivity and scenario analyses.

Dr. Powell holds a B.S. in Chemical Engineering, an M.S. in Economics, and a Ph.D. in Finance from Kent State University. He is also a Chartered Financial Analyst (CFA) charterholder. Prior to joining the faculty of the McColl School of Business at Queens University of Charlotte, he was a member of the faculty at American University and Towson University. Dr. Powell coauthored a textbook in *Financial Management*, and published more than 20 articles in academic and professional journals (including *Financial Management*, *The Financial Review*, *The Journal of Economics and Finance*, *Quarterly Review of Economics and Finance*, *Journal of Applied Finance*, and *Review of Financial Economics*). His research topics include dividend policy, stock repurchases, stock splits, exchange listing, and corporate social responsibility. As a senior associate with The Institute for Public-Private Partnerships (IP3) in Washington, DC, Dr. Powell has an extensive training and consulting record in areas related to project finance, financial modeling, determining rate structures for utilities, economics of regulation, and privatization of state-owned enterprises.

Design and Layout of the Model

Because financial models for project financings are often fairly large and complex, it is important that they are carefully designed and logically structured. As new and often more detailed information for a project will often become available during the feasibility study period, models should be designed in a manner to facilitate updates and modifications. It is not unusual for a financial model that starts out relatively small and simple to grow in both size and complexity over time. To accommodate future revisions and to allow other users to understand the model, some basic best practices should be followed. Agencies that routinely build and use financial models usually adopt these consistent guidelines and structures for all of their models.

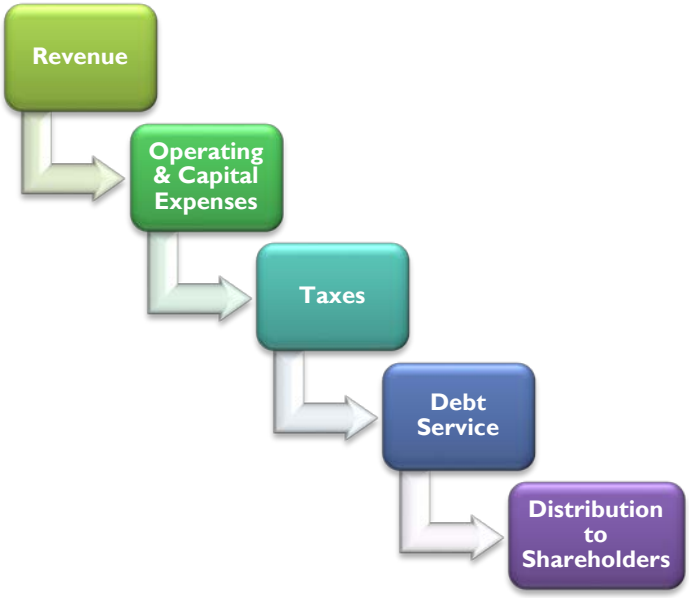
Financial models are often divided into three main areas: data, calculations, and reports. The **data** section is often a single worksheet that includes inputs and assumptions. All inputs used in calculations in a model should be entered on this single data input worksheet and not anywhere else in the model. Identify input numbers in blue font to distinguish them as input variables that can be changed; the model should produce updated output measures, i.e., net present value (NPV) and internal rate of return (IRR), when these inputs are changed. This requires that all formulas in the calculation worksheets refer back to the cell addresses for inputs. No calculations should be performed on the input worksheet; rather, all calculations should be performed on the various calculation worksheets discussed next. All relevant assumptions used in calculations of the model should also be clearly stated on the data worksheet.



The **calculation** worksheets represent the engine of the financial model where a majority of the computations are performed. This section typically includes separate worksheets for capital expenditures (capex), financing, cost of capital, revenues, operating expenses (opex), profit and loss (P&L), balance sheet, and cash flow waterfall. The capex worksheet includes all capital expenditures over the life of the project financing and is used to determine depreciation expenses for the P&L and cash flow worksheets. Interest during construction can be computed on the capex worksheet and added to determine the total project capex. Loan amortizations should be flexible to accommodate different loan amounts, interest rates, and loan term, as well as have the ability to handle "interest only" periods in the early years if relevant. The balance sheet, P&L, and cash flow statements should be integrated and they should balance. Incorporate error checks into the model to ensure that total assets are equal to liabilities plus equity invested in the project each year. Also, provide an error check to ensure that the ending cash on the cash flow waterfall statement is equal to the cash reported on the balance sheet each year. Finally, avoid duplicating the calculations in a model. For example, when total operating expense is computed on the opex worksheet, do not recompute total operating expense again on other (P&L or cash flow) worksheets. Instead, just refer to the relevant cell addresses on the opex sheet.

The final section of a financial model includes the **results** worksheets. A profitability worksheet reports the NPV and IRR for a project. These NPV and IRR measures are typically reported for both the project as a whole and for just the equity investment in the project (equity IRR and equity NPV). A debt cover worksheet details the various coverage ratios associated with the project loans, i.e., debt-service coverage ratio, loan life coverage ratio, or project life coverage ratio, that bankers will carefully scrutinize in their analysis. A sensitivity analyses worksheet will show how profitability measures (NPV or IRR) vary as key input variables (quantity of output, price, input cost, debt-equity ratios, etc.) are varied one at a time, holding all other inputs constant. Scenario analyses can also be conducted, which allow many key input variables to be changed at the same time. While not commonly done, a Monte Carlo simulation can also be performed, but this only makes sense for very large project finance undertakings. Finally, a summary worksheet summarizes key parameters of the project, such as the percent of the project financed by debt, profitability metrics such as NPV and IRR on equity, debt cover ratios, and dividends paid to shareholders over the life of the project.

The heart of a financial model is the cash flow waterfall, which differs from the traditional Statement of Cash Flows reported by corporations. A cash flow waterfall computes and presents the project cash flows from top-to-bottom in terms of their seniority. Revenue appears at the top, followed by operating and capital expenses, taxes, debt service, and lastly distributions to shareholders. The net change in cash for each period is also reported.



Model Simplicity

Simplicity is another important hallmark of good financial modeling. Try to keep your formulas short by breaking them into smaller segments. Equations that get too complex or long can be difficult to edit when troubleshooting the model; they can also be challenging for other users of the model to follow and understand. Carefully label intermediate and final outputs from equations that you obtain in your calculation worksheets. Never introduce new inputs into the calculation worksheets; all inputs for the model should be entered only on the input worksheet. Try to keep a progressive flow of calculations in your worksheet moving from top to bottom and from left to right. Finally, do not confuse brevity with simplicity. Those who are well skilled in algebra can often find creative algebraic ways to simply a long equation and reduce it to a succinct form. However, sometimes these algebraic manipulations leave us with a formula that lacks any intuition or understanding as to what the calculation is accomplishing, and confuses other users of the model.

Conduct Sensitivity and Scenario Analyses

Having the power and flexibility to conduct sensitivity and scenario analyses is another important hallmark of a good financial model. While many of the input variables, i.e., price, level of initial sales, sales growth, inflation, and interest rates are uncertain and can take on different values, only one financial model should be constructed. Avoid the temptation to create different models for various scenarios. Sensitivity analyses can be constructed and graphed showing how an important output variable such as the IRR on equity varies as a function of sales growth or how a debt-service cover ratio varies as the project debt-equity ratio varies. Scenario analyses can also be conducted using the Scenario Manager in Excel; base-case, worst case, and best-case (and other) scenarios can be developed and saved within a single model. This avoids having to edit multiple versions of a model when troubleshooting the model or when situations change and the model must be updated. These sensitivity and scenario risk analyses provide important results that help to minimize errors and lead to more informed decisions by the stakeholders in a project financing.