

**EL USO DEL SOFTWARE ESTADÍSTICO R EN LA  
ASIGNATURA DE FINANZAS CUANTITATIVAS:  
DESARROLLO DE HABILIDADES Y COMPETENCIAS**

**THE USE OF THE R STATISTICAL SOFTWARE IN THE  
QUANTITATIVE FINANCE SUBJECT: DEVELOPMENT OF  
SKILLS AND COMPETENCES**

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**Resumen:**

Los cambios en la orientación de la docencia como consecuencia de la necesaria adaptación al Espacio Europeo de Educación Superior incluyen la adopción de un nuevo paradigma, modificando la orientación docente. Así, se ha pasado de una

enseñanza por contenidos a otra orientada a los resultados de aprendizaje y el desarrollo de competencias. La introducción del software estadístico R en las clases de laboratorio de la asignatura de Finanzas Cuantitativas supone un cambio en ese sentido. Entre otras ventajas, refuerza las competencias relacionadas con el aprendizaje de los contenidos del curso. Además, esta asignatura sirve ahora de punto de control de dos competencias transversales: uso crítico de la información y empleo de instrumentos específicos. En las clase prácticas de laboratorio, se emplea el software R para resolver problemas reales, evitando plantear simples problemas teóricos.

**Palabras clave:** Software estadístico R, competencias, finanzas cuantitativas, herramientas tecnológicas

**Abstract:**

The change in the teaching orientation due to the adaptation to the new European Higher Education Area (EHEA), involved a remarking new education paradigm, moving from a learning content to an orientation based on learning results and development of competences. The introduction of the R statistical software in the Quantitative Finance subject lab-sessions implied a change in this vein. Among others, it strengthened the competences related with the learning of the contents of the subject. Moreover, among the different transversal competences (TC) and skills (a total of nine TCs), the following competences were chosen as checkpoints: Critical synthesis of information and the use of specific tools. Under the methodological vision of action-research and the critical observation of teaching in the subject we use the lab-cases and sessions in order to propose actual cases, therefore, we avoid the use of simple practical exercises. By means of the R statistical software the main goal was to reach the objectives of the proposed three lab-sessions.

**Keywords:** R Statistical Software, competences, quantitative finance, IT tools

**JEL:** M49

## 1. INTRODUCTION

The adaptation the new European Higher Education Area (EHEA) has implied a new organization of the Higher Education Teaching at its different levels. Under the MEC (Education Department) guidelines, the elaboration of the New Curriculums have been progressively implemented at the Universitat Politècnica de València (UPV). Among them, the Master in Financial and Fiscal Management.

The Master in Financial and Fiscal Management whose main objective is the formation of professionals which are able to deal with and assess in subjects as Financial Markets, Tax assessment and Accounting, Financing, Investment, etc. has a practical and applied formation in this sense.

On the other hand, the EHEA brought a change in the learning orientation, implying a new paradigm in the learning on higher education moving from focusing on learning of contents to a completely different orientation based on learning on results and by the development of concepts (Sanabria-Codesal, y otros, 2014). Currently, the UPV is implementing a formation model based in transversal competences considered necessary for the professional development of the UPV students, apart from the technical competences. This model should be incorporated in the design of educative proposals.

The implantation of the EHEA encouraged a debate about the adaptations and actions to carry out by the whole university community in order to give an answer to these new challenges. One of the lines of adaptation to the EHEA involves the integration of the ITs in the higher education learning field as support and complement to the “presential” learning, transforming the model of traditional formation into the modality of presential formation. In this sense, UPV has reinforced during last years, by means of the initiative “Teaching in the net”, the integration of the learning platform PoliformaT. A virtual environment of collaboration and learning, support for the presential learning but also for the teaching of on-line courses, which include a complete package of tools, in order to supply the students with material, improve the student-professor interaction, the programming, the evaluation and the management of the subjects (Martínez Rubio, Ramírez Blanco, & Ferrando Bataller, 2010). This kind of tool is fundamental for the

teaching of any subject and a basis element of the development of any educational project.

Research around the learning practice itself and its consequences in the learning of students, are the ones which usually lead to the proposals of learning innovations.

The subject of Quantitative finances, includes among the competences related to the learning of contents: i) to synthesize in a critic way the information which comes from different sources, ii) the specific tools. Moreover, among the transversal competences, they work the CT-01 understanding and integration, CT-02 application and practical thinking, CT-03 analysis and solving of problems, CT-07 ethical, environmental and professional responsibility, CT-09 Critical Thinking, CT-10 Knowledge of contemporary problems, CT-11 continuous learning, CT-12 Time planning and management and CT-13 specific tools.

The practical sessions are an ideal environment for the development and valuation of some of these competences in a special way. The lab-sessions are set according to duration and content in relation with the theoretical development of the subject, with an availability of 10 hours of lab-sessions in the first semester, each session lasts 2 hours, resulting in 5 lab-sessions in total. The lab-sessions groups are not numerous (18 students approximately) and each student can use a computer. On the other hand, the problems set out in the lab-sessions lead to the fulfilment of the competences set by the theoretical content of the subject itself: synthesis of information, work planning and solving of problems with the computer. It can not be limited to the simple resolution of practical exercises in the computer. Moreover, it is necessary to make the most of the time in the development of the lab-sessions together with a good knowledge of the IT tool in order to face more advanced problems with enough time. On the other hand, it is important to account with information relative to the degree of the students' knowledge acquisition.

## **2. OBJECTIVE**

The aim of this work is to introduce a teaching proposal which helps to improve the content-learning of the Quantitative Finances subject, programmed in five different sessions by means of the R statistical software package with the aim of considering the solving of true financial problems, the level of difficulty is set in the subject according to its contents, from the Financial Markets information and taking selected cases, we try to introduce the student in the development of thinking processes more or less complexed and providing the students with some calculation tools for the problem solving and ananalysis, together with the right understanding and comprehension of results. All those aspect are necessary in the decion taking.

## **3. DEVELOPMENT OF THE INNOVATION**

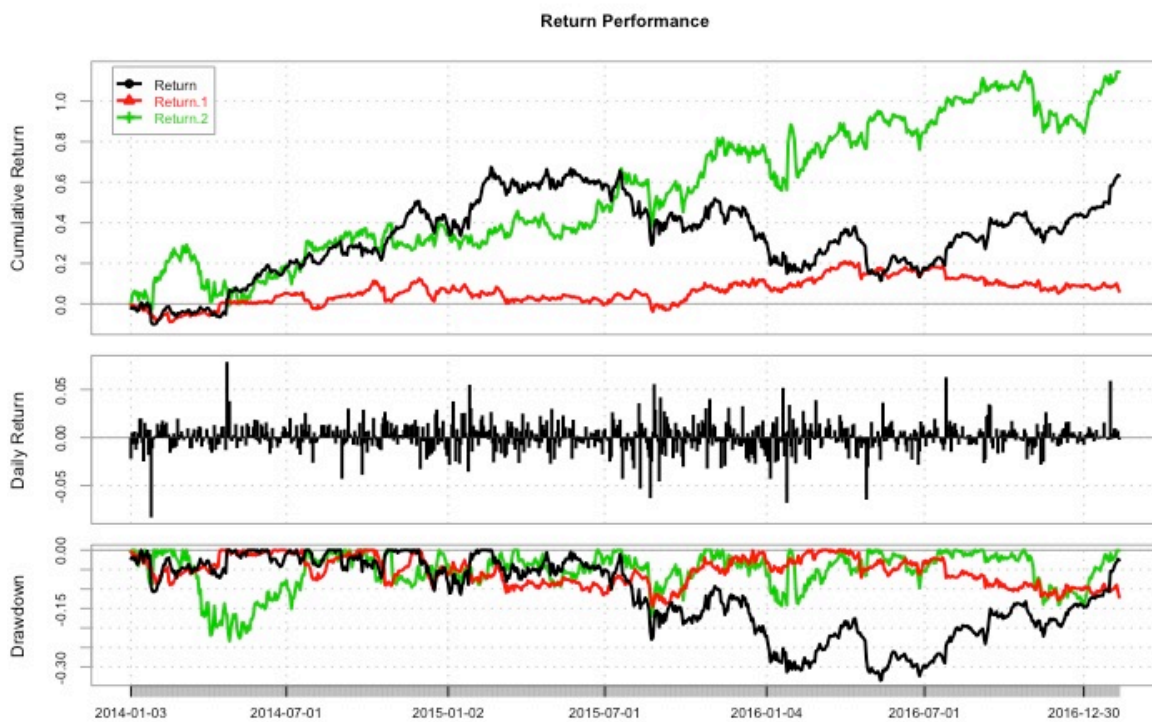
From the methodological approach of action-research, which is a methodological research orientation in order to improve the learning-teaching processes, we adopted a critical observation of the teaching situation in Quantitative Finances. It is an approach in which from a critical reflexion about the current situation, the different stages of an innovation implementation take place in a cyclical way when teaching the subject, as well as a series of reflections about the results which can lead to a practical solution.

Thus, we use the lab-sessions in order to propose true problems and not only the solution of practical exercices, in groups (18 students approximately) which need to share the IT resources in the lab-sessions classroom and the need of manage the time of the sessions in a proper way in order to reach the proposed learning objectives. With this purpose, an innovation teaching project was proposed which, by solving the problems of teaching, adds the transversal competences previously commented.

#### 4. EXAMPLE OF GUIDELINE FOR THE LAB-SESSION

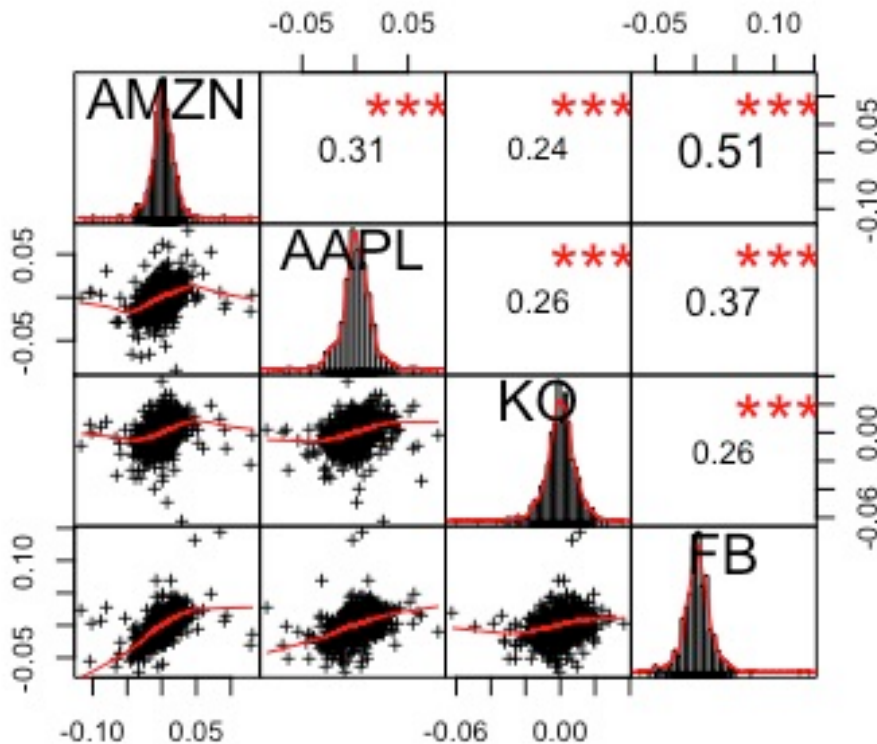
The first lab-sessions were mainly focused on knowing and getting familiar with the R-Statiscal Software. Thus, the first one focused on the fundamentals of the software and its packages, the second one on the loops and iterations and the third one in creating a Markowitz portfolio and getting Return Performance (Figure 1) and Returns Correlations with different stocks (Amazon, Apple, Coca-Cola and Facebook) (Figure 2).

Figure 1. Return performance



Source: authors' own elaboration

Figure 2. Correlations



Source: authors' own elaboration

## 5. RESULTS AND CONCLUSIONS

The subject of Quantitative Finance includes, among others, the competences related to the contents of the subject: i) Critical synthesis of information which comes from different data sources, ii) Efficient planning of work, iii) The inclusion of creative solutions when solving problems. Furthermore, among the transversal competences, the following ones were developed: i) comprehension and integration, ii) critical thinking and its application, iii) problems solving and analysis, iv) Ethical, environmental and professional responsibility, v) Critical thinking, vi) Knowledge of contemporary problems, vii) continuous learning. The following competences were chosen as checkpoints: Critical synthesis of information and the use of specific tools. With this

aim, five lab-sessions were developed, from the standpoint of the real case and using the IT resources of the laboratories, introducing the students to taking decisions in a financial environment, by using the specific tools.

Thus, all the commented transversal competences were acquired while, at the same time, the checkpoints competences (Critical synthesis of information and the use of specific tools), were also reinforced. The high results obtained by the students proved how the innovations introduced in the subject, the solving of real cases in the lab-sessions and the use of the R statistical software under the action-research approach, improved the students' learning results, reinforced all transversal competences and, in a special way, the ones chosen as checkpoints.

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