Inforum Software Development in 2013

Ronald Horst[*]

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Abstract

Recent developments to Inforum's software and web site are reported in this summary of work that was completed since the 2012 conference in Florence, Italy. Software development efforts were focused on the improvement of *G7*, with a few changes also made to *Compare* and *IdBuild*. Minor changes and routine updates also have been made to the Inforum web site.

Inforum has developed such specialized software that is well-suited to building and operating macroeconomic and macroeconomic-interindustry models and to developing and managing the associated time-series data. This report describes recent developments to the primary tools employed at Inforum and by other users around the world. In addition, development of the Inforum web site also is reported. The web site provides an important means of distributing economic data, software, and research materials. It often is the means by which research sponsors and other parties first learn about the organization.

This paper is intended to inform experienced users of recent changes. Others might be served best by first reading introductory material. Documentation is provided on the Inforum Software Documentation page; this includes a link to online Help pages. The Tutorial chapter in the Help files is a good place to start. Other chapters, including the User Guide and Reference Manual, also are helpful. To install the software for the first time, Inforum partners either can obtain a copy of the software CD or visit the Inforum SFTP server. Others can visit the Inforum Software Downloads page; select the "PDG" link and follow the instructions on the web page and in the Installation section of the User Guide. Once the software is installed, a set of demonstration routines can be found at C:\PDG\Demo; these same routines may be found on the Inforum Software Demonstrations page. Finally, reports similar to this paper have been presented at Inforum World Conferences each year since 2003. Details for the materials presented in 2010 and 2012 may be found in the bibliography, and materials for other years may be found on the Inforum World Conference pages.

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[*]Ronald Horst: Inforum - University of Maryland, Department of Economics, Tydings Hall, Ronald.Horst@gmail.com. Website: www.Inforum.umd.edu

1 *G7*

G7 is used to construct and analyze data, to estimate econometric equations, and to build large-scale structural econometric models and it displays data and results as text, in graphs, and in spreadsheets. We summarize here some of the most significant changes completed in the past year. See the "G7: New for 2013" page in the Help files for additional details.

Preliminary testing of *G7* under the Windows 8 operating system has shown no problems so far. This testing included use of the new *G7* Help documentation, and all seems to be in order. Note, however, that while older versions of *G7* also work under Windows 8, only the new Help documentation running under the latest version of *G7* can be viewed.

1.0.1 Graphical Interface Improvements

Improvements to the graphical interface have been made in several areas. The first thing that might be noticed is a new *G7* icon and image on the splash, configuration, and About panes. The configuration and About windows were redesigned.

There are several changes to the *G7* menus. First, as before, the *G7* Help files may be launched from the command box, with a button above the command box, from the Help menu, or with a shortcut key. The shortcut to the Help files was changed from *F2* to the standard (and more familiar) *F1*. Second, items have been added to the Help menu in the *G7* main menu to take the user to the online Help files, to the software download page to check for updates, and to the main Inforum web site.

Finally, a series name or algebraic expression may be selected in the editor. By clicking the right mouse button, a menu will appear. By selecting "Graph Series" from the menu, the data for the selected series or the results of the expression may be displayed in a *G7* graph. By selecting "Type Data" from the menu, the data for the series or the results of the expression may be printed in the output window.

1.0.2 Strings and Scripts

Strings, keywords, and a new set of scripting functions were introduced several years ago. Since then, this list of features has grown steadily and the tools have become more powerful and more reliable. New keywords and functions recently have been added and others have been improved.

The "listnames" command prints a list of series names that are contained in a specified database. A new option, "-l <root>", has been added to store the series names as strings, where the string names are "<root><integer>" and the string definitions are the series names. These strings then can be employed in a variety of ways within a script, often within a *do* loop that iterates over a set of integers that easily are mapped to the string names. Another function was defined to provide the number of series that are stored within a given

database, and often these two routines are used together. The new script function "%nseries(<bank_letter)" returns the number of series in the database that is loaded at the given position.

Integers often are passed to an add file or function, and integers are used as indexes for a do loop. Sometimes a simple calculation is needed that is based on these integer. The "%{}" operation allows such calculations. Numerical variables and constants may be referenced within the brackets. Addition, subtraction, multiplication, and division of variables and constants is permitted, and sub-calculations may be surrounded by parentheses. In the past, the evaluation of these equations was very crude and did not conform to standard rules of arithmetic (but instead the terms of the expression were processed in order from left to right). The routine was redesigned to evaluate properly, and in correct order, parentheses, multiplication, division, addition, and subtraction. Other keywords and scripting functions may be incorporated within the expression, and recursion is supported.

The "%exists(<series_name>)" function was added to return 1 (0) when a series is found (not found). A bank letter may be prepended to the series name. The "exists(<series_name>)" routine that previously was provided for the "if()" command now is deprecated. A similar routine was added to report the existence of a string name. The "%sexists(<series_name>)" will return 1 (0) when a string is found (not found) among the set of strings that have been defined.

G7 can read data from Excel spreadsheets, and *G7* also can modify or create new spreadsheet documents and fill them with data, formulas, and graphs. The reading techniques provide key tools for the development of databases for the EconData repository on the web site and to support model development. Extensions and revisions to these tools in the past year have been modest, but work continues to polish the routines and to expand their capabilities. The command to name a spreadsheet within a workbook now optionally returns the existing worksheet name, where earlier versions required a name to be specified and applied. If a name is not given, then the existing worksheet name will be read and can be recovered in the script with the "%xls" keyword. The "%xlcol(<arg>)" function was modified to accept either a column number and will return the equivalent spreadsheet column letters or it will accept column letters and will return the corresponding column number.

1.0.3   Numerical Routines

Several numerical routines have been added to the set of *G7* algebraic functions (@-commands) and scripting functions (%-commands). The "@sign(<x>)" function, where "x" is a series or expression, will return ± 1 depending on whether the expression is non-negative or negative. This function will operate over multiple periods for a specified time series or equation.

Scripting functions operate on a scalar value. The "%fabs(<x>)", "%log-(<x>)", and "%exp(<x>)" functions return the absolute value, logarithm, and exponential value of the given number. Note that the routine does not read and

operate on values stored in a database (though this could be done by incorporating the "%getval()" function), but instead the routines operate on a value specified in the script. Note also that calculated values easily could be stored in a database by incorporating them on the right-hand side of an "f" or other *G7* command.

G7 offers a variety of routines to scale collections of variables and to balance matrices. The family of matrix-balancing routines are known as "ras" commands, as they are variations of the familiar RAS routine. A new option now specifies the tolerance to be used by the chosen "ras" commands. Note that the beta versions of *G7* contain significant revisions to the scaling and matrix balancing routines; brief details were recorded the in the spring and fall of 2012 and may be found in the log file on Inforum web site, and additional details of this work will be published.

A check was added to the chain-weighting routines to ensure that the frequency of the specified base date matches that of the current "fdates."

1.0.4 Miscellaneous Improvements

A significant (but still little-tested) addition is the "wsreset [<path>]" command. This allows the workspace to be cleared and a new workspace established with new parameters and possibly in a new location. If "g.cfg" is included with the optionally-specified path, then *G7* automatically will attempt to open and read the file; otherwise, the familiar configuration window will prompt the user to find or specify the workspace settings in the desired directory. Note that the existing workspace may be destroyed when this routine is employed, but existing data first may be preserved by copying the workspace banks or by printing the data as text.

The "linkseries" (ls) command now reports an error when the series to be extended cannot be found; in the past, a new series was created from the mover series and the new series was added to the workspace. The "save" command now accepts "update" as a legal option; previously this was the default value, but it could not be specified manually. The maximum number of sectors that may be employed in the "resector" (rs) commands was increased from 600 to 1,500. Several internal codes were respecified to allow use of character sets with 8-bit extended ASCII representations. Several sanity checks were added to examine the dates that are specified in the *G7* Configuration window, but though additional checks are needed to ensure validity of every setting in the g.cfg file.

Various group routines and @-functions were revised to improve the internal handling of the user's script. In the past, even though *G7* properly processed and executed these segments of the user's script, certain portions of text that should have been preserved after initial operations were complete often became garbled or lost and could not be used in subsequent operations. This caused trouble for the printing of equations by the regression commands, the saving of equations by the "save" command, and the display of titles for the "(<equation>)" shortcut in the "graph" command.

In addition to these improvements, a number of problems were corrected. Some of these are described in the remainder of this section, and additional corrections are listed in the log files.

The "listnames" commands were revised to prevent overflow or run-on words when printing long series names. An attempt was made to fix other problems with "listnames" command. In particular, when a Vam bank and an associated G bank were open, the "listnames" routine would not properly process names in the associated G bank. A problem was corrected that caused incorrect date alignment between Vam banks and packed matrix files.

In recent years, several significant problems have been corrected in the "show" command, where the "show" command displays a spreadsheet of vector or matrix data. The routine now will force destruction of the existing "show" window before a new one may be created. This finally should fix most of the persistent bugs that have plagued this feature of *G7*. When multiple lines were selected in the *G7* Editor and the "Type Series" command was chosen from the pop-up menu, *G7* immediately would crash; this has been fixed. The routines that save changes to the values that were displayed in the "show" window also have been improved, though unfortunately some problems remain when saving these changes.

The "+=" operators in "f" and "vf" commands now will handle properly missing values, so that missing values that appear on either side of an expression will be preserved in the result. In previous versions, the "f" command could not reliably process the command "`f x{2008-%fdates2} = y`" because of improper treatment of the "%fdates2" keyword, but this limitation has been removed.

The operation of the "function" command, a command that allows users to define functions so that a series of operations can be executed upon command and that employ a set of specified variables, has been made more reliable. In the past, existing argument lists (e.g. arguments that were specified for an "add" file that contained an instance of the "function" command) sometimes got lost after the argument list for the user-defined function was specified, and so subsequent attempts to restore the original list would fail. This problem has been fixed.

A variety of bug fixes and other improvements are listed in the "*G7*: New for 2013" page of the Help files. Notes with some additional information are available in the logs on the Downloads page of the Inforum web site. The current version of *G7* may be found on the conference CD and on the Inforum web site. Full documentation may be found in the same locations. The current version of *G7* is 7.386.

2 *Compare*

The Compare program is a general table making program that can be used to create tables from various data sources that are compiled in Inforum database formats. As the name suggests, it particularly is suited to comparing results of several databases, but it also can list the contents of a single database or the

results of a single run of a model. The results are written to a file that can be printed, viewed as text, viewed in a spreadsheet program, or read by other software programs.

Recent corrections and improvements include the incorporation of developments to the *G7* chain-weighting algorithms, and the result of dividing zero by zero or zero by nonzero values now is zero instead of a missing value. Improvements were made to the screen format. Many printer-control command options were added. In the past, these codes could be incorporated in a *Compare* script by using the $\backslash pc$ command, a guide to printer codes, and a good text editor, but now these codes have been assigned names to allow easier use, and details are included in the software documentation. Of the dozens of codes that now are offered, a few examples are controls for duplex printing, page sizes, printer tray selection, and a variety of font controls. In addition, instructions are provided (see the Help files or the Inforum web site) for the use of third-party software that allows these printer-format files to be sent easily to a printer. The current *Compare* version number is 6.594.

3   *IdBuild*

A number of minor improvements and corrections are available for *IdBuild*. *IdBuild* translates the identity and regression equations created by *G7* into C++ code, builds a bank of all the scalar variables, and writes several files of C++ code for use in the simulation program.

Bug fixes include the plugging of memory leaks, avoidance of divide-by-zero problems, and correction of problems that appeared with groups of sector numbers. Minor improvements include the increase of buffer sizes for the storage of bank paths and names, and paths and names now may be surrounded by quotes. Byte alignment was corrected to ensure consistency with other Inforum software, though this may have few implications for *IdBuild*. Data arrays now are initialized to zero to eliminate trouble in *G7* when garbage was stored in outlying and unused portions of data series. Improvements that were made to the older version of *IdBuild* (for building non-optimizing models) were incorporated in the latest version of *IdBuild* for optimizing models. Finally, screen formatting was improved to provide a more pleasing display. The current *IdBuild* version number is 6.115.

4   Software Documentation

In 2012, an extensive collection of Inforum software documentation was converted for use with a new documentation system. This work included material for *G7*, *Compare*, *Build*, *IdBuild*, *Fixer*, *MacFixer*, and *Banker*. The documentation is presented in three forms. First is a document in book layout that is stored in the PDF file format. This version is best for printing or for reading the complete document. The second form is HTML. These files are presented

on the Inforum web site and may be viewed with any web browser. Finally, the complete set of documentation is available in a compiled Help system that is linked to the latest version of *G7*.

New material has been added for recent changes to the software; these are summarized in the introduction. Compiled Help files are bundled with *G7* software on the CD, along with the PDF document. The most recent edition of all three forms of documentation are maintained on the Inforum site.

5   www.Inforum.umd.edu

Maintenance and development of the Inforum web site continues steadily. The current site was established in 2007 and 2008. Preliminary design work for a new site has begun, and this work will continue in the year ahead.

New pages have been added for the Twentieth Inforum World Conference and the 2012 Inforum Outlook Conference. The collection of Inforum publications has expanded to include papers from the Twentieth Inforum World Conference and recent sponsored research publications. The collection of International Partners pages have been updated with new information provided by each partner. The collection of economic databases known as EconData continually is maintained and gradually is expanding. A number of items have been added to the News page in the past year, and some of these have been featured on the Home page. Finally, the Software section features Downloads and Documentation pages that have been updated with the materials reported here.

Features of Google Analytics have been incorporated in the Inforum site to monitor demand for each web page and to record file and document downloads. A variety of information can be analyzed to learn characteristics of site visitors and traffic patterns throughout the site. All data are aggregated so that nothing can be identified for particular visitors. Aggregate statistics are available for geographic location, type of browser and operating system, language, whether mobile devices are employed, the referring site, how much time is spent on the site, whether visitors are new or returning to the site, and other details. References to the Inforum site that are provided by Google Internet searches also are compiled and listed by keyword.

Work to incorporate the tools of Google Analytics remains incomplete, and so current monitoring of the Inforum web site does not provide a complete count of downloaded documents. In particular, papers and other resources that are listed on conference pages or International Partners pages are not monitored yet, though those resources are monitored in the main documents repository. Once this work has been completed, we will be able to compile complete counts of file downloads and page visits. This will help to gauge the interest of visitors for the various materials that are offered, and ultimately we can improve the site to meet the needs of the visitors.

Preliminary statistics for the web site were presented in 2012, but these were based on a short sample period. We now have more than one full year

of results to analyze, and here we show select statistics for August 21, 2012 through August 21, 2013. Table 1 displays the 40 countries and territories from which the most visits originated. The total number of visits was 17,459, and 92% of these visits originated in these 40 regions. The top two are no surprise – USA and France together accounting for more than half – but the third is India, a relative newcomer with nearly 3.5% of all visits. Mobile devices are becoming increasingly popular and important, and we have evidence that this trend applies to visitors to the Inforum site. Table 2 shows the distribution of device types that have been used to browse the site. The most popular devices (95%) still are desktops, with mobile devices (2.7%) and tablets (2.1%) comprising the rest. Desktop users visit more pages, on average, and spend far more time on the site than do mobile users. Though the sample size is fairly small, tablet users seem to spend the most time on the site per visit. Table 3 displays 10 types of mobile and tablet operating systems that have been used to browse the site, ranked by the number of visits for each type. The Apple iOS system tops the list, with Android systems coming in second. Table 4 displays 40 specific types of mobile and tablet devices that have been used to browse the site, again ranked by the number of visits. The Apple iPad and iPhone again are at the top of the list, though a wide variety of Android devices occupy many remaining spots. While clearly mobile and tablet devices are employed for only a small share of total visits, we anticipate that the share will increase and that it will become increasingly important for the site to work well on such devices. Accommodation of these technologies will be a priority in the development of the new site.

6   Conclusion

The materials described here may be found on the Inforum web site and on the conference CD. Some of the CD content is not be available on the web site, including the *InterDyme* modeling software. The full CD and other conference materials may be found on the Inforum SFTP server; for access details, please see Wittek (2010) and contact the site administrator for additional assistance.

We look forward to cooperation with Inforum partners to further improve and extend the software and web site. Support is available and comments are welcome; please contact the author directly or send email to the Inforum webmaster at Inforum.Webmaster@gmail.com.

Table 1: Demographics

	Country / Territory	Visits	Percentage
1	United States	7803	44.69%
2	France	1450	8.31%
3	India	605	3.47%
4	Italy	478	2.74%
5	Russia	467	2.67%
6	Brazil	421	2.41%
7	United Kingdom	415	2.38%
8	Poland	389	2.23%
9	China	356	2.04%
10	Germany	355	2.03%
11	Canada	298	1.71%
12	Japan	223	1.28%
13	Turkey	222	1.27%
14	(not set)	176	1.01%
15	Spain	165	0.95%
16	Australia	162	0.93%
17	Malaysia	155	0.89%
18	Netherlands	138	0.79%
19	Austria	136	0.78%
20	Indonesia	124	0.71%
21	Taiwan	117	0.67%
22	Mexico	110	0.63%
23	South Africa	110	0.63%
24	Belgium	105	0.60%
25	South Korea	95	0.54%
26	Philippines	90	0.52%
27	Thailand	89	0.51%
28	Hong Kong	88	0.50%
29	Ukraine	82	0.47%
30	Switzerland	80	0.46%
31	Iran	71	0.41%
32	Singapore	71	0.41%
33	Nigeria	67	0.38%
34	Pakistan	66	0.38%
35	Portugal	64	0.37%
36	Slovakia	63	0.36%
37	Denmark	61	0.35%
38	Czech Republic	60	0.34%
39	Greece	60	0.34%
40	Cameroon	59	0.34%
	Subtotal	16146	92.48%
	Total	17459	100.00%

Table 2: Device Overview

	Visits	Percentage	Pages per Visit	Average Duration (Seconds)
Desktop	16608	95.13%	2.65	149.54
Mobile	476	2.73%	1.61	57.60
Tablet	375	2.15%	2.01	276.35
	17459	100.00%	2.61	149.76

Table 3: Operating System

	Operating System	Visits	Percent	Pages per Visit	Average Duration (Seconds)
1	iOS	507	59.58%	1.84	219.06
2	Android	207	24.32%	1.96	78.56
3	Firefox OS	90	10.58%	1.00	0.00
4	(not set)	10	1.18%	1.30	9.40
5	BlackBerry	10	1.18%	2.20	177.10
6	Nokia	9	1.06%	1.89	60.33
7	SymbianOS	7	0.82%	1.57	35.71
8	Windows Phone	6	0.71%	4.00	150.83
9	Series40	3	0.35%	1.33	45.67
10	Windows	2	0.24%	1.50	13.00
		851	100.00%	1.79	153.99

	Mobile Device	Visits	Percent	Pages per Visit	Average Duration (Seconds)
1	Apple iPad	321	37.72%	2.05	311.47
2	Apple iPhone	183	21.50%	1.45	60.27
3	(not set)	126	14.81%	1.34	20.82
4	Google Nexus 7	12	1.41%	1.83	109.75
5	SonyEricsson LT15i Xperia Arc	10	1.18%	3.80	170.90
6	Samsung GT-P5100 Galaxy Tab 2 10.1	7	0.82%	2.14	34.00
7	Google Nexus 4	6	0.71%	1.83	2.50
8	Samsung GT-I9300 Galaxy SIII	6	0.71%	1.83	20.00
9	Samsung SGH-i717 Galaxy Note	6	0.71%	3.33	115.67
10	Nokia X2-01	5	0.59%	1.20	3.60
11	Apple iPod	4	0.47%	1.75	12.25
12	HTC ADR6350 Droid Incredible 2	4	0.47%	1.25	14.00
13	Motorola Droid X2	4	0.47%	1.00	0.00
14	Motorola MOTXT912B Droid Razr 4G	4	0.47%	1.25	8.00
15	Motorola xt875 Droid Bionic	4	0.47%	2.25	285.75
16	Samsung GT-P7510 Galaxy Tab 10.1	4	0.47%	2.25	22.75
17	Samsung GT-S5302	4	0.47%	3.75	472.75
18	HTC ADR6400L Thunderbolt 4G	3	0.35%	1.00	0.00
19	Motorola XT907 DROID RAZR M 4G LTE	3	0.35%	1.00	0.00
20	Samsung Galaxy Nexus	3	0.35%	6.67	220.33
21	Samsung GT-I9100 Galaxy S II	3	0.35%	3.00	129.00
22	Samsung GT-I9300 Galaxy S3	3	0.35%	2.00	116.00
23	Samsung GT-P3113 Galaxy Tab 2 7.0	3	0.35%	1.33	18.33
24	Asus Eee Pad TF201 Transformer Prime	2	0.24%	1.00	0.00
25	BlackBerry 9300 Curve 3G	2	0.24%	1.00	0.00
26	HTC TouchDual Nike	2	0.24%	1.50	13.00
27	Huawei U9200 Ascend P1	2	0.24%	4.50	112.00
28	Motorola Droid 2	2	0.24%	1.50	13.00
29	Motorola Xoom	2	0.24%	1.00	0.00
30	Nokia 200 Nokia Asha 200	2	0.24%	1.50	68.50
31	Nokia 5233	2	0.24%	1.00	0.00
32	Nokia C5-03 C5	2	0.24%	1.00	0.00
33	Nokia Lumia 520	2	0.24%	1.00	0.00
34	Nokia Lumia 800	2	0.24%	1.00	0.00
35	Nokia X2-00	2	0.24%	3.50	216.50
36	Opera Mini 7	2	0.24%	1.50	56.50
37	Opera Opera Mini for S60	2	0.24%	1.00	0.00
38	RIM BlackBerry 9810 Torch 4G	2	0.24%	1.00	0.00
39	Samsung GT-N8013 Galaxy Note 10.1 WiFi	2	0.24%	1.00	0.00
40	Samsung GT-P1000 Galaxy Tab	2	0.24%	1.50	55.50
	Subtotal	762	89.54%		
	Total	851	100.00%	1.79	153.99

Table 4: Mobile Devices

References

[1] Inforum. *Software Documentation.* www.inforum.umd.edu/software/documentation.html.

[2] Ronald Horst. (2013) *Inforum Software Development in 2013.* www.inforum.umd.edu/organization/conferences/iwcxxi/iwcxxi.html.

[3] Ronald Horst. (2012) *Inforum in 2012: Information and Technology.* (Paper and slides) www.inforum.umd.edu/organization/conferences/iwcxx/iwcxx.html.

[4] Troy Wittek and Ronald Horst. (2010) "New Features of G7, Compare, and the Inforum Website" (Slides) www.inforum.umd.edu/organization/conferences/iwcxviii/iwcxviii.html