PharMed

**Sample Only**

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# Reference Guide

Revision 1.0

**1. How the Calculation Works**

The PharMed model relies heavily on user-supplied input data streams that predict the global pharmaceutical market in fourteen main therapeutic areas over a twelve-year span. The global market for drugs in these therapeutic areas drives the need for market research on the part of pharmaceutical companies. The model also relies heavily on the user’s predictions of how effective the sales staff will be as reflected in the user’s estimate of PharMed’s penetration into the medical report market. A complete list of the input and output streams and parameters is listed with short descriptions in section 2 below. The following are the key calculations, including intermediate results, and are described on a worksheet-by-worksheet basis. Note: all italicized words in this section refer to variable names used in the model

On the “Sales” worksheet:

* First, the *PharMed Areas* array is computed. This computation compares the size of the global pharmaceutical market (*Global Market Size*) in each of 14 therapeutic areas to the threshold market size (*Market Size For Product Offering*). The result is essentially a Boolean array, with “1” indicating that the global pharmaceutical market meets the condition for the company to attempt to sell reports on that therapeutic area, and “0” indicating that it does not.
* Next, the *Initialization of PharMed Area* array is computed. This Boolean array displays a “1” for the first year in which the company attempts to sell reports for each therapeutic area. Therapeutic areas that do not meet the threshold requirement for all of the 12 years will not have a “1” appear in any row. The first column of the array is identical to the first column of the *PharMed Areas* array; all other values are computed as a running difference from the previous year, with the exception that the value is never allowed to be negative. (Once the company enters the medical research market in a particular therapeutic area, it is assumed to continue with that market for the remainder of the 12-year model.)
* The *Expected Sales Revenue* array is computed next. This involves a convolution of the estimated *PharMed Market Penetration* stream with the Initialization of *PharMed Area* array, which models how successfully the company sells reports on various therapeutic areas once the threshold requirement is met in the therapeutic areas. The convolution result is multiplied by the estimated size of the medical report market, which itself is estimated as the product of the global pharmaceutical market size (*Global Market Size*) times the percentage of the global market spent on research and development (*Global Market RD Budget*) time the amount of the pharmaceutical industry’s research and development budget reserved for procuring external reports (*RD External Report Budget*).
* Finally, *Total Sales* for the company is computed as the sum of each column of the *Expected Sales Revenue* array. *Total Sales* is also forwarded to the “Income” worksheet for inclusion in the income statement.

On the “EmplAnal” worksheet:

* First, the *Price Per Report* is calculated. The first entry is the base report price (*Base Price Per Report*); all other entries are calculated by multiplying the previous year’s report price by the increase represented by the *Report Price Increase Rate*.
* The total *Number of Reports* the company plans to sell is then computed as the *Total Sales* value divided by the *Price Per Report*. Note: no attempt has been made to ensure this quotient is not a division by zero. This is purposeful: if the *Price Per Report* is set to zero by the user, the number of reports “purchased” by the pharmaceutical industry would approach infinity and immediately bankrupt the company. Thus, an error due to division by zero is a valid warning that the model cannot support such a scenario.
* Next, the *Cumulative Hiring Stream Analysis* is computed. This represents the minimum number of employees needed by the company to support the *Number of Reports* that must be generated. It is computed by dividing the *Number of Reports* by the how many reports can be generated by each employee type (*Annual Number of Reports*) using a matrix multiplication. Note: a check that no division by zero is attempted here is also included in the case that the model is modified in the future in such a way that one or more category of employee is not needed to generate reports.
* Finally, the number of new hires (*New Hires Analysis*) is computed. The first column of *New Hires Analysis* is identical to the first column of the *Cumulative Hiring Stream Analysis*, since the year prior to the model year 1 is assumed to have zero employees; all subsequent columns are computed as the running difference between a column in *Cumulative Hiring Stream Analysis* and the previous column in *Cumulative Hiring Stream Analysis*, with the exception that the *New Hires Analysis* is not allowed to have a negative value. This assumption allows an easy way to estimate the total salary expense requirements of the company using a convolution on the subsequent pages.

On the “CompPlan” worksheet:

* First, the *Acceleration Base* for the annual increase in employee salaries is computed as the product of the previous year’s percentage of base pay increased by *Compensation Acceleration Per Year*. The first entry is initialized at 100%, indicating that employees receive 100% of their base salary in the year that they are hired.
* The *Acceleration Factor* array is then computed as a convolution of the *Acceleration Base* and the *New Hires Analysis* from the previous worksheet. This array represents the percentage of base salaries owed to company employees based on when they were hired and increased for each subsequent year of employment.
* *Salary Expense* is then computed as a matrix multiplication between the *Acceleration Factor* and the *Compensation Base*. *Salary Expense* is also forwarded to the “Income” worksheet for inclusion in the income statement.
* Next, commissions owed to the sales staff are considered. To simplify the calculations, all sales staff are assumed to sell exactly equally; future models may invoke a more sophisticated distribution. The average amount of sales (*Avg Sales Per Salesperson*) is computed as the Total Sales divided by the cumulative number of salespeople (*Cum Salespeople*). A check is made to unsure that the number of sales staff is not zero, as might occur in the beginning years if no reports are sold.
* *Tier A Sales* is computed as the amount of sales for the average salesperson (*Avg Sales Per Salesperson*) if the sales amount is between 0 and the *Tier A Target*. If the *Avg Sales Per Salesperson* exceeds the *Tier A Target*, the *Tier A Sales* is set equal to the *Tier A Target*.
* *Tier B Sales* computes the amount of sales in excess of the *Tier A Target*. If the *Avg Sales Per Salesperson* exceeds the sum of the *Tier A Target* and *Tier B Target*, the *Tier B Sales* is set equal to the *Tier B Target*.
* *Tier C Sales* computes the amount of sales in excess of the sum of the *Tier A Target* and *Tier B Target*. The *Tier A Sales*, *Tier B Sales*, and *Tier C Sales* comprise the *Avg Tiered Sales* array.
* Finally, the total commissions due to the sales representatives (*Commission Expense*) are computed as the number of sales representatives (*Cum Sales People*) times the matrix product of the established commission rates (*Sales Rep Commission Rate*) and the average tiered sales (*Avg Tiered Sales*). *Commission Expense* is also forwarded to the “Income” worksheet for inclusion in the income statement.

On the “SuppAnal” worksheet:

* First, the *Cost Base* for the annual increase in equipment prices is computed as the product of the previous year’s percentage of base price increased by the *Inflation Rate*. The first entry is initialized at 100%, indicating that equipment prices are expected to be 100% of their base price in year 1.
* *Depreciation Profile* is computed by dividing unity into equal fractions over the first *Depreciation Term* years, after which all equipment is considered fully depreciated.
* *Replenish Profile* computes the when equipment must be replaced. The column number of the *Replenish Profile* is compared to the column number of the first column of the *Replenish Profile*; if the difference is zero modulo the *Depreciation Term*, the *Replenish Profile* value is set to 1; otherwise, it is set to zero. The modulus is actually indirectly computed by comparing the value of the division by the *Depreciation Term* to the same value after truncating to an integer value. Some provision is made in case the *Depreciation Term* is set to a non-integer value, although the *Depreciation Term* should not normally be altered by the user.
* The *Replenish Factor* array is computed by convolving the *Replenish Profile* with the new hires (*New Hires Analysis*). This indicates the number of equipment units that must be purchased each year to support the hiring stream and replace old equipment.
* *Equipment Expense* is computed as the matrix product between the *Replenish Factor* and the *Equipment Base* cost per employee type, which is then multiplied by the *Cost Base* to account for inflation. *Equipment Expense* is also forwarded to the “Income” worksheet for inclusion in the income statement.
* *Depreciation Expense* is then computed as a convolution of the *Equipment Expense* with the *Depreciation Profile*. *Depreciation Expense* is also forwarded to the “Income” worksheet for inclusion in the income statement.
* Finally, *Supplies Expense* is computed as the matrix product of the *Supplies Base* and the total number of employees (*Cum Hiring Stream Anal*), which is then multiplied by the *Cost Base* to account for inflation. *Supplies Expense* is also forwarded to the “Income” worksheet for inclusion in the income statement.

On the “Income” worksheet:

* *Sales Revenue*, *Salary Expense*, *Commission Expense*, *Equipment Expense*, *Depreciation Expense*, and *Supplies Expense* are all computed on other worksheets; see above.
* *Benefits Expense* is the product of the *Salary Expense* and the Employee *Overhead Rate*.
* *Honoraria* are computed as the product of the *Number of Reports* and the *Honorarium Per Report*.
* *Total Expenses* are the column sums of the *Expenses* array, which consists of *Salary Expense*, *Commission Expense*, *Benefits Expense*, *Equipment Expense*, *Depreciation Expense*, *Supplies Expense*, and *Honoraria*.
* *Income Before Taxes* is computed as the difference between *Sales Revenue* and *Total Expenses*.
* *Tax Expense* is the product of *Income Before Taxes* and the *Income Tax Rate*. If *Income Before Taxes* is less than zero, *Tax Expense* is set to zero.
* *Net Income* is the difference between *Income Before Taxes* and *Tax Expense*.
* *Profit Margin* is the ratio of *Net Income* to *Sales Revenue*. Provision is made to reflect a zero profit margin if *Sales Revenue* is zero; in such a case, care must be taken when interpreting the results.

**2. How to Locate Inputs, Outputs and Intermediate Results**

In general, inputs and other constants are located on the left worksheets, intermediate calculations are carried out in the middle worksheets, and the outputs are found on the worksheets near the right. The paragraphs below detail where to find the inputs, outputs, and intermediate results.

All inputs to the model are found on two worksheets named “Defs” (short for “Definitions”) and “Inputs.” The parameters on the Defs worksheet were considered constant for the modeling effort, with values estimated by the PharMed creators from their experience in the industry; however, future modeling efforts may require changes in these values to adapt the model for different economic circumstances. The input streams and parameters on the Inputs worksheet were designated for modification by the users of the model to explore different scenarios.

Parameters on the Defs page include:

* *Global Market RD Budget*. This parameter estimates the reinvestment of pharmaceutical companies into research and development efforts as a percentage of gross sales in the global pharmaceutical market. Note: “RD” is short for “R&D,” which is itself short for “research and development.”
* *RD External Report Budget*. This parameter estimates how much each pharmaceutical company reserves for acquiring reports from the medical research market. It is expressed as a percentage of each company’s R&D budget. Note: “RD” is short for “research and development.”
* *Report Price Increase Rate*. This parameter allows for PharMed’s increase in report pricing each year, expressed as a percentage. In most cases, this should be set close to or at the current rate of inflation.
* *Compensation Acceleration Per Year*. This is the expected annual increase in salaries expressed as a percentage. In most cases, this should be set close to or at the current rate of inflation.
* *Employee Overhead Rate*. This rate, expressed as a percentage, represents the cost of employee benefits as a percentage of annual salaries paid. The number is based on the cost of benefits such as health care costs provided to employees and paid by the company.
* *Income Tax Rate*. This is the expected tax rate.
* *Honorarium Per Report*. This represents the expected cost (in year 1) paid to expert panels that supply information to the corporate employees in order to generate the required reports.
* *Inflation Rate*. This is the annual increase in many costs expressed as a percentage. It should be set near or at the current Consumer Price Index (CPI).
* *Depreciation Term*. This parameter represents the term, expressed in years, over which all company-owned equipment is expected to depreciate. The great majority of equipment consists of computer equipment, and the depreciation term should be set based on the expected life of a computer—typically about 3 years.
* *Equipment Base.* This stream represents the expected base costs (in year 1) for a computer and other required equipment for each type of employee (“ProgMgr,” or program manager; epidemiologist; analyst; and salesperson). All values must be expressed in dollars.
* *Supplies Base.* This stream represents the base cost (in year 1) for all annual consumables, such as paper and toner, as well as the average cost for rental space, for each type of employee (“ProgMgr,” or program manager; epidemiologist; analyst; and salesperson). All values must be expressed in dollars.
* *Annual Number of Reports.* This stream represents the projected maximum annual workload for three types of employees: “ProgMgr,” or program manager; epidemiologist; and analyst. The values are expressed as the maximum number of reports on which one person of each type of employee can work.
* *Annual Sales.* This parameter represents the projected maximum annual workload for a single salesperson expressed as the maximum annual sales amount, in millions of dollars.

On the Inputs page, note:

* *Global Market Size.* These 14 independent input streams must be expressed in millions of dollars.
* *PharMed Market Penetration.* This represents the user’s estimate of the company’s success in capturing the medical research market, and must be expressed as a percentage of that market.
* *Compensation Base.* These values must be in dollars.
* *Tier A Target* and *Tier B Target.* These are target threshold levels for the sales staff used to estimate commissions, and must be expressed in dollars.
* *Sales Rep Commission Rate.* This stream, representing sales commissions for sales within the ranges set by the tier targets, must be expressed as a percentage of the salesperson’s annual sales.
* *Market Size for Product Offering.* This threshold, set by the user to indicate the minimum global pharmaceutical market size necessary for the company to enter the medical research market, must be expressed in millions of dollars.
* *Base Price Per Report.* This parameter represents the base price (in year 1) of the company’s product—namely, a report—expressed in dollars.

Output streams and their locations are as follows:

* *Total Sales*. This stream is located on the “Sales” worksheet, expressed in millions of dollars. Note: this stream is also reported on the “Income” worksheet as a line of the income statement, where it is expressed in thousands of dollars and renamed “Sales Revenue” for that page only.
* *New Hires Analysis*. These streams—one for each type of employee—are located on the “EmplAnal” worksheet. This is the hiring schedule. Note: “EmplAnal” is short for “Employee Analysis.”
* *Net Income*. This stream is located on the “Income” worksheet.
* *Profit Margin*. This stream is located on the “Income” worksheet.

Intermediate results and their locations include:

* *PharMed Areas, Initialization of PharMed Area,* and *Expected Sales Revenue* are located on the “Sales” worksheet.
* *Price PerReport, Number of Reports,* and *Cumulative Hiring Stream Analysis* are located on the “EmplAnal” worksheet.
* *Acceleration Base, Acceleration Factor, Avg Tiered Sales,* and *Avg Sales Per Salesperson* are located on the “CompPlan” worksheet*.*
* *Cost Base, Depreciation Profile, Replenish Profile, Replenish Factor, Equipment Expense, Depreciation Expense,* and *Supplies Expense* are located on the “SuppAnal” worksheet*.*
* *Expenses, Honoraria, Income Before Taxes,* and *Tax Expense* are calculated on the “Income” worksheet.

Note also that all named variables and their locations are listed on the “Defs” worksheet for easy reference.

**3. Guide to Visual Cues and Naming Conventions**

A few colors are used as background colors on the worksheets with the following significance:

* *Yellow*. Yellow is used for values that are considered constant for all scenarios. Note: all fixed values are located on the “Defs” worksheet.
* *Light blue.* A light blue background indicates user-modifiable data. All input streams and parameters appear with a light blue background and are all located on the “Inputs” worksheet.
* *Aqua blue.* Aqua blue is used for all output streams.
* *Sage green.* Sage green is used for all values that are (1) not considered output streams but that (2) also appear in the income statement calculation on the “Income” worksheet.

Very few abbreviations are used in an attempt to make the named parameters intuitive. In cases when abbreviations were used, the following conventions hold:

* *RD* is short for “Research and Development.”
* *ProgMgr* is short for “Program Manager.”
* *Rep* is short for “Representative,” and is always used in conjunction with “Sales” (as in “Sales Rep”) to indicate a salesperson.
* *Avg* is short for “Average.”
* *Cum* is short for “Cumulative.”

Finally, the abbreviations used in the naming of the worksheets include:

* *Info* for “Information.”
* *Defs* for “Definitions.”
* *EmplAnal* for “Employee Analysis.”
* *CompPlan* for “Compensation Plan.”
* *SuppAnal* for “Supplies Analysis.”

**4. How to Make Changes**

In general, it is recommended that any additional parameters or streams that are not subject to variation across different scenarios should be added to the “Defs” worksheet, while any new parameters or streams that will vary from scenario to scenario should be added to the “Inputs” worksheet. However, if any of the parameters on the “Defs” page will be considered variable inputs to the scenarios, or alternatively if any of the values on the “Inputs” worksheet are to be considered fixed across all scenarios, it is not recommended to move the values in question to the other worksheet since such an action would require updating the formulae on potentially numerous other worksheets. In such a case, it is recommended that the background color change to reflect the new use of the values in accordance with the established visual cues.

If additional calculations are to be made that involve different or more detailed modeling of processes that affect the company sales, it is recommended that such computations be made on the “Sales” worksheet. Similarly, for modifications to the hiring streams or number of employees needed, such computations should be made on the “EmplAnal” worksheet; modifications to expenses directly related to compensation expenses should be made on the “CompPlan” worksheet; modifications to all other (non-employee related) expenses (such as capital lease computations) should be conducted on the “SuppAnal” worksheet.

The model may be extended to include other standard accounting reports, such as a balance statement worksheet to reflect the company’s position at the end of each of the 12 years, a cash flow worksheet, and a worksheet for a statement of retained earnings. If such an extension is made, an additional worksheet may be necessary to estimate the time delays in receiving cash and paying expenses.