

COMPUSTAT TOOLS  
FOR TRANSFER PRICING ANALYSIS  
DEVELOPED BY THE APA PROGRAM

March 5, 1998

CONTENTS

1.	Introduction and Summary .....	2
2.	Installation .....	5
3.	Running TPTOOL .....	6
4.	Reading the Printout .....	11
5.	Asset Intensity Adjustment Formulas .....	14
6.	Overall Logic .....	16
7.	Year Alignment Calculations .....	21
8.	Interquartile Range Calculations .....	23

APPENDIX A: Report Template

APPENDIX B: Sample Printout of Results

APPENDIX C: Text File of Concept Definitions

## 1. Introduction and Summary

This document describes software tools for transfer pricing analysis developed by the Advance Pricing Agreement (APA) Program within the IRS' Office of Associate Chief Counsel (International).<sup>1</sup> The software runs on PCPlus, a service of Compustat (a subsidiary of Standard & Poors).<sup>2</sup> The software consists of: (1) a PCPlus report named TPTOOL (in file TPTOOL.RPT),<sup>3</sup> and (2) a set of user-defined PCPlus "concepts" (akin to macros in a spreadsheet or word processing program), named TPCONC (in file TPCONC.TXT), which are used by TPTOOL. TPTOOL will compute profit level indicators (PLIs) for a set of comparable firms, both before and after asset intensity adjustments designed to put the comparable firms on the same footing as the taxpayer or tested party. Based on user-supplied information, TPTOOL offers the following capabilities:

- C Handles three different types of case/PLI. The first, called "inbound", is for a tested party that purchases from a related party. It is typically used for foreign-owned U.S. distributors. The PLI used is operating margin (operating profit divided by sales). The second case, called "maquiladora," is used for maquiladoras. The PLI used is operating profit divided by total costs. The third case, called "outbound", is used for a tested party, other than a maquiladora, that sells to a related party. The PLI used is operating profit divided by total costs, as for maquiladoras, but the asset intensity adjustments performed are somewhat different.
- C Calculates PLIs for any 5 consecutive years.
- C Aligns the comparable firms' years so that they always have at least six months' overlap with the tested party's taxable year. (Compustat stated that PCPlus will not do this automatically. The software includes special programming to accomplish this

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<sup>1</sup>The development team was led by Robert Weissler and included Dave Wallenstein, Donna McComber, and Tracy Gomes. The team received assistance from Dwight Toscano, a Computer Specialist with the Office of the Associate Chief Counsel (International); and from Howard Bernheim, the Compustat sales representative. Beta testing is in progress by the APA Program and one or more IRS economists in the field.

If you have questions about the software or documentation, please contact Robert Weissler at telephone 202-917-3216 or 202-874-4360, or at fax 202-874-3990.

<sup>2</sup>The APA Program developed and tested the software on PCPlus version 6.2.

<sup>3</sup>A modified version of TPTOOL, in file TPTOOLQU.RPT, is also provided. See the last bullet below.

alignment.)

- C In calculating asset intensity adjustments, optionally performs an adjustment for “other operating assets,” defined as plant, property, and equipment.
- C In doing asset intensity adjustments, optionally uses either start-of-year or end-of-year financial ratios when the average of both is not available.
- C In computing both unadjusted and adjusted PLIs, corrects for LIFO reserves, and optionally makes certain assumptions when certain LIFO reserve data are unavailable.
- C Computes the weighted average unadjusted and adjusted PLI for the last  $n$  of these years, where  $n$  can be from 1 to 5. Requires that a comparable firm, to be considered to have an available average, must have data available for at least  $m$  of the last  $n$  years, where  $m$  can be from 1 to  $n$ . Ranks the firms by the weighted average unadjusted or adjusted PLI, and prints the firms in rank order.<sup>4</sup>
- C Using the ranking just mentioned, computes the IRS-defined median and interquartile range. (Compustat stated that PCPlus would not compute the IRS-defined interquartile range. The software includes special programming to perform this calculation.) However, this feature causes TPTOOL to start up slowly: Initially calling up the report takes about ten minutes on the APA Program’s PC (a 133 MHz Pentium with 32 megabytes of RAM), although once loaded the report runs without undue delay. To avoid the slow calling up, one can make a modified copy of the report by deleting the last three columns from the report template. The modified report, which does not compute interquartile ranges and medians, takes about one minute to call up on the APA Program’s PC. The modified report has been provided to you in a file called TPTOOLQU.RPT, which stands for “TPTOOL Quick.”

It is hoped that this software, without modification, will be useful and easy to use for transfer pricing analysis. However, the software was written so as to facilitate modification by the user to suit special needs. Possible modifications would be to use different PLIs; to use different formulas for asset intensity adjustments (e.g., to substitute a different definition of “other operating assets”); and to use different algorithms for how to proceed when certain data are unavailable. Some possible modifications are discussed below.<sup>5</sup> (Of course, one should keep an unmodified archival copy of the report and

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<sup>4</sup>One could easily edit TPTOOL to print the companies in another order, such as alphabetically by company name.

<sup>5</sup>Unfortunately, the report cannot be modified to do “data pooling,” in which each year’s observation of each comparable firm is considered separately, and all such observations are put in a

concepts files.)

This document assumes a familiarity with transfer pricing, and in particular with the concepts of asset intensity adjustments and interquartile range. It also assumes familiarity with Compustat's PCPlus. (PCPlus questions can be answered by the user's sales representative or by Compustat's help line at 1-800-523-4534.)

Section 2 describes how to install TPTOOL and TPCONC (in case they are not already installed on the PC you use to run Compustat's PCPlus). Sections 3 and 4 explain respectively how to run TPTOOL and how to interpret the printout from a run. Reading sections 1-4 will be sufficient if you only want to run the software without modification. Section 5 gives the asset intensity adjustment formulas used. Section 6 describes the software's overall logic and explains the meaning of most of the concepts in TPCONC; this section is especially useful if you contemplate modifying the software. Sections 7 and 8 explain in detail the logic behind the year alignment and interquartile range calculations respectively. Read these only if they interest you or if you suspect that these calculations are not being done correctly. Appendices give the TPTOOL report template; a sample printout of results; and a printout of TPCONC, the concepts text file.

The usefulness of this software is somewhat limited by limitations or problems with Compustat's PCPlus software system. First, long waits to call up the report may make it preferable to use a modified version of the report that omits interquartile range calculations (see the last bullet above). Second, slowness and possible other system limitations prevented the APA Program's software development team from including calculations to perform Tukey filters (see section 6(E) below). Third, an apparent limitation in the capacity to import concept definitions makes installing this software more cumbersome (see section 2 below).

Fourth, the APA Program's software development team has demonstrated a system bug in which the same report can be run twice with different answers produced. This bug has been reproduced by our Compustat sales representative on his own PC. The problem has occurred with TPTOOL as well as a much simpler report written and used by the team. This could call into question results from TPTOOL, as well as results from other Compustat reports. Compustat has not yet provided an analysis of this problem. The tentative analysis by the APA Program's software development team is as follows.

So far, the problem has only shown up with reports that have one or more "defined names," which are variables whose value the user enters just before the report is run. The problem occurs when the same report is run twice, with different values for one or more variables. Sometimes the printout of results from the second run incorrectly reflects the values input for the first run. (If one instead runs the

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common pool.

report with the second set of values immediately after starting up the Compustat PCPlus program, one gets the correct answers in the printout.) This error pattern suggests a problem with "memory caching," by which to save time a computer will save values calculated or retrieved to use again when needed, rather than having to calculate or find them again. Memory caching is as common to computers as breathing is to humans, and almost as necessary. However, a computer also needs to realize when an old value is no longer correct, in which case a new value must be calculated or retrieved. The team hypothesizes that the problem at hand arises because the Compustat software in some cases does not realize this.

The reports most typically run by IRS personnel have no "defined names," so perhaps the problem at hand would not affect them. However, the Compustat software does memory caching in some contexts even with reports that have no defined names, so perhaps a memory caching problem could surface then too. The most aggressive approach to preventing the problem from occurring might be to start up Compustat's PCPlus program, run one report once, shut down PCPlus, start up PCPlus again, run one report once, shut down PCPlus, etc.

## 2. **Installation**

To install the tools on your computer (assumed already to be running Compustat's PCPlus), you need a diskette with two files: TPTOOL.RPT, and TPCONC.TXT.

First, import the concepts from TPCONC.TXT as follows. At the PCPlus main menu, choose "File", "Import". In the dialog box, specify "concepts" as the type of item to be imported; specify the file TPCONC.TXT on the appropriate drive; and click on "Import."

Two of the concepts, PLIavg and ADJPLIavg, apparently have definitions that are too long for PCPlus to import correctly. PCPlus generates the following two error messages during the importing process:

(AWEIGHTYA5+ADJPLIYA5-ADJPLIYA5,0),0) - Cannot add a concept that has no formulas.

] +SALE[-10] - Cannot add a concept that has no formula.

PCPlus does import the two concepts mentioned, but truncates their definitions, leaving out the last half line or so of the definitions. You will need first to find the full definitions in Appendix C, and then to edit these two concepts to restore the missing end of the definition. To edit a concept, from the main PCPlus screen, click on "Databases," then on "Concept". Type in the concept name (e.g., PLIavg) on the top line (the line labeled "CONCEPT"), and hit "Enter." The concept's definition will appear. Go to the end of the definition (scrolling if necessary) and add the missing characters. Click the

“Accept” box, and answer that you do wish to overwrite the old definition. It may take a minute for the computer to store the new definition.

If you have any preexisting user-defined concepts with the same names as concepts in TPCONC.TXT, PCPlus will alert you to the problem during the importing process. One approach is to tell PCPlus not to overwrite those concepts; note which ones they are; rename the preexisting concepts; and reimport the concepts from TPCONC.TXT. (The concepts in TPCONC.TXT were given somewhat unusual names in the hope of avoiding such conflicts.)

Next, copy file TPTOOL.RPT (and, if desired, TPTOOLQU.RPT, the modified version that loads more quickly) into the appropriate directory on your hard drive, normally spws\csrpts. The report will then be ready to run just like any other PCPlus report.

It is expected that successive versions of the software will be released. The version number is given in the title line of TPTOOL.RPT, which shows up in the report template and in the printout of results. The concept TPVERSION in file TPCONC.TXT also gives the version number.

### 3. **Running TPTOOL**

Before running TPTOOL, build a set of comparable firms and save the set as a file in PCPlus' default set directory, normally spws\cssets. The filename must have the extension “.set”. Also, compute the tested party's financial ratios called for below.

When you start up TPTOOL, follow the following steps:

- (1) You will be asked to enter companies or a set of companies. Enter the set you have saved, in the following format. If the set is called NAME.SET, type in \$NAME.
- (2) Select the period as follows:
  - (a) Select Absolute Years (not Calendar Years or Relative Years).
  - (b) Choose the year in which the tested party's last fiscal year under consideration ends. For example, if the tested party's last year ends in any month of 1996, choose “Y96”.<sup>6</sup>

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<sup>6</sup>Experienced PCPlus users may notice that this is contrary to normal practice with PCPlus. Normally, when one runs a report using Absolute Years, one would choose the PCPlus-defined “fiscal

(c) Click on “Accept.”

(3) Click on “OK”.

You will then be prompted to enter a series of “defined names,” data that the program uses as input. Entering this data takes a few minutes. If you plan to make similar runs in the future, it is smart to save a copy of the report (give it your own name) after you have entered the data and run the report. When you call the report up in the future, the same data will be there; you will need only to make any changes desired. It is also smart, after running the report, to print the report template itself (in addition to the results discussed in section 4), as a complete record of the data you used.

The defined names include several of the tested party’s financial ratios for the five years involved, which are used to compute asset intensity adjustments to PLIs. The defined names use the convention that a “1” at the end of the name refers to the most recent year, a “2” the previous year, and so on up to “5”. (The concept names discussed in section 6 use the same convention.) However, when referring directly to years, a different convention is used: 0 refers to the most recent year, -4 to the earliest year. The numerators of the ratios are, respectively (1) average accounts payable, (2) average trade accounts receivable, (3) average inventory, and (4) average other operating assets (defined as plant, property, and equipment). The denominators are sales for inbound cases, total costs for maquiladora cases; and cost of goods sold for outbound cases. To compute these ratios, the tested party must be put on a FIFO basis for inventory accounting.<sup>7</sup>

You do not necessarily have to enter the ratios for all five years. For example, if you are interested only in a three-year period, enter the ratios for years 0, -1, and -2. The printout will show that asset-intensity-adjusted PLIs for the other years are unavailable. Or you could enter no ratios at all; while no adjusted PLIs would be computed, the printout would still show unadjusted PLIs.<sup>8</sup>

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year” in which the tested party’s year ends. This departure from normal practice is necessary because the software does its own year alignment calculations, as described in sections 6(C) and 7.

<sup>7</sup>This discussion assumes that you are performing an asset intensity adjustment that adjusts the comparable firms to bring their asset levels equal to those of the tested party. An alternative form of asset intensity adjustment involves adjusting both the tested party and the comparable firms to bring their asset levels to zero. This “zero asset” adjustment is more complex but is considered by some economists to be more accurate in some circumstances. If you wish to do a zero asset adjustment, enter zeroes for all of the financial ratios discussed in the text. (But do not enter zeroes for the interest rates.) You will then need to compute the proper adjustments for the tested party (this software will not do that for you).

<sup>8</sup>One can easily edit TPTOOL to “hide” undesired columns from the printout.

Below is a list of the defined names, with instructions for what to enter. Each defined name has an internal PCPlus name (given in italics), and a prompt that you will see. The defined names are listed in the order in which they will appear, which is alphabetically by the internal name.

***AP1* Acct Pay Ratio Yr 0**  
***AP2* Acct Pay Ratio Yr -1**  
***AP3* Acct Pay Ratio Yr -2**  
***AP4* Acct Pay Ratio Yr -3**  
***AP5* Acct Pay Ratio Yr -4**

Enter the accounts payable ratios discussed above.

***AR1* Acct Rec Ratio Yr 0**  
***AR2* Acct Rec Ratio Yr -1**  
***AR3* Acct Rec Ratio Yr -2**  
***AR4* Acct Rec Ratio Yr -3**  
***AR5* Acct Rec Ratio Yr -4**

Enter the trade accounts receivable ratios discussed above.

***CPSET* set name**

Enter the name of your set of comparable firms. You already entered this on starting up TPTOOL, but an awkwardness in the PCPlus system requires this to be entered again here. Use the same format as before, e.g. \$NAME if the set is called NAME.SET.

***FLGADJTYPE* 1=In, 2=Maq, 3=Out**

Enter a code for the type of case/PLI/adjustment performed. 1 denotes an “inbound” case, 2 a “maquiladora” case, and 3 an “outbound” case, as defined in section 1.

***FLGDOOOA* Adjust OOA?**

To make the asset intensity adjustments include an adjustment for other operating assets (defined as plant, property, and equipment<sup>9</sup>), enter 1; to perform no adjustment for other operating assets, enter 0.

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<sup>9</sup>Other definitions of other operating assets are possible. To use a different definition, one can (1) redefine concept OOA, now defined as PPENT, to use the new definition for the comparable firms, and (2) use the new definition in computing the tested party’s financial ratios.



**FLGFDGDAT            Make certain assumptions when certain financial data ratios are unavailable**

Enter 1 to make the assumption described here; enter 0 to not do so. Normally, for a comparable firm, the average level of accounts payable, accounts receivable, inventory, and other operating assets is computed as the average of the starting and ending values for the year. The assumption in question is that, if only the starting or the ending value is available for a particular year, that value will be used as a proxy for the unavailable average. In such cases, without such an assumption, data for that year needed to perform asset intensity adjustments will be considered unavailable, so no adjusted PLI will be computed.<sup>10</sup>

**FLGFDGLIF            Make certain assumptions when certain LIFO reserve data are unavailable?**

Enter 1 to make certain assumptions, as described, if certain data on LIFO reserves are unavailable; enter 0 to not make these assumptions. (This should only affect companies that do LIFO accounting for inventory. For companies that do FIFO accounting for inventory, the LIFO reserves should all be zero.)

Normally, accountants adjust cost of goods sold (COGS) by subtracting the difference between the year-end LIFO reserve and the year-beginning LIFO reserve. TPTOOL performs this adjustment in computing all PLIs (both with and without asset intensity adjustments). If FLGFDGLIF is set to 1, then if this difference cannot be computed because the data are unavailable, the difference will be assumed to be zero. If FLGFDGLIF is set to 0 and the needed data are not available, no PLI (adjusted or unadjusted) for that year can be computed for that company.<sup>11</sup>

Normally, the software computes the average LIFO reserve for a given year as the average of the year-end LIFO reserve and the year-beginning LIFO reserve. The average LIFO reserve is used to adjust the average inventory level, which is needed to make asset intensity adjustments. If FLGFDGLIF equals 1, then, if this average is not available, then (1) either the year-end or year-beginning figure will be used by itself, if available, and (2) if neither the year-end or year-beginning LIFO reserve is available, then the average LIFO reserve will be assumed to be zero. If FLGFDGLIF is set to 0 and the needed data are not available, asset intensity adjustments cannot be performed for

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<sup>10</sup>The decision logic is embodied in the concepts APAAV, RECTRAV, INVTAV, and OOAAV. One could use different logic by changing the definitions of those concepts. (For example, one might want in some cases to use total accounts receivable if trade accounts receivable is unavailable.)

<sup>11</sup>The decision logic is embodied in the concept LIFRDIF. One could change the logic by redefining this concept.

that year for that company, so no adjusted PLI can be computed.<sup>12</sup>

**FLGRANK Rnk 0=un, 1=adj**

Enter 0 to rank companies by the weighted average unadjusted PLI; enter 1 to rank companies by the weighted average adjusted PLI. Interquartile ranges will be determined for either unadjusted or adjusted PLIs according to this flag.

**INT1 Int Rate, Year 0**

**INT2 Int Rate, Year -1**

**INT3 Int Rate, Year -2**

**INT4 Int Rate, Year -3**

**INT5 Int Rate, Year -4**

Enter the interest rates to be used for the asset intensity adjustments. To be most accurate, the rate should probably correspond to the precise taxable years of the tested party.

**INVT1 Inventory Ratio Yr 0**

**INVT2 Inventory Ratio Yr-1**

**INVT3 Inventory Ratio Yr-2**

**INVT4 Inventory Ratio Yr-3**

**INVT5 Inventory Ratio Yr-4**

Enter the inventory ratios discussed above.

**OOA1 OOA Ratio, Year 0**

**OOA2 OOA Ratio, Year -1**

**OOA3 OOA Ratio, Year -2**

**OOA4 OOA Ratio, Year -3**

**OOA5 OOA Ratio, Year -4**

Enter the other operating assets ratios discussed above.

**TPFYEND TP's fye (1 to 12)**

Enter the number of the month (1 to 12) in which the tested party's fiscal year ends. This information will be used to align the years of the comparable companies to always have at least six

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<sup>12</sup>The decision logic is embodied in concept LIFRAV. To change the logic, one could redefine this concept.

months overlap with the year of the tested party.

If you do not want to do this alignment, there are other options. To make the latest year for all comparable firms end in the same calendar year, enter 6. For example, if you select Y96 on starting up the report and then enter 6 for TPFYEND, the latest year for all comparable firms will end sometime in calendar year 1996. To match Compustat's "fiscal years," enter 12. For example, if you select Y96 on starting up the report and then enter 12 for TPFYEND, the latest year for all comparable firms will end some time during Compustat's "fiscal year" 1996, which is defined as running from June, 1996 through May, 1997.

***YRSAVG*      No. of yrs averaged**

Enter an integer  $n$  from 1 through 5, to compute weighted average PLIs for the latest  $n$  years. The weighted average will be the basis for ranking the companies and computing the interquartile range. To rank the companies and compute the interquartile range based just on the latest year, enter a value of 1 for *YRSAVG*.

***YRSREQ*      Req'd yrs of data**

If you entered  $n$  for *YRSAVG*, then enter here an integer  $m$  from 1 through  $n$ . A comparable firm will be considered to have an available weighted average PLI only if the PLI is available for  $m$  of the last  $n$  years.

**(4)      Reading the Printout**

The printout of results from a run of TPTOOL consists of a one-line title that gives the software version number and date, and a table with company names along the left margin. The table contains two types of data, which could be called "vector" data and "scalar" data. Vector data varies from company to company, while scalar data applies to the report as a whole. Unfortunately, PCPlus requires that even scalar of data take up a whole column of space in the printout. The scalar data printed consists of the values of all of the defined names entered before running the report, except the tested party's financial ratios and the applicable interest rates. (To preserve a record of the ratios and interest rates used, you can print out the report template.)

The report's column headings, from left to right, are listed below. Under each heading, the meaning of that column is described. The formulas evaluated to compute each column can be found in

the report template.<sup>13</sup>

### **Company Name**

The company's name.

### **Ticker**

The abbreviation by which PCPlus identifies the company.

### **compyradj**

(This column is here to facilitate debugging. It prints the value of compyradj, a concept discussed in Section 7. You do not need to worry about it.)

### **TP's End Mo.**

The month in which the tested party's fiscal year ends. (The convention used throughout for months is that 1 denotes January, 2 denotes February, and so on.)

### **End Mo.**

The month in which the comparable company's fiscal year ends.

### **Latest Yr ends in**

Gives the calendar year in which the comparable company's latest fiscal year under consideration ends. This could be different for different companies because of the software's year alignment feature, by which the latest fiscal year for each comparable company has at least six months overlap with the tested party's latest fiscal year under consideration.

### **Case Type**

This column gives the value of the defined name *FLGADJTYPE*. This flag has value 1 for inbound cases, 2 for maquiladora cases, and 3 for outbound cases, as defined in section 1.

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<sup>13</sup>One column in the report is "hidden," meaning that it does not show up on the screen or in the printout. This column, with formula SELAVG and column heading "Selected Wtd. Average," is used to sort the companies for printout.

## **Adjust OOA?**

This column gives the value of the defined name *FLGDOOOA*. A value of 1 means that the asset intensity adjustment will include an adjustment for other operating assets; a value of 0 means that the asset intensity adjustment will not include an adjustment for other operating assets.

## **Project data?**

This column gives the value of the defined name *FLGFDGDAT*. A value of 1 means that certain assumptions will be made if certain data are unavailable concerning a company's accounts payable, trade accounts receivable, inventory, and other operating assets; a value of 0 means that those assumptions will not be made.

## **Project Lifo Res.?**

This column gives the value of the defined name *FLGFDGLIF*. A value of 1 means that certain assumptions will be made if certain data are unavailable concerning a company's LIFO reserves; a value of 0 means that those assumptions will not be made.

Unadj. PLI [-4]

**Adj. PLI [-4]**

Unadj. PLI [-3]

**Adj. PLI [-3]**

Unadj. PLI [-2]

**Adj. PLI [-2]**

Unadj. PLI [-1]

**Adj. PLI [-1]**

Unadj. PLI [0]

**Adj. PLI [0]**

These ten columns give profit level indicators for individual years. Year 0 denotes the latest year under consideration, year -1 the year before that, and so on until -4, which denotes the earliest year. "Unadj." denotes that the profit level indicator is computed without asset intensity adjustments; "Adj." denotes that the profit level indicator is computed with asset intensity adjustments. For ease of reading, the columns for adjusted profit level indicators are printed in bold face.

## **Avg'ing Period**

This column prints the value of the defined name *YRSAVG*, which gives the number of years for which weighted average profit level indicators are computed. (The averaging period's latest year is always the latest of the five years shown in the previous columns. Thus, if less than five years are

averaged, the earlier years get omitted.)

### **Need Years**

This column gives the value of the defined name *YRSREQ*, which gives the minimum number of years in the averaging period for which a profit level indicator must be available, in order for a weighted average profit level indicator to be considered available.

### **Avail. Unadj.**

The number of years during the averaging period for which an unadjusted PLI is available.

### **Avail. Adj.**

The number of years during the averaging period for which an adjusted PLI is available.

### **Rank by Adj.?**

This column gives the value of the defined name *FLGRANK*. The value is 1 if the companies are to be ranked by weighted average adjusted profit level indicators; the value is 0 if the companies are to be ranked by weighted average unadjusted profit level indicators.

### **Rank**

The company's rank. The company with the highest profit level indicator has rank 1.

Wtd. Ave. Unadj. PLI

**Wtd. Ave. Adj. PLI**

These columns give the weighted average unadjusted and adjusted profit level indicators, respectively, for the averaging period.

## **(5) Asset Intensity Adjustment Formulas**

This section describes the formulas used to perform asset intensity adjustments. The formulas are slightly different for the three case types: inbound, maquiladora, and outbound (defined in section 1). The formulas used were selected by APA Program economists; others have at times used somewhat different formulas.

Certain conventions will be used in the formulas below. In the absence of parentheses,

multiplication and division take precedence over addition and subtraction. The symbols TP, TR, TO, and TI denote respectively the tested party's ratios for accounts payable, trade accounts receivable, other operating assets, and inventory. The numerators of the ratios are accounts payable, trade accounts receivable, and so on; the denominators are sales for inbound cases, total costs for maquiladora cases; and cost of goods sold for outbound cases. These ratios are computed after putting the tested party on a LIFO basis for inventory accounting. The symbol I denotes the applicable interest rate. The following symbols are used for comparable firms:

adsale	adjusted sales
adjcogs	adjusted cogs
adjopexpse	adjusted operating expense
sales	sales
ncogs	("new cogs") cost of goods sold, after any needed LIFO adjustment (i.e., subtract year-end LIFO reserve and add year-beginning LIFO reserve)
opexpse	operating expenses
apav	average accounts payable
rectrav	average trade accounts receivable
ninvtav	("new average inventory") average inventory, after needed LIFO adjustment (i.e., add average LIFO reserve)
ooaav	average other operating assets

The inbound formulas are:

PLI: operating margin, defined as  $(adsale - adjcogs - adjopexpse) / adsale$

$$\begin{aligned}
 adsale &= \text{sale} + (TR * \text{sale} - \text{rectrav}) * I / (1 + I) \\
 adjcogs &= \text{ncogs} + (TP * \text{sale} - \text{apav}) * I / (1 + I) - (TI * \text{sale} - \text{ninvtav}) * I \\
 adjopexpse &= \text{opexpse} - (TO * \text{sale} - \text{ooaav}) * I \text{ if other operating assets} \\
 & \quad \text{adjustment is done;} \\
 &= \text{opexpse otherwise}
 \end{aligned}$$

The maquiladora formulas are:

PLI: markup on total costs, defined as  $(adsale - adjcogs - adjopexpse) / (adjcogs + adjopexpse)$

$$\begin{aligned}
 adsale &= \text{sale} + (TR * \text{sale} - \text{rectrav}) * I / (1 + I) \\
 adjcogs &= \text{ncogs} + (TP * (\text{ncogs} + \text{opexpse}) - \text{apav}) * I / (1 + I) - (TI * \text{sale} - \text{ninvtav}) * I
 \end{aligned}$$

$$\begin{aligned} \text{adjopexpse} &= \text{opexpse} - (\text{TO} * \text{sale} - \text{ooaav}) * \text{I} \text{ if other operating assets} \\ &\text{adjustment is done;} \\ &= \text{opexpse} \text{ otherwise} \end{aligned}$$

The outbound formulas are:

PLI: markup on total costs, defined as  
 $(\text{adjsale} - \text{adjcogs} - \text{adjopexpse}) / (\text{adjcogs} + \text{adjopexpse})$

$$\begin{aligned} \text{adjsale} &= \text{sale} + (\text{TR} * \text{ncogs} - \text{rectrav}) * \text{I} / (1 + \text{I}) \\ \text{adjcogs} &= \text{ncogs} + (\text{TP} * \text{ncogs} - \text{apav}) * \text{I} / (1 + \text{I}) - (\text{TI} * \text{ncogs} - \text{ninvtav}) * \text{I} \\ \text{adjopexpse} &= \text{opexpse} - (\text{TO} * \text{ncogs} - \text{ooaav}) * \text{I} \text{ if other operating assets} \\ &\text{adjustment is done;} \\ &= \text{opexpse} \text{ otherwise} \end{aligned}$$

## (6) Overall Logic

TPTOOL uses many user-defined PCPlus concepts, contained in TPCONC. Some of these concepts depend on others, which in turn depend on others, and so on for many “layers”. The definitions also use system-defined concepts and the “defined names” entered at run time. The overall logic of the software (TPTOOL and TPCONC together) can be explained in several topics: building blocks, PLI calculations for individual years, year alignments, weighted averages, and interquartile ranges.

Before discussing these topics, some conventions will be explained. Concepts defined in TPCONC will be written in block capital letters; system-defined concepts will be written in underlined block capital letters; defined names will be written in block capital italics. Many concepts and some defined names come in groups of 5, with the last character of the name varying from 1 to 5. An example, is ACOGSIN1, ACOGSIN2, ACOGSIN3, ACOGSIN4, and ACOGSIN5. For such concepts, 1 denotes the latest year, 2 the previous year, and so on until 5, the earliest year. Such groups will be referred to here as, for example, ACOGSINn.

When the five years examined are referred to directly, another convention is used: 0 is the latest year, -1 the next year, and so on until -4, which denotes the earliest year.

### (A) Building Blocks

Certain concepts are used as general building blocks. These include OOA, APAV, RECTRAV, INVTAV, OOAAV, LIFRAV, and LIFRDIF. These are discussed in section 3, in the discussions of the defined names FLGDOOOA, FLGFDGDAT, and FLGFDGLIF.



Another building block is OPEXPSE, operating expense. This is defined as selling, general, and administrative expenses plus depreciation (XSGA+DP) if available, and otherwise as sales minus cost of goods sold minus operating income after depreciation (SALE-COGS-OIADP).

## (B) **PLI Calculations for Individual Years**

The concepts PLIn and ADJPLIn represent, respectively, the unadjusted and adjusted profit level indicators for individual years.<sup>14</sup> The definitions of these concepts select the appropriate profit level indicator based on the case/adjustment type (the value of *FLGADJTYPE*).

PLIn is defined as UOMINn (unadjusted operating margin, inbound) for case type 1; UMRKMAQn (unadjusted markup, maquiladora) for case type 2; and UMRKOUTn (unadjusted markup, outbound) for case type 3. These concepts in turn are defined in terms of the building blocks listed above, and system-defined concepts.

ADJPLIn is defined as AOMINn (adjusted operating margin, inbound) for case type 1; AMRKMAQn (adjusted markup, maquiladora) for case type 2; and AMRKOUTn (adjusted markup, outbound) for case type 3. These concepts in turn are defined in terms of the building blocks listed above, system-defined concepts, defined names (the tested party's financial ratios, and applicable interest rates), and some other concepts defined in TPCONC. For the inbound case, these other concepts are ASALEINn (adjusted sales), AOEINn (adjusted operating expenses), and ACOGSINn (adjusted cost of goods sold). For the maquiladora case, these concepts are ASALEMAQn (adjusted sales), AOEMAQn (adjusted operating expenses), and ACOGSMAQn (adjusted cost of goods sold). For the outbound case, these concepts are ASALEOUTn (adjusted sales), AOEOUn (adjusted operating expenses), and ACOGSOUTn (adjusted cost of goods sold). The mathematical formulas used for asset intensity adjustments for these three cases are given in section 5 above.

It would be straightforward to add a new case type. One would need to define appropriate unadjusted and adjusted PLIs; edit the definitions of PLIn and ADJPLIn to include this new choice; and make some other changes regarding weighted averages, as discussed in subsection D below.

## (C) **Year Alignment**

As discussed in section 3 (under the defined name *TPFYEND*), the software aligns the years of the comparable companies to overlap at least six months with the years in question of the tested party. To do this, the software computes concept COMPYRADJ (comparable year adjustment), which will

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<sup>14</sup>These concepts by themselves actually would compute the profit level indicators for years that are not always properly aligned to the tested party's fiscal year. As discussed in subsection C below, concepts that build on these concepts accomplish the year alignment.

always have value 0 or -1. If the value is 0, no adjustment is necessary. If the value is -1, the software tells PCPlus to use data one year earlier from what PCPlus would normally choose. The calculation of COMPYRADJ depends on the concept FYRVAL, which gives a company's fiscal year end (a value 1 to 12, depending on the month). FYRVAL is defined in terms of the system concept FYR; if FYR is not available for the most recent year, previous years are checked to find a value. (Section 7 explains in detail the formula used to compute COMPYRADJ.)

The concepts PLIYAn (year-aligned unadjusted profit level indicators) and ADJPLIYAn (year-aligned adjusted profit level indicators) use COMPYRADJ to accomplish this alignment. For example, PLIYA1 is defined to be PLI1 if COMPYRADJ equals 0, but to be PLI1[-1] if COMPYRADJ equals 0. The other nine definitions are analogous. PCPlus propagates the time reference [-1] backward through all calculations that go into defining these concepts, so that from the beginning the calculations will use data from the correct years.<sup>15</sup>

#### (D) **Weighted Averages**

The software computes the weighted unadjusted and adjusted average profit level indicator for each comparable firm, using the latest *n* of the five years examined, where *n* is the value of *YRSAVG*. The concepts representing these weighted averages are PLIAVG and ADJPLIAVG respectively. Only years for which the profit level indicator in question is available are counted in the weighted average. The weighting is by sales for inbound cases, and by total costs (costs of goods sold plus operating expenses) for maquiladora and outbound cases. (For ADJPLIAVG, the weighting is by the *adjusted* sales or total costs.)

The weights used for each year are represented by the concepts UWEIGHTn (weight for unadjusted profit level indicator) and AWEIGHTn (weight for adjusted profit level indicator). The definitions of these concepts in turn select the appropriate quantities depending on the case type. However, UWEIGHTn and AWEIGHTn, by themselves, do not always properly align the comparable firm's year to that of the taxpayer. The proper alignment is computed by the concepts UWEIGHTYAn (year-aligned weight for unadjusted profit level indicator) and AWEIGHTYAn (year-aligned weight for adjusted profit level indicator). As discussed in subsection C above, the adjustment to the PCPlus time reference propagates backward for all calculations.

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<sup>15</sup>One could in principle simplify the structure of the concepts used by instead coding COMPYRADJ directly into time references, e.g. PLIYA1[COMPYRADJ]. However, this approach does not work properly in PCPlus. The software development team documented this issue for Compustat and requested advice, but has not received an explanation of what the problem is and of what approaches will or will not work. Perhaps concepts are not in general able to be used in time references.

The software considers that a weighted average profit level indicator is available only if a profit level indicator is available for at least  $m$  of these  $n$  years, where  $m$  is the value of *YRSREQ*. To apply this test, the software computes *YRSAVAILU*, the number of these  $n$  years for which the unadjusted PLI is available; and *YRSAVAILA*, the number of these  $n$  years for which the adjusted PLI is available. The definitions of *PLIAVG* and *ADJPLIAVG* are written to return “not available” if *YRSAVAILU* and *YRSAVAILA* respectively are less than  $m$ .<sup>16</sup>

Subsection B above mentioned that it would be straightforward to add a new case type. In addition to the steps mentioned there, one would also have to edit the definitions of *AWEIGHTn* and *UWEIGHTn* to give the weighting definitions for the new case type.

### (E) **Ranking and Interquartile Ranges**

The software ranks the comparable companies. If *FLGRANK* is 0, the ranking is by the weighted average unadjusted profit level indicator (*PLIAVG*). If *FLGRANK* equals 1, the ranking is by the weighted average adjusted profit level indicator (*ADJPLIAVG*). The company with rank 1 has the highest weighted average profit level indicator. The firms are printed in rank order, starting with the highest profit level indicator.<sup>17</sup> Companies for which the weighted average profit level indicator in question is unavailable are listed at the end, alphabetically by company name. (It would be easy to edit the report, for example, to instead print all companies in alphabetical order by company name.) The software uses the concept *SELAVG* (selected average), which is defined as *PLIAVG* or *ADJPLIAVG*

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<sup>16</sup>PCPlus does not seem to have a way to automatically return “not available”. The definitions of *PLIAVG* and *ADJPLIAVG* use the formula *SALE[30]+SALE[-10]*, which is designed to return “not available”.

The logic behind the definitions of *PLIAVG* and *ADJPLIAVG* is as follows. First, a test is made whether enough of the years in question have a profit level indicator available. If not, a “not available” is returned as already described. Next, a fraction is formed. The numerator is the sum, for each appropriate year, of the profit level indicator times the weighting used for that year. The denominator is the sum, for each appropriate year, of the weighting used for that year. A year is “appropriate” if (1) it is within the averaging period, and (2) the profit level indicator is available for that year. The contributions for each year are coded so that a year that does not meet these two criteria will contribute zero to both the numerator and denominator. (In the denominator, the addition and subtraction of the profit level indicator, which would seem to be a useless net addition of zero, is designed to return a “not available” if the profit level indicator is not available, to force that year’s contribution to zero.)

<sup>17</sup>The sorting of companies for printout is actually done on the basis of the value a “hidden” column in the report, one that does not show up on the screen or in the printout. This column has formula *SELAVG* (the selected weighted average).

depending on *FLGRANK*.

The software then computes interquartile range and median according to the definition in Treasury Regulation 1.482-1(e)(2)(iii)(C); computes the Tukey range, identifies outliers, and recomputes the interquartile range and median. However, inclusion of these features in TPTOOL causes the report to take about ten minutes to load when first called up. (After that, it does not run particularly slowly.) If one removes the pertinent columns from the report, it will load in about one minute instead. (The columns must be deleted, not merely “hidden”.) An intermediate option is to remove just the three columns that give the recomputed interquartile range and median after the Tukey filter. The report will then load in about three minutes.

The interquartile range calculations are based on the weighted average unadjusted or adjusted PLI, depending on *FLGRANK*. Only companies for which the pertinent weighted average is available are considered. The concepts IQRBOT, IQRMED, and IQRTOP represent the bottom, median, and top, respectively, of the interquartile range. Section 8 describes the logic behind how these concepts are computed.

Some development versions of the software additionally computed the Tukey Range, identified outliers, and recomputed the interquartile range and median with those outliers excluded. However, these features involves such complex calculations that they considerably slowed down the system. (The report took perhaps twenty minutes to load, though it did not run particularly slowly.) As the overall software complexity increased, the complexity of these particular features apparently became too much for PCPlus to handle, at least running on the APA Program’s Pentium computer under Windows NT; attempts to add those features to the report cause the computer to freeze. The pertinent concepts have been kept in TPCONC, but the development team has been unable to do final testing on these features. These concepts are as follows.

The concepts TUKBOT and TUKTOP represent the bottom and top of the Tukey range respectively, defined as follows:

$$\begin{aligned} \text{TUKTOP} &= \text{IQRTOP} + 1.5 * (\text{IQRTOP} - \text{IQRBOT}) \\ \text{TUKBOT} &= \text{IQRBOT} - 1.5 * (\text{IQRTOP} - \text{IQRBOT}) \end{aligned}$$

The concepts IQRBOTNEW, IQRMEDNEW, and IQRTOPNEW represent the interquartile range bottom, median, and top, respectively, after all companies lying outside the Tukey range are eliminated. The definitions of these concepts are the same as for IQRBOT, IQRMED, and IQRTOP, except that instead of performing the calculation on the initial set entered by the user, the calculations are performed on that subset of the initial set that lies within the Tukey range. (Where “CPSET” occurs in the formulas for IQRBOT, IQRMED, and IQRTOP, the formulas for IQRBOTNEW, IQRMEDNEW, and IQRTOPNEW contain instead “@SET(CPSET,@INRANGE(SELAVG,TUKBOT,TUKTOP))”.)

If the computer freezing problems could be resolved, these features could be used by adding six columns at the end of TPTOOL, as follows:

<u>Column Heading</u>	<u>Formula</u>
Tukey Range Bottom	TUKBOT
Tukey Range Top	TUKTOP
In Tukey Range?	@INRANGE(SELAVG,TUKBOT,TUKTOP)
New IQR Bottom	IQRBOTNEW
New Median	IQRMEDNEW
New IQR Top	IQRTOPNEW

## 7. Year Alignment Calculations

The concept COMPYRADJ computes a year adjustment flag, which always has value 0 or -1. The definition in turn uses a defined name, *TPFYEND*, which represent the end month of the tested party's fiscal year (from 1 to 12). The definition of COMPYRADJ is as follows:

$$\text{@IF}((\text{FYRVAL}+6)-12*\text{@INT}((\text{FYRVAL}+6)/12)>\text{TPFYEND},-1,0)$$

This formula says that if the comparable firm's end month plus 6, modulo 12, is greater than the tested party's end month, the flag should be -1; otherwise, the flag should be 0. This definition computes values for COMPYRADJ according to the following pattern:

Comparable  
 company's  
 end month 6 5 4 3 2 1 12 11 10 9 8 7 6

TP's end  
 month 9

12	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
10	-1	0	0	0	0	0	0	0	0	0	0	0	0
9	-1	-1	0	0	0	0	0	0	0	0	0	0	0
8	-1	-1	-1	0	0	0	0	0	0	0	0	0	0
7	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0
6	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0
5	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0
4	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0
3	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0
2	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0
1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0

One can verify, case by case, that this pattern satisfies the following criterion. A comparable company's year selected as the *PCPlus-defined "fiscal year"* ( $y+COMPYRADJ$ ) will always have at least six months overlap with the *fiscal year (as normally defined) of a tested party that ends in calendar year y*. (Recall that PCPLUS defines, for example, fiscal year 96 as any year ending from June, 1996 through May, 1997.) So if, as prescribed in section 3, one runs TPTOOL using Compustat's "Absolute Years" (which are defined as following the PCPLUS-defined "fiscal years"), but specifies the year to be the *calendar year* during which the tested party's last fiscal year (as

ordinarily defined) ends, one will get the desired overlap.<sup>18</sup>

## 8. Interquartile Range Calculations

The concepts IQRBOT, IQRMED, and IQRTOP compute the bottom of the interquartile range, the median, and the top of the interquartile range, respectively. This section provides a proof or explanation that the definitions of these concepts actually accomplish this.

### A. The Core Calculation of IQ Range Boundaries

Suppose that we have a set of  $n$  firms with available data for the profit level indicator desired, ranked 1 through  $n$ , where firm 1 has the highest profit level and firm  $n$  the lowest.

To calculate the interquartile range boundaries, it is useful to consider separately the cases where  $n$  is or is not divisible by 4. The calculation for each case will be put in a somewhat funny form, in order that later the two cases may be handled in the same way.

#### (i) If $n$ is divisible by 4

If  $n$  is divisible by 4, the top of the IQ range will be the average of the values for firms with ranks  $n/4$  and  $(n/4)+1$ . (See reg. 1(e)(2)(iii)(C). Exactly 75 percent of the firms are at or below the value of the firm with rank  $(n/4)+1$ . Example: with 16 firms, exactly 75 percent of the firms are at or below the value of the firm with rank 5.)

Similarly, the bottom of the IQ range will be the average of the values for firms with ranks  $3n/4$  and  $(3n/4)+1$ . (See reg. 1(e)(2)(iii)(C). Exactly 25 percent of the firms are at or below the value of the firm with rank  $(3n/4)+1$ . Example: with 16 firms, exactly 25 percent of the firms are at or below the value of the firm with rank 13.)

Define  $\text{int}(x)$  as the greatest integer that is less than or equal to  $x$ . Since  $n$  is divisible by 4, the following are true:

$$n/4 = \text{int}(n/4) = \text{int}((n-1)/4)+1$$

---

<sup>18</sup>An alternative approach that the development team explored would involve running TPTOOL on Compustat's "Calendar Year" basis. The pattern of adjustments would be less confusing, as would be the formula to compute the adjustment flag. However, the flag would then have three possible values: 1, 0, and -1. Compustat's staff recommended sticking with Compustat-defined fiscal-year-based runs, which Compustat's staff believed were less likely to present PCPlus system problems.

$$(n/4)+1 = \text{int}(n/4)+1$$

$$3n/4 = \text{int}(3n/4) = \text{int}((3n-1)/4)+1$$

$$(3n/4)+1 = \text{int}(3n/4)+1$$

So one could restate the previous two paragraphs as follows. The top of the IQ range will be the average of the values for firms with ranks  $\text{int}((n-1)/4)+1$  and  $\text{int}(n/4)+1$ . The bottom of the IQ range will be the average of the values for firms with ranks  $\text{int}((3n-1)/4)+1$  and  $\text{int}(3n/4)+1$ .

**(ii) If n is not divisible by 4**

If n is not divisible by 4, the top of the IQ range will be the value of the firm with rank  $\text{int}(n/4)+1$ . (See reg. 1(e)(2)(iii)(C). Slightly more than 75 percent of the firms are at or below the firm with rank  $\text{int}(n/4)+1$ . Less than 75 percent of the firms are at or below the firm with rank  $\text{int}(n/4)+2$ . Example: with 15 firms, 12 firms (slightly more than 75 percent) are at or below the firm with rank  $\text{int}(15/4)+1 = 4$ . Less than 75 percent of the firms are at or below the firm with rank 5.)

Similarly, the bottom of the IQ range will be the value of the firm with rank  $\text{int}(3n/4)+1$ . (See reg. 1(e)(2)(iii)(C). Slightly more than 25 percent of the firms are at or below the firm with rank  $\text{int}(3n/4)+1$ . Less than 25 percent of the firms are at or below the firm with rank  $\text{int}(3n/4)+2$ . Example: with 15 firms, 4 firms (slightly more than 25 percent) are at or below the firm with rank  $\text{int}(15*3/4)+1 = 12$ . Less than 25 percent of the firms are at or below the firm with rank 13.)

Since n is not divisible by 4,  $\text{int}(n/4) = \text{int}((n-1)/4)$  and  $\text{int}(3n/4) = \text{int}((3n-1)/4)$ . So one could restate the previous two paragraphs as follows. The top of the IQ range is the average of the values for the firms with rank  $\text{int}(n/4)+1$  or  $\text{int}((n-1)/4)+1$ . (There is only one such firm, since these ranks are the same.) The bottom of the IQ range is the average of the value for the firms with rank  $\text{int}(3n/4)+1$  or  $\text{int}((3n-1)/4)+1$ . (There is only one such firm, since these ranks are the same.)

**(iii) Combining the Two Cases**

The last paragraphs respectively of subsections (i) and (ii) above give the same calculation for the two different cases. To get the top of the IQ range, take the average value of all firms (there will be either one or two such firms) that have either rank  $\text{int}(n/4)+1$  or rank  $\text{int}((n-1)/4)+1$ . To get the bottom of the IQ range, take the average value of all firms (there will be either one or two such firms) that have either rank  $\text{int}(3n/4)+1$  or rank  $\text{int}((3n-1)/4)+1$ .

**B. The Concept Definitions**

The concept definitions are as follows:



### IQRTOP:

```
@cavg(selavg,  
  @set(cpset,@or(  
    @rank(selavg,cpset)=(@int(@ccount(selavg,cpset)/4)+1),  
    @rank(selavg,cpset)=(@int((@ccount(selavg,cpset)-  
      1)/4)+1))))
```

### IORMED:

```
@cmed(selavg,  
  @set(cpset,@isvalue(selavg)=1))
```

### IQRBOT:

```
@cavg(selavg,  
  @set(cpset,@or(  
    @rank(selavg,cpset)=(@int(@ccount(selavg,cpset)*3/4)+1),  
    @rank(selavg,cpset)=(@int((@ccount(selavg,cpset)*3-  
      1)/4)+1))))
```

For the top of the IQ range, the last three lines of the formula specify the ranks described in the last paragraph of subsection A above. The set of firms entered at runtime is called cpset. The value being used for the firms is selavg, the selected weighted average adjusted operating margin. The function @ccount returns the number of elements of cpset for which selavg is available; this function lets the software ignore all elements of cpset for which the data are unavailable. The second line in this formula builds a set consisting of all of the elements of cpset with the ranks specified on the last two lines. The first line of the formula takes the average of the value of selavg for all elements of this set.

For the bottom of the IQ range, the same explanation applies.

For the median, the second line of the formula constructs a set consisting of the elements of cpset for which selavg is available. The first line of the formula takes the median value of selavg for that set. (If one tried to take the median directly from cpset, then if at least half of the elements of cpset did not have selavg available, Compustat's median function @cmed would return the answer as undefined.)