A Hybrid Approach for Selecting an Econometric Software Package

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Abstract

In recent years, the number of commercial econometric software packages has not only increased but also showed significant improvement in terms of technology. Thus, many researchers, especially inexperienced ones, are faced with the problem of selecting an appropriate software package. The present paper introduces a hybrid approach based on the theory of fuzzy set and the Analytical Hierarchy Process (AHP) and capable of integrating evaluation results obtained from a number of experts to select an appropriate software package. The proposed approach is demonstrated by solving an application of five highly popular regression software packages used mostly in the field of economics and finance and are readily available in the commercial markets.

Key Words

Fuzzy set theory, Multicriteria, Analytical Hierarchy Process (AHP).

1. Introduction

Over the past decade, the evolution of end user computing technology has led to a wide range of econometric software development packages. Such packages are being used at every organizational level as a means to improve software outcomes. It is apparent that the selection of a software package will have a great impact on the development process through providing state-of-the-art capabilities to the user. It is obvious that econometric software varies not only in speed and user-friendliness, but also in numerical accuracy and reliability. Thus, the number of capabilities and characteristics inherent within the package will have a significant impact on its usefulness and acceptance.

Many researchers are always faced with the problem of choosing an appropriate package for a particular problem since the fit between the software package and the application where it will be used is a crucial aspect of outcome quality. Thus, it is believed that adequate selection of a software package will to great extent enhance the prospects of reaching widely accepted outcomes. But in the absence of well defined quantitative methods, it is common that the selection process of a software package can be based on some qualitative criteria which are subjectively evaluated.

The selection of the candidate package will largely depend on the acquired knowledge about such a package and the selection criteria used to compare packages. The amount and richness of available knowledge can be improved by involving a number of experts in the field and integrating their opinions after ensuring that an acceptable level of agreement has been achieved. Undoubtedly there are many advantages associated with involving some experts in the selection process which include increasing validity, reliability, accuracy, and acceptance of the software outcome [1].

The objective of the present paper is to develop a decision support system using the AHP being integrated with fuzzy set theory for selecting an econometric software development package. The proposed system combines and extends the advantages of both the AHP and fuzzy set theory. The rest of the paper is organized as follows: Section 2 explains the method of the AHP and defines its criteria and subcriteria used in the proposed methodology. In section 3, a fuzzy procedure is used to integrate the results obtained from experts to reach a final decision of selecting an econometric software development package. Section 4 contains the summary and conclusion of the study.

2. Development of the model

2.1 The Anaical Hierarchy Process (AHP)

The AHP was developed by Thomas Saaty and published in his 1980 seminal book [2], who describes it as a general method for dealing with unstructured problems and shows how it can be used in a wide range of problem areas from simple personal to complex and capital intensive decisions. The success of the theory is a consequence of its simplicity and robustness.

The AHP is based on three principles: Decomposition, Measurement of performances, and Synthesis. Decomposition breaks a problem down into manageable elements that are treated individually. It begins with implicit description of the problem (the goal) and proceeds logically to criteria in terms of which outcomes are evaluated. This will lead to a hierarchic structure consisting of levels for grouping issues together as to importance or influence with respect to the elements in the adjacent level above. The relative ratio scale of measurement is derived from paired comparisons of the element in the level above. Pairwise comparisons (PWCs) are done with judgments provided as verbal statements about the strength of dominance (importance or likelihood) of one element over another represented numerically on an absolute scale [3]. Table 1 shows the numerical scale and its verbal equivalent [4]. These judgments are made in the frame-

Table 1

Measures Used for Pairwise Comparisons

Value	Definition	Explanation
1	Equal importance	The two elements being compared contribute equally to the objective
3	Moderate importance	Experience and judgement slightly favor one element over another
5	Strong importance	Experience and judgement strongly favor one element over another
7	Very strong importance	An element is strongly favored and its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between the two adjacent judgments	When compromise is needed
Reciprocals of above non-zero numbers		If an element has one of the above number (e.g. 3) compared with a second element, then the second element has the reciprocal value (i.e. 1/3) when compared to the first

work of a matrix used to derive a local priority vector as an estimate of relative magnitudes associated with the elements being compared. When priority vectors are derived for all comparisons in the hierarchy, we proceed to synthesize the local priorities to derive a global measure of priority used in reaching the final decision [5].

As an elementary example of this process, we take the case of buying a new car. It has been determined that the most important overall criteria are cost, maintenance, and brand name. There are three possible alternatives (cars) to choose from which are: Camry, Maxima, and Caprice. We use Table 2 to construct a pairwise comparison matrix for the first criterion, cost, concerning the three types of cars. This is shown in Table 2. It should be noted that values of the diagonal must be 1's, and values below the diagonal are the reciprocal of the corresponding values above diagonal. By applying AHP, we use this information to determine the evaluation criteria for cost for the three types of cars.

Table 2

Pairwise Comparison Matrix for Criterion Cost

Cost	Camry	Maxima	Caprice
Camry	1	3	8
Maxima	1/3	1	5
Caprice	1/8	1/5	1

We first get column totals:

Cost	Camry	Maxima	Caprice
Camry	1	3	8
Maxima	1/3	1	5
Caprice	1/8	1/5	1
Column Totals	1.4583	4.20	14

Next, the numbers in the matrix are divided by their respective column totals and, then, we calculate the average of each row to determine the priorities for criterion cost for the three types of cars as follows:

Cost	Camry	Maxima	Caprice	Row Average
Camry	0.6857	0.7143	0.5714	0.6571
Maxima	0.2286	0.2381	0.3571	0.2746
Caprice	0.0857	0.0476	0.0714	0.0682

From the above table, it shows that the criterion evaluations for the three alternatives are 0.6571, 0.2746, 0.0682, respectively. The same procedure is used to get the criterion evaluations for the other two criteria, maintenance and brand name. But before we proceed to do such calculations, we have to determine whether the PWCs of the original matrix are consistent by calculating the so-called Consistency Ratio (*CR*).

To calculate the *CR*, we begin with determining the weighted sum vector (*WSV*) as follows:

$$WSV = \begin{bmatrix} (0.6571)(1)+(0.2746)(3)+(0.0682)(8) \\ (0.6571)(0.333)+(0.2746)(1)+(0.0682)(5) \\ (0.6571)(0.125)+(0.2746)(0.2)+(0.682)(1) \end{bmatrix} = \begin{bmatrix} 2.0265 \\ 0.8344 \\ 0.2053 \end{bmatrix}$$

We, then, use the *WSV* to determine the Consistency Vector (*CV*). The can be done by dividing the *WSV* by the criterion evaluation values found previously.

$$CV = \begin{bmatrix} 2.0265/0.6571 \\ 0.8344/0.2746 \\ 0.2053/0.0682 \end{bmatrix} = \begin{bmatrix} 3.0840 \\ 3.0386 \\ 3.0103 \end{bmatrix}$$

Now, we need to compute the Consistency Index (*CI*). The *CI* can be computed by using the following formula:

$$CI = (\lambda - n)/(n-1)$$

Where, n is the number of alternatives being compared, in our example, $n = 3$. And λ is the average value of the CV, that is 3.0443. Thus, the value of the CI is 0.0222.

Finally, the CR is computed as follows:

$$CR = CI/RI$$

Where RI is the random consistency index, which is based on statistical simulation as given by Saaty [6]. A CR value of less than 0.10 is typically considered acceptable and the decision maker's responses are relatively consistent. On the other hand, if the CR is greater than 0.10, the decision maker must reevaluate responses during PWCs which were used to construct the original matrix of PWCs. In the present example, CR=0.0222/0.58=0.038, which means that we are relatively consistent with the given responses. we follow the same process to make the same calculations for the other two criteria, namely maintenance and brand name. Suppose the PWC matrices are given as follows:

Maintenance	Camry	Maxima	Caprice
Camry	1	1/4	3
Maxima	4	1	6
Caprice	1/3	1/6	1

Brand Name	Camry	Maxima	Caprice
Camry	1	1/2	2
Maxima	2	1	5
Caprice	1/2	1/5	1

We perform the same type of calculations to determine the criterion evaluations for both criteria, maintenance and brand name, for the three alternatives. The criterion evaluations of the three criteria for the three alternatives are summarized in Table 3.

Table 3

Criterion Evaluations

Alternative Criterion	Camry	Maxima	Caprice
Cost	0.657	0.275	0.068
Maintenance	0.218	0.691	0.091
Brand Name	0.276	0.595	0.128

With CRs of 0.05 and 0.01 for the criteria maintenance and brand name, respectively. The CRs are both less than 0.10 which means that responses to the PWCs are acceptably consistent.

Next, we determine weights for each criterion. We use the AHP and PWCs to calculate the criterion weights for cost, maintenance, and brand name. To do so, suppose we have the following PWC matrix:

Criterion	Cost	Maintenance	Brand Name
Cost	1	2	9
Maintenance	1/2	1	6
Brand Name	1/9	1/6	1

Following the same process as before, we end up with criterion weights, which are: 0.606, 0.333, and 0.061, for the criteria cost, maintenance, and brand name, respectively. The *CR* is 0.01 which means that the given responses are consistent. Then, we use these weights to determine the overall ranking of the three alternatives. This can be done by multiplying the criterion evaluations in Table 3 times the criterion weights. The overall ranking for the three types of cars is shown in Table 4. From Table4, it is apparent that the alternatives that received the highest final ranking is the alternative camry and is selected as the best buying car.

Table 4

Total Weighted Evaluations

Alternative	Total Weighted Evaluations
Camry	0.4876
Maxima	0.4330
Caprice	0.0793

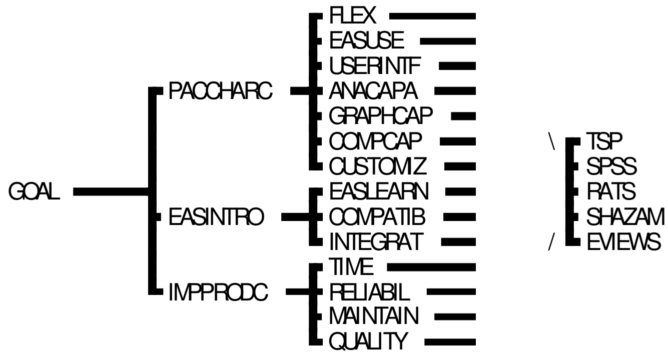
The popularity of the AHP could be attributed to two important factors: 1) its ability and great flexibility in dealing with quantitative and qualitative criteria alike, 2) the availability of a friendly-user commercial package called Expert Choice that can be used to solve all types of AHP applications.

2.2 Description of the Hierarchy

The overall hierarchy representation of the selection process used for selecting an econometric package is presented in Figure 1**.** The hierarchy has three levels. At the top, the ultimate objective of the package selection process, is to assess the overall capabilities of the econometric software. Three major criteria from the second level of the hierarchy: package characteristics, ease of introduction, and impact on productivity. Each of these criteria is further decomposed into fourteen specific subcriteria and form level three. The criteria are the main components defined by a user when making a decision of what a software development package to use. Selecting a development package requires considering and evaluating many different criteria. The selection

Figure 1

The Hierarchical Structure of evaluating Econometric Software Packages



Abbreviation	Definition
GOAL	
ANACAPA	Analytical Capability
COMPATIB	Compatibility
COMPCAP	Computational Capability
CUSTOMIZ	Customization
EASINTRO	Ease of Introduction
EASLEARN	Ease of Learning
EASUSE	Ease of Use
EVIEWS	EViews
FLEX	Flexibility
GRAPHCAP	Graphical Capability
IMPPRODC	Impact on Productivity
INTEGRAT	Integratability
MAINTAIN	Maintainability
PACCHARC	Package Characteristics
QUALITY	Quality
RATS	RATS
RELIABIL	Reliability
SHAZAM	SHAZAM
SPSS	SPSS
TIME	Time
TSP	TSP
USERINTF	User Interface

of criteria was determined through literature survey [7], [8], [9], [10], and [11], discussion and consultation with many econometricians, statisticians, and financial practitioners. These criteria were then divided into fourteen subcriteria to give more depth for the representation of the selection process. A brief summary of the selected criteria is presented next.

Criterion 1: *Characteristics of the development packages* refer to the desired attributes that the packages should have in order to achieve the requirements of its users. This main criterion consists of a number of criteria such as flexibility of the package, ease of use, user interface, analytical capability, graphical capability, computational capability and customization which are briefly described below.

- *Flexibility of the package* refers to the extent to which the package provides the developer with the ability to explore different alternatives in a reasonable time and to modify structure of the model and the ability to accommodate changes that require restructuring the model. Also, it includes the ability of the package to meet specific user needs and to respond to changes in user needs.

- *User interface* which is an important aspect of any software package. It includes consistency of the interface, clarity of diagnosis, input methods, screen layout quality, prompts and menu structure for routine use availability.

- *Analytical capability* of the package which measures the extent to which the package provides the user with the ability to perform several kinds of data analysis and build mathematical expressions and perform sensitivity analysis.

- *Graphical capability* of the packages which describes the graphical representations of the data provided by the package that can be used in data analysis and decision support.

- *Computational capability* of the packages which means the ability of the package to perform many complex computations with the use of powerful single commands.

- *Customization* which refers to the extent that the model can be built exactly in a way that matches the requirements of the user. Higher level of customization of the package means that the package can be tailored to fit the needs of the user and the problem, while lower level of customization means that the needed model and users' requirements have to be modified in order to fit the capabilities of the package.

Criterion 2: *Ease of introduction* of the development package which refers to the extent to which the package will be introduced and accepted easily in the development environment and by the users. It includes several criteria such as ease of use and learn, compatibility and integratability of the package.

- *Ease of use and learn* which includes the availability of tutorial, help facilities, organization of package documentation and the extent to which it is easy to search and navigate through the package, accessibility of explanations for commands, prompts and menu structure, clarity of massages produced by the shell, errors handling, and the amount of time and effort required for a user to understand the package.

- *Integratability* of the package which refers to the ability of the package to interoperate with and/or directly exchange data and information with other packages such as spreadsheets, databases and other available software systems.

- *Compatibility* refers to the extent to which the package is compatible with work and development practices existing in the working environment.

Criterion 3: *Impact on productivity* measures the extent to which the package increases development productivity of its users and it can consists of several criteria including time and cost of the development of the model, maintainability, reliability and quality of the developed model.

- *Time needed* to develop the required model.
- *Maintainability* of the developed model which refers to the extent that the developed model by using a particular package is easy to be modified and changed to respond to changes in users' requirements.
- *Reliability of the developed model* refers to the accuracy of the results produced by the package.
- *Quality of the developed model* refers to the overall quality of the model that has been developed by using the package.

The fourth and final level of the hierarchy consists of the alternatives, which are the software packages, to be evaluated. Five highly popular menu-driven econometric software packages, which are: TSP 4.4, SPSS 9.0.0, RATS 5.0, SHAZAM 8.0, and Eviews 4.0, were evaluated using the approach developed in the present paper. Table 5 provides some details about these packages.

After the criteria and alternatives for the selection process have been identified, the next step is to determine PWC matrices between all elements in the hierarchy. These PWCs consist of 17 matrices as follows:

- One PWC matrix to compare all criteria to assess its importance to the overall objective of the selection process.
- Three PWC matrices to compare subcriteria to each criterion.
- Fourteen PWC matrices to compare alternatives (econometric software packages) to each subcriteria.

A comparison data base which contains the PWCs for all elements at all levels of the hierarchy were created via direct contact with some professionals and practitioners in financial industry and educational institutions. Totally, fifteen questionnaires were sent out, and received eight forms back. Only five experts' opinions were chosen for the purpose of analysis because it represents the most knowledge of all software packages. Figure 2 shows one of the PWC matrices which represents PWCs between subcriteria to reflect the importance of criterion package characteristics, e.g. the subcriterion "ease of use" is three times more important than the subcriterion "graphical capability", whereas the subcriterion "user interface" is three times less important than subcriterion

Table 5

Contact Information, Price, and Platforms

Product	Contact	Price	Other Operating Systems
TSP	TSP International POB 61015 station A Palo Alto, CA 94306 Tel.: (650)326-1927 Fax: (650)328-4163	Academic: $480 Non-academic: $480 Site license available	DOS, Windows 3.1, 9x, NT, MacOS, Linux, most versions of Unix, some mainframe systems
SPSS	SPSS Inc. Headquarters 233 S. Wacker Dr. 11th Chicago, Illinois 60606 Tel: 1(800) 543-2185 Fax: 1(800) 841-0064 http://www.spss.com	Academic: $499 Non-academic: $999 Site license available	Windows 9x, Me, XP, NT 4.0, 2000
RATS	1800 Sherman Ave, Suite 301 Evanston, IL 60201 Tel: (847)864-8772 Fax: (847)864-6221 http://www.estima.com	Academic: $300 Non-academic: $500	Windows 3.1, 9x, NT, MacOS, Linux, OpenVMS most versions of Unix
SHAZAM	SHAZAM Economics Department University of British Columbia Vancouver, BC V6T-1Z1 Tel.: (604)822-5062 Fax: (604)822-9299 http://shazam.econ.ubc.ca	Academic: $395 Non-academic: $395 Site license available	DOS, Windows 3.1, 9x, NT, MacOS, Linux, most versions of Unix, some mainframe systems
EViews	Quantitative Micro Software, LLC 4521 Campus Dr. #336 Irvine, CA 92612 Tel.: (949)856-3368 Fax : (949)856-2044 www.eviews.com	Academic: call Non-academic: $895 Site license available	Windows 9x, Me, 2000, NT 4.0

"analytical capability."* Also, Figure 3 shows another matrix which represents PWCs between alternatives (software packages) with respect to subcriterion ease of use.

3. A Fuzzy Approach for Aggregating Experts' Judgements

No doubt that whenever human judgement is involved in a situation, imprecision and vagueness exist. Thus, the selection process of the software package is vague in nature since it involves experts' opinions. To overcome such vagueness, fuzzy set theory is capable of modeling inexactness resulting from human judgement [12]. The fuzzy set theory is applied to the software

* It should be noted that the AHP software used in the present study shows decimal fractions as integer numbers but written in different color (red).

Figure 2

A PWC matrices between subcriteria with respect to the criterion package characteristics

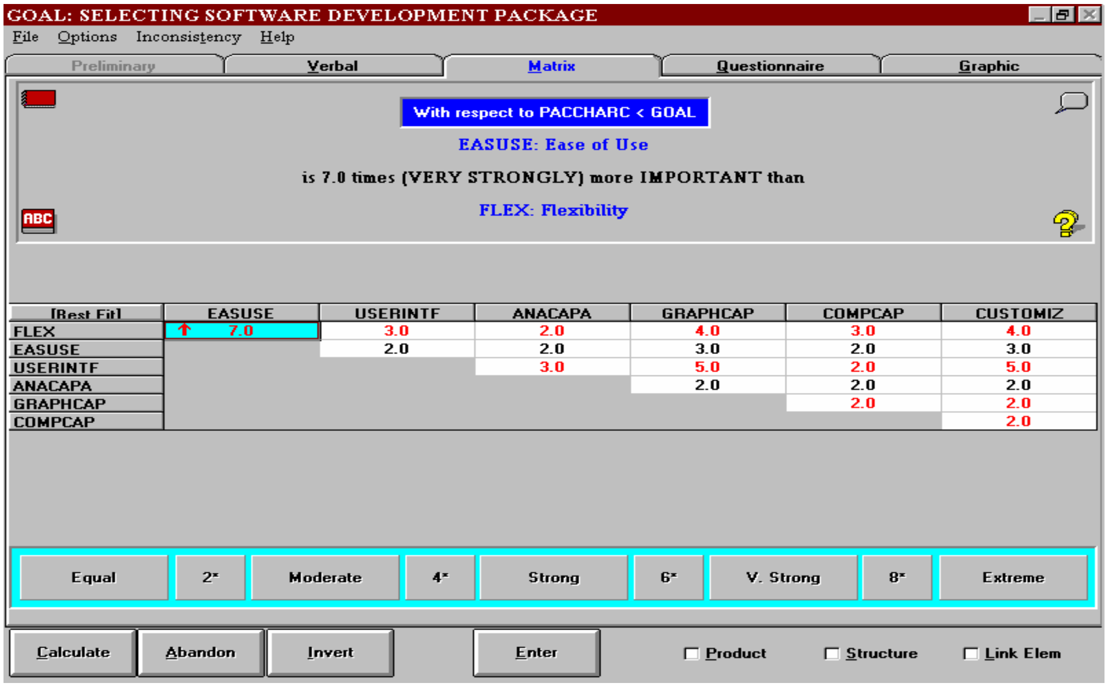
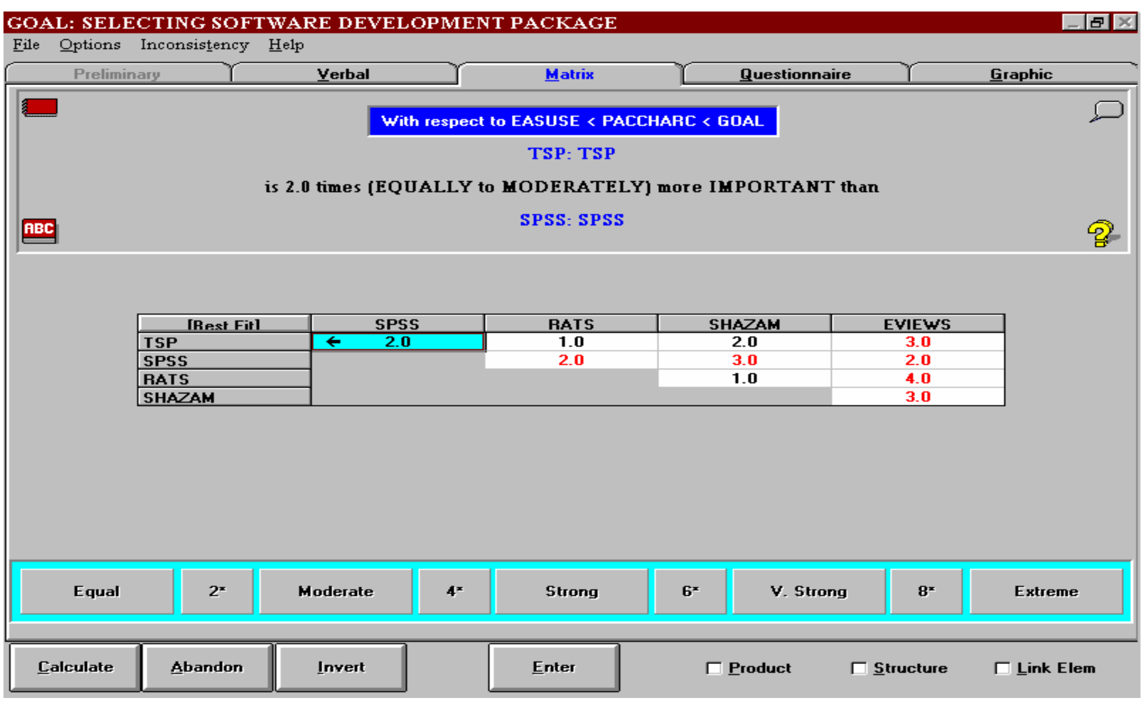


Figure 3

A PWC matrices between alternatives with respect to the subcriterion package characteristics



package selection problem and suggested a method to make the software package evaluation more accurate.

3.1 Fuzzy Set Theory

A fuzzy set A is characterized by a generalized characteristic function $\mu_A(\chi) \rightarrow [0,1]$ called membership function of A and defined over a universe of discourse U. This universe of discourse in a concrete case has to be chosen according to the specific situation of this case. The most elementary operations for usual sets are the union as well as the intersection of any two sets and the complement of any set with respect to some superset of it. For the basic set algebraic operations, Zadeh [13] has already given such extensions. The union operation of two fuzzy sets A and B is a fuzzy set A∪B such that

$$\mu_{A\cup B}(\chi) = \max\{\mu_A(\chi), \mu_B(\chi)\} \text{ for all } \chi \in \mathrm{U},$$

The intersection of two fuzzy sets A and B is a fuzzy set A∩B such that

$$\mu_{A\cap B}(\chi) = \min\{\mu_A(\chi), \mu_B(\chi)\} \text{ for all } \chi \in U,$$

And the complement of a fuzzy set is denoted by A and defined by

$$\mu_A(\chi) = \{1 - \mu_A(\chi)\} \text{ for all } \chi \in \mathrm{U},$$

All these operations on fuzzy sets are straightforward generalizations of the corresponding operations on ordinary sets [14,15].

3.2 The Fuzzy Approach Procedure

In real life problem, one type of decisions consists of a situation where a set of criteria are given in terms of requirements where the decision process is to select the "best" alternative, which satisfied all the set of criteria. As Zadeh [15] and Bellman and Zadeh [16] suggested, using the rule of implied conjunction, these criteria are stated as

$$C_1 \text{ and } C_2 \text{ and } C_3 \text{ . . . . . .} \tag{1}$$

If we associate with each criterion a fuzzy subset over the set of alternatives, then, in terms of fuzzy subsets the decision *D* becomes:

$$D = C_1 \cap C_2 \cap C_3 \ldots\ldots. \quad (2)$$

The decision *D*, is a fuzzy subset of the set of alternatives whose membership function $\mu_D(x)$ shows how well each of the alternatives satisfies the set of evaluation criteria. The alternative that has the highest degree of membership in *D* is selected as the best alternative.

In situations where the importance of an objective (or expert's judgements) affects the final selection of that objective (or alternative), different degrees of relative importance have to be assigned to each objective (or expert's judgements). Yager [16] suggests an approach that takes into account the decision maker's opinion of the importance of each objective by assigning a positive number α_i to each objective (expert's judgements) C_i as an indication of its importance. Hence, the above decision *D* can be rewritten as follows:

$$D = C_1^{\alpha_1} \cap C_2^{\alpha_2} \cap C_3^{\alpha_3} \ldots\ldots. \quad (3)$$

The above modified approach is based on the assumption that the expert judgements is uncertain due to some factors such as:

1) The expert judgements may not be accurate because the expert doesn't know exactly the degree to which an alternative satisfies the given criteria.
2) The questions in the questionnaire may not be clear or well understood and hence the judgements will be inaccurate.
3) The inability of the AHP to take into account uncertainty in the final estimation of ranking to reach a more accurate ranking.

The experts' responses to the questionnaires were used as inputs to the AHP model. The AHP results contain the relative weights of the compared criteria (or alternative). Figure 4 shows the relative weights of subcriteria which show the importance of the criterion "package characteristics" to the selected software. These weights were obtained from the PWC matrix shown in Figure 2 given by one expert. It is apparent that the subcriterion "ease of use" has the highest weight of 0.286 compared to other subcriteria. Likewise, Figure 5 shows the relative weights of alternatives (software packages) with respect to the subcriterion "ease of use".

It can be seen that the alternative Eviews has the highest relative weight of 0.416 and is followed by the alternative TSP. It should be noted that the Consistency Ratio (CR) is less than 0.10 which means that the PWC matrices are consistent.

Finally, Figure 6 shows the relative weights of software packages with respect to the overall objective of selecting a software package. It is clear that the Eviews package has the highest weight

Figure 4

Relative Weights of Subcriteria with respect to the Criterion Package Characteristics

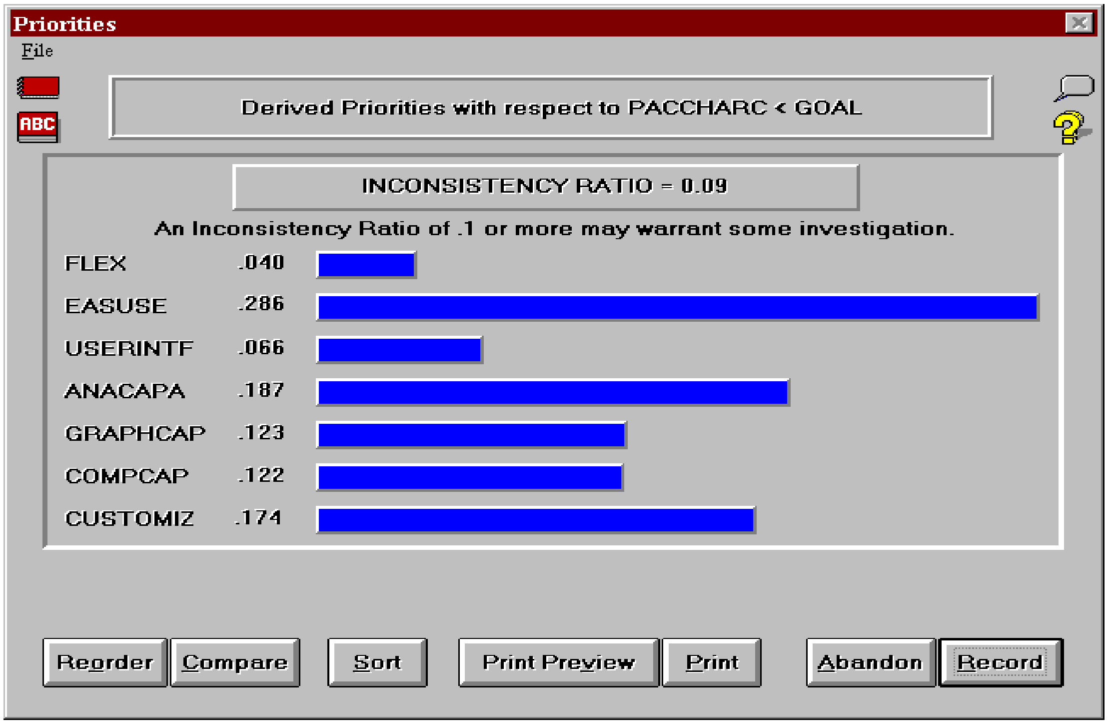


Figure 5

Relative Weights of Alternatives with respect to the Subcriterion Ease of Use

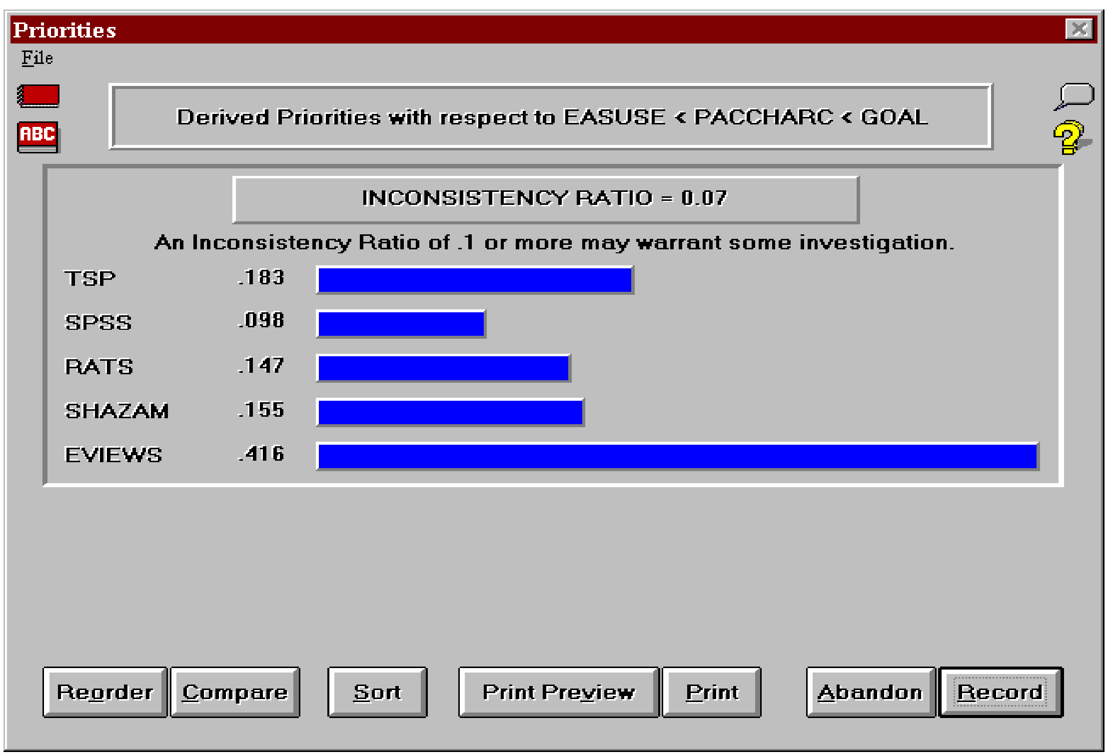
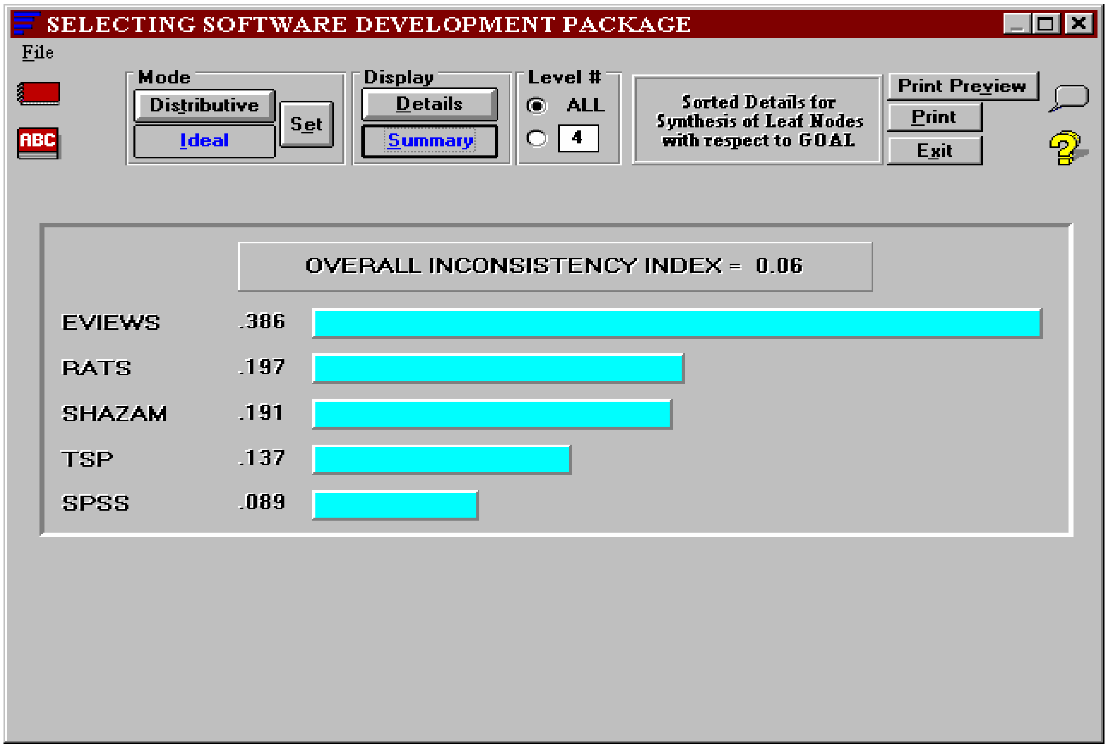


Figure 6

Relative Weights of Alternatives Obtained from the AHP Model with respect to the Overall Objective of Selecting a Software Package for One Expert



and is ranked first. Then, the other packages RATS, SHAZAM, TSP, SPSS are ranked second, third, fourth, and fifth, respectively. Table 6 shows the resultant weights of alternatives for all experts.

Table 6

Experts' Judgements of all Alternatives

	Eviews	RATS	SHAZAM	TSP	SPSS
$Expert_1$	0.386	0.197	0.191	0.137	0.089
$Expert_2$	0.218	0.210	0.204	0.184	0.183
$Expert_3$	0.357	0.175	0.162	0.156	0.150
$Expert_4$	0.262	0.220	0.205	0.196	0.117
$Expert_5$	0.299	0.188	0.183	0.167	0.164

The weights corresponding to each expert shown in Table 6 can be rewritten as follows:

$Expert_1$ = {0.386/Eviews, 0.197/RATS, 0.191/SHAZAM, 0.137/TSP, 0.089/SPSS}
$Expert_2$ = {0.218/Eviews, 0.210/RATS, 0.204/SHAZAM, 0.184/TSP, 0.183/SPSS}
$Expert_3$ = {0.357/Eviews, 0.175/RATS, 0.162/SHAZAM, 0.156/TSP, 0.150/SPSS}
$Expert_4$ = {0.262/Eviews, 0.220/RATS, 0.205/SHAZAM, 0.196/TSP, 0.117/SPSS}
$Expert_5$ = {0.299/Eviews, 0.188/RATS, 0.183/SHAZAM, 0.167/TSP, 0.164/SPSS}

Based on our experience, the experts' weights (α_i) are set to be: 0.90, 0.95, 0.50, 0.70, 0.20, respectively. The experts' weights will be incorporated into equation (3) for each expert in order to determine the final relative weights for each alternative. The equations are written as follows:

$(\text{Expert}_1)^{0.90}$ = {0.425 / Eviews, 0.232 / RATS, 0.225 / SHAZAM, 0.167 / TSP, 0.113 / SPSS}
$(\text{Expert}_2)^{0.95}$ = {0.235 / Eviews, 0.227 / RATS, 0.221 / SHAZAM, 0.200 / TSP, 0.199 / SPSS}
$(\text{Expert}_3)^{0.50}$ = {0.597 / Eviews, 0.418 / RATS, 0.402 / SHAZAM, 0.395 / TSP, 0.387 / SPSS}
$(\text{Expert}_4)^{0.70}$ = {0.392 / Eviews, 0.346 / RATS, 0.330 / SHAZAM, 0.320 / TSP, 0.223 / SPSS}
$(\text{Expert}_5)^{0.20}$ = {0.785 / Eviews, 0.716 / RATS, 0.712 / SHAZAM, 0.699 / TSP, 0.697 / SPSS}

Thus, the final ranking of the alternatives according to the proposed approach, will be as follows:

D = {0.235 / Eviews, 0.227 / RATS, 0.221 / SHAZAM, 0.167 / TSP, 0.113 / SPSS}

The decision *D* is a fuzzy subset of econometric software packages whose membership function $\mu_D(\chi)$ Shows the weight for each package as indicated by experts. The software package that has the highest grade of membership in *D* is selected as the best alternative. It is apparent that the package that has the highest grade of membership is the Eviews package.

4. Summary and Conclusion

Selecting an econometric software package to work with is a very important task in doing research. The task becomes more important when the researcher lacks practical knowledge of the available econometric software packages. Selecting the appropriate package, that will fit most of the researcher's needs, will to a large extent safe time, efforts, and most importantly produce more accurate as well as reliable results. The present study outlined a hybrid approach derived from different fields of knowledge to evaluate the most widely used econometric software packages available in the commercial markets. Inputs for the selection model were collected from a number of experts in the field and were then integrated to reach final evaluation weights for all alternatives. Although the proposed approach was applied to a small number of popular packages, it can be generalized to accommodate a large number of software packages.

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Oct. 20, 2003

Dear Prof. Ch Berger-Vachon,

First, I would like to thank you for your wonderful effort as an AMSE general secretary. Second, I'm sending you a new revised version of my paper (Ref. No: 02 291 2D), along with the original reviewer form and my response to his/her comments.

Before I present my response, I would like to thank the reviewer for praising the proposed approach. Next, I will rewrite the reviewer's comments and then I will respond to each of them.

1. *Reviewer's comment*:

"It is necessary to clarify the criteria of the H-P approach."

Author's response:

First, I decided to use a number for each section and subsection to make it easier for the reader to follow the construction of the paper and the proposed approach. Thus, section 2.2 contains the hierarchical structure of the proposed approach which consists of 17 criteria and subcriteria, along with a detailed explanation for each criterion and subcriteria (see page 7, 8, and 9). Therefore, there is no need for more clarification of the criteria and subcriteria of the AHP since these criteria and subcriteria are well defined in this section.

2. *The reviewer's comment*:

"At the level of introduction, it would be very appropriate to add a small section describing the objectives and organization of the paper."

Author's response:

The last paragraph of the introduction is completely changed, and a new paragraph is written which implies two ideas: First, the objective of the study is well stated and defined. Second, the structure of the paper is clearly present in this paragraph.

Finally, this paper is to be published in AMSE periodical: **Advances in Modeling & Analysis.**

Please do not hesitate to contact me for any further information concerning this paper. Awaiting your reply, I still remain.

Sincerely,

Dr. Zayed F. Alhosan
Assistant Professor of Economics & Finance

-Cover Page-

Dr. Zayed F. Alhosan
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Dear Prof. Ch Berger-Vachon,

First, I would like to introduce myself. I'm an assistant professor of Economics and Finance at king Saud University, College of Business & Economics, Saudi Arabia. On July, 2002, I sent you the following paper:

A Hybrid Approach for Selecting an Econometric Software Package
(Ref. No 02 291 2D)

to be published in your AMSE periodical: **Advances in Modeling & Analysis.**

I received the reviewer form on Oct 16, 2003. Attached is my response to the reviewer's comments and a revised copy of the paper.

Thank you so much for your wonderful kindness and cooperation. I am Looking forward to hear from you.

Sincerely yours',

Dr. Zayed F. Alhosan
Assistant Professor of Economics & Finance

Dr. Zayed F. Alhosan
King Saud University
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Saudi Arabia

Dear AMSE editor;

First, I would like to introduce myself. I'm an assistant professor of Economics and Finance at king Saud University, College of Business & Economics, Saudi Arabia. Currently I teach finance and economic courses. My research interests include financial markets and instituations, performance evaluation, forecasting. My primary goal in doing research is to try to take advantage of developments in the high-tech industry to enhance and diversify research tools in the field of business and economics to reach more accurate outcomes. I am so glad to send you my latest paper entitled:

A Hybrid Approach for Selecting an Econometric Software Package

to be published in your AMSE periodical: **Advances in Modeling & Analysis.**

Please do not hesitate to contact me for any further information concerning this paper. Awaiting your reply, I still remain.

Sincerely,

Dr. Zayed F. Alhosan
Assistant Professor of Economics & Finance

To: **Prof. Ch Berger-Vachon**
AMSE General Secretary
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