The enlightenment of stability

"Economic stability, with financial stability at its epicentre, is intelligible only in terms of development, including when it is conceived according to the precepts of the political philosophy of austerity."

Treated as a depth problem of the financial market, financial stability has valid solutions when financial flows exist to and from the economic processes which are centred on exploiting the resources in their diversity, while respecting the fundamental correlations of economicity. In a financial market where only the quasi-general circuit of bank financing resources makes the rule, stability cannot be sustained. The rarity of capitalization resources, including the classical savings, as well as the almost null stock exchange capitalization, transform stability into an illusion and the convergence potential into an impossibility.

Without the hope of sustaining long-term strategic objectives and of being a consequence of development, financial stability in a lightly structured, emergent and open economy is a challenge. The basis for this truth is that, on the one side, financial stability settles after a difficult, sometimes distorted transition, on the incomplete pillars of social and economic stability, while on the other side general stability is less probable and even inconsistent in terms of underdevelopment.

Today a balancing is about to take place at the level of the theoretical vision, as well as the level of the trial of practice. It is signalled by the more precise targeting of solutions to the complicated problems of exiting the crisis, especially after it became a virulent economic crisis which threatens to degenerate into a social crisis. But the sense sought by the analyses on its stability is, surprisingly, a quite confusing challenge: is "equilibrium" being favoured through decisions on the minimal slope of the development curve, or are there stimulated the trends for recuperating the recoil of the development stirred by the crisis? On principle, the analysis has sense when economic stability is seen as the support for permanently establishing the trends of social development, while financial stability is seen as a consequence of economic stability.

As such, types of financial stability are yet to be defined according to the slope-parameters of development or to the actual state of configuration of the economy, from a development standpoint. By dulling/deactivating the sources of

development, as suggested by the strategies of austerity, or by utilizing these sources sustainably, with – naturally for an emergent country – milestones set for the long term, the accurate image of these types of stability obscures the success of the strategy for the functional integration of these economies. The comparative analysis, using the global result indicators and recognized as a usual method for the characterization of the economy's capacity – including the potential of the financial system, offers scarce evidence that the finality of the stability process is being insured.

The cruel reality is that for a long time from now on Central and Eastern Europe will deplete its energies in the process of escaping underdevelopment, and as such it will unavoidably face instability. The levelling of the economic behaviour under the effect of integration, especially through the voluntary acceptance of the functional standards specific to the Euro zone, has jammed the potential of the emergent post-planning economies of absorbing the integration's force of traction, a situation also prolonged by the misfortune of some of adhering right at the time of the start of the economic crisis, which has affected the integrated European economy.

The key to the understanding is the truth that the recurring instability under-layer is persistent in a post-communist emergent economy and that breaking the knot of under-development problems is a decisional and actional initiative postponed for far too long. Among other things, it is worth taking into consideration the in-depth documentation of the behaviour which denies capital structure the ability to create savings for development investments, either directly through investments which spur social and economic development or indirectly, through taxable profitability which sustains public investments. Documenting this behaviour must be realized in an empirical manner, unaffected by the demands of some ideologically over-expanded theories. To this come added the consequences of the deepening rift between the strategy of commercial banks, the majority of them owned by foreign capital, which maintain their position through a non-combat in the area of respecting the demands of prudentiality and through the answer given to the problems of demand in conditions of aversion to credit-risk.

Economic stability, with financial stability at its epicentre, is intelligible only in terms of development, including when it is conceived according to the precepts of the political philosophy of austerity. We find ourselves at the inflection point in which powering through the blockages in development demands the conceptual interaction in the universe of stability. Here we must rebuild the logical alignment between the monetary economy – which was somewhat compelled by the mainstream to be autistic with regard to development – and the real economy, crisscrossed by the decremental trends of the natural factors of development.

This is how the apparent state of stability is, in fact, the materialization of an involutionary effect – to the point of assimilating the crisis – of the consequences which would stimulate the virtuous circles of development. In order to change direction, the economic fundamentals must be re-centred on the dynamical and motivating meanings of wealth, especially with regard to the correct sources: salaries and profit. It is in this context that we need to judge the causal link between the relaxation of direct fiscality in the pre-crisis period and the mid-crisis expansion of the indirect fiscality (the Romanian case in which the 16% taxation of revenue led to the 24% taxation of consumption!).

Financial stability, from a structural point of view, was thus established on top of the vicious circles of poverty. Proof of this is the fact which must be carefully explained in order to be fully understood: the sense of the financial flows almost exclusively generates extra-system profitability (suggestively – *exporting profits and importing debt!),* which complicates the budget problem in the emergent post-communist economies.

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Contents

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www.economieteoreticasiaplicata.ro; www.ectap.ro

Reception of texts: economia.ta@edeconomica.com

ISSN 1841-8678 (Print)
ISSN 1844-0029 (Online)

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 7-24

Specific patterns in portfolio analysis

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Abstract. *In the mid-twentieth century, under an unprecedented growth of the business of trading in securities, the need to provide a modern framework for assessing the performance of portfolios of financial instruments was felt. To that effect, it is noted that over this period, more and more economists have attempted to develop statistical-mathematical models that ensure the evaluation of profitability and portfolio risk securities. These models are considered to be part of "the modern portfolio theory".*

Keywords: Markowitz model; the optimal portfolio; profitability portfolios; inefficient portfolios; efficient portfolios.

JEL Classification: G11, G15.
REL Classification: 11B.

1. The Markowitz model

A. General aspects regarding the Markowitz portfolio of the management model

The first attempts to develop a modern model designed for the evaluation of the portfolio performance tools belongs to the American professor, Harry Markowitz, who proved in his study, "Portfolio Selection. Efficient Diversification of Investments", that the selection of the portfolio can be achieved through the study of “the rate of expected return and portfolio variance or standard deviation as a measure of risk." This is true with certainty.

The model developed by Markowitz is based on a number of assumptions which may be summarized as follows:

- The investors consider each investment alternative as being represented by the distribution of hoped profit probability for a time period;
- The investors maximize the expected utilities within a period of time, while the utility curve maximises the marginal utility of their welfare;
- The investors estimate the risk based on the modifications in the hoped profits;
- The investors take decisions only based on risk and hoped profit, therefore the utility curve is expressed as a function of expected profit and variance of profit;
- For a given level of risk, investors prefer a bigger profit; for a given level of expected profit, investors prefer lesser risk.

The practical use of the Markowitz model allows the determination of the level of individual dispersions of return in financial instruments for both a simplified portfolio of instruments (consisting of only two financial titles), as well as a portfolio composed of "n" financial instruments.

Even if it is about two or more titles on different markets, the construction of an efficient portfolio involves to gradually follow the steps:

- identifying the risk profile-win for each combination of alternative securities in the portfolio;
- predicting what combination of risky titles with minimal variance depending on the aversion degree of each investor;
- determining the complete portfolio by combining the minimum variance portfolio with the risk-free securities that the investor intends to introduce in its portfolio.

B. The profitability and the risk of a portfolio composed of two financial titles

The simplest portfolio that can be analyzed using the model developed by Markowitz is composed of two financial instruments. Thus, we consider that a capital investor has the possibility of choosing to invest their savings in one of the two available financial titles T1 and T2, or he equally has the possibility of

creating a portfolio P, dividing the amount that he wants to invest in the two mentioned above titles.

From a mathematical perspective, the investors anticipations about the behavior of the two titles in the future period can be summarized as follows:

$$T_1 \begin{cases} E_1 \\ \sigma_1 \end{cases} \quad T_2 \begin{cases} E_2 \\ \sigma_2 \end{cases}, \text{cov}_{12} = \rho_{12} \times \sigma_1 \times \sigma_2$$

where:
E_i - the mathematical expected value and the rate of return of title i;
σ_i - the standard deviation of the rate of return of title i;
ρ_{ij} - the correlation coefficient between the rates of return of titles i and j;
Cov_{ij} - the covariance between the rates of return of titles i and j.

A capital investor has the possibility to form a portfolio combining the two financial titles in the proportion X1 and X2. In this case, the total available amount is invested in T1 (the amount of the first type of financial instrument acquisition), respectively T2 (the amount of the purchase of the second type of financial instrument). In this case we can establish the following relationship for the calculation:

$X_1 + X_2 = 1$with $X_1, X_2 \geq 0$ or $0 \leq X_1 \leq 1$ and $0 \leq X_2 \leq 1$

Given the above, one can determine the mathematical expectation of the rate of return of the portfolio P (Ep), using this formula:

$$E_p = X_1 \times E_1 + X_2 \times E_2$$

As it can be seen from the above relationship, the yields hope is the weighted average of the bond yields hope, the proportions being the share.

The second element that should be studied in order to characterize the efficiency of the considered portfolio is the scattering rate of the return portfolio P (Vp), which is actually a measure of the risk of the portfolio investment. For this purpose we will use the following mathematical relationship of calculation:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times \text{cov}_{12}$$

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times \rho_{12} \times \sigma_1 \times \sigma_2$$

From the formulas mentioned above, it results that the portfolios variance is significantly influenced by the following elements:

- dispersion of each title included in the portfolio;
- the proportions combining the two financial titles;
- the covariance between the two considered titles.

To complete the analysis based on the above relations, in specialized literature it is recommended to study the correlation between the two financial titles included in the portfolio. Thus, we can see that depending on the coefficient value of correlation between the two financial titles T1 and T2, there can be identified three different cases, which can be summarized as follows:

- **The correlation coefficient is 1 ($\rho_{12} = 1$)**

In this case, we can say that the financial instruments T1 and T2 are perfectly and positively correlated, which means the anticipation to return these securities movements while perfectly consistent, but with different amplitudes. In this situation, it is considered that the portfolio risk is highest, because the factors that influence the two titles are similar and almost equal in intensity action. It also notes that, in this case, changing the share structure of the portfolio securities does not significaly improve the risk level associated with it.

For this correlation value of the degree, the relations on which we can make an assessment of the portfolio, consisting of two financial titles, may be given as follows:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times cov_{12}$$

to write:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times \rho_{12} \times \sigma_1 \times \sigma_2$$

with: ρ_{12}=1

that is:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times \sigma_1 \times \sigma_2 = (X_1 \times \sigma_1 + X_2 \times \sigma_2)^2$$

$$\sigma_p = X_1 \times \sigma_1 + X_2 \times \sigma_2$$

In this case, it is noted that the standard deviation of the the portfolio is equal to the average standard deviation of the financial titles in it. Bringing together the two equations and reporting the performance and portfolio risk P,

$$E_p = X_1 \times E_1 + X_2 \times E_2$$

and:

$$\sigma_p = X_1 \times \sigma_1 + X_2 \times \sigma_2$$

we get the equation:

$$E_p = f(\sigma_p)$$

as space of combining the titles T_1 şi T_2 in plan E – σ.

is known that:

$X_1 + X_2 = 1$

respectively:

$X_2 = 1 - X_1$

In these circumstances, the equation that can determine the mathematical expected value of the portfolios rate of the return $P(E_p)$ is:

$$E_p = X_1 \times E_1 + (1 - X_1)E_2$$

In this case, the share of title T1 in the portfolio P can be determined using the formula:

$$X_1 = \frac{E_p - E_2}{E_1 - E_2}$$

It is also found that if the mathematical expectations of the rate of return of the two titles are not equal ($E_1 \neq E_2$), the standard deviation of the performance of the portfolio can be calculated as follows:

$$\sigma_p = E_p\left(\frac{\sigma_1 - \sigma_2}{E_1 - E_2}\right) + \frac{E_1 \times \sigma_2 - E_2 \times \sigma_1}{E_1 - E_2}$$

- **The correlation coefficient is -1 ($\rho_{12} = -1$)**

If the correlation coefficient is ρ12 = -1, then T1 and T2 units are perfectly negatively correlated. In such a situation yield expectations on these securities fluctuates perfectly opposites.

It is worth noting that if the two titles are strictly negative correlated it can be reached, in a certain combination, at the total elimination of risk for the portfolio of securities.

Also in this case, the calculation relations of the standard deviation may be transformed as follows:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times cov_{12}$$

To write:

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_2^2 \times \sigma_2^2 - 2X_1 \times X_2 \times \sigma_1 \times \sigma_2$$

That is:

$$\sigma_p^2 = (X_1 \times \sigma_1 - X_2 \times \sigma_2)^2$$

The standard deviation is always positive, so the discution for the expressions sign $(X_1 \times \sigma_1 - X_2 \times \sigma_2)$ that can vary by X_1 and X_2.

For:

$$X_1 > \frac{\sigma_2}{\sigma_1 + \sigma_2}$$

This relation, along with the relation $E_p = X_1 \times E_1 + X_2 \times E_2$, allows the determination of the linked equation between E_p şi σ_p.

We obtain:

$$\sigma_p = E_p \frac{\sigma_1 + \sigma_2}{E_1 - E_2} - \frac{E_2 \times \sigma_1 + E_1 \times \sigma_2}{E_1 - E_2}$$

It is a linear relationship shown graphically by a straight line. Part of this line, corresponding to:

$$X_1 > \frac{\sigma_2}{\sigma_1 + \sigma_2}$$

It is the place of the securities portfolios obtained from T_1 and T_2.

For

$$X_1 < \frac{\sigma_2}{\sigma_1 + \sigma_2}$$

We have:

$$X_1 \times \sigma_1 - X_2 \times \sigma_2 < 0$$

and

$$\sigma_p = -(X_1 \times \sigma_1 - X_2 \times \sigma_2)$$

In a similar manner, if the value of the correlation degree is equal to 1, we obtain the linear equation linking E_p and σ_p.

$$\sigma_p = -E_p \frac{\sigma_1 + \sigma_2}{E_1 - E_2} + \frac{E_2 \times \sigma_1 + E_1 \times \sigma_2}{E_1 - E_2}$$

A part of this straight line, the one corresponding to

$$X_1 < \frac{\sigma_2}{\sigma_1 + \sigma_2}$$

Is the law obtained by combining T_1 and T_2 portfolios.

Finally, for

$$X_1 = \frac{\sigma_2}{\sigma_1 + \sigma_2}$$

we have $\sigma_p = 0$.

This result must be mentioned separately because it shows that starting from two risky titles is likely that, choosing rigorous the proportions ($0 \leq X_1$ and $X_2 \leq 1$), to construct an un-risky portfolio. This result is possible if T1 and T2 of the securities are perfectly and negative correlated.

- **The correlation coefficient different from +-1 ($\rho_{12} \neq +-1$)**

If $-1 < \rho_{12} < +1$ (including $\rho_{12} = 0$) the fluctuations anticipated for the securities T_1 and T_2 are not perfectly dependent (positive and negative). It is the general case, where there is a certain degree of correlation between the yield rate due to the fact that all titles follow more or less the fluctuations of the national economy.

A low correlation may lead to significant improvement in the value of the risky portfolio investment. Also, a null value of this coefficient is considered to be a potential source of a 50% reduction of the portfolios risk analysis.

In the general case (the correlation coefficient different from +1 and -1), for a second portfolio of risky titles is obtained the following expression:

$$\sigma_p^2 = X_1^2 \times V_1 + X_2^2 \times V_2 + 2X_1 \times X_2 \times cov_{12}$$

$$cu - 1 < \rho_{12} < +1$$

meaning:

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_2^2 \times \sigma_2^2 + 2X_1 \times X_2 \times \sigma_1 \times \sigma_2 \times \rho_{12}$$

As it can be seen, in this case, unlike the previous situations, the term of risk can be reduced as a perfectly square, which makes it more difficult to determine its practical value.

Starting from this equation and from that of E_p ($E_p = X_1 \times E_1 + X_2 \times E_2$), we establish the relation that links the E_p and σ_p.

From the equation of E_p we obtain $X_1 = (E_p\text{-}E_2)/(E_1\text{-}E_2)$ value that you enter in the equation of th V_p. Developing we get:

$$\sigma_p^2 = E_p^2 \left[\frac{V_1 + V_2 - 2 \times cov_{12}}{(E_1 - E_2)^2}\right] + 2E_p \frac{E_1(cov_{12} - V_2) + E_2(cov_{12} - V_1)}{(E_1 - E_2)^2} +$$
$$+ \frac{E_2^2 \times V_1 + E_1^2 \times V_2 - 2 \times E_1 \times E_2 \times cov_{12}}{(E_1 - E_2)^2}$$

E-V equation is obtained in terms of a parabola. In E-σ plan, the equation

$$\sigma_p = \sqrt{V_p} = f(E_p)$$

is a hyperbole of which retain a branch, namely that corresponding positive σ_p values.

- ***The analysis of the contribution of a security risk and yields portfolio that is included (case of two securities portfolio)***

An interesting aspect in the analysis of any portfolio of financial instruments is the risk assessment of the contribution of each title and the overall yield of the portfolio to which it belongs.

To illustrate the methodology for analyzing this contribution we consider the case of a portfolio formed from two titles combined T_1 and T_2 ratios X_1 and X_2.

The contribution of each title to the portfolio return is easily expressed and represents the contribution to the yields formation of each title. The sum of all contributions will be exactly this yield.

It is known that $E_p = X_1 \times E_1 + X_2 \times E_2$.

Title 1 is the contribution of X_1E_1 to the portfolios expectancy. This contribution is based on the expectation of return of title and the proportion invested in the title.

In terms of risk, the problem is more complex.

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_2^2 \times \sigma_2^2 + 2X_1 \times X_2 \times cov_{12}$$

We can write:

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_1 \times X_2 \times cov_{12} + X_2^2 \times \sigma_2^2 + 2X_1 \times X_2 \times cov_{12}$$

$$\sigma_p^2 = X_1(X_1 \times \sigma_1^2 + X_2 \times cov_{12}) + X_2(X_2 \times \sigma_2^2 + X_1 \times cov_{12})$$

$$\sigma_p^2 = X_1(X_1 \times cov_{11} + X_2 \times cov_{12}) + X_2(X_2 \times cov_{22} + X_1 \times cov_{12})$$

$$\sigma_p^2 = X_1 cov(T_1, X_1 \times T_1 + X_2 \times T_2) + X_2 cov(T_2, X_1 \times T_1 + X_2 \times T_2)$$

$$\sigma_p^2 = X_1 \times cov_{1p} + X_2 \times cov_{2p}$$

$X_1 \times cov_{1p}$ is the contribution of title 1 to the risk of the portfolio.

This contribution is based on the proportion invested in the title and risk of the portfolio measured by cov_{1p}/σ_p.

This portfolio risk is measured based on Title 1 and portfolio covariation of the constitution of which it participates. Based on the formula that defines a security risk in a portfolio,

$$\frac{\text{cov}_{1p}}{\sigma_p} = \frac{X_1 \times \sigma_1^2 + X_2 \times \text{cov}_{12}}{\sigma_p}$$

we conclude:

- choosing a title for inclusion in a portfolio will not be based on its individual characteristics (σ_1), but on the behavior of the portfolio (cov_{1p});
- the risk of a title is not unique, it depends on the portfolio is included in.

- ***The determination of the absolute minimum variance of the portfolio structure with (PVMA) (case of the portfolio of two titles)***

The portfolio with minimum absolute variance or the optimal portfolio is that portfolio that ensures a maximum return while minimizing risk exposures.

Depending on the absolute minimum absolute variance portfolio it is possible to separate the multitude of portfolios into two distinct sections, as follows:

a) *Inefficient portfolios (mostly)* – are those portfolios below the PVMA level and any increase in risk is associated with a decrease in expected returns.
b) *Efficient portfolios (dominant)* – are those portfolios located above the PVMA level and that associates any risk increase with non-linear growth of expected returns.

C. Portfolio management that consists of two instruments on the capital market in our country

To study the applicability of the model, we have built a portfolio of securities issued by the two companies in our country and that are traded through Bucharest Stock Exchange. For this purpose, we used two of the 10 companies selected to be part of the portfolio (of 20 analyzed). The two companies chosen are OMV Petrom SA and Transylvania Bank.

Table 1. *Return securities included in the portfolio*

SNP	0.001669
TLV	0.001933

Estimated yield of the regarded portfolio is determined as follows:

$E_p = X_1 \times E_1 + X_2 \times E_2$

where:

$X_{1,}$ X_2 = participation shares in portofolio;

$E_{1,}$ E_2 = returns of the two titles;

$E_p = X_{SNP} \times E_{SNP} + X_{TLV} \times E_{TLV}$.

Simultaneously, we calculated the risk related to the investment, according to the equation:

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_2^2 \times \sigma_2^2 + 2 \times X_1 \times X_2 \times \sigma_{12}$$

$$\sigma_p^2 = X_{SNP}^2 \times \sigma_{SNP}^2 + X_{TLV}^2 \times \sigma_{TLV}^2 + 2 \times X_{SNP} \times X_{TLV} \times \sigma_{SNP/TLV}$$

The investor has the possibility to choose over the weights assigned to each type of action in virtual portfolio that will be created. The influence on the evolution of the share over the portfolios and risk is presented in the following table:

Table 2. *Company profitability and risk analysis for a portfolio of shares of SNP and TLV*

X_{SNP}	X_{TLV}	$X \times E_{SNP}$	$X \times E_{TLV}$	E_P	X^2_{SNP}	X^2_{TLV}	$X^2_{SNP} \times \sigma^2_{SNP}$	$X^2_{TLV} \times \sigma^2_{TLV}$
100.00%	0.00%	0.001669	0.000000	0.001669	1.00	0.00	0.000221	0.000000
90.00%	10.00%	0.0015021	0.0001933	0.001695	0.81	0.01	0.000179	0.000003
80.00%	20.00%	0.0013352	0.0003866	0.001722	0.64	0.04	0.000141	0.000013
70.00%	30.00%	0.0011683	0.0005799	0.001748	0.49	0.09	0.000108	0.000030
60.00%	40.00%	0.0010014	0.0007732	0.001775	0.36	0.16	0.000080	0.000053
50.00%	50.00%	0.0008345	0.0009665	0.001801	0.25	0.25	0.000055	0.000083
40.00%	60.00%	0.0006676	0.0011598	0.001827	0.16	0.36	0.000035	0.000120
30.00%	70.00%	0.0005007	0.0013531	0.001854	0.09	0.49	0.000020	0.000163
20.00%	80.00%	0.0003338	0.0015464	0.001880	0.04	0.64	0.000009	0.000212
10.00%	90.00%	0.0001669	0.0017397	0.001907	0.01	0.81	0.000002	0.000269

$2 \times X_{SNP} \times X_{TLV} \times \sigma_{SNP/TLV}$	σ^2_P	σ_P
0	0.000221	0.014866
0.00001998	0.000202	0.014224
0.00003552	0.000190	0.013793
0.00004662	0.000185	0.013594
0.00005328	0.000186	0.013637
0.0000555	0.000194	0.013919
0.00005328	0.000208	0.014428
0.00004662	0.000229	0.015139
0.00003552	0.000257	0.016026
0.00001998	0.000291	0.017062

The interpretation of previous results is concluded:

- in the case of the echiponderat portfolio, consisting of two titles, for example, was a daily return of 0.1801% with a standard deviation of 1.3919%, which

means that future hoped profitability will most likely be equal with 0.1801% ± 1.3919% and will be in the range {-1.2118, 1.572};

- the maximum value of the return that can be obtained is 1.572%, which enjoys the investor preference for accepting securities with a risk as high volatility in the belief that it will earn above average profitability;
- Instead, an investor with adversity towards risks will not accept anything else than securities that records the highest return per unit of risk, or the reverse situation, when titles have the lowest risk per unit of forecast return.

D. Profitability and the risk of a portfolio composed of "n" financial titles

Based on the above methodology, it is possible to determine the yield and the risk for any type of financial instrument portfolio, regardless of the number of securities included in its structure.

If we extend, in a first phase, the previous analysis to a portfolio of three financial titles, we believe that this new title is a combination of portfolio included and the two financial instruments previously considered. This combination is particularly effective in the curve risk - gain and is closer to the vertical axis and the top of the chart (hazard minimum - maximum gain). As the correlation between titles is lower (negative), so the curve is inclined to the right.

The above elements can be represented graphically as follows:

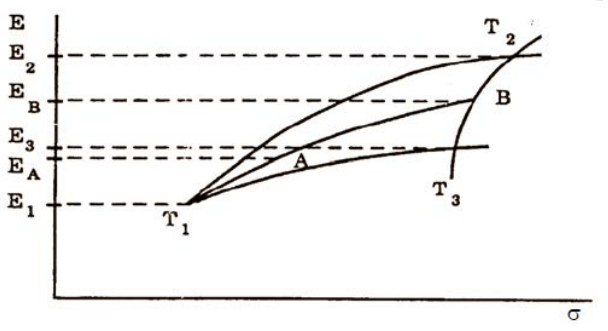

Figure 1. *The combination of three titles*

Based on the methodology presented elements, in the case of n titles portfolio, the profitability and risk can be determined as follows:

$$E_p = \sum_{i=1}^{n} X_i E_i$$

$$\sigma_p^2 = \sum_i X_i^2 \times \sigma_i + \sum_i \sum_j X_i \times X_j \times cov_{ij}; \qquad i \neq j$$

or if we note cov_{ij} by σ_{ij} and $V_i = \sigma_i^2$ by σ_{ii} then:

$$\sigma_p^2 = \sum_i \sum_j X_i \times X_j \times \sigma_{ij}$$

As you can see, even in the portfolios consisting of "n" financial titles, the portfolio return depends on the expected return of each title included in the structure of the portfolio, and the share which they hold in this structure.

In the case of portfolio risk can be seen that its level is influenced both by:

- individual risks of each title included in the portfolio;
- share of the title in the portfolio;
- covariance of the returns of securities, taken two by two.

E. The determination of the optimum portfolio using the Markowitz model

The Markowitz model of portfolio diversification of financial instruments may lead to the identification of the optimal portfolio of risky titles, respectively of companies providing a maximum expected the return for a given level of risk that the capital investors are willing to assume due to their behavior towards risk.

From a mathematical perspective, the optimal portfolio will satisfy the following conditions:

$$\min \sigma_p = \left(\sum_i \sum_j X_i \times X_j \times cov_{ij} \right)^2$$

under restrictions:

$$E_p = \sum_i X_i \times E_i = E_e$$

$\sum_i X_i = 1.$

In this case, using the Lagrange method, with which the optimal solution is determined as follows:

$$L = \sigma_p + \lambda_1 \left(E_e - \sum_i X_i \times E_i \right) + \lambda_2 \left(1 - \sum_i X_1 \right)$$

To obtain the optimal solution is resolved the system:

$$\frac{\delta L}{\delta \lambda_1} = E_e - \sum_i X_i \times E_i = 0$$

$$\frac{\delta L}{\delta \lambda_2} = 1 - \sum_i X_i = 0$$

$$\frac{\delta L}{\delta X_1} = \frac{\delta \sigma_p}{\delta X_1} - \lambda_1 \times E_1 - \lambda_2 = 0$$

....

$$\frac{\delta L}{\delta X_n} = \frac{\delta \sigma_p}{\delta X_n} - \lambda_1 \times E_n - \lambda_2 = 0$$

In which for whatever "i" and "j", it results:

$$\frac{\delta \sigma_p}{\delta X_n} - \lambda_1 \times E_i = \frac{\delta \sigma_p}{\delta X_n} - \lambda_1 \times E_j$$

The multiplier λ_1 measures the risk per unit change in yield variation, $\lambda_1 = \delta\sigma_e/\delta E_e$ that is the slope of the tangent to the efficient frontier at the point e.

Denote by:

$$s_e = \frac{\delta E_e}{\delta \sigma_e} \Longrightarrow \lambda_1 = \frac{1}{s_e} \Longrightarrow E_j - E_i = s_e \left(\frac{\delta \sigma_e}{\delta E_j} - \frac{\delta \sigma_e}{\delta E_i} \right)$$

Multiplying each term by X_{ie} and summing after i we will obtain:

$$\sum_i X_{ie}(E_j - E_i) = s_e \left(\sum_i X_{ie} \frac{\delta \sigma_e}{\delta E_j} - \sum_i X_{ie} \frac{\delta \sigma_e}{\delta E_i} \right) \Longrightarrow$$

$$E_j - \sum_i X_{ie} \times E_i = s_e \left(\frac{\delta \sigma_e}{\delta E_j} - \sum_i X_{ie} \frac{\delta \sigma_e}{\delta E_i} \right)$$

where:

$\sum_i X_{ie} \times E_i$ = contributions amount to yield securities in portfolio e (E_e)

$\frac{\delta \sigma_e}{\delta E_j}$ = the titles risk in portfolio e ($\frac{cov_{je}}{\sigma_e}$)

$\sum_i X_{ie} \frac{\delta \sigma_e}{\delta E_i}$ = the titles amount contributions at the risk of portfolio e (σ_e).

Finally, you get the relation according to which:

$$E_j - E_e = s_e\left(\frac{cov_{ip}}{\sigma_e} - \sigma_e\right).$$

This is the necessary but not sufficient condition of efficiency for a title to be held efficiently in a portfolio.

All combinations of all optimal portfolios with n titles in a market can be joined by a curve called the efficient frontier, a concept introduced by Harry Markowitz in his work entitled "Portfolio Selection" (1952). This curve has a convex shape by default. For any point inside the efficient frontier there is at least one portfolio on the market which can be put into correspondence a set of risk - gain variables. The portfolios from the efficient frontier have the following property: at a certain level of earning it has the minimum variance (low risk) or a certain level of risk it offers the maximum expected gain among all other variants of possible combinations.

The efficient frontier of a market is made up of the points of minimum variance of the curves related to risk - gain profiles for all combinations of titles on a market. This new concept associated with placements in financial markets is difficult to empirically highlight due to the risky number of titles that can be combined.

The action strategy of an investor is determined by the meeting between the desires set and the multitude of posibilities. The desires multitude consists of the indifference curves that are the expression of the investors preference in plan E - σ and results directly from its utility function. The multitude of possibilities is represented by the plane's efficiency frontier in plan E - σ which is obtained starting from the securities set of individual investor expectations. Only the efficient portfolios, however, are considered by the investor. The choice of the investor will be the corresponding point of tangency between the two curves. At this point the optimal portfolio is obtained.

The chosen portfolio will depend on the aversion degree of risk of the investor. If his aversion is strong, he will choose a portfolio located on the left of the efficient frontier corresponding to the weakest level of risk. With a weaker aversion he will choose a portfolio further to the right on the border.

According to the studies developed by Markowitz and continued later by Sharpe, the second stage involves the construction of an efficient portfolio of securities included in the portfolio without risk. Each portfolio has an associated straight line of capital allocation – DAC which starts at the point corresponding to the risk-free rate of the market. The investor will try a number of combinations until he will get the right combination for which the line allocation of capital is tangent to the efficient frontier. The point P in which the straight line DAC is tangent to the efficient frontier corresponds to the optimal portfolio that maximizes the

earning rate of risk accepted ("reward - to - variability ratio"). This portfolio P is the final point in the construction of the optimal portfolio (effective) according to the theory of capital allocation (Markovitz).

F. The portfolio management consisting of three financial instruments on the capital market in our country

The portfolio composed of the two financial titles (shares issued by OMV Petrom SA and Transylvania Bank) previously analyzed may be varied by introducing in its structure a third financial instrument.

In this respect, the capital investor has the opportunity to purchase two categories of financial instruments as follows:

- securities issued by an economic entity;
- government securities.

- ***Efficiency and risk of a portfolio composed of three classes of shares***

In order to form this portfolio, we have included in its structure of financial instruments shares issued by the Financial Investment Company "SIF Muntenia S.A.". Based on the above methodology we will calculate the yield and the risk attached to shares issued by the considered issuer.

$E_p = X_1 \times E_1 + X_2 \times E_2 + X_3 \times E_3$

$E_p = X_{SNP} \times E_{SNP} + X_{TLV} \times E_{TLV} + X_{SIF4} \times E_{SIF4}$

Further to this, we will determine the values for the correlation coefficients between the three financial instruments included in its structure:

$$\sigma_p^2 = \sum_i \sum_j X_i \times X_j \times \sigma_{ij}$$

$$\sigma_p^2 = X_1^2 \times \sigma_1^2 + X_2^2 \times \sigma_2^2 + X_3^2 \times \sigma_3^2 + 2 \times X_1 \times X_2 \times \sigma_{12} + 2 \times X_1 \times X_3 \times \sigma_{13} + 2 \times X_2 \times X_3 \times \sigma_{23}$$

$$\sigma_p^2 = X_{SNP}^2 \times \sigma_{SNP}^2 + X_{TLV}^2 \times \sigma_{TLV}^2 + X_{SIF4}^2 \times \sigma_{SIF4}^2 + 2 \times X_{SNP} \times X_{TLV} \times \sigma_{SNP/TLV} + 2 \times \sigma_{SNP/SIF4} + 2 \times X_{TLV} \times X_{SIF4} \times \sigma_{TLV/SIF4}$$

Also in this case, the investor may choose the weights assigned to each type of shares in the portfolio built. The influence on the evolution of this share portfolio of return and risk is presented in the following table:

Table 3. *Analyse indicators of profitability and risk for the portfolio made of shares SNP, TLV and SIF4*

X_{SNP}	X_{TLV}	X_{SIF4}	$X_{SNP}\times E_{SNP}$	$X_{TLV}\times E_{TLV}$	$X_{SIF4}\times E_{SIF4}$	E_P	X^2_{SNP}
100.00%	0.00%	0.00%	0.001669	0.000000	0.000000	0.001669	1.000000
80.00%	10.00%	10.00%	0.001335	0.000193	0.000134	0.001662	0.640000
10.00%	80.00%	10.00%	0.000167	0.001546	0.000134	0.001847	0.010000
60.00%	20.00%	20.00%	0.001001	0.000387	0.000268	0.001656	0.360000
40.00%	30.00%	30.00%	0.000668	0.000580	0.000401	0.001649	0.160000
30.00%	40.00%	30.00%	0.000501	0.000773	0.000401	0.001675	0.090000
20.00%	40.00%	40.00%	0.000334	0.000773	0.000535	0.001642	0.040000
40.00%	20.00%	40.00%	0.000668	0.000387	0.000535	0.001589	0.160000
0.00%	50.00%	50.00%	0.000000	0.000967	0.000669	0.001636	0.000000
50.00%	0.00%	50.00%	0.000835	0.000000	0.000669	0.001504	0.250000
30.00%	10.00%	60.00%	0.000501	0.000193	0.000803	0.001497	0.090000
10.00%	30.00%	60.00%	0.000167	0.000580	0.000803	0.001550	0.010000
10.00%	20.00%	70.00%	0.000167	0.000387	0.000937	0.001490	0.010000
10.00%	10.00%	80.00%	0.000167	0.000193	0.001070	0.001431	0.010000
20.00%	0.00%	80.00%	0.000334	0.000000	0.001070	0.001404	0.040000
0.00%	20.00%	80.00%	0.000000	0.000387	0.001070	0.001457	0.000000
10.00%	0.00%	90.00%	0.000167	0.000000	0.001204	0.001371	0.010000
0.00%	10.00%	90.00%	0.000000	0.000193	0.001204	0.001398	0.000000
0.00%	0.00%	100.00%	0.000000	0.000000	0.001338	0.001338	0.000000
33.00%	33.00%	34.00%	0.000551	0.000638	0.000455	0.001644	0.108900

X^2_{TLV}	X^2_{SIF4}	$X^2_{SNP}\times\sigma^2_{SNP}$	$X^2_{TLV}\times\sigma^2_{TLV}$	$X^2_{SIF4}\times\sigma^2_{SIF4}$	$2\times X_{SNP}\times X_{TLV}\times \sigma_{SNP/TLV}$
0.000000	0.000000	0.000221	0.000000	0.000000	0.000000
0.010000	0.010000	0.000141	0.000003	0.000003	0.000018
0.640000	0.010000	0.000002	0.000212	0.000003	0.000018
0.040000	0.040000	0.000080	0.000013	0.000013	0.000027
0.090000	0.090000	0.000035	0.000030	0.000029	0.000027
0.160000	0.090000	0.000020	0.000053	0.000029	0.000027
0.160000	0.160000	0.000009	0.000053	0.000051	0.000018
0.040000	0.160000	0.000035	0.000013	0.000051	0.000018
0.250000	0.250000	0.000000	0.000083	0.000079	0.000000
0.000000	0.250000	0.000055	0.000000	0.000079	0.000000
0.010000	0.360000	0.000020	0.000003	0.000114	0.000007
0.090000	0.360000	0.000002	0.000030	0.000114	0.000007
0.040000	0.490000	0.000002	0.000013	0.000155	0.000004
0.010000	0.640000	0.000002	0.000003	0.000203	0.000002
0.000000	0.640000	0.000009	0.000000	0.000203	0.000000
0.040000	0.640000	0.000000	0.000013	0.000203	0.000000
0.000000	0.810000	0.000002	0.000000	0.000257	0.000000
0.010000	0.810000	0.000000	0.000003	0.000257	0.000000
0.000000	1.000000	0.000000	0.000000	0.000317	0.000000
0.108900	0.115600	0.000024	0.000036	0.000037	0.000024

$2 \times X_{SNP_x} X_{SIF_x} \sigma_{SNP/SIF4}$	$2 \times X_{TLV} \times X_{SIF4} \times \sigma_{TLV/SIF4}$	σ^2_P	σ_P
0.000000	0.000000	0.000221	0.014866
0.000016	0.000002	0.000183	0.013545
0.000002	0.000016	0.000253	0.015910
0.000024	0.000008	0.000164	0.012794
0.000024	0.000017	0.000162	0.012713
0.000018	0.000023	0.000169	0.013011
0.000016	0.000031	0.000177	0.013316
0.000032	0.000016	0.000164	0.012819
0.000000	0.000049	0.000211	0.014517
0.000050	0.000000	0.000184	0.013565
0.000036	0.000012	0.000191	0.013830
0.000012	0.000035	0.000200	0.014130
0.000014	0.000027	0.000216	0.014706
0.000016	0.000016	0.000242	0.015556
0.000032	0.000000	0.000243	0.015601
0.000000	0.000031	0.000247	0.015723
0.000018	0.000000	0.000277	0.016637
0.000000	0.000017	0.000278	0.016660
0.000000	0.000000	0.000317	0.017804
0.000022	0.000022	0.000165	0.012846

As it can be seen, the introduction to the portfolios structure of the third type of financial instruments, respectively the actions of SIF4 - Muntenia, led to an increase in the performance of the portfolio, simultaneously with a decrease in risk associated with this investment. This is due to the fact that the new shares in the portfolio are some with a specific lower-risk.

- **The yield and the risk of a portfolio composed of two categories of actions and a state title**

Another option of diversifying its portfolio of financial instruments is represented by the purchase of government bonds. They have the great advantage that, unlike the securities issued by business entities, they are not risk-bearing. To analyze this type of portfolio we have included state securities with a daily yield of 0.015836%. The interest rate for government bonds with interest was taken from the National Bank of Romania site www.bnro.ro, but because it is available as annual percentage rate, daily interest rate was obtained from the following formula:

$$(1 + \text{rate}_{\text{annual}}) = \left(1 + \text{rate}_{\text{daily}}\right)^{365}$$

Table 4. *Profitability of securities included in the portfolio*

SNP	0.001669
TLV	0.001933
TS	0.015836

Also, in this case, we simulated several options for allocating percentages of participation of the titles in the construction of the portfolio, the results being presented in the following table:

Table 5. *Analyse indicators of profitability and risk for the portfolio made of the shares of SNP, TLV and a state title*

X_{SNP}	X_{TLV}	X_{TS}	E_P	σ^2_P	σ_P
100.00%	0.00%	0.00%	0.001669	0.000221	0.014866
80.00%	10.00%	10.00%	0.003112	0.000183	0.013545
10.00%	80.00%	10.00%	0.003297	0.000253	0.015910
60.00%	20.00%	20.00%	0.004555	0.000164	0.012794
40.00%	30.00%	30.00%	0.005998	0.000162	0.012713
30.00%	40.00%	30.00%	0.006025	0.000169	0.013011
20.00%	40.00%	40.00%	0.007441	0.000177	0.013316
40.00%	20.00%	40.00%	0.007389	0.000164	0.012819
0.00%	50.00%	50.00%	0.008885	0.000211	0.014517
50.00%	0.00%	50.00%	0.008753	0.000184	0.013565
30.00%	10.00%	60.00%	0.010196	0.000191	0.013830
10.00%	30.00%	60.00%	0.010248	0.000200	0.014130
10.00%	20.00%	70.00%	0.011639	0.000216	0.014706
10.00%	10.00%	80.00%	0.013029	0.000242	0.015556
20.00%	0.00%	80.00%	0.013003	0.000243	0.015601
0.00%	20.00%	80.00%	0.013055	0.000247	0.015723
10.00%	0.00%	90.00%	0.014419	0.000277	0.016637
0.00%	10.00%	90.00%	0.014446	0.000278	0.016660
0.00%	0.00%	100.00%	0.015836	0.000317	0.017804
33.00%	33.00%	34.00%	0.006573	0.000165	0.012846

References

Badea, L. (2006). „Studiu asupra aplicabilităţii modelului Markowitz pe piaţa bursieră din România", *Economie teoretică şi aplicată*, nr. 6

Chen, N., Roll, R., Ross, S. (1986). "Economic Forces and the Stock Market", *Journal of Business*, Nr. 59

Dragotă, V. (coordonator) (2009). *Gestiunea portofoliului de valori mobiliare*, ediţia a doua, Editura Economică, Bucureşti

Fama, E. (1993). "Common Risk Factors in the Returns on Stocks and Bonds", *Journal of Financial Economics*

Fama, E. (1970). "Efficient capital markets: a review of theory and empirical work", *Journal of Finance*, Vol. 25

French K., Fama, E. (1994). "Size and Book-to-Market Factors in Earnings and Returns", *Journal of Finance*

Markowitz, H. (1959). "Portofolio selection. Efficient Diversification of Investments", *Journal of Finance* 7

Roman, M. (2003). *Statistica financiar – bancară şi bursieră*, Editura ASE, Bucureşti

Sharpe, W. (1963). "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Management Sciences Journal*

Stancu, I. (2007). *Finanţe. Pieţe financiare şi gestiunea portofoliului*, Editura Economică, Bucureşti

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 25-40

A turnpike theorem involving a modified Golden Rule

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Abstract. *In the current study, we investigate efficient capital accumulation in a stochastic neoclassical aggregate growth model. The underlying uncertainty is driven by Brownian-motion shocks and the major results do not rely on the specification of production functions. The stochastic balanced path of the capital-labor ratio is naturally derived by a martingale, and the corresponding modified Golden Rule path of capital accumulation is well-defined. The powerful martingale theory is thus employed, and a stochastic turnpike theorem involving the modified Golden Rule is proved. That is, the underlying path of capital accumulation is asymptotically efficient in the sense of consumption maximization. We focus on asymptotic turnpike theorems and our turnpike theorem only relies on the requirement that the modified Golden-Rule path of capital accumulation is reachable in any almost surely finite Markov time. Finally, it is asserted that the modified Golden-Rule path of capital accumulation indeed provides us with a robust turnpike under very weak assumptions.*

Keywords: capital accumulation; stochastic balanced path; martingale path; modified golden rule; turnpike theorem; robustness.

JEL Classification: C60, E13, E22.
REL Classification: 8E, 10Z.

1. Introduction

In his seminal paper, Merton (1975) extends the one-sector neoclassical growth model of Solow-type to stochastic cases where the dynamics of capital-labor ratio is driven by a diffusion process, thereby providing us with an asymptotic theory of economic growth under uncertainty. Later on, Chang and Malliaris (1987) prove a theorem that confirms the existence and uniqueness of the stochastic growth path derived by Merton under certain assumptions. Therefore, noting the important and interesting properties reflected by Merton's model, the motivation of present exploration is to derive a well-defined modified Golden Rule path of capital accumulation and establish corresponding turnpike theorem based upon Merton's framework and also the theorem demonstrated by Chang and Malliaris. In other words, the current study enriches Merton's model and conclusion by uncovering a robust turnpike theorem involving the modified Golden Rule implicitly implied by the basic model.

In deterministic neoclassical models, Golden Rule or modified Golden Rule is usually derived through the balanced path of capital-labor ratio (Cass, 1966, 1972). Similarly, the present modified Golden Rule is established via letting the drift term of the diffusion process of capital-labor ratio be equal to zero, thereby producing a martingale path of capital accumulation. That is, we define the stochastic balanced path of capital-labor ratio of the current stochastic neoclassical model by the martingale-path of capital-labor ratio. As a matter of fact, there is a natural one-to-one correspondence between the modified Golden Rule and the martingale-path of capital-labor ratio. Consequently, it is ensured that the modified Golden Rule derived through the stochastic balanced path, i.e., the martingale path, of capital-labor ratio is well defined. And this creates a natural opportunity such that the powerful martingale theory can be appropriately employed to demonstrate the turnpike theorem. Rather, the present turnpike theorem shows that the martingale-path of capital-labor ratio will converge to the modified Golden Rule almost surely and in the sense of uniform topology (Dai, 2012) as long as the modified Golden Rule is reachable in any almost surely finite time. And one can easily notice the differences between the present result and those proved by Cass (1966) and Samuelson (1965) in deterministic neoclassical aggregate growth models.

When we define the concept of capital in a very broad sense, i.e., including human capital, health capital, environmental capital, and so on, then capital accumulation indeed plays a crucial role in modern economic growth. For example, the Germany and Japan after World War II and China after 1978s (Song et al., 2011). We, hence, are motivated to explore efficient capital accumulation in stochastic growth economies with Brownian-motion shocks. The major contribution of the

present paper can be summarized as follows: first, since Brownian motion shocks are widely used in continuous-time stochastic growth models, we provide an appropriate definition of the modified Golden-Rule path of capital accumulation in such kind of economies and this definition does not rely on the explicit specification of the Brownian shocks; second, we develop a systematic mathematical method for proving robust turnpike theorems in such kind of circumstances involving the above modified Golden-Rule path of capital accumulation, and we believe that our method is general enough to be used in other related environments. In other words, our contribution mainly focuses on theoretical issues of macroeconomic growth theory.

There are some related literatures. As is argued by Yano (1985), existing turnpike theorems in optimal growth theory can be summarized as the following two types, one is neighborhood turnpike theorem (Yano, 1984, McKenzie, 1982, Kamihigashi, Roy, 2007, Kondo, 2008, Dai, 2012) which asserts that an optimal path in a growth model converges to a small neighborhood of a stationary path, the other is asymptotic turnpike theorem (Bewley, 1982, Yano, 1985, Sahashi, 2002, Dai, 2012) which means that an optimal path converges to a stationary path. As you will see below, the present paper focuses on asymptotic turnpike theorem and we have confirmed the corresponding robustness in a continuous-time stochastic growth model. On the other hand, it is well-known that the Golden Rule path has been playing a very important role in neoclassical theory of capital accumulation (Cass, 1966, 1972, Samuelson, 1965, de la Croix and Ponthiere, 2010, Mitra, Ray, 2012, Acemoglu, 2012) starting from the pioneering papers of Phelps (1962, 1965). Recently, Schenk-Hoppé (2002) also studies the Golden Rule in stochastic Solow growth model. Schenk-Hoppé employs dynamical systems theory, especially the concept of a random fixed point (Schenk-Hoppé, Schmalfuss, 2001), to prove the existence of a Golden-Rule savings rate for the stochastic Solow model. Methodologically, in studying the Golden-Rule path of capital accumulation, Brock and Mirman (1972) use the classical stochastic stability theory of Markov chains while Bayer and Wälde (2011) expand their distributional analysis by using the stability theory for Markov processes in continuous time. We heavily employ martingale theory, which depends on continuous-time Markov processes driven by Brownian motions in the present economy, to demonstrate the corresponding turnpike theorem involving the modified Golden-Rule path of capital accumulation. This method can be regarded as a useful complement to existing literatures involving the issue of efficient capital accumulation under uncertainty.

The rest of the paper is organized as follows. Section 2 presents the basic model. Section 3 defines the modified Golden Rule path of capital accumulation, proves the turnpike theorem and also confirms the corresponding robustness. Section 4

closes the paper with some concluding remarks. All proofs, unless otherwise noted in the text, appear in the Appendix.

2. The model

The major goal of the model is to introduce the stochastic path of capital accumulation in a one-sector neoclassical growth model with the uncertainty coming from the population size $L(t)$, i.e., following Merton (1975),

$$dL(t) = nL(t)dt + \sigma L(t)dB(t). \quad (1)$$

which is based upon the underlying filtered probability space $\left(\Omega, \mathrm{F}, \{\mathrm{F}_t\}_{0\le t\le T}, \mathrm{P}\right)$ with E denoting the expectation operator depending on $\mathrm{F}_0 \triangleq \{\Omega, \varnothing\}$.

As usual, the neoclassical production function $Y(t) = F\left(K(t), L(t)\right)$ is assumed to be strictly concave, homogeneous of first degree and also exhibit constant returns to scale with the law of motion of capital accumulation expressed as follows,

$$\frac{dK(t)}{dt} = F\left(K(t), L(t)\right) - \delta K(t) - C(t). \quad (2)$$

in which, δ, an exogenously given constant, denotes the depreciation rate and $C(t)$ represents aggregate consumption at time *t*.

Now, combining (1) with (2) and applying the classical Itô's rule yields the following SDE of capital-labor ratio,

$$dk(t) = \left[f\left(k(t)\right) - \left(\delta + n - \sigma^2\right)k(t) - c(t) \right]dt - \sigma k(t)dB(t). \quad (3)$$

subject to $k(0) \equiv k_0 > 0$, a deterministic constant. And $f\left(k(t)\right) \triangleq Y(t)/L(t)$, $c(t) \triangleq C(t)/L(t)$ stand for per capita output and per capita consumption, respectively, at time t. Specifically, for the SDE of capital-labor ratio given by (3), Chang and Malliaris (1987) proved the following result,

PROPOSITION 1: If the production function f is strictly concave, continuously differentiable on $[0,\infty)$, $f(0) = 0$, and $\lim_{k(t)\to\infty} f'\left(k(t)\right) \triangleq \lim_{k(t)\to\infty} \frac{df(k(t))}{dk(t)} = 0$, then there exists a unique solution to (3).

In order to make things much easier, we need,

ASSUMPTION 1: The assumptions or conditions given by Proposition 1 are assumed to be fulfilled throughout the current paper.

3. Turnpike theorem

In the present section, we will derive a modified Golden Rule and establish the corresponding turnpike theorem under relatively weak conditions. For the SDE of capital-labor ratio given by (3), we denote the drift term by,

$$b(t) \triangleq f\left(k(t)\right) - \left(\delta + n - \sigma^2\right)k(t) - c(t). \tag{4}$$

which implies that the capital-labor ratio $k(t)$ tends to increase if $b(t) > 0$, and the capital-labor ratio tends to decrease if $b(t) < 0$. Noting that the Golden Rule or modified Golden Rule is usually derived via the balanced path of capital-labor ratio in the deterministic case (Cass, 1966, 1972), we similarly derive the modified Golden Rule by letting $b(t) = 0$, which corresponds to the stochastic balanced path of capital-labor ratio and this gives rise to,

$$c(t) = f\left(k(t)\right) - \left(\delta + n - \sigma^2\right)k(t). \tag{5}$$

Hence, the corresponding stochastic Golden Rule k^* is determined by,

$$f'\left(k^*\right) = \delta + n - \sigma^2. \tag{6}$$

Meanwhile, substituting (5) into (3) leads us to,

$$dk(t) = -\sigma k(t) dB(t). \tag{7}$$

which hence defines a martingale-path of capital-labor ratio. Now, we can establish,

THEOREM 1 (Turnpike Theorem): *If the following Markov time,*

$$\tau^*(\omega) \triangleq \inf\left\{t \geq 0; k(t) = k^*\right\} < \infty \ \ a.s.$$

then we get that the martingale-path of capital-labor ratio given by (7) will strongly converge to the stochastic Golden Rule k^* given by (6) a.s. and in the sense of uniform topology.

PROOF: By the Doob's Martingale Inequality,

$$\mathrm{P}\left(\sup_{0\leq t\leq T}\left|k(t)\right| \geq \lambda\right) \leq \frac{1}{\lambda}\mathrm{E}\left[\left|k(T)\right|\right] = \frac{k_0}{\lambda}, \ \forall \lambda > 0, \ \forall T > 0.$$

Without loss of generality, we put $\lambda = 2^m$ for $m \in \mathrm{N}$, then,

$$\mathrm{P}\left(\sup_{0\leq t\leq T}\left|k(t)\right| \geq 2^m\right) \leq \frac{1}{2^m}k_0, \ \forall m \in \mathrm{N}, \ \forall T > 0.$$

Using the well-known Borel-Cantelli Lemma, we arrive at,

$$\mathrm{P}(\sup_{0\le t\le T}|k(t)|\ge 2^m \text{ for infinitely many } m)=0,\ \forall T>0.$$

So for a.a. $\omega\in\Omega$, there exists $\bar{m}(\omega)\in\mathrm{N}$ such that,

$$\sup_{0\le t\le T}|k(t)|<2^m \text{ a.s. for } m\ge\bar{m}(\omega),\ \forall T>0.$$

i.e.,

$$\lim_{T\to\infty}\sup_{0\le t\le T}|k(t)|\le 2^m \text{ a.s. for } m\ge\bar{m}(\omega). \tag{8}$$

Thus, $k(t)=k(t,\omega)$ is uniformly bounded for $t\in[0,T]$, $\forall T>0$ and for a.a. $\omega\in\Omega$. Define,

$$B_{2^{-m}}\left(\tau^*(\omega)\right)\triangleq\left\{\tau(\omega)\ge 0;\left|\tau(\omega)-\tau^*(\omega)\right|<2^{-m}\right\}\ \ \forall m\in\mathrm{N}.$$

Thus, for $\forall\tau^m\in B_{2^{-m}}\left(\tau^*\right)$, and based on the assumption that $\tau^*(\omega)<\infty$ a.s., applying Doob's optional sampling theorem and Doob's martingale inequality lead us to,

$$\mathrm{P}\left(\sup_{0\le t\le\tau^m}\left|k(t)-k^*\right|\ge\varepsilon\right)\le\frac{1}{\varepsilon}\mathrm{E}\left[\left|k(\tau^m)-k^*\right|\right],\ \forall\varepsilon>0.$$

According to (8) and the continuity of martingale w. r. t. time t, an application of Lebesgue bounded convergence theorem shows,

$$\limsup_{m\to\infty}\mathrm{P}\left(\sup_{0\le t\le\tau^m}\left|k(t)-k^*\right|\ge\varepsilon\right)\le\frac{1}{\varepsilon}\limsup_{m\to\infty}\mathrm{E}\left[\left|k(\tau^m)-k^*\right|\right]=0,\ \forall\varepsilon>0.$$

which yields,

$$\limsup_{m\to\infty}\mathrm{P}\left(\sup_{0\le t\le\tau^m}\left|k(t)-k^*\right|<\varepsilon\right)=1,\ \forall\varepsilon>0.$$

It follows from Fatou's Lemma that,

$$\mathrm{P}\left(\sup_{0\le t\le\tau^*}\left|k(t)-k^*\right|<\varepsilon\right)=1,\ \forall\varepsilon>0.$$

Thus, we get,

$$\sup_{0\le t\le\tau^*}\left|k(t)-k^*\right|<\varepsilon, \text{ a.s. for } \forall\varepsilon>0.$$

i.e.,

$$\limsup_{\tau^*\to\infty}\sup_{0\le t\le\tau^*}\left|k(t)-k^*\right|<\varepsilon, \text{ a.s. for } \forall\varepsilon>0.$$

Noting the arbitrariness of ε, the required assertion follows. ■

Next, we proceed to analyze the robustness of the turnpike theorem given by Theorem 1, i.e., we show that the modified Golden Rule k^* indeed provides us with a robust turnpike under relatively weak assumptions. Based upon the martingale path given by (7), we set,

$$d\tilde{k}(t) = -\tilde{\sigma}\tilde{k}(t)dB(t). \tag{9}$$

subject to $\tilde{k}(0) \triangleq k_0 > 0$, a deterministic constant, such that,

ASSUMPTION 2: For any $\xi > 0$, suppose that,

$$\left|\sigma - \tilde{\sigma}\right| \le \xi .$$

for any non-zero constants σ and $\tilde{\sigma}$ with $\left|\sigma\right| \vee \left|\tilde{\sigma}\right| < \infty$.

As preparations, we need the following two lemmas,

LEMMA 1: There exist constants $e(k_0, p, T) < \infty$ and $\tilde{e}(k_0, p, T) < \infty$ such that,

(i) $\mathrm{E}\left[\sup_{0\le t\le T}\left|k(t)\right|^p\right] \le e(k_0, p, T)$.

and,

(ii) $\mathrm{E}\left[\sup_{0\le t\le T}\left|\tilde{k}(t)\right|^p\right] \le \tilde{e}(k_0, p, T)$.

for $\forall 0 < T < \infty$, $\forall p \in \mathrm{N}$, $p \ge 2$.

PROOF: See Appendix A. ■

Rather, we can obtain the following result for the present case,

LEMMA 2: For $k(t)$ defined in (7) and $\tilde{k}(t)$ defined in (9), one can get that,

(i) $\mathrm{E}\left[\sup_{0\le t\le T}\left|k(t)\right|^p\right] \le \left(\frac{p}{p-1}\right)^p \lambda^{p-1} k_0$.

and,

(ii) $\mathrm{E}\left[\sup_{0\le t\le T}\left|\tilde{k}(t)\right|^p\right] \le \left(\frac{p}{p-1}\right)^p \tilde{\lambda}^{p-1} k_0$.

for $\forall 0 < \lambda < \infty$, $\forall 0 < \tilde{\lambda} < \infty$, $\forall 0 < T < \infty$, and $\forall p \in \mathrm{N}$, $p \ge 2$.

PROOF: See Appendix B. ■

Then, the following proposition is derived,

PROPOSITION 2: Based upon the above assumptions and Lemma 1 or 2, then we have,

$$\mathrm{E}\left[\lim_{T\to\infty}\sup_{0\le t\le T}\left|k(t)-\tilde{k}(t)\right|^2\right]\to 0 \text{ as } \xi\to 0.$$

PROOF: See Appendix C. ■

As you can see in the proof of Proposition 2, Lemma 1 or Lemma 2 plays a technical role in confirming the corresponding stability of the underlying turnpike. Indeed, Lemma 1 proves the uniform bound property of the path of capital accumulation and we have further provided the explicit supremum of the path of capital accumulation in Lemma 2, which imply that both Lemma 1 and Lemma 2 are of independent interest in characterizing intrinsic properties of the underlying path of capital accumulation. Consequently, combining Theorem 1 with Proposition 2 reveals that,

COROLLARY 1 (Robust Turnpike Theorem): *Provided Theorem* 1 *and Proposition* 2*, we get that the turnpike theorem keeps invariant as the perturbation* $\xi\to 0$*, i.e., the modified Golden Rule* k^* *is indeed a robust turnpike in the present model economy.*

4. Concluding remarks

As is broadly known, both turnpike theorems and the Phelps-Koopmans Theorem play very important roles in macroeconomics (Acemoglu, 2012). Turnpike theory (McKenzie, 1976, 1998, Joshi, 1997, Dai, 2012) characterizes the mathematical properties of the equilibrium or optimal path of resource allocation while the classical Phelps-Koopmans Theorem (Phelps, 1962, 1965, Ray, 2010, Mitra, Ray, 2012) clearly uncovers that the efficient path of capital accumulation will definitely converge to the Golden Rule in the long run, otherwise, dynamically inefficient accumulation happens. Samuelson (1965) proved a neighborhood turnpike theorem involving the Golden Rule in the classical Ramsey (1928) model, while the present paper demonstrates an asymptotic turnpike theorem involving the modified Golden Rule in a stochastic neoclassical growth model, which implies that the path of capital accumulation is dynamically efficient. Finally, it is also confirmed that the modified Golden Rule path of capital accumulation is indeed a robust turnpike.

Finally, noting that the present paper just represents a simple starting point in exploring turnpike properties of capital accumulation from the present perspective, some interesting extensions can be taken into account in future

research. For example, since we only proves an asymptotic turnpike theorem in the underlying economy, one interesting and possible extension is to find out conditions supporting a neighborhood turnpike theorem for neighborhood efficiency characterization of stochastic capital accumulation. Moreover, notice that the (modified) Ramsey rule also plays a crucial role in savings behavior and macroeconomic growth, it is interesting to investigate the corresponding turnpike theorems involving Ramsey rules by effectively employing the mathematical method developed in the present study. As a final point, if we are motivated to investigate the effect of stochastic TFP imposed on the efficient path of capital accumulation, geometric Brownian motion can be naturally employed with the purpose of introducing technology fluctuation into the underlying economy as in Wälde (2011) and Bucci et al. (2011).

References

Acemoglu, D. (2012). "Introduction to Economic Growth", *Journal of Economic Theory*, 147, pp. 545-550

Bayer, C., Wälde, K. (2011). "Existence, Uniqueness and Stability of Invariant Distributions in Continuous-Time Stochastic Models", *Working paper*

Bewley, T. (1982). "An Integration of Equilibrium Theory and Turnpike Theory", *Journal of Mathematical Economics*, 10, pp. 233-267

Brock, W.A., Mirman L.J. (1972). "Optimal Economic Growth and Uncertainty: The Discounted Case", *Journal of Economic Theory* , 4, pp. 479-513

Bucci, A., Colapinto, C., Forster, M., Torre, D.L. (2011). "Stochastic Technology Shocks in an Extended Uzawa–Lucas Model: Closed-Form Solution and Long-Run Dynamics", *Journal of Economics*, 103, pp. 83-99

Cass, D. (1966). "Optimum Growth in an Aggregative Model of Capital Accumulation: A Turnpike Theorem", *Econometrica*, 34, pp. 833-850

Cass, D. (1972). "On Capital Overaccumulation in the Aggregative, Neoclassical Model of Economic Growth: A Complete Characterization", *Journal of Economic Theory*, 4, pp. 200-223

Chang, F.-R., Malliaris, A.G. (1987). "Asymptotic Growth under Uncertainty: Existence and Uniqueness", *Review of Economic Studies*, 54, pp. 169-174

Dai, D. (2012). "Stochastic Versions of Turnpike Theorems in the Sense of Uniform Topology", *Annals of Economics and Finance*, 13, pp. 389-431

de la Croix, D., Ponthiere, G. (2010). "On the Golden Rule of Capital Accumulation under Endogenous Longevity", *Mathematical Social Sciences*, 59, pp. 227-238

Higham, D.J., Mao, X.R., Stuart, A.M. (2003). "Strong Convergence of Euler-Type Methods for Nonlinear Stochastic Differential Equations", *SIAM Journal on Numerical Analysis*, 40, pp. 1041-1063

Joshi, S. (1997). "Turnpike Theorem in Nonconvex and Nonstationary Environment", *International Economic Review*, 38, pp. 225-248

Kamihigashi, T., Roy, S. (2007). "A Nonsmooth, Nonconvex Model of Optimal Growth", *Journal of Economic Theory*, 132, pp. 435-460

Karatzas, I. Shreve, S.E. (1991). "Brownian Motion and Stochastic Calculus", *Graduate Texts in Mathematics*, New York: Springer-Verlag, second edition

Kondo, A. (2008). "On the Inefficacy of Temporary Policy in a Dynamic General Equilibrium with Money", *Japanese Economic Review*, 59, pp. 324-344

McKenzie, L. (1976). "Turnpike Theory", *Econometrica*, 44, pp. 841-865

McKenzie, L. (1982). "A Primal Route to the Turnpike and Liapounov Stability", *Journal of Economic Theory*, 27, pp. 194-209

McKenzie, L. (1998). "Turnpikes", *American Economic Review*, 88, pp. 1-14

Merton, R.C. (1975). "An Asymptotic Theory of Growth under Uncertainty", *Review of Economic Studies*, 42, pp. 375-393

Mitra, T., Ray, D. (2012). "On the Phelps–Koopmans Theorem", *Journal of Economic Theory*, 147, pp. 833-849

Phelps, E.S. (1962). "The End of the Golden Age in Solovia: Comment", *American Economic Review*, 52, pp. 1097-1099

Phelps, E.S. (1965). "Second Essay on the Golden Rule of Accumulation", *American Economic Review*, 55, pp. 793-814

Ramsey, F.P. (1928). "A Mathematical Theory of Saving", *Economic Journal*, 38, pp. 543-559

Ray, D. (2010). "The Phelps-Koopmans Theorem and Potential Optimality", *International Journal of Economic Theory*, 6, pp. 11-28

Sahashi, Y. (2002). "The Convergence of Optimal Forestry Control", *Journal of Mathematical Economics*, 37, pp. 179-214

Samuelson, P.A. (1965). "A Catenary Turnpike Theorem Involving Consumption and the Golden Rule", *American Economic Review*, 55, pp. 486-496

Schenk-Hoppé, K.R. (2002). "Is There A Golden Rule For The Stochastic Solow Growth Model?", *Macroeconomic Dynamics*, 6, pp. 457-475

Schenk-Hoppé, K.R., Schmalfuss, B. (2001). "Random Fixed Points in a Stochastic Solow Growth Model", *Journal of Mathematical Economics*, 36, pp. 19-30

Song, Z., Storesletten, K., Zilibotti, F. (2011). "Growing Like China", *American Economic Review*, 101, pp. 202-241

Wälde, K. (2011). "Production Technologies in Stochastic Continuous Time Models", *Journal of Economic Dynamics and Control*, 35, pp. 616-622

Yano, M. (1984). "Competitive Equilibria on Turnpikes in a McKenzie Economy, I: A Neighborhood Turnpike Theorem", *International Economic Review*, 25, pp. 695-717

Yano, M. (1985). "Competitive Equilibria on Turnpikes in a McKenzie Economy, II: An Asymptotic Turnpike Theorem", *International Economic Review*, 26, pp. 661-669

Appendix

A. Proof of Lemma 1

Applying Itô's rule to (7),

$$|k(t)|^2 = k_0^2 + \int_0^t \sigma^2 k^2(s)ds + 2\int_0^t \left(-\sigma k^2(s)\right) dB(s) .$$

Thus, for $\forall t_1 \in [0,T]$ and for some constant $e = e(p)$, which may be different from line to line throughout the proof, we get,

$$\sup_{0\le t\le t_1} |k(t)|^p \le e\left\{ k_0^p + \left[\int_0^{t_1} \sigma^2 k^2(s)ds\right]^{\frac{p}{2}} + \sup_{0\le t\le t_1}\left|\int_0^t \left(-\sigma k^2(s)\right) dB(s)\right|^{\frac{p}{2}}\right\}.$$

It follows from Cauchy-Schwarz Inequality that,

$$\sup_{0\le t\le t_1} |k(t)|^p \le e\left\{ k_0^p + \int_0^{t_1} |k(s)|^p \, ds + \sup_{0\le t\le t_1}\left|\int_0^t \left(-\sigma k^2(s)\right) dB(s)\right|^{\frac{p}{2}}\right\}.$$

Taking expectations on both sides and applying the Burkholder-Davis-Gundy Inequality (see, Karatzas Shreve, 1991, p. 166) shows,

$$\mathrm{E}\left[\sup_{0\le t\le t_1} |k(t)|^p\right] \le e\left\{ k_0^p + \int_0^{t_1} \mathrm{E}\,|k(s)|^p \, ds + \mathrm{E}\left[\int_0^{t_1} k^4(s)ds\right]^{\frac{p}{4}}\right\}. \qquad \text{(A.1)}$$

By the Young Inequality (Higham et al., 2003) and Rogers-Hölder Inequality,

$$\mathrm{E}\left[\int_0^{t_1} k^4(s)ds\right]^{\frac{p}{4}}$$

$$\le \mathrm{E}\left[\sup_{0\le t\le t_1} |k(t)|^{\frac{p}{2}} \left(\int_0^{t_1} k^2(s)ds\right)^{\frac{p}{4}}\right]$$

$$\le \frac{1}{2e}\mathrm{E}\left[\sup_{0\le t\le t_1} |k(t)|^p\right] + \frac{e}{2}\mathrm{E}\left[\int_0^{t_1} k^2(s)ds\right]^{\frac{p}{2}}$$

$$\le \frac{1}{2e}\mathrm{E}\left[\sup_{0\le t\le t_1} |k(t)|^p\right] + e\mathrm{E}\left[\int_0^{t_1} |k(s)|^p \, ds\right].$$

Substituting this into (A.1) yields,

$$\mathrm{E}\left[\sup_{0\le t\le t_1}|k(t)|^p\right]\le e\left\{k_0^p+\int_0^{t_1}\mathrm{E}\,|k(s)|^p\,ds\right\}. \tag{A.2}$$

Applying Itô's rule to (7) produces,

$$k(t)=k_0\exp\left(-\sigma B(t)-\frac{1}{2}\sigma^2 t\right).$$

which implies,

$$\mathrm{E}\left[|k(t)|^p\right]=k_0^p\exp\left(\frac{1}{2}\sigma^2 p(p-1)t\right). \tag{A.3}$$

by the Wald's Identity. By (A.3), we hence get,

$$\int_0^{t_1}\mathrm{E}\,|k(s)|^p\,ds=\frac{2k_0^p}{\sigma^2 p(p-1)}\left[\exp\left(\frac{1}{2}\sigma^2 p(p-1)t_1\right)-1\right].$$

Inserting this into (A.2) reveals that there exists a constant $e(k_0,p,T)<\infty$ such that for $\forall 0<T<\infty$,

$$\mathrm{E}\left[\sup_{0\le t\le T}|k(t)|^p\right]\le e(k_0,p,T).$$

as required in (i). Noting that the proof of (ii) is quite similar to that of (i), we omit it. And thus the proof is complete. ■

B. Proof of Lemma 2

By Doob's martingale inequality,

$$\mathrm{P}\left(\sup_{0\le t\le T}|k(t)|\ge\lambda\right)\le\frac{1}{\lambda}\mathrm{E}\left[|k(T)|\right]=\frac{k_0}{\lambda},\ \forall 0<\lambda<\infty,\ \forall T>0. \tag{B.1}$$

Using Doob's martingale inequality again shows,

$$\mathrm{P}\left(\sup_{0\le t\le T}|k(t)|\ge\lambda\right)\le\frac{1}{\lambda^p}\mathrm{E}\left[|k(T)|^p\right],\ \forall 0<\lambda<\infty,\ \forall T>0,\ \forall p\in\mathrm{N},\ p\ge 2.$$

which combines with (B.1) produces,

$$\frac{1}{\lambda^p}\mathrm{E}\left[|k(T)|^p\right]\le\frac{k_0}{\lambda}\ \Leftrightarrow\ \mathrm{E}\left[|k(T)|^p\right]\le\lambda^{p-1}k_0,\ \forall 0<\lambda<\infty,\ \forall T>0. \tag{B.2}$$

Define,

$$\Sigma^*\triangleq\sup_{0\le t\le T}|k(t)|,\ \|\Sigma\|_p\triangleq\|k(T)\|_p\triangleq\left\{\mathrm{E}\left[|k(T)|^p\right]\right\}^{\frac{1}{p}}.$$

for $\forall T>0$, $\forall p\in\mathrm{N}$, $p\ge 2$. Let $H>0$ be some constant, then by Doob's Maximal Inequality and Fubini Theorem, we obtain,

$$\mathrm{E}\left[\left|\Sigma^* \wedge H\right|^p\right] = p\int_0^\infty x^{p-1}\mathrm{P}\left(\Sigma^* \wedge H \geq x\right)dx \leq p\int_0^\infty x^{p-2}\left(\int_{\left\{\Sigma^* \wedge H \geq x\right\}} \Sigma d\mathrm{P}\right)dx$$

$$= p\int_0^\infty x^{p-2}\left(\int_\Omega \Sigma 1_{\left\{\Sigma^* \wedge H \geq x\right\}} d\mathrm{P}\right)dx = p\int_\Omega \Sigma\left(\int_0^{\Sigma^* \wedge H} x^{p-2}dx\right)d\mathrm{P}$$

$$= \frac{p}{p-1}\mathrm{E}\left[\Sigma\left|\Sigma^* \wedge H\right|^{p-1}\right].$$

It follows from Hölder Inequality that,

$$\left\|\Sigma^* \wedge H\right\|_p^p = \mathrm{E}\left[\left|\Sigma^* \wedge H\right|^p\right] \leq \frac{p}{p-1}\left\|\Sigma\right\|_p \left\|\left|\Sigma^* \wedge H\right|^{p-1}\right\|_{\frac{p}{p-1}} = \frac{p}{p-1}\left\|\Sigma\right\|_p \left\{\mathrm{E}\left[\left|\Sigma^* \wedge H\right|^p\right]\right\}^{\frac{p-1}{p}}.$$

i.e.,

$$\left\{\mathrm{E}\left[\left|\Sigma^* \wedge H\right|^p\right]\right\}^{\frac{1}{p}} \leq \frac{p}{p-1}\left\|\Sigma\right\|_p = \frac{p}{p-1}\left\{\mathrm{E}\left[\left|k(T)\right|^p\right]\right\}^{\frac{1}{p}}.$$

Hence, applying Lebesgue Dominated Convergence Theorem shows,

$$\mathrm{E}\left[\left|\Sigma^*\right|^p\right] \leq \left(\frac{p}{p-1}\right)^p \mathrm{E}\left[\left|k(T)\right|^p\right].$$

i.e.,

$$\mathrm{E}\left[\sup_{0\leq t\leq T}\left|k(t)\right|^p\right] \leq \left(\frac{p}{p-1}\right)^p \lambda^{p-1}k_0 \quad \forall 0 < \lambda < \infty,\ \forall T > 0,\ \forall p \in \mathrm{N},\ p \geq 2.$$

by (B.2). And this gives the required result in (i). Noting that the proof of (ii) is similar to that of (i), we take it omitted here. And the proof is thus complete. ■

C. Proof of Proposition 2

By using Lemma 1 or 2, there is a constant $W < \infty$ such that for $\forall T > 0$, $\forall p \in \mathrm{N}$, $p \geq 2$,

$$\mathrm{E}\left[\sup_{0\leq t\leq T}\left|k(t)\right|^p\right] \vee \mathrm{E}\left[\sup_{0\leq t\leq T}\left|\tilde{k}(t)\right|^p\right] \leq W. \qquad \text{(C.1)}$$

where by Assumption 1,

$$k(t) = k_0 + \int_0^t \left(-\sigma k(s)\right)dB(s).$$

$$\tilde{k}(t) = k_0 + \int_0^t \left(-\tilde{\sigma}\tilde{k}(s)\right) dB(s).$$

Suppose that $|k(t)| \vee |\tilde{k}(t)| \le \bar{W}$ for $t \ge 0$, otherwise, we just consider $k(t) \wedge \bar{W}$ and $\tilde{k}(t) \wedge \bar{W}$ instead of $k(t)$ and $\tilde{k}(t)$, respectively, for some constant $0 < \bar{W} < \infty$. And also the same assertion follows by applying Lebesgue Dominated Convergence Theorem as $\bar{W}$ approaching infinity. In what follows, we first define the following stopping times,

$$\tau_{\bar{W}} \triangleq \inf\left\{t \ge 0; |k(t)| \ge \bar{W}\right\},\ \tilde{\tau}_{\bar{W}} \triangleq \inf\left\{t \ge 0; |\tilde{k}(t)| \ge \bar{W}\right\},\ \hat{\tau}_{\bar{W}} \triangleq \tau_{\bar{W}} \wedge \tilde{\tau}_{\bar{W}}.$$

By the Young Inequality (Higham et al., 2003) and for any $R > 0$,

$$\begin{aligned}
&\mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^2\right] \\
&= \mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^2 1_{\{\tau_{\bar{W}} > T, \tilde{\tau}_{\bar{W}} > T\}}\right] + \mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^2 1_{\{\tau_{\bar{W}} \le T, or \tilde{\tau}_{\bar{W}} \le T\}}\right] \\
&\le \mathrm{E}\left[\sup_{0\le t\le T} |k(t\wedge\hat{\tau}_{\bar{W}}) - \tilde{k}(t\wedge\hat{\tau}_{\bar{W}})|^2 1_{\{\hat{\tau}_{\bar{W}} > T\}}\right] + \frac{2R}{p}\mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^p\right] \\
&+ \frac{1 - \frac{2}{p}}{R^{\frac{-2}{p-2}}} \mathrm{P}\left(\tau_{\bar{W}} \le T, or \tilde{\tau}_{\bar{W}} \le T\right). \qquad \text{(C.2)}
\end{aligned}$$

It follows from (C.1) that,

$$\mathrm{P}\left(\tau_{\bar{W}} \le T\right) = \mathrm{E}\left[1_{\{\tau_{\bar{W}} \le T\}} \frac{|k(\tau_{\bar{W}})|^p}{\bar{W}^p}\right] \le \frac{1}{\bar{W}^p}\mathrm{E}\left[\sup_{0\le t\le T} |k(t)|^p\right] \le \frac{W}{\bar{W}^p}.$$

Similarly, one can get $\mathrm{P}\left(\tilde{\tau}_{\bar{W}} \le T\right) \le W/\bar{W}^p$. So,

$$\mathrm{P}\left(\tau_{\bar{W}} \le T, or \tilde{\tau}_{\bar{W}} \le T\right) \le \mathrm{P}\left(\tau_{\bar{W}} \le T\right) + \mathrm{P}\left(\tilde{\tau}_{\bar{W}} \le T\right) \le \frac{2W}{\bar{W}^p}.$$

Noting that by (C.1),

$$\mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^p\right] \le 2^{p-1}\mathrm{E}\left[\sup_{0\le t\le T}\left(|k(t)|^p + |\tilde{k}(t)|^p\right)\right] \le 2^p W.$$

Hence, (C.2) can be rewritten as follows,

$$\mathrm{E}\left[\sup_{0\le t\le T} |k(t) - \tilde{k}(t)|^2\right]$$

$$\leq \mathrm{E}\left[\sup_{0\leq t\leq T}\left|k\left(t\wedge\hat{\tau}_{\bar{W}}\right)-\tilde{k}\left(t\wedge\hat{\tau}_{\bar{W}}\right)\right|^2\right]+\frac{2^{p+1}RW}{p}+\frac{2(p-2)W}{pR^{\frac{2}{p-2}}\bar{W}^{p}}. \qquad \text{(C.3)}$$

Noting that,

$$\left|k\left(t\wedge\hat{\tau}_{\bar{W}}\right)-\tilde{k}\left(t\wedge\hat{\tau}_{\bar{W}}\right)\right|^2=\left|\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left[(-\sigma)k(s)-(-\tilde{\sigma})\tilde{k}(s)\right]dB(s)\right|^2$$

$$=\left|\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left[(-\sigma)k(s)-(-\sigma)\tilde{k}(s)\right]dB(s)+\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left[(-\sigma)\tilde{k}(s)-(-\tilde{\sigma})\tilde{k}(s)\right]dB(s)\right|^2$$

$$\leq 2\left(\sigma^2\left|\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left[k(s)-\tilde{k}(s)\right]dB(s)\right|^2+\left|\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left[(\tilde{\sigma}-\sigma)\tilde{k}(s)\right]dB(s)\right|^2\right).$$

Taking expectations on both sides and using Itô's Isometry, we have for $\forall\,\tau\leq T$,

$$\mathrm{E}\left[\sup_{0\leq t\leq\tau}\left|k\left(t\wedge\hat{\tau}_{\bar{W}}\right)-\tilde{k}\left(t\wedge\hat{\tau}_{\bar{W}}\right)\right|^2\right]$$

$$\leq 2\sigma^2\mathrm{E}\left[\int_0^{t\wedge\hat{\tau}_{\bar{W}}}\left(k(s)-\tilde{k}(s)\right)^2ds\right]+2(\tilde{\sigma}-\sigma)^2\mathrm{E}\left[\int_0^{\tau}\left(\tilde{k}(s)\right)^2ds\right]$$

$$\leq 2\sigma^2\int_0^{\tau}\mathrm{E}\left[\sup_{0\leq t_0\leq s}\left|k\left(t_0\wedge\hat{\tau}_{\bar{W}}\right)-\tilde{k}\left(t_0\wedge\hat{\tau}_{\bar{W}}\right)\right|^2\right]ds+2\xi^2\int_0^{\tau}\mathrm{E}\left|\tilde{k}(s)\right|^2ds. \qquad \text{(C.4)}$$

where we have used Assumption 2. Applying Itô's rule to (9) produces,

$$\tilde{k}(t)=k_0\exp\left(-\tilde{\sigma}B(t)-\frac{1}{2}\tilde{\sigma}^2t\right).$$

which implies,

$$\mathrm{E}\left[\left|\tilde{k}(t)\right|^2\right]=k_0^2\exp\left(\tilde{\sigma}^2t\right).$$

by the Wald's Identity. Hence, we get,

$$\int_0^{\tau}\mathrm{E}\left|\tilde{k}(s)\right|^2ds=\frac{k_0^2}{\tilde{\sigma}^2}\left[\exp\left(\tilde{\sigma}^2\tau\right)-1\right].$$

Inserting this into (C.4) gives rise to,

$$\mathrm{E}\left[\sup_{0\leq t\leq\tau}\left|k\left(t\wedge\hat{\tau}_{\bar{W}}\right)-\tilde{k}\left(t\wedge\hat{\tau}_{\bar{W}}\right)\right|^2\right]$$

$$\le 2\sigma^2 \int_0^{\tau} \mathrm{E}\left[\sup_{0\le t_0\le s} \left| k\left(t_0 \wedge \hat{\tau}_{\bar{W}}\right) - \tilde{k}\left(t_0 \wedge \hat{\tau}_{\bar{W}}\right) \right|^2 \right] ds + 2\xi^2 \frac{k_0^2}{\tilde{\sigma}^2}\left[\exp\left(\tilde{\sigma}^2 \tau\right) - 1 \right].$$

Hence, applying Gronwall's Inequality (see, Higham et al., 2003) yields,

$$\mathrm{E}\left[\sup_{0\le t\le T} \left| k\left(t \wedge \hat{\tau}_{\bar{W}}\right) - \tilde{k}\left(t \wedge \hat{\tau}_{\bar{W}}\right) \right|^2 \right] \le 2\frac{k_0^2}{\tilde{\sigma}^2}\left[\exp\left(\tilde{\sigma}^2 T\right) - 1 \right] \exp\left(2\sigma^2\right)\xi^2 .$$

substituting this into (C.3) leads us to,

$$\mathrm{E}\left[\sup_{0\le t\le T} \left| k(t) - \tilde{k}(t) \right|^2 \right] \le 2\frac{k_0^2}{\tilde{\sigma}^2}\left[\exp\left(\tilde{\sigma}^2 T\right) - 1 \right] \exp\left(2\sigma^2\right)\xi^2 + \frac{2^{p+1} RW}{p} + \frac{2(p-2)W}{pR^{\frac{2}{p-2}} \bar{W}^p}.$$

Accordingly, for $\forall \varepsilon > 0$, we can choose R and $\bar{W}$ such that,

$$\frac{2^{p+1} RW}{p} \le \frac{\varepsilon}{3} \text{ and } \frac{2(p-2)W}{pR^{\frac{2}{p-2}} \bar{W}^p} \le \frac{\varepsilon}{3}.$$

And for any given $T > 0$, we put ξ such that,

$$2\frac{k_0^2}{\tilde{\sigma}^2}\left[\exp\left(\tilde{\sigma}^2 T\right) - 1 \right] \exp\left(2\sigma^2\right)\xi^2 \le \frac{\varepsilon}{3}.$$

Thus, for $\forall \varepsilon > 0$, we obtain,

$$\mathrm{E}\left[\sup_{0\le t\le T} \left| k(t) - \tilde{k}(t) \right|^2 \right] \le \frac{\varepsilon}{3} + \frac{\varepsilon}{3} + \frac{\varepsilon}{3} = \varepsilon .$$

So,

$$\mathrm{E}\left[\sup_{0\le t\le T} \left| k(t) - \tilde{k}(t) \right|^2 \right] \to 0 \text{ as } \varepsilon \to 0 .$$

i.e.,

$$\lim_{T\to\infty} \mathrm{E}\left[\sup_{0\le t\le T} \left| k(t) - \tilde{k}(t) \right|^2 \right] \to 0 \text{ as } \varepsilon \to 0 .$$

By the Levi Lemma, we obtain,

$$\mathrm{E}\left[\lim_{T\to\infty} \sup_{0\le t\le T} \left| k(t) - \tilde{k}(t) \right|^2 \right] \to 0 \text{ as } \varepsilon \to 0 .$$

which gives the desired result. And this proof is thus complete. ■

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 41-52

General aspects regarding the evolution of GDP in Romania

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Abstract. *The macroeconomic results indicators have recorded a disastrous trend over the period January 2009 - January 2012 as a result of the effects of the economic and financial extended crisis, worsened by the extended political and moral crisis, the lack of efficiency of the government activity and lack of a coherent anti-crisis program, based on pro-active steps.*

Keywords: purchasing power; deficit; resource; price; adjusted.

JEL Classification: J08.
REL Classification: 12G.

1. The major macroeconomic evolutions

The indicator the most synthetic for Romania, concerning the outcomes recorded in 2010, is given by the Gross Domestic Product which counted for 513,640.8 million of lei, expressed in the current prices of the year 2010. For 2011, under the reserve of further corrections, data are clear and edifying, emphasizing the increase of GDP by some 1.1% as against 2010, which, adjusted at the level of 2011, reveals a value of 519,290.8 million lei. For 2012 there are no predictable significant modifications, thus GDP will stagnate.

Thus, the GDP recorded a decrease of 1.3% in 2010, as against 2009. Meantime, the inflation target could not be hit, the direct foreign investment diminished drastically, being only 2,411 billion euro, in 2011, and several hundred thousand Euro in 2012, the foreign debt increased, the domestic public debt multiplied, the foreign payments balance is recording a huge cumulated deficit, the population income decreased dramatically, the national economy branches recorded decreases or stagnations, the consolidated budget became volatile due to uncertain doubtless incomes as a result of an adverse or unconcerned collection etc.

GDP/capita, calculated on the basis of the purchasing power parity, counted for 10,395 units standard purchasing parity, which represents the monetary unit of reference at the level of the European Union, as conventional currency which excludes the influences of the differences between the national prices.

The evolution of the Gross Domestic Product at the European Union level and for each EU member state for the year 2010, by quarters, as seasonally adjusted data, each of the four quarters, being shown both as dynamics of the increase as against the previous quarter and as comparison with the corresponding quarter of the previous year, namely 2009. Out of the data analysis we see, first of all, that for almost all the cases, the quarter to quarter evolution is a relatively positive one, both in respect of the comparison with the previous quarter and as against the corresponding quarter of the previous year, emphasizing an increase at the level of EU27. This development is indicating the coming out of the recession for EU.

The second part of the table, comparison with the corresponding period of the previous year, is also showing a positive evolution, namely the constant diminishing of the decrease (for all three quarters) comparatively with the corresponding quarters of the year 2009.

Table 1. *Trimester growth rates of GDP in 2011, seasonally adjusted data*

	In % against the previous trimester		In % against the corresp. trim., previous year	
	Quarter I	**Quarter II**	**Quarter I**	**Quarter II**
EU 27	0.4	1.0	0.7	2.0
Belgium	0.1	1.0	1.7	2.6
Bulgary	-0.5	0.5	-0.8	-0.3
Czech Republic	0.5	0.9	1.1	2.5
Denmark	0.6	1.3	-0.9	3.0
Germany	0.6	2.3	2.1	3.9
Estonia**	1.1	1.9	-2.6	3.1
Ireland	2.2	-1.2	-0.7	-1.8
Greece	-0.6	-1.7	-2.7	-4.0
Spain	0.1	0.3	-1.4	0.0
France	0.2	0.7	1.1	1.6
Italy	0.4	0.5	0.5	1.3
Cyprus	0.4	0.5	-1.2	0.2
Letonia	0.9	0.8	-5.1	-2.9
Lithuania	-0.1	0.5	-0.6	-0.3
Luxembourg	0.8	-0.3	2.9	5.3
Hungary	1.0	0.4	-1.1	0.5
Malta	1.4	0.1	3.5	3.7
Netherlands**	0.5	0.9	0.6	2.2
Austria	0.0	1.2	0.1	2.2
Poland	0.7	1.2	3.1	3.8
Portugal	1.1	0.2	1.7	1.4
Romania	-0.3	0.3	-3.2	-1.5
Slovenia	-0.1	1.0	-0.2	1.4
Slovakia**	0.8	1.0	4.6	4.4
Finland	0.1	1.9	0.6	3.4
Sweden	1.7	2.0	2.8	4.5
Great Britain	0.4	1.2	-0.3	1.7

** non-adjusted data; : missing data.

Source: Eurostat, data on first six months.

These data are showing that Poland, Estonia and Sweden have recorded in quarter III 2010 the greatest increases of GDP.

We can notice that a series of seven countries have recorded reduced, insignificant growths.

The rest of the countries, including Romania as well, keep on facing the effects of the crisis triggered by recession. In 2011, the growth rhythms tempered, and make way for the interpretation of the crisis effects' comeback, in the second wave. The problem of the Euro union, triggered by the situation in Greece, Italy, Spain, Portugal and Ireland, stirring many analyses that lead towards pessimistic perspectives.

The nominal value of the GDP (raw series) amounted, in the quarter II 2011, 117.2 billion lei, decreasing (in comparable terms) by 0.5% as against the quarter II 2009, while at the level of the first half of the year 2010, the GDP amounted 214.4 billion of lei, recording a decrease of 1.5 pp as against the first half of the year 2009. In the third trimester of 2010, we can speak abut an increase (139.4 billion lei), also valid for the fourth trimester of the same year (159.8 billion lei), ensuring a GDP of 513.6 billion lei in 2010. In 2011, new increases of GDP were recorded, trimester by trimester, against 2010. So, the level recorded during the first two trimesters of 2011 was 233.7 billion lei, against 214.4 billion lei in 2010.

If considering the European context, from the point of view of the recession phenomenon the situation is showing that there is only one country, i.e. Poland, which managed to stay out of this condition, recording subsequent increases. Other 14 EU member countries, among which Germany (the engine of the European economy), with a noticeable increase in 2011 too, by 3.2%, have recorded increases. Some of them, such as France, Holland, Slovakia, Denmark, have recorded consolidated increases during the two quarters, which forecasts a positive evolution expected at the level of the entire year 2011.

Other countries, such as Belgium, Spain, Hungary, have marked labile comings out at least for one of the two quarters, which denotes a certain uncertainty for the end of 2011, getting back to recession being any time possible in case there would be decreases to record until December 31st, 2011.

The deficit of the foreign trade balance (export FOB/import CIF) counted for 9 billion Euro in 2010 and 7.75 billion Euro in 2011 and some 4 billion Euro in the first six months of 2012.

The situation occurring in this respect implies certain discussions which, briefly, may resume to the following basic aspects:

- The imports decreased comparatively to the previous year. The imports kept on being profitable since, even if sometime an appreciation of the national currency against Euro and USD has been recorded, the wholesale and retail prices were not adjusted by cutting-off, the companies considering that they are a gained position which is not advisable to give up;
- On the other side, the exports increased in 2010 as against 2009 and in 2011 compared with 2010, because this fluctuation of the exchange rate against the two currencies of the foreign exchange panel of reference did stimulate the domestic production for export, this becoming much more profitable at export, the situation maintains on the same trend in 2012.

2. The GDP alteration factors by categories of resources

In 2011, as in 2012, the GDP has been achieved on the account of the activity carried out in the frame of the main branches of the national economy.

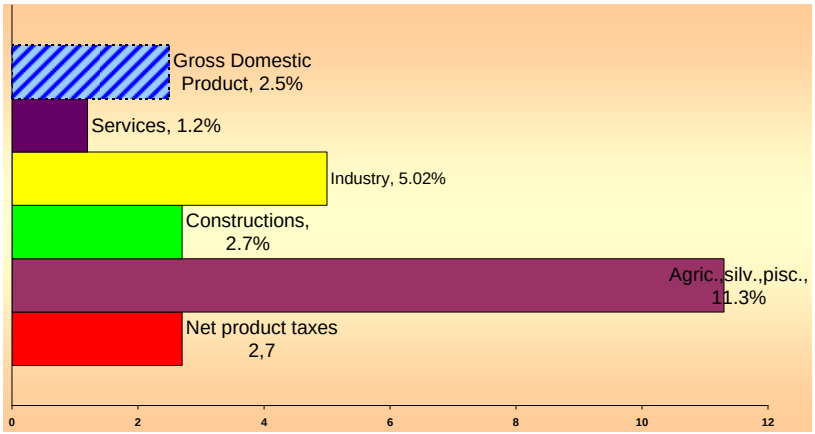
The contribution differed from the point of view of the gross added value recorded at the level of each branch. The net tax on product brought in 2011 a positive contribution of 2.7%, services activity contributed with 1.2%, constructions with 2.7%. Industry increased by 5.0%.

Also, in 2011 the contribution of the agriculture, forestry and fish breeding was positive, 11.3%.

In 2012, the same trends persisted, with the mention that agriculture marked a serious recoil, as it can compromise at the end of the year the results measured through the evolution of GDP.

The activities carried out by services, industry, constructions and the net taxes on product, together, brought in a decisive contribution to the GDP decrease, which means a negative feature for the Romanian economy which, although restructured, gave up a number of industrial sub-branches committing itself on the way of developing the services production, constructions and so on, but failing to cope with the devastating effects of the crisis, correlated also with the non-existence of an appropriate governing plan.

We can consider that all the national economy branches had a negative influence on the GDP decrease, less the agriculture, hunting and forestry, fishing and fish breeding sector.



Source: National Institute of Statistics, Statistical Bulletin no. 6/2012.

Figure 1. *Contributions to the GDP decrease, by categories of resources 2011/2010*

For the first half of the year 2012, there is a new fall to note for the economy evolution, the industry recording a decrease of 0.2. The GDP decrease kept on being influenced by the services, constructions and the net taxes on product. The agriculture kept on maintaining within positive parameters of influence, recording a constant evolution in 2011. In 2012, the situation is totally in reverse.

Table 2. *Contribution of the main categories of resources to GDP increase in the year 2012 (%)*

Indicator	Qtr.IV	Total year
Gross Domestic Product	1.9	2.5
Agriculture, forestry and fish breeding.	3.1	1.3
Industry, including energy	2.0	5.0
Constructions	5.7	2.7
Trade, cars and household appliances repairs; hotels and restaurants, telecommunications	0.9	1.2
Financial, real estate, renting and services to companies activities	-1.8	-2.1
Other services activities	0.4	-0.3
Total gross added value	1.7	2.4
Net taxes on product	4.5	2.7

Source: National Institute of Statistics.

The weight of the main categories of resources to the GDP forming in 2012 is showing that the services production held over 46%, with a slight tendency to decrease as comparatively with the corresponding period of the previous year.

Table 3. *Weight of the main categories of resources to the GDP forming (%)*

Indicatorul	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Agriculture, hunting, forestry, fishing and fish breeding.	11.6	12.6	8.4	7.8	5.8	6.7	6.3	6.0	11.3	4.0
Industry, including energy	24.7	24.9	24.8	24.5	24.3	22.9	23.8	26.4	5.0	-0.2
Constructions	5.7	5.9	6.5	7.4	9.1	10.6	9.8	7.3	2.7	0
Trade, cars and household appliances repairs; hotels and restaurants, telecommunications	20.3	20.6	21.7	22.2	22.7	21.9	21.2	20.9	1.2	-0.3
Financial, real estate, renting and services to companies activities	12.3	12.3	13.2	13.3	13.7	14.0	15.1	16.2	-2.1	-2.2
Other services activities	14.3	13.0	13.7	13.1	13.0	13.0	13.8	12.0	0.8	0.8
Net taxes on product	11.1	10.7	11.7	11.7	11.4	10.9	10.0	11.2	2.7	6.1

Source: National Institute of Statistics.

3. The GDP evolution by categories of utilizations

From the point of view of the "utilizations" in the GDP forming during the year 2011, it has been achieved by the contribution of the stocks variation, the net export, the gross forming of fixed capital, the final collective consumption of the public administration, the final individual consumption of the households.

When analyzing the data available for 2012, we have to consider as starting point the actual situation being recorded by our country during this year.

Thus, for instance, the stocks variations recorded a lower contribution, while the net export, namely the difference between exports and imports, recorded a negative effect, counting for -4.8%.

Under such circumstances, we find out that, from the point of view of the utilizations, the GDP formation has been achieved by the contribution of the following factors: gross forming of the fixed capital, final individual consumption of households with a decrease of -1.8%, which implies the following conclusions:

- From the point of view of utilizations, positive influences on the GDP achievement have been recorded by the final collective consumption of the public administration, stocks variation and net exports;
- Negative influences on the GDP forming have been recorded by the final individual consumption of households, and the gross forming of fixed capital.

The analysis of the influence factors of the GDP forming by categories of utilizations may be emphasized by the analysis of rhythm at which the categories of utilizations considered for the GDP achievement have influenced this achievement in 2012 comparatively with 2009. Thus, the individual consumption of households and the collective consumption of the public administration, together, have been reduced.

Table 4. *Evolution of the main categories of utilization to GDP forming in the year 2011 (%)*

Indicator	2012	Quarter I 2013
Gross Domestic Product	2.5	0.3
Actual individual consumption of the households	0.7	0.3
Actual collective consumption of the public administrations	-3.6	-2.1
Gross forming of fix capital	6.9	12.2
Stocks variation	2.7	3.1
Net export	5.5	-5.2

Source: National Institute of Statistics.

A more marked decrease has been recorded by the net export. Another negative effect has been recorded by the rhythm of increasing of the gross forming of fixed capital, respectively – 15.2%.

The GDP evolution during 2012 follows line of going over the "process" of the marked recession.

Table 5. *The weight of the main categories of utilizations in GDP during the period 2003-2012*

Indicator	Year									
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Actual individual consumption of the households	75.7	77.5	78.5	77.9	75.3	74.0	72.7	72.6	72.4	72.1
Actual collective consumption of the public administration	9.8	7.9	8.3	7.7	7.6	7.7	8.2	7.1	7.3	7.0
Capital gross forming	21.5	21.8	23.7	25.6	30.2	31.9	25.6	22.5	22.3	3.8
Stocks variations	0.6	1.8	-0.3	0.9	0.8	-0.6	-0.6	3.5	3.9	-6.0
Net export	-7.6	-9.0	-10.2	-12.1	-13.9	-13.0	-5.9	-5.7	-5.9	

Source: National Institute of Statistics.

Thus, the GDP decreased by – 1.3% as comparatively with 2009; all the branches recorded negative contributions, which implies the entrance into a macroeconomic managerial mess; the structure by branches and utilizations has been negative. In 2011, GDP grew by 2.5% as against 2010 and follows an oscillatory course in 2012.

The survey on the economic evolution, considering the modifications of the GDP in the European Union countries, emphasizes the extremely critical situation existing on the European and, at a larger extent, international plan.

4. GDP evolution – seasonally adjusted series

When analyzing the quarterly evolution of the seasonally adjusted GDP during the year 2010 comparatively with the corresponding quarter of the previous year, it can be stated out that the biggest decrease has been recorded during the II quarter while the smallest one occurred during the fourth quarter. The same positive rhythm was also observed in 2011. During quarter IV, 2011 and quarter I, 2012, GDP decreases were recorded again.

In connection with the other European Union member countries, Romania recorded for the IV quarter 2010 as against the previous quarter, an economic decrease while a significant number of countries have recorded increases (Belgium, Denmark, France, Lithuania, Austria, Poland, Slovenia, Great Britain), or recorded decreases bellow 0.5%. Meantime, the overall GDP of the EU increased by 0.1%.

Comparatively with the IV quarter 2008, in 2009, 2010 and 2011 the EU member countries have recorded reduced volumes of the GDP, the biggest ones being recorded in Latvia (-17.9%) and Lithuania (-13.2%), followed by Romania (-6.9%), Slovenia (-5.8%) and Hungary (-5.3%). The overall decrease at the EU level counted for -2.3%. In 2009, it has maintained an accelerated decrease rhythm. In 2010, fourth quarter and 2011, some recovery, but uncertain, due to the crisis within the Euro union. In 2012, the unconvincing evolution of GDP continues.

Significant contributions to the negative evolution of the GDP during 2010 and 2011 comparatively with 2009 are given by the constructions, which recorded a decrease as well as by the section trade, cars and households appliances repair, hotels and restaurants, transports and telecommunications recording a decrease.

The other branches have recorded small decreases of activity volumes.

Table 6. *GDP structure by categories of resources, in 2011*

– million lei –

Indicator	Romania
Gross Domestic Product	**57855.,9**
Total gross added value	509,350.7
Agriculture, hunting and forestry; fishing and fish breeding	37,837.7
Industry, including energy	152,062.9
Constructions	56,744.5
Trade; cars and household appliances repair; hotels and restaurants; transports and telecommunications	109,665.7
Financial, real estate, renting and services for companies	11,760.3
Other services activities	11,319
Net taxes on product	69,201.2

Source: National Institute of Statistics.

The previously mentioned branches had the highest negative impact on the GDP volume decrease during the period 2009-2011 comparatively to 2008, as they have recorded decreases.

As far as the utilization is concerned, the highest impact on the GDP decrease during the period 2009-2011, comparatively with 2008, went to the gross forming of fix capital, the individual consumption of the population households, the collective consumption of the public administrations.

Table 7. *GDP structure by categories of utilizations, in 2011*

– million lei –

Indicator	Romania
Gross Domestic Product	578,551.9
Final consumption	441,657.1
Gross forming of fix capital	166,675.7
Export of goods and services	221,841.1
Import of goods and services	251,623.1
Net export of goods	-29,780.9

Source: National Institute of Statistics.

The increase of the exports of goods and services had a positive impact.

According to the seasonally adjusted data, the gross forming of fix capital had the biggest negative contribution. These reductions have been partially compensated by the increase of the volume of the exports of goods and services, and the collective consumption of the public administration.

Based of a comparison between the GDP structure by categories of utilizations in Romania as against the EU, there is a superior weight of the gross forming of fix capital and a lower weight of the exports of goods and services in Romania comparatively with the European Union.

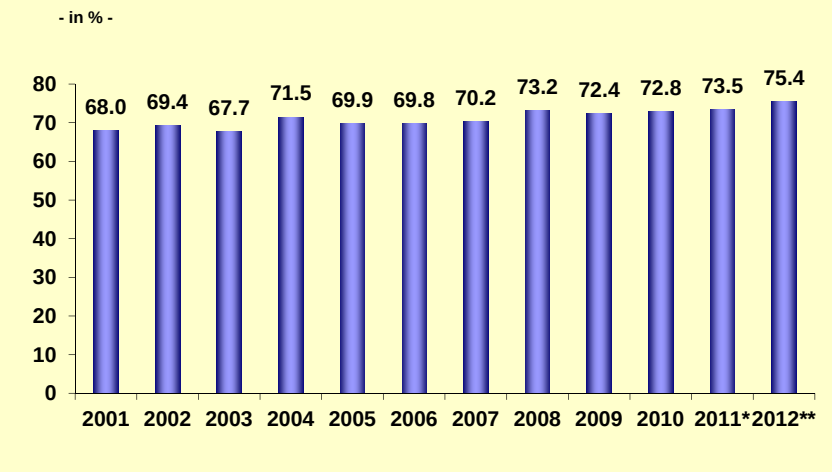
5. The achievement of the Gross Domestic Product by ownership forms

Out of the performed analysis, it results that for the period 2009-2012, for which there are provisional data, the private sector contributed with 72.4%-75.4% to the GDP forming. The weight of the private sector, still low, has been generated mainly by the gross added value in the agriculture. Such an influence is a normal one if to consider that the agriculture has to face negative natural conditions.

If comparing the weight of the private sector in the GDP achievement with the figures recorded for the previous periods, we find out that this weight is superior to all the periods being analyzed as from the year 2000, even as from the year 1990, up to date.

In 2010-2012, for which we are actually performing a complete analysis, we find that the weight of the private sector in the gross added value increased as for the constructions field.

What is really important is the fact that the weight of the private sector in the achievement of the gross added value by branches of the national economy and, eventually, to the GDP forming, kept on maintaining at a high level.



*1) Semi-final data. **) Estimate data.

Source: National Institute of Statistics.

Figure 2. *Gross Domestic Product, weight of the private sector in 2004-2012*

It is obvious that the privatization of other administrations or extending the privatization at the level of branches already privatized will have the targeted effect.

Here we have to underline the fact that such an analysis is not always pertinent since there will be and remain sectors of activity absolutely important for the national economy for which the state must keep its attributes of sole owner.

References

Anghelache, C-tin (2012). *România 2012. Starea economică în criză perpetuă,* Editura Economică, Bucureşti

Anghelache, C-tin**,** Manole, A. (2012). "Correlation between GDP direct investments–An econometric approach", *Metalurgia Internaţional*, Nr. 8/2012, pp. 96-98, categorie ISI.

Anghelache, C-tin, Anghelache, G.V. (2012). *"GDP and the final consumption of Romania. Evolution and correlation in the last decades", Metalurgia Internaţional*, Nr. 8/2012, pp. 158-160, categorie ISI

Anghelache, C-tin, Cucu, V. (2012). "Model for the analysis of GDP", *Metalurgia Internaţional*, Nr. 5/2012, pp. 182-185, categorie ISI

Andrei, E.A., Bugudui, E. (2011). „Modelarea econometrică a seriei de timp GDP", *Theoretical and Applied Economics*, Nr. 10/2011, pp. 91-98

*** *Anuarul statistic al României*, ediţiile 2002, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012

*** *Buletinul Statistic* nr. 1-12/2002, 1-12/2003, 1-12/2004, 1-12/2005, 1-12/2006, 1-12/2007, 1-12/2008, 1-12/2009, 1-12/2010 şi 1-12/2011 şi 1-12/2012 editat de Institutul Naţional de Statistică

www.insse.ro

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 53-72

Interday drifts in opening stock returns

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Abstract. *In present study, I make an effort to shed light on the actual mechanism of autocorrelations in individual stocks' opening returns. I analyze intraday price data on thirty stocks currently making up the Dow Jones Industrial Index. Employing the sample average and the sample median of opening stock returns for each of the trading days within the sample period as two alternative proxies for the general market opening returns, I document that if the previous day's market and individual stock's opening returns are taken together to explain the stock's opening returns, then the effect of the lagged general market opening returns is significantly negative, while the effect of the lagged stock's opening returns is significantly positive. Moreover, following days characterized by both positive and negative market opening returns, a given stock's opening returns tend to be higher if its previous day's opening returns were positive. Such price behavior seems to contradict the concept of market efficiency. Finally, I construct a number of portfolios based on the opening trading sessions and involving a long position in the stocks on the days when, according to the findings, their opening returns are expected to be high and a short position in the stocks on the days when, according to the findings, their opening returns are expected to be low. All the portfolios are found to yield significantly positive returns, providing an evidence for the practical applicability of the pattern of drifts in opening stock prices.*

Keywords: opening returns; return autocorrelations; stock market efficiency; stock price drifts and reversals.

JEL Classification: G11, G14, G19.
REL Classification: 11B, 11D.

1. Introduction

In the last few decades, an increasing number of papers have investigated stock market anomalies, reporting strong evidence that daily stock returns show empirical regularities that are difficult to explain using standard asset pricing theories. The main bottom line of these studies suggests that the use of historical data could be of some help for predicting future returns, with obvious implications for the efficiency of equity markets.

One of the most visible stylized facts in empirical finance is the autocorrelation of stock returns at fixed intervals (daily, weekly, monthly). This autocorrelation presents a challenge to the main models in continuous-time finance, which rely on some form of the random walk hypothesis. Consequently, there is an extensive literature on stock return autocorrelation; it occupies 55 pages of Campbell, Lo, and MacKinlay (1997). Most researchers suggest explanations based on non-synchronous trading as the cause of the positive return autocorrelation observed across international stock markets (Fisher, 1966, Scholes, Williams, 1977, Atchinson et al., 1987, Ahn et al., 2002). For example, Kadlec and Patterson (1999) argue that non-synchronous trading can explain 85%, 52%, and 36% of daily autocorrelations on portfolios of small, random, and large stocks, respectively. Accordingly, since daily returns are usually computed through a stock market index, the inclusion in the index of securities that are subjected to infrequent trading could cause positive stock return autocorrelation. However, since a significant level of first-order serial correlation has been found on common stock portfolios of large and actively traded firms (Perry, 1985, Safvenblad, 2000), non-synchronous trading seems to be not the only cause of correlation in daily market indexes. In this context, several studies suggest that the gradual incorporation of market-wide information may cause serial correlation in short-term stock returns Lo, MacKinlay, 1990, Sias, Starks, 1997, Chordia, Swaminathan, 2000). Other potential explanations for stock return autocorrelation include, but are not limited to, bid-ask bounce (Rhee, Wang, 1997); partial price adjustment, i.e. the observation that trade takes place at prices that do not fully reflect the information possessed by traders (Campbell, Lo, MacKinlay, 1997); and the time-varying risk premium (Anderson, 2006).

Over the last years, as increasing computer power and new statistical methods have permitted the analysis of very large datasets using intraday data, the focus has shifted to intraday patterns in stock returns and trading volumes. Blandon (2007) shows that while close-to-close stock returns are highly autocorrelated, daily returns calculated on an open-to-close basis do not exhibit significant levels of autocorrelation. Amihud and Mendelson (1987) and Stoll and Whaley (1990) report that the interday stock returns computed using open-to-open prices have

greater variance and show more evidence of reversals than comparable returns computed from close-to-close prices. They attribute this result to differences in trading mechanisms between the opening and closing transactions. Gerety and Mulherin (1994) estimate transitory volatility throughout the trading day based on hourly Dow Jones sixty-five Composite price index data, and find that the interday 24-hour volatilities decline steadily, reflecting information processing. A long-standing literature on intraday stock price patterns identifies the distinct U-shaped return and return volatility pattern over the trading day (Wood et al., 1985, Harris, 1986, Jain, Joh, 1988, Pagano et al., 2008). In other words, these studies indicate that average stock returns and return volatilities tend to be higher at the beginning and end of the trading day.

Several recent studies detect systematic correlations, both within and between subsequent trading days, between different intraday return measures. Kudryavtsev (2012) finds that, for the majority of stocks, open-to-close returns tend to be significantly lower, and in most cases negative, if on that respective day their opening returns are higher than the average or median opening return on the stocks in the sample. That is, relatively high opening stock returns may serve an indication for subsequent intraday price reversals and for even more pronounced intraday U-shaped return pattern. Furthermore, Kudryavtsev (2013) documents that stock returns in opening trading sessions tend to be higher following days with relatively low (either negative, or lower than the same day's average and median for the total sample of stocks) open-to-close returns. These findings are interpreted as reversals following stock price overreactions[(1)].

In present study, I make an effort to further develop the idea of the two above-mentioned studies. Since, according to Kudryavtsev (2012), open-to-close stock returns tend to be lower following relatively high opening returns at the beginning of the same trading day, and furthermore, according to Kudryavtsev (2013), opening stock returns tend to be higher following days with relatively low open-to-close returns, then one might expect opening returns to be higher following relatively high previous day's opening returns for the respective stock. In other words, there may exist interday (between two subsequent trading days) drifts in opening stock returns.

I analyze the opening and the opening returns on thirty stocks currently making up the Dow Jones Industrial Index, and find support for my research hypothesis. Namely, I detect that after controlling for the previous day's average or median opening return on the stocks in the sample (showing evidence of significantly negative autocorrelations), opening stock returns tend to be positively correlated with the respective stocks' previous day's opening returns. The result holds

separately following the days with positive and negative average opening returns within the sample(2).

Based on these findings, I construct a number of daily-adjusted portfolios involving a long (short) opening-session position in the stocks on the days when, according to the findings, their opening returns are expected to be high (low), and demonstrate that the returns on these portfolios are significantly positive.

The rest of the paper is structured as follows: In Section 2, I describe the data sample. Section 3 comprises the research hypotheses and the results. Section 4 concludes.

2. Data description

For the purposes of present research, I employ daily opening and closing prices of thirty stocks currently making up the Dow Jones Industrial Index over the period from January 2, 2002 to September 30, 2011 (overall, 2,456 trading days), as recorded at www.finance.yahoo.com. I adjust the prices to dividend payments and stock splits, by multiplying each actual price by the ratio of the respective day's reported adjusted (by Yahoo finance) closing to actual closing price. For each stock *i* in the sample and for each trading day *t*, except for the first day of the sampling period, I calculate:

- Stock's opening return ($R_{O,it}$), i.e., stock price's change from last day's closing price to today's opening price, as

$$R_{O,it} = \frac{P_{O,it}}{P_{C,it-1}} - 1 \qquad (1)$$

where:
$R_{O,it}$ is stock *i*'s opening return on day *t*; $P_{O,it}$ is stock *i*'s opening price on day *t*; and $P_{C,it-1}$ is stock *i*'s closing price on day *t-1*(3).

Table 1 comprises the basic descriptive statistics of the opening returns for the thirty sample stocks. At this stage, we may note that, as it might be expected for the largest industrial companies of the US, 21 (24) out of 30 stocks have positive mean (median) opening returns, the remaining 9 (6) showing negative, yet close to zero daily returns. Overall, the mean opening returns range from -0.116 to 0.158 percentage points, with standard deviations ranging from 0.663 to 2.045 percentage points.

3. Research hypotheses and results

3.1. Interday drifts in opening stock returns

The main goal of present study is to shed light on the nature and the characteristics of the interday correlations of opening stock returns. Based on previous results by Kudryavtsev (2012) who finds that, for the majority of stocks, open-to-close returns tend to be significantly lower, and in most cases negative, if on that respective day their opening returns are higher than the average or median opening return on the stocks in the sample, and by Kudryavtsev (2013) who documents that stock returns in opening trading sessions tend to be higher following days with relatively low (either negative, or lower than the same day's average and median for the total sample of stocks) open-to-close returns, I hypothesize that:

Hypothesis 1: A given stock's opening return on day t should be higher the higher was the stock's opening return on day t-1.

In other words, I suggest that if relatively high day-t opening stock returns serve an indication for subsequent intraday (open-to-close) price reversals, while relatively low day-t open-to-close stock returns serve an indication for subsequent reversals in day-t-1 opening returns, then we may expect interday (between day t-1 and day t) drifts, or positive autocorrelations, in opening stock returns.

In order to test Hypothesis 1, one should first of all take into consideration the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals. At the first glance, these results seem to contradict the Hypothesis, but, in fact, may refer to another effect which does not imply any contradiction. The point is that the above-mentioned findings may be driven by generally negative first-order autocorrelations in the opening returns of the stock market as a whole. In this case, the general picture of the correlations in opening stock returns may look as follows:

a) If on day t-1, the general market, either average or median, opening return is positive (negative), then, according to the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990), the general market opening return on day t may be expected to be negative (positive).
b) According to (a), day-t-1 opening returns for the majority of stocks are positive (negative), and day-t opening returns for the majority of stocks are negative (positive).
c) According to (b), stock i's opening returns are positive (negative) mostly on the days when the general market opening returns are also positive (negative), and in many cases, due to the negative autocorrelation in the general market

opening returns, stock i's opening returns on subsequent trading days are negative (positive), which, in the absence of any other explanatory factors, represents an evidence for the negative first-order autocorrelation in stock i's opening returns.

d) If Hypothesis 1 is true, it means that stock i's opening returns may actually be positively autocorrelated given the sign of the previous day's general market opening return. That is, given the sign and possibly the magnitude of the day-t-1 general market opening return, the day-t opening return on stock i may be higher the higher was stock i's opening return on day t-1.

Therefore, in order to check the validity of Hypothesis 1, first of all, I test the model where stock i's opening return on day t depends on the stock's opening return on day t-1, controlling for day-t-1 general market opening return. As two alternative proxies for the general market opening return, I employ the average (equally-weighted) and the median opening returns on the stocks making up the sample. That is, for each of the thirty sample stocks, I run two regressions:

$$OR_{it} = \beta_0 + \beta_1 AOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it} \quad (1)$$

where: OR_{it} represents stock i's opening return on day t; and AOR_{t-1} is the average day-t-1opening return for the stocks in the sample.

and

$$OR_{it} = \beta_0 + \beta_1 MOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it} \quad (2)$$

where: MOR_{t-1} is the median day-t-1opening return for the stocks in the sample.

Tables 2a and 2b report the results of regressions (1) and (2), respectively, for each of the sample stocks. First of all, we should pay attention to a very strong result regarding the effect of the general market opening returns on the next day's returns on individual stocks – with both market return proxies employed, the effect is negative for all the 30 stocks in the sample, being statistically significant at the 5% level for 27 of them, including 26 at the 1% level. Therefore, we may conclude that the reversals in opening stock returns documented by Amihud and Mendelson (1987) and Stoll and Whaley (1990) are actually driven by the negative effect of the previous trading day's general market opening returns and not by "stock-specific" price behavior.

Furthermore, both Tables clearly support Hypothesis 1. With average (median) proxy for the general market opening returns, the effect of the previous day's stocks' opening returns is positive for 27 (23) out of 30 stocks. Out of these 27 (23) positive regression coefficients 13 (12) are statistically significant, including 11 (11) at the 5% level, and 10 (10) at the 1% level. None of the remaining 3(7) negative coefficients is significant.

Thus, we may conclude that the negative, and usually non-significant, first-order autocorrelations in separate stocks' returns documented in previous literature represent a "combination" of two effects: on the one hand, a strong and significantly negative effect of previous day's average or median opening market returns, and on the other hand, not that strong but pretty consistent positive effect of previous day's opening returns on the stocks themselves, indicating that if the general market effect on stocks' opening returns is controlled for, then the latter, in fact, tend to exhibit *positive* first-order autocorrelations.

Now, having detected the positive effect of stocks' opening returns on their next day's opening returns, I am interested in verifying if the effect persists separately both for the days characterized by positive and negative opening market returns. Table 3a presents for each stock *i* in the sample, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \le 0$), and the respective return differences, *given* that the previous days were characterized by positive average opening returns ($AOR_{t-1} > 0$). Table 3b provides similar statistics following the days characterized by non-positive average opening returns ($AOR_{t-1} \le 0$). In other words, the Tables contain mean opening stock returns for the 2 x 2 sample partition by the sign of the previous days' average opening returns and individual stocks' opening returns, and perform comparisons given the sign of the previous days' average opening returns. Finally, Tables 3a and 3b report and compare, for the days characterized by $AOR_{t-1} > 0$ and $AOR_{t-1} \le 0$, respectively, the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \le 0$ [(4)].

Table 3a demonstrates that at the individual stocks' level, the positive effect of a stock's previous day's opening return is quite weak, given that that the previous day showed a positive average opening return. The number of positive and negative return differences between stocks' opening returns following $OR_{it-1} > 0$ and $OR_{it-1} \le 0$ is equal, yet, 5 of the positive and none of the negative differences are statistically significant. On the other hand, if we consider the equally-weighted daily portfolios of stocks, then the results clearly corroborate Hypothesis 1, showing a significantly higher mean opening return for the portfolio made up of stocks with $OR_{it-1} > 0$. We should also note that mean opening returns on both portfolios and on the vast majority of individual stocks are negative, indicating once again the generally negative effect of previous day's average opening returns.

Table 3b analyzes mean opening returns, given that that previous day showed a non-positive average opening return, and provides a strong support for Hypothesis 1 both at the individual stocks' level and for the equally-weighted portfolios. 22 out

of 30 mean opening return differences between the stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$ are positive, 5 of them being statistically significant, including two at the 5% level, and one at the 1% level. All the negative return differences are close to zero, and none of them is even close to being significant. The positive return difference between the mean opening returns of the portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$ is quite large (0.089% daily) and significant at the 1% level. Finally, we should note that mean opening returns on both portfolios and on the vast majority of individual stocks are positive, in line with the generally negative effect of previous day's average opening returns(5).

3.2. Interday drift-based trading strategy

In previous subsection, I have documented interday drifts in opening stock returns, suggesting that if the general market direction of the previous day's opening session is controlled for, then day-*t* opening return for a stock *i* tends to be higher the higher was the stock's opening return on day *t-1*. Now, the goal of this subsection is to verify if one can formulate profitable trading strategies that would be based on the expectation of interday drifts in opening returns.

Recall that Table 3a demonstrated that following the days characterized by positive average opening returns, individual stocks' opening returns tend to be negative and are significantly lower for the stocks whose previous day's opening returns were non-positive, while Table 3b indicated that following the days characterized by non-positive average opening returns, individual stocks' opening returns tend to be positive and are significantly higher for the stocks whose previous day's opening returns were positive. Therefore, the idea behind all the trading strategies I formulate is to hold an equally-weighted long position in the stocks with $OR_{it-1} > 0$ following the days of general decreases during the opening session, and an equally-weighted short position in the stocks with $OR_{it-1} \leq 0$ following the days of general increases during the opening session. The respective positions in stocks are taken at the end of each trading day, according to the general direction of the day's opening returns, and closed at the end of the next day's opening session.

For all the stocks in the sample and over the whole sampling period, I construct six alternative investment portfolios:

a) Portfolios based on the sign of the previous day's Average opening returns:

Portfolio AP: Portfolio that following the days of non-positive Average opening returns, implies an equally-weighted long position (for the days' opening sessions)

in the stocks whose previous day's opening returns were positive, and following the days of positive average opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive(6).

Portfolio AA: Portfolio that following the days of non-positive average opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive average opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio AM: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

b) Portfolios based on the sign of the previous day's median opening returns:

Portfolio MP: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and, following the days of positive median opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio MA: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio MM: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and, following the days of positive median opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Table 4 concentrates the basic daily performance measures over the sampling period for all the six portfolios. Strikingly, all the portfolios yield positive and highly significant mean daily returns. These results, first of all, provide a strong

support for my research hypothesis. That is, general market opening returns are negatively autocorrelated, but if we control for the sign of the previous day's market opening return, then, for an individual stock, opening returns tend to be higher following the days when they were relatively high (either positive, or higher than the sample average or median for the same day). Moreover, from the practical point of view, at least if trading commissions are not a problem, the six portfolios represent potentially profitable investment strategies. Mean opening returns of about 0.1 percentage point may, at the first glance, seem not quite impressive, but since we are talking about single-day opening returns, the mean annual return of about 37% on Portfolios AP or MP, for example, look promising (recall that the yield significantly positive returns).

Overall, the results in this section strongly indicate that interday drifts, contradicting market efficiency, are exhibited in stocks' opening returns, and, therefore, investment strategies built upon the expectation of such drifts may possess a non-negligible potential.

4. Conclusion

The main goal of present study is to shed light on the actual mechanism of autocorrelations in individual stocks' opening returns. I suggest that the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals may be driven by generally negative first-order autocorrelations in the opening returns of the stock market as a whole, and that, if the general market opening returns are controlled for, then individual stocks' opening returns may actually exhibit positive, rather than negative, autocorrelations, in line with the results by Kudryavtsev (2012, 2013) indicating reversals in stocks' open-to-close returns with respect to opening returns, and also reversals in the next day's opening returns with respect to today's open-to close returns. In other words, I expect to find drifts in opening returns caused by a kind of "reversals of reversals".

I analyze intraday price data on thirty stocks currently making up the Dow Jones Industrial Index, and find supporting evidence for my research hypothesis. Employing the sample average and the sample median of opening stock returns for each of the trading days within my sample period as two alternative proxies for the general market opening returns, I document that if the previous day's market and individual stock's opening returns are taken together to explain the stock's opening returns, then, in line with my hypothesis, the effect of the lagged general market opening returns is significantly negative, while the effect of the lagged stock's opening returns is significantly positive. Furthermore, to support my findings, I separately demonstrate that following days characterized by both

positive and negative market opening returns, a given stock's opening returns tend to be higher if its previous day's opening returns were positive.

Finally, I test if on the basis of these results it may be possible to define potentially profitable investment strategies. I construct a number of portfolios based on the opening trading sessions and involving a long position in the stocks on the days when, according to the findings, their opening returns are expected to be high and a short position in the stocks on the days when, according to the findings, their opening returns are expected to be low. All the portfolios are found to yield significantly positive returns, providing an evidence for the practical applicability of the pattern of drifts in opening stock prices.

To summarize, at least in a perfect stock market with no commissions, the daily-adjusted strategies based on the expectations of interday drifts in opening stock returns look promising. This may prove a valuable result for both financial theoreticians in their eternal discussion about stock market efficiency, and practitioners in search of potentially profitable investment strategies. Potential directions for further research may include expending the analysis to other stock exchanges and greater samples.

Notes

(1) The focus on long-term dynamics of stock returns' overreaction and subsequent reversals from the pioneering studies by Shiller (1984) and De Bondt and Thaler (1985) is more recently realigned to short-run return behavior, ranging over time periods from a few days up to a month, in the major part of the subsequent literature (Lehmann, 1990, Zarowin, 1989, Atkins, Dyl, 1990, Cox, Peterson, 1994, Park, 1995, Bowman, Iverson, 1998, Nam et al., 2001). A continuously growing body of literature concentrates on even shorter time intervals, and studies intraday price reversals (Grant et al., 2005, Zawadowski et al., 2006). The major focus of these studies is on identifying potentially profitable contrarian strategies built on a reverting behavior of stock prices in the short run.

(2) At the first glance, this result seems to contradict the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals, but, in fact, there is no contradiction (as explained in some more detail in Section 3). The point is that the average or median opening returns are negatively autocorrelated, and since most of positive (negative) opening returns for a given stock happen on the days when the average or median opening return is also positive (negative), the stock's next day's opening returns tend to be negative (positive), providing an evidence of a generally negative autocorrelation in opening stock returns. But if the effect of the previous day's median or average opening returns is controlled for, it appears that, following days with both positive and negative average returns, opening stock returns tend to be higher, the higher are the respective previous day's opening returns.

(3) During the sampling period, the database on Yahoo Finance was missing only two trading days for Kraft Foods stock and one trading day for The Travelers Companies stock. I assumed the missing days' opening and closing prices to be equal to the average of the previous and the next trading days' opening and closing prices, respectively, for the respective stock.

(4) To construct the equally-weighted portfolios, for each day t characterized by, say, $AOR_{t-1} > 0$ (previous day's average opening return was positive – relevant for Table 3a), I construct two portfolios, where the return on the first one is the equally-weighted opening return on all the stocks whose previous day's opening return was positive ($OR_{it-1} > 0$), and the return on the second one is the equally-weighted opening return on all the stocks whose previous day's opening return was non-positive ($OR_{it-1} \leq 0$). I furthermore, calculate mean returns on both portfolios over all the days like t.

(5) I have repeated the analysis presented in Tables 3a and 3b, employing the sign of the previous trading day's median (instead of average) opening returns for the stocks in the sample as a proxy for the general market opening returns. The results are qualitatively similar and available upon request from the author.

(6) This is, in fact, a portfolio based on the same approach as the one employed in Tables 3a and 3b.

References

Ahn, D.H., Boudoukh, J. Richardson, M.P., Whitelaw, R.F. (2002). "Partial Adjustment or Stale Prices? Implications from Stock Index and Futures Return Autocorrelations", *Review of Financial Studies*, 15, pp. 655-689

Amihud, Y., Mendelson, H. (1987). "Trading Mechanisms and Stock Returns: An Empirical Investigation", *Journal of Finance*, 42, pp. 533-553

Anderson, R.M. (2006). "Time-Varying Risk Premia and Stock Return Autocorrelation", *Working Paper*, University of California at Berkeley

Atchison, M.D., Butler, K.C., Simonds, R.R. (1987). "Nonsynchronous Security Trading and Market Index Autocorrelation", *Journal of Finance*, 42, pp. 533-553

Atkins, A.B., Dyl, E.A. (1990). "Price Reversals, Bid-Ask Spreads, and Market Efficiency", *Journal of Financial and Quantitative Analysis*, 25, pp. 535-547

Blandon, J.G. (2007). "Return Autocorrelation Anomalies in Two European Stock Markets", *Journal of Economic Analysis*, 22, pp. 59-70

Bowman, R.G., Iverson, D. (1998). "Short-Run Overreaction in the New Zealand Stock Market", *Pacific-Basin Finance Journal*, 6, pp. 475-491

Campbell, J.Y., Lo, A.W., MacKinlay, A.C. (1997). *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ

Chordia, T., Swaminathan, B. (2000). "Trading Volume and Cross-Autocorrelations in Stock Returns", *Journal of Finance*, 55, pp. 913-935

Cox, D.R., Peterson, D.R. (1994). "Stock Returns Following Large One-Day Declines: Evidence on Short-Term Reversals and Longer-Term Performance", *Journal of Finance*, 49, pp. 255-267

De Bondt, W F.M., Thaler, R. (1985). "Does the Stock Market Overreact?", *Journal of Finance*, 40(3), pp. 793-805

Fisher, L. (1966). "Some New Stock Market Indexes", *Journal of Business*, 39, pp. 191-225

Gerety, M.S., Mulherin, J.H. (1994). "Price Formation on Stock Exchanges: The Evolution of Trading within the Day", *Review of Financial Studies*, 7, pp. 609-629

Grant, J.L., Wolf, A., Yu, S. (2005). "Intraday Price Reversals in the US Stock Index Futures Market: A 15-Year Study", *Journal of Banking and Finance*, 29, pp. 1311-1327

Harris, L. (1986). "A Transaction Data Study of Weekly and Intraday Patterns in Stock Returns", *Journal of Financial Economy* 16, pp. 99-117

Jain, P.C., Joh, G.H. (1988). "The Dependence between Hourly Prices and Trading Volume", *Journal of Financial and Quantitative Analysis*, 23, pp. 269-283

Kadlec, G.B., Patterson, D.M. (1999). "A Transactions Data Analysis of Nonsynchronous Trading", *Review of Financial Studies*, 12, pp. 609-630

Kudryavtsev, A. (2012). "Early to Rise: When Opening Stock Returns Are Higher than Daily Returns?", *Studies in Business and Economics*, 7, pp. 58-73

Kudryavtsev, A. (2013). "Reversals in Opening Stock Returns", *Empirical Economics Letters*, forthcoming

Lehmann, B.N. (1990). "Fads, Martingales, and Market Efficiency", *Quarterly Journal of Economics*, 105, pp. 1-28

Lo, A.W., MacKinlay, A.C. (1990). "An Econometric Analysis of Nonsynchronous Trading", *Journal of Econometrics*, 45, pp. 181-212

Nam, K., Pyun, C.S., Avard, S.L. (2001). "Asymmetric Reverting Behavior of Short-Horizon Stock Returns: An Evidence of Stock Market Overreaction", *Journal of Banking and Finance*, 25, pp. 807-824

Pagano, M.S., Peng, L., Schwartz, R.A. (2008). "The Quality of Price Formation at Market Openings and Closings: Evidence from the Nasdaq Stock Market", *Working paper*, Villanova University

Park, J. (1995). "A Market Microstructure Explanation for Predictable Variations in Stock Returns following Large Price Changes", *Journal of Financial and Quantitative Analysis*, 30, pp. 241-256

Perry, P. (1985). "Portfolio Serial Correlation and Non-Synchronous Trading", *Journal of Financial and Quantitative Analysis*, 20, pp. 517-523

Rhee, S.G., Wang, C.J. (1997). "The Bid-Ask Bounce Effect and the Spread Size Effect: Evidence from the Taiwan Stock Market", *Pacific-Basin Finance Journal*, 5, pp. 231-258

Säfvenblad, P. (2000). "Trading Volume and Autocorrelation: Empirical Evidence from the Stockholm Stock Exchange", *Journal of Banking and Finance*, 24, pp. 1275-1287

Sias, R.W., Starks, L.T. (1997). "Return Autocorrelation and Institutional Investors", *Journal of Financial Economics*, 46, pp. 103-131

Scholes, M.S., Williams, J. (1977). "Estimating Betas from Nonsynchronous Data", *Journal of Financial Economics*, 5, pp. 309-328

Shiller, R.J. (1984). "Stock Prices and Social Dynamics", *Brookings Papers on Economic Activity*, XII(2), pp. 457-498

Stoll, H.R., Whaley, R.E. (1990). "Stock Market Structure and Volatility", *Review of Financial Studies*, 3, pp. 37-71

Wood, R.A., McInish, T.H. Ord, J.K. (1985). "An Investigation of Transactions Data for NYSE Stocks", *Journal of Finance*, 40, pp. 723-739

Zarowin, P. (1989). "Short-Run Market Overreaction: Size and Seasonality Effects", *Journal of Portfolio Management*, 15, pp. 26-29

Zawadowski, A.G., Andor, G., Kertesz, J. (2006). "Short-Term Market Reaction after Extreme Price Changes of Liquid Stocks", *Quantitative Finance*, 6, pp. 283-295

Appendix

Table 1. *Descriptive statistics of sample stocks' opening returns*

The table presents for each of the 30 sample stocks and over the sampling period (2,455 trading days), the basic descriptive statistics of the opening returns calculated as follows:

$$R_{O,it} = \frac{P_{O,it}}{P_{C,it-1}} - 1$$

where: $R_{O,it}$ is stock i's opening return on day t; $P_{O,it}$ is stock i's opening price on day t; and $P_{C,it-1}$ is stock i's closing price on day t-1.

Company (Ticker symbol)	Opening returns, %					
	Mean	Median	St. Deviation	Maximum	Minimum	% of positive
Alcoa Inc. (AA)	0.158	0.084	1.551	18.969	-11.636	58.62
American Express (AXP)	-0.008	0.004	1.212	8.201	-11.064	51.12
Boeing (BA)	0.033	0.015	1.004	9.636	-9.638	54.34
Bank of America (BAC)	0.104	0.015	2.045	26.050	-20.020	53.48
Caterpillar (CAT)	0.086	0.029	1.198	11.365	-10.945	57.03
Cisco Systems (CSCO)	0.026	0.022	1.410	16.379	-16.452	51.36
Chevron Corporation (CVX)	0.032	0.030	0.808	4.033	-8.638	56.74
E.I. Du Pont de Nemours (DD)	0.039	0.020	0.879	5.201	-7.156	54.75
Walt Disney (DIS)	-0.048	-0.003	1.094	15.941	-9.875	49.29
General Electric (GE)	0.086	0.026	1.275	17.511	-11.583	53.81
Home Depot Inc. (HD)	0.001	-0.002	1.047	8.841	-9.479	49.57
Hewlett-Packard (HPQ)	-0.116	-0.046	1.386	14.379	-20.034	45.46
IBM (IBM)	-0.061	-0.033	0.956	12.177	-10.028	45.25
Intel Corporation (INTC)	0.038	0.070	1.377	8.567	-18.117	54.26
Johnson & Johnson (JNJ)	0.005	0.008	0.715	6.092	-16.552	52.79
JP Morgan Chase & Co (JPM)	0.043	0.013	1.436	16.616	-11.570	53.36
Kraft Foods Inc. (KFT)	-0.013	0.002	0.829	5.433	-12.779	50.84
Coca-Cola (KO)	-0.009	-0.002	0.663	7.072	-4.787	49.37
McDonald's Corporation (MCD)	0.007	0.007	0.860	4.554	-9.366	51.93
3M Company (MMM)	0.017	0.007	0.756	8.270	-6.285	53.85
Merck & Company Inc. (MRK)	-0.022	0.009	1.110	6.543	-25.878	52.55
Microsoft Corporation (MSFT)	0.017	0.008	1.020	12.550	-11.080	50.47
Pfizer Inc. (PFE)	0.054	0.029	1.047	11.400	-15.100	53.89
Procter & Gamble (PG)	-0.043	-0.014	0.625	4.846	-6.057	46.07
AT&T Inc. (T)	0.053	0.038	0.933	5.734	-8.469	56.13
The Travelers Companies (TRV)	0.042	0.011	0.996	11.292	-9.025	53.40
United Technologies Corp. (UTX)	0.042	0.015	0.824	6.470	-7.192	54.58
Verizon Communications (VZ)	0.035	0.027	0.839	4.359	-7.286	55.56
Wal-Mart Stores Inc. (WMT)	0.018	0.011	0.735	5.044	-7.620	52.91
Exxon Mobil Corporation (XOM)	-0.005	0.011	0.801	4.215	-9.071	52.46

Table 2a. *Regression analysis of opening stock returns: General market opening returns proxied by average opening returns for the stocks in the sample*

The table presents the regression coefficients and the t-statistics for the following model:

$$OR_{it} = \beta_0 + \beta_1 AOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it}$$

where: OR_{it} represents stock i's opening return on day t; and AOR_{t-1} is the average day-t-1opening return for the stocks in the sample.

	Regression coefficients (t-statistics)		
Company (Ticker symbol)	Intercept	AOR_{t-1}	OR_{it-1}
Alcoa Inc. (AA)	***0.0015 (4.78)	***-0.4667 (-7.08)	***0.1121 (3.66)
American Express (AXP)	-0.0001 (-0.15)	***-0.2140 (-3.75)	0.0204 (0.60)
Boeing (BA)	*0.0003 (1.73)	***-0.2479 (-6.49)	***0.0952 (3.47)
Bank of America (BAC)	**0.0010 (2.43)	***-0.6126 (-7.57)	***0.1641 (5.75)
Caterpillar (CAT)	***0.0009 (3.70)	-0.0041 (-0.08)	-0.0446 (-1.50)
Cisco Systems (CSCO)	0.0003 (1.01)	***-0.1571 (-2.87)	0.0003 (0.01)
Chevron Corporation (CVX)	**0.0003 (2.13)	***-0.1008 (-2.96)	-0.0135 (-0.44)
E.I. Du Pont de Nemours (DD)	***0.0004 (2.40)	***-0.1035 (-2.73)	-0.0354 (-1.14)
Walt Disney (DIS)	**-0.0004 (-1.99)	***-0.1666 (-4.12)	0.0375 (1.41)
General Electric (GE)	***0.0008 (2.97)	***-0.4038 (-7.06)	***0.2190 (6.77)
Home Depot Inc. (HD)	0.0001 (0.21)	***-0.1481 (-3.65)	0.0088 (0.32)
Hewlett-Packard (HPQ)	***-0.0011 (-4.02)	-0.0659 (-1.33)	0.0058 (0.22)
IBM (IBM)	***-0.0007 (-3.48)	-0.0137 (-0.36)	***0.1057 (3.69)
Intel Corporation (INTC)	0.0004 (1.53)	***-0.1734 (-3.27)	-0.0311 (-1.12)
Johnson & Johnson (JNJ)	0.0001 (0.52)	***-0.1306 (-5.28)	***0.0904 (3.62)
JP Morgan Chase & Co (JPM)	*0.0005 (1.67)	***-0.2921 (-4.28)	0.0131 (0.38)
Kraft Foods Inc. (KFT)	-0.0001 (-0.53)	***-0.1426 (-5.32)	***0.0805 (3.45)
Coca-Cola (KO)	-0.0001 (-0.55)	***-0.0764 (-3.29)	***0.0733 (2.90)
McDonald's Corporation (MCD)	0.0001 (0.54)	***-0.1464 (-5.01)	0.0226 (0.92)
3M Company (MMM)	0.0002 (1.25)	***-0.1319 (-4.50)	0.0440 (1.57)
Merck & Company Inc. (MRK)	-0.0002 (-0.90)	**-0.0872 (-2.40)	0.0127 (0.54)
Microsoft Corporation (MSFT)	0.0002 (0.97)	***-0.1745 (-4.37)	*0.0541 (1.91)
Pfizer Inc. (PFE)	**0.0005 (2.49)	***-0.1166 (-3.30)	***0.0698 (2.87)
Procter & Gamble (PG)	***-0.0004 (-3.05)	***-0.0911 (-4.13)	*0.0441 (1.73)
AT&T Inc. (T)	***0.0005 (2.59)	***-0.1924 (-5.48)	***0.1586 (5.84)
The Travelers Companies (TRV)	**0.0004 (2.24)	***-0.2112 (-5.39)	*0.0474 (1.67)
United Technologies Corp.	***0.0004 (2.59)	***-0.1179 (-3.28)	0.0321 (1.02)
(UTX)	**0.0004 (2.13)	***-0.1377 (-4.23)	**0.0578 (2.07)
Verizon Communications (VZ)	0.0002 (1.32)	***-0.0950 (-3.77)	0.0380 (1.54)
Wal-Mart Stores Inc. (WMT)	-0.0001 (-0.15)	***-0.1339 (-4.05)	0.0244 (0.82)
Exxon Mobil Corporation (XOM)			

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 2b. *Regression analysis of opening stock returns: General market opening returns proxied by median opening returns for the stocks in the sample*

The table presents the regression coefficients and the t-statistics for the following model:

$$OR_{it} = \beta_0 + \beta_1 MOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it}$$

where: OR_{it} represents stock i's opening return on day t; and MOR_{t-1} is the median day-t-1opening return for the stocks in the sample.

Company (Ticker symbol)	Regression coefficients (t-statistics)		
	Intercept	MOR_{t-1}	OR_{it-1}
Alcoa Inc. (AA)	***0.0015 (4.67)	***-0.5236 (-7.36)	***0.1040 (3.57)
American Express (AXP)	-0.0001 (-0.25)	***-0.2112 (-3.41)	0.0048 (0.15)
Boeing (BA)	0.0003 (1.60)	***-0.2787 (-6.36)	***0.0956 (3.45)
Bank of America (BAC)	**0.0010 (2.32)	***-0.6557 (-7.71)	***0.1436 (5.42)
Caterpillar (CAT)	***0.0009 (3.67)	-0.0264 (-0.48)	-0.0362(-1.24)
Cisco Systems (CSCO)	0.0003 (0.96)	**-0.1167 (-1.98)	-0.0212 (-0.80)
Chevron Corporation (CVX)	**0.0003 (2.06)	***-0.1111 (-2.82)	-0.0143 (-0.46)
E.I. Du Pont de Nemours (DD)	**0.0004 (2.33)	***-0.1371 (-3.14)	-0.0236 (-0.75)
Walt Disney (DIS)	**-0.0005 (-2.07)	***-0.1907 (-4.23)	0.0364 (1.39)
General Electric (GE)	***0.0007 (2.83)	***-0.4576 (-7.41)	***0.2131 (6.92)
Home Depot Inc. (HD)	0.0001 (0.12)	***-0.1433 (-3.15)	-0.0023 (-0.08)
Hewlett-Packard (HPQ)	***-0.0012 (-4.11)	-0.0388 (-0.71)	-0.0051 (-0.20)
IBM (IBM)	***-0.0007 (-3.59)	-0.0341 (-0.81)	***0.1288 (4.62)
Intel Corporation (INTC)	0.0004 (1.47)	***-0.1751 (-3.06)	-0.0414 (-1.57)
Johnson & Johnson (JNJ)	0.0001 (0.44)	***-0.1608 (-5.70)	***0.0981 (3.91)
JP Morgan Chase & Co (JPM)	0.0005 (1.58)	***-0.3141 (-4.38)	0.0021 (0.06)
Kraft Foods Inc. (KFT)	-0.0001 (-0.63)	***-0.1513 (-5.02)	***0.0747 (3.23)
Coca-Cola (KO)	-0.0001 (-0.61)	***-0.0913 (-3.45)	***0.0764 (3.00)
McDonald's Corporation (MCD)	0.0001 (0.46)	***-0.1761 (-5.38)	0.0252 (1.04)
3M Company (MMM)	0.0002 (1.16)	***-0.1479 (-4.39)	0.0443 (1.56)
Merck & Company Inc. (MRK)	-0.0002 (-0.95)	**-0.0962 (-2.36)	0.0110 (0.47)
Microsoft Corporation (MSFT)	0.0002 (0.88)	***-0.1718 (-3.93)	0.0396 (1.45)
Pfizer Inc. (PFE)	**0.0005 (2.44)	***-0.1186 (-3.00)	***0.0639 (2.66)
Procter & Gamble (PG)	***-0.0004 (-3.10)	***-0.1088 (-4.27)	*0.0496 (1.91)
AT&T Inc. (T)	**0.0005 (2.49)	***-0.2079 (-5.19)	***0.1544 (5.66)
The Travelers Companies (TRV)	**0.0004 (2.14)	***-0.2172 (-4.96)	0.0359 (1.28)
United Technologies Corp.	**0.0004 (2.53)	***-0.1133 (-2.67)	0.0216 (0.66)
(UTX)	**0.0003 (2.04)	***-0.1688 (-4.56)	**0.0648 (2.31)
Verizon Communications (VZ)	0.0002 (1.25)	***-0.1054 (-3.69)	0.0368 (1.49)
Wal-Mart Stores Inc. (WMT)	-0.0001 (-0.23)	***-0.1573 (-4.07)	0.0299 (0.97)
Exxon Mobil Corporation (XOM)			

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 3a. *Opening stock returns following the days of positive and non-positive opening returns: Statistics following the days characterized by positive average opening returns.*

The table presents for each stock i, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \leq 0$), given that the previous days were characterized by positive average opening returns ($AOR_{t-1} > 0$). The table also reports the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$. The rightmost column reports the differences between the respective mean opening returns, and their significance.

Company (Ticker symbol)	Mean opening returns, %, for the days when:		
	$OR_{it-1} > 0$ (No. of days)	$OR_{it-1} \leq 0$ (No. of days)	Difference (t-statistic)
Alcoa Inc. (AA)	0.079 (1096)	0.050 (223)	0.029 (0.26)
American Express (AXP)	-0.103 (1034)	-0.021 (285)	-0.082 (-1.00)
Boeing (BA)	-0.023 (1004)	-0.049 (315)	0.026 (0.40)
Bank of America (BAC)	0.017 (1054)	-0.240 (265)	*0.257 (1.80)
Caterpillar (CAT)	0.036 (1087)	0.056 (232)	-0.020 (-0.22)
Cisco Systems (CSCO)	-0.046 (1037)	-0.134 (282)	0.088 (0.93)
Chevron Corporation (CVX)	-0.024 (1021)	-0.018 (298)	-0.006 (-0.12)
E.I. Du Pont de Nemours (DD)	-0.044 (1041)	-0.001 (278)	-0.043 (-0.67)
Walt Disney (DIS)	-0.125 (964)	-0.076 (355)	-0.049 (-0.78)
General Electric (GE)	0.028 (1098)	0.032 (221)	-0.004 (-0.05)
Home Depot Inc. (HD)	-0.070 (973)	-0.057 (346)	-0.013 (-0.19)
Hewlett-Packard (HPQ)	-0.017 (908)	-0.018 (411)	0.001 (0.10)
IBM (IBM)	-0.075 (919)	-0.139 (400)	0.064 (1.19)
Intel Corporation (INTC)	-0.073 (1081)	-0.053 (238)	-0.020 (-0.21)
Johnson & Johnson (JNJ)	-0.019 (968)	-0.084 (351)	*0.065 (1.65)
JP Morgan Chase & Co (JPM)	-0.100 (1060)	-0.061 (259)	-0.039 (-0.38)
Kraft Foods Inc. (KFT)	-0.066 (869)	-0.045 (450)	-0.021 (-0.38)
Coca-Cola (KO)	-0.012 (923)	-0.064 (396)	0.052 (1.29)
McDonald's Corporation (MCD)	-0.054 (954)	-0.023 (365)	-0.031 (-0.61)
3M Company (MMM)	-0.028 (995)	-0.035 (324)	0.007 (0.16)
Merck & Company Inc. (MRK)	-0.032 (971)	-0.145 (348)	*0.113 (1.73)
Microsoft Corporation (MSFT)	-0.063 (1032)	-0.030 (287)	-0.033 (-0.48)
Pfizer Inc. (PFE)	0.017 (1005)	0.016 (314)	0.001 (0.01)
Procter & Gamble (PG)	-0.074 (879)	-0.103 (440)	0.029 (0.82)
AT&T Inc. (T)	0.029 (1029)	-0.134 (290)	***0.163 (2.73)
The Travelers Companies (TRV)	0.045 (991)	-0.056 (328)	*0.101 (1.66)
United Technologies Corp. (UTX)	-0.015 (1018)	0.001 (301)	-0.016 (-0.35)
Verizon Communications (VZ)	0.001 (1034)	-0.092 (285)	*0.093 (1.67)
Wal-Mart Stores Inc. (WMT)	-0.043 (991)	-0.011 (328)	-0.032 (-0.70)
Exxon Mobil Corporation (XOM)	-0.059 (981)	-0.018 (338)	-0.041 (-0.81)
Equally-Weighted Portfolios	-0.020 (1319)	-0.094 (1319)	**0.074 (2.55)

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 3b. *Opening stock returns following the days of positive and non-positive opening returns: Statistics following the days characterized by non-positive average opening returns*

The table presents for each stock *i*, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \leq 0$), given that the previous days were characterized by non-positive average opening returns ($AOR_{t-1} \leq 0$). The table also reports the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$. The rightmost column reports the differences between the respective mean opening returns, and their significance.

Company (Ticker symbol)	Mean opening returns, %, for the days when:		
	$OR_{it-1} > 0$ (No. of days)	$OR_{it-1} \leq 0$ (No. of days)	Difference (t-statistic)
Alcoa Inc. (AA)	0.232 (343)	0.263 (792)	-0.031 (-0.30)
American Express (AXP)	0.054 (221)	0.088 (914)	-0.034 (-0.38)
Boeing (BA)	0.179 (330)	0.075 (805)	0.104 (1.56)
Bank of America (BAC)	0.307 (259)	0.253 (876)	0.054 (0.38)
Caterpillar (CAT)	0.089 (313)	0.159 (822)	-0.070 (-0.91)
Cisco Systems (CSCO)	0.225 (224)	0.107 (911)	0.118 (1.14)
Chevron Corporation (CVX)	0.109 (372)	0.089 (763)	0.020 (0.41)
E.I. Du Pont de Nemours (DD)	0.112 (303)	0.130 (832)	-0.018 (-0.30)
Walt Disney (DIS)	0.108 (246)	0.001 (889)	0.107 (1.27)
General Electric (GE)	0.277 (223)	0.124 (912)	*0.153 (1.66)
Home Depot Inc. (HD)	0.194 (244)	0.049 (891)	**0.155 (1.96)
Hewlett-Packard (HPQ)	0.014 (208)	-0.067 (927)	0.081 (0.69)
IBM (IBM)	-0.013 (192)	0.011 (943)	-0.024 (-0.29)
Intel Corporation (INTC)	0.190 (251)	0.153 (884)	0.027 (0.37)
Johnson & Johnson (JNJ)	0.079 (328)	0.044 (807)	0.035 (0.70)
JP Morgan Chase & Co (JPM)	0.266 (250)	0.180 (885)	0.086 (0.86)
Kraft Foods Inc. (KFT)	0.049 (379)	0.036 (756)	0.013 (0.31)
Coca-Cola (KO)	0.012 (289)	0.011 (846)	0.001 (0.03)
McDonald's Corporation (MCD)	0.101 (321)	0.054 (814)	0.047 (0.79)
3M Company (MMM)	0.064 (327)	0.074 (808)	-0.010 (-0.21)
Merck & Company Inc. (MRK)	0.118 (319)	-0.014 (816)	*0.132 (1.71)
Microsoft Corporation (MSFT)	0.202 (207)	0.080 (928)	0.122 (1.59)
Pfizer Inc. (PFE)	0.245 (318)	0.040 (817)	***0.205 (3.09)
Procter & Gamble (PG)	-0.001 (252)	0.001 (883)	-0.002 (-0.16)
AT&T Inc. (T)	0.171 (349)	0.100 (786)	0.071 (1.14)
The Travelers Companies (TRV)	0.181 (320)	0.106 (815)	0.075 (1.10)
United Technologies Corp. (UTX)	0.159 (322)	0.080 (813)	0.079 (1.48)
Verizon Communications (VZ)	0.164 (330)	0.070 (805)	*0.094 (1.74)
Wal-Mart Stores Inc. (WMT)	0.118 (308)	0.065 (827)	0.053 (1.06)
Exxon Mobil Corporation (XOM)	0.044 (307)	0.045 (828)	-0.001 (-0.03)
Equally-Weighted Portfolios	0.161 (1135)	0.072 (1135)	***0.089 (2.71)

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 4. *Historical performance measures of the portfolios based on the idea of drifts in opening stock returns*

The table presents the basic performance measures of opening returns over the sampling period (January 2, 2002 to September 30, 2011) for six portfolios constructed daily based on the expectation of drifts in opening stock returns and on the sign of previous day's opening market returns:

Portfolio AP: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio AA: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio AM: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Portfolio MP: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio MA: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio MM: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions)

in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Statistics	Portfolio performance measures (opening returns) over the sampling period (2454 days)					
	Portfolio AP	Portfolio AA	Portfolio AM	Portfolio MP	Portfolio MA	Portfolio MM
Mean, %	0.125	0.095	0.094	0.126	0.097	0.094
Median,%	0.060	0.077	0.079	0.057	0.075	0.075
Standard	0.791	0.662	0.650	0.793	0.666	0.653
Deviation, %	9.121	7.183	7.121	9.121	7.183	7.121
Maximum, %	-7.072	-4.154	-4.364	-7.072	-4.154	-4.364
Minimum, %	54.81	58.27	58.60	55.01	58.27	58.64
Percent of positive						
t-statistic (Mean=0)	***7.80	***7.09	***7.18	***7.84	***7.19	***7.15

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 73-82

Entrepreneurship among higher education graduates in 13 European countries

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Abstract. *Our paper investigates the school-to-work transition of higher education graduates from European countries. Exploring REFLEX data set which includes information on first jobs held by the ISCED 5 graduates, we study the incidence and characteristics of youth entrepreneurship. Also, we find the educational, institutional and personal factors influencing entrepreneurship along the 13 European countries. Our results are important for designing future policies and programs for encouraging youth entrepreneurship, especially among those with higher education.*

Keywords: entrepreneurship; youth; higher education.

JEL Classification: J24.
REL Classification: 14D.

Introduction

The study of youth entrepreneurship improves the knowledge about creation of youth employment opportunities. Starting his/her own micro or small enterprise or becoming self-employed could represent one important way of negotiating school-to-work transition. However, there is a gap of knowledge on youth entrepreneurship and its barriers and incentives. Our paper aims to investigate the choice of this career pattern by higher education graduates from 13 European countries.

It is well known that the reduction of youth unemployment is a key objective for policy makers from both developed and least developed countries. Analysis of labour market indicators by age shows that there is a strong need for employment creation focussed on young people (Schoof, 2006). Also, youth unemployment represents an important loss of human capital that could contribute to the economic growth. Therefore, increasing youth employment would be beneficial for the entire society on long term.

While economies face an increasing need of employment opportunities for youth, entrepreneurship represents a valuable path of insertion on the labour market. That is why, entrepreneurship could contribute to a better usage of the economic potential of young people and to overcoming poverty. Youth entrepreneurship is important from many economic and social points of view: unemployment reduction, increasing social inclusion, enhancing self confidence among youth, reduction of the risk of youth delinquency, improving youth skills and knowledge, promoting innovation and new economic niches. Therefore, we must sustain youth entrepreneurship as a valuable source of job creation and economic dynamism. However, scholars warn us that youth entrepreneurship shouldn't be considered a wide-ranging solution for all sorts of economic and social problems, but a valuable career alternative to be promoted.

Entrepreneurship represents "the process whereby individuals become aware of business ownership as an option or viable alternative, develop ideas for business, learn the process of becoming an entrepreneur and undertake the initiation and development of a business" (Stevenson, 1989 apud. Chigunta, 2002). On the other hand, entrepreneurship is understood in close connection with qualities such as initiative, innovation, creativity and risk-taking and knowledge to obtain success in specific economic and cultural environments.

On the other hand, growth of youth entrepreneurship is sensible to a number of factors, among which the most important are awareness and public attitude on youth entrepreneurship, entrepreneurship education, business support, institutional framework and access to financing mechanisms (Schoof, 2006).

Data and methodology

Objective of our paper is to investigate the incidence of entrepreneurship among higher education graduates and factors shaping it. Information on career of school leavers come from a large scale survey conducted in 13 European countries (Portugal, Spain, Italy, France, Austria, Germany, Netherlands, Belgium, United Kingdom, Norway, Finland, Estonia and Czech Republic) on a representative sample drawn of graduates from ISCED 5 who got their diploma in the academic year 1999/2000. The survey was part of the REFLEX Project ("The Flexible Professional in the Knowledge Society New Demands on Higher Education in Europe"). Data were collected in 2005 via mail questionnaire and graduates offered information on their jobs after leaving education. Total number of respondents is 31,846.

Table 1. *Distribution of graduates included in the sample, by country*

Country	Frequency	%
Portugal	645	2.0
Spain	3916	12.3
Italy	3139	9.9
France	1700	5.3
Austria	1821	5.7
Germany	1700	5.3
Netherlands	3425	10.8
Belgium	1291	4.1
United Kingdom	1578	5.0
Norway	2201	6.9
Finland	2676	8.4
Estonia	960	3.0
Czech Republic	6794	21.3
Total	31846	100

Results

In total, 10.3% of graduates had no job 5 years after leaving education. France, Italy, Finland and Spain display highest share of graduates who don't work. While 81.9% of graduates have one job, 7.8% of them have more than one job. Higher incidence of respondents with two or more jobs is registered in Estonia, Austria and Portugal. One should notice the case of Norway which performs best in this respect. It registers the lowest share of graduates with no job and the highest share of school leavers with more than one job.

Table 2. *Distribution of graduates, by current employment (%)*

	One job	More than one job	No job	Total
Portugal	78.6	12.5	8.9	100
Spain	81.3	6.4	12.2	100
Italy	83.0	4.0	13.0	100
France	82.9	3.7	13.4	100
Austria	75.7	12.1	12.2	100
Germany	85.0	5.5	9.5	100
Netherlands	86.5	6.8	6.7	100
Belgium	89.6	6.3	4.1	100
United Kingdom	82.8	5.4	11.8	100
Norway	84.4	10.4	5.2	100
Finland	80.3	7.0	12.7	100
Estonia	76.6	15.4	8.1	100
Czech Republic	79.2	10.3	10.5	100
Total	81.9	7.8	10.3	100

11.4% of the investigated graduates have become entrepreneurs five years after leaving education. The incidence of entrepreneurship is higher in Italy where we find that almost one quarter of the respondents are in this category. Also, Portugal, Austria and Czech Republic register higher shares of entrepreneurs, while United Kingdom has the poorest share of entrepreneurs among graduates with higher education.

Table 3. *Distribution of employed graduates, by type of employment (%)*

	Entrepreneurs	Non-entrepreneurs	Total
Portugal	15.8	84.2	100
Spain	9.3	90.7	100
Italy	22.7	77.3	100
France	6.4	93.6	100
Austria	14.4	85.6	100
Germany	12.7	87.3	100
Netherlands	6.7	93.3	100
Belgium	12.7	87.3	100
United Kingdom	5.2	94.8	100
Norway	6.2	93.8	100
Finland	6.9	93.1	100
Estonia	9.9	90.1	100
Czech Republic	14.5	85.5	100
Total	11.4	88.6	100

For understanding the entrepreneurial behavior, we estimate a logistic binomial regression for the dependent variable ”being an entrepreneur” which takes the value 1 for those becoming entrepreneurs and 0 otherwise. Model 1 finds the numerous significant predictors, including contextual and personal variables. From the country point of view, graduates from Italy have larger odds to be entrepreneurs as compared to those from Czech Republic (reference category), while most of the other countries display smaller probabilities. Also, field of education influences the youth career as those graduating humanities and arts and agriculture and veterinary became entrepreneurs in the highest extend (reference category being education). In accordance with results of other studies, male graduates have higher propensity towards entrepreneurship as against women. Moreover, age has a positive effect on entrepreneurship as older school leavers register higher odds to be entrepreneurs. On the other hand, values and attitudes to work represent significant predictors for entrepreneurship. Graduates valuing work autonomy, having new challenges, enjoying social status and good career prospects are more present among entrepreneurs, while those valuing job security, opportunity to learn, chance to combine work with family, chance to help the society are less present. Regarding the economic sector, young entrepreneurs activate more in agriculture, construction, hotels and restaurants, real estates, health and other services. From the point of view of the features of the economic environment, school leavers have more odds to be entrepreneurs in environments characterized by unstable demand, with strong competition and in businesses operating at local and regional level.

Model 2 kept all the above stated variables, while replacing the country variable with the Economic Complexity Index (ECI). The Economic Complexity Index was introduced by R. Hausmann and C. Hidalgo as a holistic measure of a country´s economy and it attempts to synthesize the collective knowledge of the society. It is based on the product space concept and it measures the diversity of capabilities existing in a specific country (Hausmann, Hidalgo, 2009). The authors recommend using it not only as a descriptive measure of a specific country, but also as a predictive tool of the country´s future economic development, because the creation of new products is positive correlated with the existing capabilities. Using the international trade data, the authors create a bipartite network that links the countries to the products they export (4-digit level according to The Standard International Trade Classification) and on it estimate a series of variables with the Method of Reflections (Hausmann, Hidalgo, 2009). These variables are the inputs on which they calculate the economic complexity index. We use the computed Economic Complexity Index at national level for 2005. Results of Model 2 show that higher ECI at national level is associated with higher odds to become entrepreneur.

Model 3 kept variables from Model 1, while replacing the field of education with other predictors characterizing the educational systems. Our results show that use of problem-based learning and oral presentations by students as teaching methods is associated with higher propensity towards entrepreneurship, while the use of traditional teaching methods reduce the chance to entrepreneurship. On the other hand, participation in student and other voluntary organizations increases the odds of becoming an entrepreneur. Also, self-assessed abilities influence careers of school leavers. Ability to negotiate, to perform well under pressure, to be alert to new opportunities, to come up with new ideas and solutions, to present products, ideas or reports to an audience and to write and speak in a foreign language increase the propensity toward entrepreneurship. Finally, higher number of years of education currently attained determines higher chances to become entrepreneur for graduates of higher education studies.

Table 4. *Results of the logistic regression for being an entrepreneur (1 = entrepreneur, 0 = non-entrepreneur) – method: Enter*

Variables	Model 1 Exp (B)	Model 2 Exp (B)	Model 3 Exp (B)
Country (ref. = Czech Republic)			
Portugal	0.774		0.710**
Spain	0.638***		0.567***
Italy	1.280***		0.961
France	0.469***		0.335***
Austria	0.697***		0.594***
Germany	0.568***		0.489***
Netherlands	0.376***		0.356***
Belgium	1.135		1.076
United Kingdom	0.373***		0.465***
Norway	0.319***		0.265***
Finland	0.417***		0.396***
Estonia	0.840		0.776
Economic Complexity Index		1.191***	
Field of education (ref. = Education)			
Humanities and Arts	1.593***	1.608***	
Social sciences, Business and Law	0.986	1.069	
Science, Mathematics and Computing	0.651***	0.667***	
Engineering, Manufacturing and Construction	0.958	1.056	
Agriculture and Veterinary	1.562***	1.630***	
Health and Welfare	0.891	0.908	
Services	1.058	0.994	
Use of lectures as a method of teaching and learning (ref. = no high extend)			
High extend			0.832***
Use of group assignments as a method of teaching and learning (ref. = no high extend)			

Variables	Model 1 Exp (B)	Model 2 Exp (B)	Model 3 Exp (B)
High extend			0.763***
Use of internships, workplacement as a method of teaching and learning (ref. = no high extend)			
High extend			0.878**
Use of theories and paradigms as a method of teaching and learning (ref. = no high extend)			
High extend			0.863***
Use of project and/or problem-based learning as a method of teaching and learning (ref. = no high extend)			
High extend			1.239***
Use of oral presentations by students as a method of teaching and learning (ref. = no high extend)			
High extend			1.193***
Number of hours spent for study per week			1.004**
Participation in student or other voluntary organizations (ref. = no)			
Yes			1.134*
The degree in which the study programme was a good basis for development entrepreneurial skills (ref. = no high extend)			
High extend			0.656***
Self assessed ability to negotiate effectively (ref. = no high extend)			
High extend			1.132**
Self assessed ability to perform well under pressure (ref. = no high extend)			
High extend			1.220***
Self assessed ability to be alert to new opportunities (ref. = no high extend)			
High extend			1.319***
Self assessed ability to work productively with others (ref. = no high extend)			
High extend			0.683***
Self assessed ability to use computers and the internet (ref. = no high extend)			
High extend			0.833**
Self assessed ability to come up with new ideas and solutions (ref. = no high extend)			
High extend			1.276***
Self assessed ability to present products, ideas or reports to an audience (ref. = no high extend)			
High extend			1.146**
Self assessed ability to write reports, memos or documents (ref. = no high extend)			
High extend			0.870**
Self assessed ability to write and speak in a foreign language (ref. = no high extend)			

Variables	Model 1 Exp (B)	Model 2 Exp (B)	Model 3 Exp (B)
High extend			1.120*
Years of higher education currently attained			1.122***
Gender (ref. = female)			
Male	1.515***	1.539***	1.313***
Age	1.046***	1.035***	1.045***
Values: work autonomy (ref. = no high importance)			
High importance	1.626***	1.654***	1.567***
Values: job security (ref. = no high importance)			
High importance	0.500***	0.509***	0.526***
Values: opportunity to learn new things (ref. = no high importance)			
High importance	0.786***	0.764***	0.781***
Values: high earnings (ref. = no high importance)			
High importance	0.919	0.827***	0.878*
Values: new challenges (ref. = no high importance)			
High importance	1.227***	1.068	1.066
Values: good chance to combine work with family tasks (ref. = no high importance)			
High importance	0.807***	0.936	0.733***
Values: chance of doing something useful for society (ref. = no high importance)			
High importance	0.777***	0.706***	0.838***
Values: social status (ref. = no high importance)			
High importance	1.159***	1.251***	1.131**
Values: enough time for leisure activities (ref. = no high importance)			
High importance	1.087	1.164***	1.015
Values: good career prospects (ref. = no high importance)			
High importance	1.188***	1.269***	1.174**
Work related training in the last 12 months (ref. = no)			
Yes	0.850***	0.843***	0.829***
International Standard Industrial Classification (ref. = education)			
Agriculture, hunting, forestry and fishing	1.534**	1.532**	1.925***
Mining and quarrying	0.234**	0.221***	0.259**
Manufacturing	0.693***	0.723***	0.668***
Electricity, gas and water supply	0.620	0.663	0.765
Construction	1.591***	1.572***	1.518***
Wholesale and retail trade; repair of motor vehicles	1.008	1.021	0.956
Hotels and restaurants	1.549*	1.553*	1.752**
Transport, storage and communications	0.700**	0.710**	0.682**
Financial intermediation	0.680***	0.706**	0.615***
Real estate, renting and business activities	2.242***	2.290**	2.109***
Public administration and defence; compulsory social security	0.712*	0.691**	0.710*
Health and social work	1.380***	1.269**	1.378***
Other services	2.211***	2.180***	2.282***

Variables	Model 1 Exp (B)	Model 2 Exp (B)	Model 3 Exp (B)
How strong is the competition in the market in which your organization operates (ref. = week)			
Medium	1.346***	1.413***	1.428***
Strong	1.632***	1.760***	1.613***
How stable is demand in the market in which your organization operates? (ref. = stable)			
Medium	1.175***	1.213***	1.135***
Unstable	1.362***	1.344***	1.343***
What is the scope of operations of your organization? (ref. = international)			
Local	4.565***	5.083***	4.615***
Regional	2.776***	2.769***	2.922***
National	1.743***	1.809***	1.744***
Constant	0.015	0.010	0.019
Chi-square	2149.67***	1833.28***	2047.93***
Nagelkerke R Square	0.2014	0.1732	0.2195
Overall % Correct	87.08	86.89	87.71

*p<0.1; **p<0.05; ***p<0.01.

Conclusions

Our study investigated the incidence of entrepreneurship among higher education graduates five years after leaving education. Analysing survey data, we find most important factors for youth entrepreneurship. So, most important conclusions are as follows:

- Our study finds that 11.4% of higher education graduates became entrepreneurs five years after leaving education;
- Italy, Portugal, Czech Republic and Austria display the highest propensity to entrepreneurship among higher education graduates;
- Level and complexity of economic development is very important for youth entrepreneurship;
- Personal factors such as gender, age and values and attitudes towards work shape significantly model the entrepreneurship behavior;
- Educational profile of graduates influences the chance of becoming entrepreneur, especially the use of specific teaching methods in faculties, number of years of education and the acquired abilities.

References

Chigunta, F. (2002). "Youth Entrepreneurship: Meeting the Key Challenges", European Youth Forum Position Paper on Youth Entrepreneurship

Gartner, W. B., Baker T. (2010). "A Plausible History and exploration of Stevenson's definition of entrepreneurship", *Frontiers of Entrepreneurship Research*, 30, 4, p. 2

Hausmann, R., Hidalgo, C.A. et al. (2011). *The Atlas of Economic Complexity*, Cambridge MA: Puritan Press. ISBN 0615546625

Hidalgo, C. A., Hausmann R. (2009). *The Building Block of Economic Complexity*, *PNAS* 106 (106(26)), pp. 10570-10575

Schoof, U. (2006). "*Stimulating Youth Entrepreneurship: Barriers and incentives to enterprise start-ups by young people*", International Labour Office

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 83-100

Innovative methods to analyze the stock market in Romania. Studying the volatility of the Romanian stock market with the ARCH and GARCH models using the "R" software

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Abstract. *In recent years more and more complex software packages and more specialized are used to model and to explain economic process. In this paper we present a study on Romanian's capital market volatility in ARCH and GARCH models using programming environment "R" as new statistical software. We consider the BET and BETC indexes as representative elements of capital market developments. With this study we want to highlight the advantages of using the package "rugarch" that can implement a set of GARCH models and allows the inclusion of external regressors in the variance equation.*

Keywords: R packages; programming language; capital market; data analysis; regression models.

JEL Classification: C63, G17, O16.
REL Classification: 11B.

1. Introduction

To innovate means to make a change, to bring something new for a field or a system, but also to introduce, to adopt or to spread an innovation. During the industrial cycle the innovation process can be found in three forms (Horner, 2012):

- empowering innovations – that provides products and services to a new class of beneficiaries;
- sustaining innovations – a process that improves the value of existing products and services;
- efficiency innovations – this process reduces costs of production and distribution of products and services.

In this paper we present rugarch functions package of R software environment for statistical analysis, one of the most popular data analysis tools developed by statisticians and now developed by a large community of specialists.

This statistical application development environment merges all three forms of innovation, even if initially it belongs, as intrinsic value, of innovation itself by introducing a new concept analysis tools market data. Empowering of innovation is achieved by enabling the possibility that scientific community has to create and introduce scientific software packages, which summarize a number of functions in a particular area of research. The second form of innovation is achieved because of the potential of the scientific community to contribute to improve the existing packages by changing these functions or by adding new functions within the legal framework of open source licensing. The third form of innovation is supported by the programming environment simply because scientists can find procedures or functions within already functional packages, considerably reducing the number of hours spent developing and testing their own functions. In addition, non-commercial license type makes information dissemination to have the fastest possible speed by removing financial barriers that can create a gap between those who can afford new innovations and those who expect lower prices, while the information may be lack of scientific importance of novelty.

2. Literature review

The analysis of the performance of stock market indices, in general, and of the price of a single company, in particular, was carried out by using the ARCH(1) and GARCH(2) models (Engle, 1982). These models were initially designed by Engle, and subsequently further developed by Bollerslev (1986) and Nelson (1991).

Compared to other data series, financial data is characterised by several specific aspects, such as “fat tails” and volatility clustering, which can be illustrated by

using GARCH-type models. In addition, ARCH-type models highlight the conditioned dispersion of returns (σ_t) through the method of maximum likelihood, which is preferred to using the sample standard deviation. The first test carried out in this study is ARCH(q), where q has values between 1 and 5, and σ_t is determined according to the past square values of q. In the GARCH(p,q) model, additional dependencies are permitted for p lags of past values of σ_t. For testing the data series we will use the GARCH(1,1) model, considered to be the most suitable in the case of financial time series (Bollerslev, 1986, Taylor, 1987).

Negative dispersion can be avoided by applying the EGARCH (Exponential GARCH) model, which uses logarithmical conditioned dispersion, thus eliminating the need to impose constraints on the estimates (Nelson, 1991).

Charles Cao (1992) and Ruey Tsay (1987) preferred the EGARCH model for determining the volatility of the stock market indices and of the exchange rate. After the appearance of the GJR-GARCH model, which was created by Glosten et al. (1993) and further developed by Brailsford and Faff (1996), GJR-GARCH has proven to be more accurate than GARCH in explaining stock indices.

3. The use of the "R" software for statistical computing

The "R" software has quickly become one of the most popular instruments used in data analysis in the field of statistics and econometrics, being continuously developed by the international scientific community. Since it is open source, *R* can be installed on any computer without requiring a trade licence.

The *R* package has the advantages specific to any open source system: reduced costs (the costs involved are related to training the staff who use it); easy customization and use of the package; technical support due to the existence of a large community of users and of specific blogs; constant upgrade (Caragea et al., 2012, pp. 450-456).

The *R* package has been increasingly used in the last few years, and the trend is expected to continue, so that in approximately three years the software is estimated to have more users than SAS and SPSS. Regarding the number of users of statistical computing, data mining and large data bases applications, R held the first position during May 2010-May 2012, being used by over 30% of the respondents (Muenchen, 2012).

The rugarch software package provides a comprehensive set of methods for modelling univariate GARCH processes, including fitting, filtering, forecasting, simulation, as well as diagnostic tools, including graphic representations and various tests.

The rugarch package also makes it possible for users to check the uncertainty of models (through various significance tests), respectively their stability in time (through rolling estimates), as well as to make bootstrap forecasts.

4. The models

4.1. ARCH model

Robert Engle proposed the ARCH model (AutoRegressive Conditional Heteroskedasticity) for modeling the serial correlation of squared residuals, or heteroskedasticity (Engle, 1982). The model has the form:

$$y_t = E_{t-1}[y_t] + \varepsilon_t, \quad (1)$$

$$\varepsilon_t = z_t \sigma_t, \quad (2)$$

$$\sigma_t^2 = a_0 + a_1 \varepsilon_{t-1}^2 + ... + a_p \varepsilon_{t-p}^2, \quad (3)$$

where $E_{t-1}[y_t]$ is the conditional expected value on information available at the time t-1, and z_t, is a sequence of independent and identically distributed random variables (iid) with mean zero and unit variance (Tudor, 2008).

Restrictions $a_0 > 0$ şi $a_i > 0$ (i = 1,...,p) are necessary for the dispersion is positive ($\sigma_t^2 > 0$).

Dispersion equation in (3) can be rewritten as a process AR (p) series residual values ε as follows:

$$\varepsilon_t^2 = a_0 + a_1 \varepsilon_{t-1}^2 + ... + a_p \varepsilon_{t-p}^2 + u_t \quad (4)$$

where $u_t = \varepsilon_t^2 - \sigma_t^2$ is a sequence of martingale differences (MDS[3]), seeing that $E_{t-1}[y_t] = 0$ and it is assumed that $E(\varepsilon_i^2) < \infty$.

If $a_1 + ... + a_p < 1$, then ε is stationary generating process.

Stationarity of ε^2_t şi σ^2_t is measured by the amount $a_1 + ... + a_p$, and variance of ε_t is calculated as:

$$\overline{\sigma}^2 = \text{var}(\varepsilon_t) = E(\varepsilon_t^2) = \frac{a_0}{(1 - a_1 - ... - a_p)} \quad (5)$$

4.2. Univariate ARFIMAX model

The univariate GARCH specification allows to define dynamics for the conditional mean from the general ARFIMAX model with the addition of ARCH-in-mean effects introduced by Engle et al. (1987). The ARFIMAX-ARCH-in-mean specification may be formally defined as:

$$\Phi(L)(1-L)^{d}(y_t-\mu_t)=\theta(L)\varepsilon_t, \quad (6)$$

with the left hand side denoting the Fractional AR specification on the demeaned data and the right hand side the MA specification on the residuals. (L) is the lag operator, $(1\text{-}L)^d$ the long memory fractional process with $0 < d < 1$, and equivalent to the Hurst Exponent H - 0,5, and μ_t, defined as:

$$\mu_t=\mu+\sum_{i=1}^{m-n}\delta_i x_{i,t}+\sum_{i=m-n+1}^{m}\delta_i x_{i,t}\sigma_t+\xi\sigma_t^{k} \quad (7)$$

where we allow for m external regressors x of which n (last n of m) may optionally be multiplied by the conditional standard deviation σ_t, and ARCH-in-mean on either the conditional standard deviation, k = 1 or conditional variance k = 2. These options cal all be passed via the arguments in the mean.model list in the ugarchspec function,

Since the specification allows for both fixed and starting parameters to be passed, it is useful to provide the naming convention for these here,

- AR parameters are ‘ar1’, ‘ar2’, ...;
- MA parameters are ‘ma1’, ‘ma2’, ...;
- mean parameter is ‘mu’;
- archm parameter is ‘archm’;
- the arfima parameter is ‘arfima’;
- the external regressor parameters are ‘mxreg1’, ‘mxreg2’, ...

Note that estimation of the mean and variance equations in the maximization of the likelihood is carried out jointly in a single step. While it is perfectly possible and consistent to perform a 2-step estimation, the one step approach results in greater efficiency, particularly for smaller datasets.

4.3. Univariate GARCH model

In GARCH models, the density function is usually written in terms of the location and scale parameters, normalized to give zero mean and unit variance,

$$\alpha_t=(\mu_t,\sigma_t,\omega) \quad (8)$$

where the conditional mean is given by:

$$\mu_t = \mu(\theta, x_t) = E(y_t \mid x_t) \tag{9}$$

and the conditional variance is

$$\sigma_t^2 = \sigma^2(\theta, x_t) = E\left((y_t - \mu_t)^2 \mid x_t\right) \tag{10}$$

with $\omega = \omega(\theta, x_t)$ denoting the remaining parameters of the distribution, perhaps a shape and skew parameter. The conditional mean and variance are used to scale the innovations,

$$z_t(\theta) = \frac{y_t - \mu(\theta, x_t)}{\sigma(\theta, x_t)} \tag{11}$$

having conditional density which may be written as

$$g(z \mid \omega) = \frac{d}{dz} P(z_t < z \mid \omega) \tag{12}$$

and related to $f(Y \mid \alpha)$ by

$$f(y_t \mid \mu_t, \sigma_t^2, \omega) = \frac{1}{\sigma_t} g(z_t \mid \omega). \tag{13}$$

The rugarch package implements a rich set of univariate GARCH models and allows for the inclusion of external regressors in the variance equation as well as the possibility of using variance targeting as Engle and Mezrich (1995). These options can all be passed via the arguments in the variance.model list in the ugarchspec function.

4.4. The standard GARCH model ('sGARSCH')

The standard GARCH model (Bollerslev, 1986) may be written as

$$\sigma_t^2 = \left(\omega + \sum_{i=1}^{m} \zeta_j v_{jt}\right) + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-j}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \tag{14}$$

with σ_t^2 denoting the conditional variance, ω the intercept and ε_t^2 the residuals from the mean filtration process44 discussed previously. The GARCH order is defined (q,p) (ARCH, GARCH), with possibly m external regressors v_j which are passed pre-lagged. If variance targeting is used, the ω is replaced by

$$\bar{\sigma}^2\left(1 - \hat{P}\right) - \sum_{j=1}^{m} \zeta_j \bar{v}_j \tag{15}$$

where $\overline{\sigma}^2$ is the unconditional variance of ε^2, which is consistently estimated by its sample counterpart at every iteration of the solver following the mean equation filtration, and $\overline{v}_j$ represents the sample mean of the j^{th} external regressors in the variance equation (assuming stationarity) and $\hat{P}$ is the persistence and defined below. One of the key features of the observed behavior of financial data which GARCH models capture is volatility clustering which may be quantified in the persistence parameter $\hat{P}$. For the 'sGARCH' model this may be calculated as

$$\hat{P} = \sum_{j=1}^{q} \alpha_j + \sum_{j=1}^{p} \beta_j \tag{16}$$

Related to this measure is the "half-life" (call it *h2l*) defined as the number of days it takes for half of the expected reversion back towards $E(\sigma^2)$ to occur.

$$h2l = \frac{-\log_e 2}{\log_e \hat{P}} \tag{17}$$

Finally, the unconditional variance of the model $\hat{\sigma}^2$, as related to its persistence, is

$$\hat{\sigma}^2 = \frac{\hat{\omega}}{1-\hat{P}} \tag{18}$$

where $\hat{\omega}$ is the estimated value of the intercept from the GARCH model. The naming conventions for passing fixed or starting parameters for this model are:

- ARCH(q) parameters are 'alpha1', 'alpha2', ...,
- GARCH(p) parameters are 'beta1', 'beta2', ...,
- variance intercept parameter is 'omega'
- the external regressor parameters are 'vxreg1', 'vxreg2', ...,

5. Preliminary considerations

The functions available in the *rugarch* package were applied to the official indices of the Bucharest Stock Exchange (BVB – Bursa de Valori București): BET[(4)], BETC[(5)] and BETFI[(6)].

BET is a free float weighted capitalization index of the most liquid 10 companies listed on the BVB regulated market.

BET-C is the composite index of the BVB market which reflects the price movement of all the companies listed on the BVB regulated market, 1st and 2nd category, with the exception of the investment funds (SIFs). BET-C is a market capitalization weighted index.

BET-FI is the first sectorial index of the BVB and it reflects the overall price movement of the investment funds traded on the BVB regulated market. BET-FI is a free float weighted capitalization index.

6. The diagnosis and estimation of the models

The data series for the daily closing values of the three stock market indices were the following:

- BET: 3,800 observations during the period: 19.09.1997 - 31.10.2012;
- BETC: 3,662 observations during the period: 16.04.1998 - 31.10.2012;
- BETFI: 3,009 observations during the period: 31.10.2000 - 31.10.2012.

As shown in the presentation of the models, we will use the logarithmic form of daily returns, both for avoiding negative dispersion and for reducing values too high/low compared to the mean.

The main statistical values of the three series, expressed in nominal values, are the following:

	BET	BETC	BETFI
Observations	3800.0000	3662.0000	3009.0000
NAs	0.0000	0.0000	0.0000
Minimum	281.2000	422.0000	944.7000
Quartile 1	759.0250	623.6000	7484.2000
Median	3298.6000	2388.7500	21229.6000
Arithmetic Mean	3656.4911	2429.2428	25070.4700
Geometric Mean	2359.3671	1754.9763	15824.2700
Quartile 3	5535.6500	3393.5750	32593.7000
Maximum	10813.6000	7432.6000	95197.9000
SE Mean	45.3958	28.9128	383.8227
LCL Mean (0.95)	3567.4886	2372.5559	24317.8900
UCL Mean (0.95)	3745.4937	2485.9296	25823.0500
Variance	7830973.1953	3061253.5276	443285400.0000
Stdev	2798.3876	1749.6438	21054.3400
Skewness	0.4642	0.6834	1.1350
Kurtosis	-0.8930	-0.3405	0.6360

The evolution of the value of the three indices is according to expectations, as the highest variation was recorded by the index for investment funds (BETFI) due to the strong pro-cyclical characteristic of these shares. During periods of economic growth these shares are overvalued, while during recessions or financial crises there is a tendency to undervalue them.

A moderate variation is registered by the BET index, which refers only to the 10 most liquid companies listed to the Bucharest Stock Exchange, but which represents more than 60% of the volume of transactions. The lowest variation is registered by te BETC index, due to the fact that since this index incorporates all the listed companies, this leads to reduced volatility of some companies as a result of the stability provided by other companies, which are not included in the BET index.

The statistical values of logarithmic returns specific to the three data series are the following:

	BET	BETC	BETFI
Observations	3800.0000	3662.0000	3009.0000
NAs	0.0000	0.0000	0.0000
Minimum	-0.1312	-0.1212	-0.1864
Quartile 1	-0.0078	-0.0065	-0.0112
Median	0.0004	0.0006	0.0002
Arithmetic Mean	0.0004	0.0003	0.0011
Geometric Mean	0.0003	0.0001	0.0007
Quartile3	0.0089	0.0079	0.0129
Maximum	0.1056	0.1089	0.2593
SE Mean	0.0003	0.0003	0.0005
LCL Mean (0.95)	-0.0002	-0.0002	0.0001
UCL Mean (0.95)	0.0010	0.0008	0.0020
Variance	0.0003	0.0003	0.0007
Stdev	0.0184	0.0159	0.0266
Skewness	-0.3307	-0.6392	0.1742
Kurtosis	6.0982	7.5997	8.5304

Testing ARCH(1) and ARCH(5) was initially unsuccessful due to convergence issues, so we eliminated extreme values from the data series. After this procedure was carried out both models provided relevant information. ARCH(3) and ARCH(4) models were applied successfully directly to the data series without requiring the elimination of extreme values. The ARCH(2) model did not provide any data even after the elimination of extreme values, while the GARCH(1,1) model was estimated successfully.

Briefly, the data resulted after applying the six models to the BET data series are the following:

	arch1	arch2	arch3	arch4	arch5	garch11
Akaike	-0.066070	NA	-5.4597	-5.4651	-5.5239	-5.5250
Bayes	-0.061142	NA	-5.4515	-5.4553	-5.5124	-5.5168
Shibata	-0.066072	NA	-5.4597	-5.4651	-5.5239	-5.5250
Hannan-Quinn	-0.064319	NA	-5.4568	-5.4616	-5.5198	-5.5221

Thus, the most appropriate model for the BET index is GARCH(1,1) since the latter registered the lowest values for Akaike, Bayes, Shibata and Hannan-Quinn.

The coefficients of the dispersion equation have the notations mu – the mean, omega – the intercept, ARCH(1) (alpha1 – the ARCH term represented by lags from the equation of the mean) and GARCH(1) (beta1 – the lag of conditioned dispersion).

Optimal Parameters

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.001009	0.000211	4.7829	2e-06
omega	0.000012	0.000002	6.2996	0e+00
alpha1	0.224545	0.018667	12.0289	0e+00
beta1	0.761419	0.017670	43.0909	0e+00

Robust Standard Errors:

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.001009	0.000239	4.2149	0.000025
omega	0.000012	0.000004	2.8422	0.004481
alpha1	0.224545	0.038154	5.8853	0.000000
beta1	0.761419	0.042020	18.1205	0.000000

The sum of the coefficients is subunitary – alpha1 + beta1 = 0.985964 – which is a necessary condition for the process to be mean reverting. If the sum of the ARCH and GARCH coefficients is higher than 1, then the series cannot be modelled by using GARCH. The value extremely close to 1 shows that the processes which generate these series revert to the mean very slowly.

The coefficients estimated from the equation of dispersion are statistically significant at very low values for p-value.

The LM (Lagrange multiplier) test, which can help to prove the existence of these ARCH effects in the residual values, verifies the null hypothesis for lags 2, 5 and 10.

ARCH LM Tests

	Statistic	DoF	P-Value
ARCH Lag[2]	13.74	2	0.0010378
ARCH Lag[5]	22.76	5	0.0003745
ARCH Lag[10]	29.96	10	0.0008687

The Q-statistics test corresponding to the null hypothesis shows that there is no autocorrelation between residual values for lags 10, 15 and 20.

Q-Statistics on Standardized Residuals

	statistic	p-value
Lag10	128.1	0
Lag15	137.6	0
Lag20	145.7	0

Q-Statistics on Standardized Squared Residuals

	statistic	p-value
Lag10	31.37	0.0005093
Lag15	36.04	0.0017424
Lag20	38.03	0.0087709

H0 : No serial correlation

7. Conclusions

The GARCH(1,1) model is suitable for the BET index data series.

The availability through open source-type licence, the processing power and the option to work easily with data series of any size by using the *R* software and its specific programs have led to a worldwide revolution in the practice of statistical analysis. *R* is being increasingly used in official statistical institutes, being the main instrument of statistical analysis in many companies, among which we can mention: Pfizer, Shell, Facebook, Google, Mozilla, Times, The New York Times, The Economist, NewScientist, Lloyd's, Bing, Johnson&Johnson(7).

As further acknowledgement, *R* is described by Norman Nie, cofounder of SPSS at the end of the 60s, in the following way: "*R* is the most powerful and flexible statistical programming language in the world". Currently, Nie is the CEO(8) and president of Revolution Analytics, a company which provides commercial versions of the *R* programs(9).

Notes

(1) ARCH = Autoregressive Conditional Heteroskedasticity.
(2) GARCH = Generalized Autoregressive Conditional Heteroskedasticity.
(3) MDS = Martingale Difference Sequence.
(4) BET = Bucharest Exchange Trading® Index.
(5) BETC = Bucharest Exchange Trading Composite® Index.
(6) BETFI = Bucharest Exchange Trading Investment Funds® Index.
(7) http://www.revolutionanalytics.com/what-is-open-source-r/companies-using-r.php.
(8) CEO = Chief Executive Officer.
(9) Smith D., *R is Hot*. (2010) from www.revolutionanalytics.com/R-is-Hot/.

References

Becker, R.A., Chambers, J.M., Wilks, A.R. (1988). *The New S Language: A Programming Environment for Data Analysis and Graphics*, Pacific Grove, CA: Wadsworth and Brooks Cole

Bollerslev, T. (1986). „Generalized autoregressive conditional heteroskedasticity", *Journal of Econometrics*, 31, pp. 307-327

Caragea, N., Alexandru, A.C., Dobre, A.M. (2012). „Bringing New Opportunities to Develop Statistical Software and Data Analysis Tools in Romania", *The Proceedings of the VIth International Conference on Globalization and Higher Education in Economics and Business Administration*, ISBN: 978-973-703-766-4, pp. 450-456

Caragea, N. (2010). *Statistică economică*, Mustang Publisher, ISBN 978-606-8058-37-5, Bucureşti

Chambers, J.M, Hastie, T.J. (1992). *Statistical Models in S*, Pacific Grove, CA: Wadsworth and Brooks Cole

Engle, R.F. (1982). "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of the United Kingdom Inflation", *Econometrica* 50(4), pp. 987-1008

Engle, R.F., Lilien, D.M., Robins, R.P. (1987). "Estimating time varying risk premia in the term structure: The arch-m model", *Econometrica: Journal of the Econometric Society*, 55(2), pp. 391-407

Engle, R.F. Mezrich, J. (1995). „Grappling with garch", *Risk*, 8(9), pp. 112-117

Ghalanos, A. (2012). "Rugarch: Univariate GARCH models", R package version 1.0-12

Hodgess, E. (2004). "A Computer Evolution in Teaching Undergraduate Time Series", *Journal of Statistics Education*, Volume 12, Number 3 (2004). www.amstat.org/publications/jse/v12n3/hodgess.html

Horner, J. (2012). "Innovation in Statistical Computing", http://jeffreyhorner.tumblr.com/post/35782252672/innovation-in-statistical-computing

Ihaka, R., Gentleman, R. (1996). "R: A Language for Data Analysis and Graphics", *Journal of Computational and Graphical Statistics*, 5, pp. 299-314

Krause, A., Olson, M. (2000). *The Basics of S and S-Plus*, New York: Springer

Laird, N.M., Ware, J.H. (1982). "Random-Effects Models for Longitudinal Data", *Biometrics*, 38, pp. 963-974

Molnar, M., Hrehorciuc-Caragea, N. (2007). *Statistică*, Bren Publisher, ISBN 978-973-648-603-6, Bucuresti

Muenchen, R. (2012). "The Popularity of Data Analysis Software", http://r4stats.com/articles/popularity/

Nelson, D.B. (1991). "Conditional Heteroskedasticity in Asset Returns: a New Approach", *Econometrica*, 59(2)

Nelson, D.B., Cao, C.Q. (1992). "Inequality Constraints in the Univariate GARCH Model", *Journal of Business and Economic Statistics*, 10(2)

Pinheiro, J.C., and Bates, D.M. (2000). *Mixed-Effects Models in S and S-Plus*, New York: Springer

Spector, P.C. (1994). *An Introduction to S and S-Plus*, Belmont, CA: Duxbury

Tudor, C. (2008). „Modelarea volatilitatii seriilor de timp prin modele GARCH simetrice", *Romanian Economic Journal*, Department of International Business and Economics from the Academy of Economic Studies Bucharest, Vol. 11(30), pp. 183-208

Taylor, S.J. (1987). "Forecasting the volatility of currency exchange rates", *Journal of International Forecasting*

Tsay, S.T. (1987). "Conditional heteroskedastic time series models", *Journal of the American Statistical Association*, 82

Tsay, S.T. (2001). *Analysis of Financial Time Series*, John Wiley & Sons, New York

Venables, W.N., Ripley, B.D. (2000). *S Programming*, New York: Springer

Venables, W.N., Ripley, B.D. (2002). *Modern Applied Statistics with S-Plus* (4th ed.), New York: Springer

Venables, W.N., Smith, D.M. and the R Development Core Team (2003). *An Introduction to R*, London: Network Theory Limited

Zivot, E., Wang, J. (2002). *Modeling Financial Time Series With S-Plus*, New York: Springer-Verlag

* * *, 2000-2010, Romanian Statistical Yearbook, Bucharest

* * *, 2001-2011, BNR annual and monthly reports, Bucharest

* * *, Bucharest Stock Exchange, www.bvb.ro

Annex I
Estimation of ARCH(1) model

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* GARCH Model Fit *

Conditional Variance Dynamics

GARCH Model : sGARCH(1,0)
Mean Model : ARFIMA(0,0,0)
Distribution : norm

Optimal Parameters

	Estimate	Std. Error	t value	Pr(>|t|)
mu	-0.047117	0.000021	-2203.013	0
omega	0.000001	0.000000	279.505	0
alpha1	0.998686	0.010624	94.007	0

Robust Standard Errors:

	Estimate	Std. Error	t value	Pr(>|t|)
mu	-0.047117	0.000263	-179.274	0
omega	0.000001	0.000000	28.964	0
alpha1	0.998686	0.079029	12.637	0

LogLikelihood : 128.5337
Information Criteria

Akaike	-0.066070
Bayes	-0.061142
Shibata	-0.066072
Hannan-Quinn	-0.064319

Q-Statistics on Standardized Residuals
----

	statistic	p-value
Lag10	172.7	0
Lag15	174.4	0
Lag20	179.4	0

H0 : No serial correlation

Q-Statistics on Standardized Squared Residuals
----

	statistic	p-value
Lag10	261.9	0
Lag15	262.0	0
Lag20	262.2	0

ARCH LM Tests

	Statistic	DoF	P-Value
ARCH Lag[2]	0.192	2	0.9085
ARCH Lag[5]	2.868	5	0.7204
ARCH Lag[10]	259.524	10	0.0000

Nyblom stability test

Joint Statistic: 8.5174
Individual Statistics:
mu 0.2024
omega 2.9667
alpha1 8.0596

Asymptotic Critical Values (10% 5% 1%)
Joint Statistic: 0.846 1.01 1.35
Individual Statistic: 0.35 0.47 0.75

Sign Bias Test
---

	t-value	prob sig
Sign Bias	17.993	1.583e-69 ***
Negative Sign Bias	16.414	1.522e-58 ***
Positive Sign Bias	6.838	9.294e-12 ***
Joint Effect	427.626	2.294e-92 ***

Adjusted Pearson Goodness-of-Fit Test:
---

	group	statistic	p-value(g-1)
1	20	8766	0
2	30	8950	0
3	40	9050	0
4	50	9135	0

Estimation of ARCH(2) model

----
* GARCH Model Fit *

Conditional Variance Dynamics

GARCH Model : sGARCH(2,0)
Mean Model : ARFIMA(0,0,0)
Distribution : norm

Convergence Problem:
Solver Message:

Estimation of GARCH(1,1) model

----
* GARCH Model Fit *

Conditional Variance Dynamics

GARCH Model : sGARCH(1,1)
Mean Model : ARFIMA(0,0,0)
Distribution : norm

Optimal Parameters

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.001009	0.000211	4.7829	2e-06
omega	0.000012	0.000002	6.2996	0e+00
alpha1	0.224545	0.018667	12.0289	0e+00
beta1	0.761419	0.017670	43.0909	0e+00

Robust Standard Errors:

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.001009	0.000239	4.2149	0.000025
omega	0.000012	0.000004	2.8422	0.004481
alpha1	0.224545	0.038154	5.8853	0.000000
beta1	0.761419	0.042020	18.1205	0.000000

LogLikelihood : 10462.36

Information Criteria

Akaike	-5.5044
Bayes	-5.4978
Shibata	-5.5044
Hannan-Quinn	-5.5021

Q-Statistics on Standardized Residuals
----

	statistic	p-value
Lag10	128.1	0
Lag15	137.6	0
Lag20	145.7	0

H0 : No serial correlation

Q-Statistics on Standardized Squared Residuals

	statistic	p-value
Lag10	31.37	0.0005093
Lag15	36.04	0.0017424
Lag20	38.03	0.0087709

ARCH LM Tests

	Statistic	DoF	P-Value
ARCH Lag[2]	13.74	2	0.0010378
ARCH Lag[5]	22.76	5	0.0003745
ARCH Lag[10]	29.96	10	0.0008687

Nyblom stability test

Joint Statistic: 10.1903

Individual Statistics:

mu	0.3182
omega	5.8674
alpha1	0.1931
beta1	0.2464

Asymptotic Critical Values (10% 5% 1%)

Joint Statistic:	1.07 1.24 1.6
Individual Statistic:	0.35 0.47 0.75

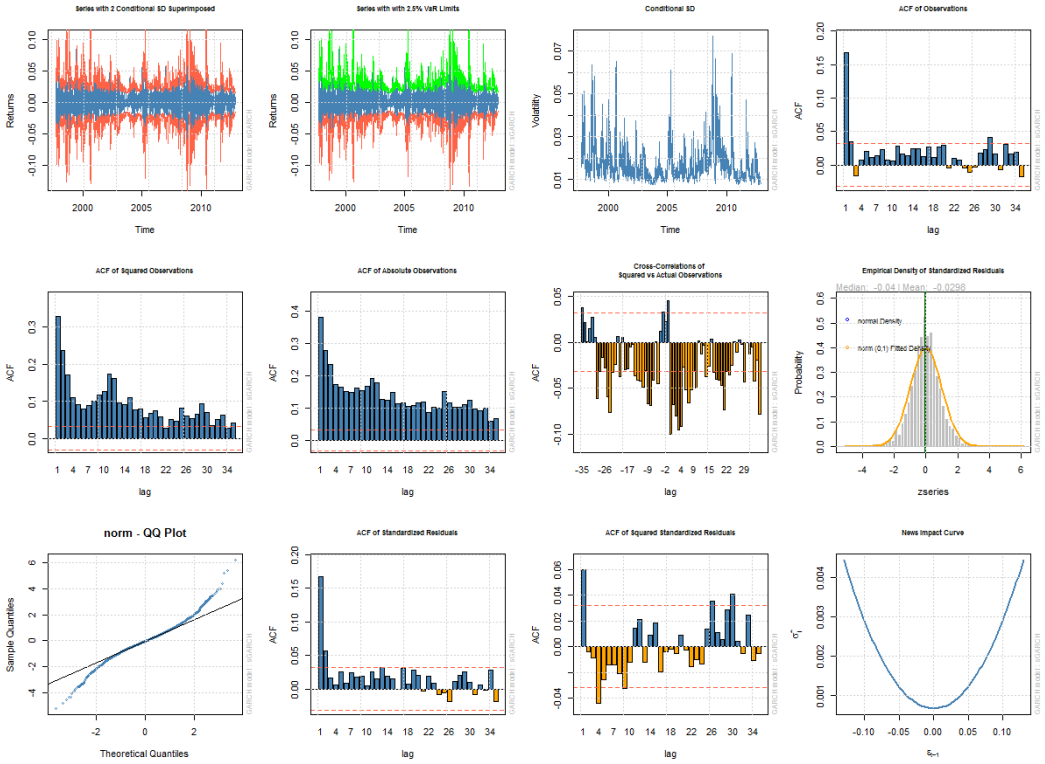
Sign Bias Test

	t-value	prob sig	
Sign Bias	0.6712	0.50211	
Negative Sign Bias	1.8305	0.06725	*
Positive Sign Bias	0.7770	0.43719	
Joint Effect	6.2044	0.10208	

Adjusted Pearson Goodness-of-Fit Test:

group	statistic	p-value(g-1)
1 20	135.6	1.279e-19
2 30	166.0	3.821e-21
3 40	168.3	5.391e-18
4 50	186.9	5.599e-18

Annex II
Plots of GARCH for BET



Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 101-116

Anomalies on the capital markets from the former communist European countries

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Abstract. *The anomalies on the capital markets represent patterns in financial asset returns that are not predicted by a central theory or paradigm. This study made an inventory of the most important anomalies initially identified for the US capital market, in the context of the capital markets from the former communist European countries. Further, this study emphasizes the implications of the presence of these anomalies on the asset pricing models for the analyzed capital markets. Also, this paper presents some methodological issues concerning the identification of capital market anomalies.*

Keywords: anomaly; CAPM; capital markets from the former communist European countries.

JEL Classification: G12, G14.
REL Classification: 11B.

1. Introduction

The anomalies on the capital markets represent patterns in financial asset returns that are not predicted by a central theory or paradigm. Although these anomalies were initially discovered on the US capital market, their presence was confirmed also on other capital markets. The central theory to which the anomalies are related is the Capital Asset Pricing Model (CAPM), developed for the first time by Sharpe (1964). Other contribution in the CAPM development can be attributed to Lintner (1965), Mossin (1966) and Black (1972), but the list can be completed with other papers which led to the development of the CAPM.

Initially, the identification of some capital market anomalies was interpreted as evidence of market inefficiency, but the persistence of some anomalies led to a second interpretation. As such, the presence of anomalies on the capital market could indicate some shortcomings of CAPM. According to CAPM, the financial asset returns are influenced by a single factor, the return of market portfolio. Also, CAPM predicts that the expected return of a financial asset is higher compared to the expected return of another financial asset if its risk is greater. Under these conditions, the measure of risk from CAPM fully explains the differences between the expected returns of financial assets.

Nevertheless, empirical tests of the CAPM led to the identification of some anomalies that are not in accordance with the philosophy of the model. The most important anomalies discovered on the US capital market are the value effect, size effect and momentum effect. According to the value effect, the stocks of companies with high ratio between some accounting measures (earnings per stock, book value of equity per stock, cash flow per stock etc.) and the market price of stock earn higher return than those predicted by CAPM. Furthermore, the stocks of companies with high ratio earn higher return than those with low ratios although their risk is similar according to the measure of risk from CAPM. Also, the size effect represents evidence against the philosophy of CAPM. The stocks of companies with small market capitalization earn higher return than those predicted by CAPM. Moreover, the stocks of companies with small market capitalization earn higher return than those of companies with big capitalization although their risk is similar according to the measure of risk from CAPM. Further, the momentum effect reveals the relation between the past and future return of stocks. According to the momentum effect, the financial assets with prices on an upward trajectory, over a prior period of three to 12 months, have a higher probability of continuing on that upward trajectory over the subsequent three to 12 months. In the same time, the financial assets with prices on a downward trajectory over prior months have a higher probability of continuing on that downward trajectory over the subsequent months. In other words, the future

returns of financial assets with an upward trend of prices are higher than those of financial assets with a downward trend. Further, the stocks with an upward trajectory of prices appear to be less risky than those with a downward trend according to the measure of risk from CAPM.

Based on these anomalies, some studies have proposed the development of multifactor asset pricing models. These multifactor models are extensions of the CAPM, built to eliminate anomalies that are not consistent with the philosophy of CAPM. The most popular multifactor models are the three factor model developed by Fama and French (1993) and the four factor model proposed by Carhart (1997).

The aim of this article is to inventory the results of the paper that examined the presence of the most important anomalies initially identified for the US capital market, in the context of the capital markets from the former communist European countries. Based on this inventory, a comparison between the capital market from US and the capital markets from the former communist European countries can be made. This is very important because the presence of the size effect, the value effect or the momentum effect may suggest the applicability of multifactor asset pricing models for the less developed capital markets such as those in the former communist European countries. If the size effect, the value effect and the momentum effect are identified on the capital markets from the former communist European countries, then the CAPM seems to be an incomplete model which omitted to include some important factors with a systematic impact on the return of financial assets. Also, the presence of anomalies make the CAPM an inappropriate model used to estimate the cost of equity or to assess the performance of a portfolio manager that operates in the capital markets from the former communist European countries.

Compared with the results on the capital market from US, the size effect is present in some capital markets from the former communist European countries, absent or reverse for others. The value effect is perhaps the most important anomaly identified in the capital markets from the former communist European countries. However, for some markets the value effect is identified and for others the value effect was absent or it is reverse. The momentum effect was discovered for all analyzed capital markets from the former communist European countries. These results highlight the specificity of capital markets from the former communist European countries, the anomalies were found in some markets, absent or reverse in others.

The paper is structured as follows. Section 2 presents some theoretical aspects of the CAPM, some methodological aspects regarding the empirical tests of the model and some results of empirical tests. Section 3 presents the main anomalies

identified for US capital market and summarizes the literature that examined the anomalies in the context of capital markets from the former communist European countries. Section 4 compares the results of studies that examine the anomalies in the context of capital markets from the former communist European countries with the results for the US capital market. Section 5 concludes.

2. Theoretical aspects and the empirical examination of the CAPM

2.1. Theoretical aspects

CAPM evaluates the return of a financial asset in relation to risk. CAPM predicts that the expected return of a financial asset is higher compared to the expected return of another financial asset if its risk is greater. In other words, an investor will expect to obtain higher returns if the risk is greater. According to CAPM, the financial asset returns are influenced by a single factor, the return of market portfolio. Since the market portfolio is unobservable, being more a theoretical concept, it is usually approximated by a comprehensive capital market index. The relationship between return and risk is evidenced by the CAPM as follows:

$$E(R_i) = R_f + \beta_i \times [E(R_M) - R_f]$$

where: $E(R_i)$ is the expected return of financial asset *i*, R_f is the risk free rate or the expected return of a portfolio with a volatility/beta coefficient equal to 0, β_i is the volatility/beta coefficient of financial asset *i* computed as the covariance of its return with the market portfolio return divided by the variance of the market portfolio return, $E(R_M)$ is the expected return of market portfolio *M* and $[E(R_M) - R_f]$ represents the market risk premium.

Regarding the volatility coefficient, it measures the sensitivity of the financial asset return to variation in the market portfolio return. In other words, the variation of the financial asset return due to the variation of market portfolio return is more significant for assets with big beta coefficients.

2.2. Empirical examination of the CAPM

Tests of the CAPM are based on three implication of the relation between expected return and risk measured by the volatility coefficient implied in the model. First, expected return of all assets is linear related to their volatility coefficients and the differences in expected return across assets are completely explained by differences in beta coefficient and other variables should add nothing to the explanation of expected return. Second, the market risk premium is positive which means that the expected return of market portfolio is always higher than the return of a portfolio with a volatility/beta coefficient equal to 0. Finally,

given the various developments of the CAPM, in the original version of the model, the expected return of a portfolio with a beta coefficient equal to zero is assumed to be equal to the risk free rate, at which investors can borrow or lend without limitation. In this case, the market risk premium is the difference between the expected return of market portfolio and the risk free rate.

The most common methods to verify the implication of the risk-return relationship suggested by the CAPM are the cross-section regression and the time series regression. Next, these two methods will be described (for details and other extensions of the test methods, see, Goyal, 2012)

2.2.1. Test based on cross-section regression

The main goal of the CAPM is to explain the differences between the expected returns of financial assets. As such, the cross-section regression is an appropriate method to see if the implications of the risk-return relationship are respected. First of all, the expected return of a financial asset is approximated by the average return of financial asset. Since the volatility coefficient of a financial asset is unobservable, to implement the test methodology is necessary to estimate it. The volatility coefficient can be estimated as the ratio of the covariance between the asset return and market portfolio return and the variance of market portfolio return or by estimating a time series regression of the form:

$$R_{it} = \alpha_i + \beta_i \times R_{Mt} + \varepsilon_{it} \quad (1)$$

where: R_{it} is the realized return of financial asset *i* over the interval *t*, α_i is the intercept of financial asset *i*, β_i is the volatility/beta coefficient of financial asset *i*, R_{Mt} is the realized return of market portfolio *M* over the return interval *t*, ε_{it} is the residual term over the return interval *t*, *t* is the interval length for construction of financial asset and market portfolio return and *t*=1...T.

Building the series of expected returns and volatility coefficients, as mentioned above, in the next step, the implications of the risk-return relationship can be tested. The approach is to regress a cross-section of average asset returns on estimates of asset volatility coefficients as follow:

$$\overline{R_i} = \lambda_0 + \lambda_1 \times \hat{\beta}_i + u_i \quad (2)$$

where: $\overline{R_i}$ is the average return of financial asset *i*, λ_0 is the intercept of regression, λ_1 is the slope of regression, $\hat{\beta}_i$ is the beta estimate of financial asset *i* and u_i is a residual term.

According with the CAPM, the estimate of intercept from equation (2) must be equal to the risk free rate (approximated in general with the average return of a

risk free asset) and the estimate of λ_1 coefficient must be equal to the market risk premium (the market risk premium is computed as the difference between average return of market portfolio and average return of a risk free asset).

This method is based only on the financial asset listed on the capital market for the entire time period considered by a study. The new listed financial assets are not included in the analysis. Given this limitation, Fama and MacBeth (1973) proposed an extension of this methodology by estimating the equation (2) for each moment in the analyzed period, not only one time. In this case, the average of intercept's estimates from equation (2) is compared with the average return of a risk free asset and the average of slope's estimates from equation (2) is compared with the market risk premium.

2.2.2. Test based on time series regression

Jensen (1968) observed that the relationship between expected return and volatility coefficient can be tested using a time series regression. CAPM suggests that the expected excess return of a financial asset (the difference between expected return of a financial asset and the risk free rate) is completely explained by the expected excess return of market portfolio (the difference between expected return of market portfolio and risk free rate). In this case, the test regression has the following form:

$$R_{it} - R_{ft} = \alpha_i + \beta_i \times (R_{Mt} - R_{ft}) + v_{it} \quad (3)$$

where: R_{it} is the realized return of financial asset *i* over the interval *t*, α_i is the intercept of financial asset *i*, R_{ft} is the realized return of a risk free asset over the interval *t*, β_i is the volatility/beta coefficient of financial asset *i*, R_{Mt} is the realized return of market portfolio *M* over the return interval *t*, v_{it} is the residual term over the return interval *t*, *t* is the interval length for construction of financial asset and market portfolio return and t=1...T.

The CAPM, will be empirically validated if the estimate of intercept from equation (3) is zero for each financial asset.

2.2.3. CAPM test results

Starting with the first tests of CAPM for the capital market in the US, studies have partial validated the model. Fama and French (2004) review the literature that tested the CAPM for the US capital market and noted the empirical rejection of the model. The estimate of intercept from equation (2) is higher than the average return of a risk free asset and the estimate of slope from equation (2) is lower than the market risk premium. The studies that used the time series regression to test the CAPM reported that the estimate of intercept from equation (3) is significantly

different from zero. Furthermore, the estimate of intercept is positive for assets with low volatility coefficients and negative for assets with high volatility coefficients. In conclusion, the assets with low betas have actual returns that are higher that the returns predicted by CAPM and assets with high betas have actual returns lower than the returns predicted by CAPM.

For the European capital markets, one article that tested the implication of CAPM was conducted by Modigliani et al. (1972). The relationship between return and risk was positive in the case of France, UK and Italy. These results were similar with those obtained early on the US capital market. However, for the German capital market the relationship was negative. Bark (1991) using the methodology developed by Fama and MacBeth (1973) tested the applicability of CAPM for the capital market of South Korea. The relationship between return and risk was negative, which means that the CAPM is definitely rejected. Claessens et al. (1995) examined the relationship between return and risk for nineteen emerging capital markets: Brazil, Chile, Colombia, South Korea, Philippines, Greece, India, Indonesia, Jordan, Malaysia, Mexico, Nigeria, Pakistan, Portugal, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe. For only nine from the nineteen capital markets the estimate of slope from equation (2) was different from zero. On eight countries the estimates were positive (South Korea, Philippines, Greece, Malaysia, Mexico, Nigeria, Taiwan and Turkey) and in Pakistan the estimate is negative. Nevertheless, the empirical validation of the model for six of those eight capital markets is questioned because the estimate of intercept from equation (2) is different from the risk free rate (Philippines, Greece, Malaysia, Mexico, Nigeria, Pakistan and Taiwan). The results of Claessens et al. (1995) contradict the evidence obtained by Bark (1991) for the capital market in South Korea. However, it should be noted that the methodologies used to test the CAPM were different and this may lead to conflicting results. Novak and Petr (2010) examined the relationship between return and risk for the capital market in Sweden. The results showed no relationship between return and risk.

3. Anomalies on the capital markets

The main conclusion from the previous section is that the CAPM has some drawbacks. The estimate of intercept from equation (2) is higher than the average return of a risk free asset and the estimate of slope from equation (2) is lower than the market risk premium. However, according to the CAPM, the differences in expected return across assets are completely explained by differences in beta coefficient and other variables should add nothing to the explanation of expected return. In this regard, Fama and MacBeth (1973) obtained consistent results in accordance with the specification of CAPM. Fama and MacBeth (1973) added

other variables on the right side of equation (2) and observed that these variables do not contribute to the explanation of the differences in expected returns. The volatility coefficient is the only variable which explains the differences in expected returns.

However, the existence of beta as the only factor which explains the differences in expected returns of financial assets is questionable. For the US capital market, Basu (1977), Banz (1981) identified other sources with explanatory power. These sources are generally characteristics of companies listed on the stock market such as earnings-to-price-ratio, book-to-market ratio, market capitalization etc.

The discovery of these additional variables which explain the differences between the average return of stock represents anomalies that seem to be inconsistent with the philosophy of CAPM. In what follows, this section presents the main anomalies observed over time that led to the development of multifactor asset pricing models.

3.1. Evidence of the anomalies' presence on the international capital markets

The value effect. The value effect refers to the positive relationship between stock returns and the ratio between some accounting measures as earnings, cash flow and market price of stocks. Basu (1977) observed that the stocks of companies with high earnings-to-price ratios earn higher returns than those predicted by CAPM. Furthermore, the stocks of companies with high earnings-to-price ratios earn higher returns than those with low ratios in the case of US capital market. Ball (1978) confirmed the results obtained by Basu (1977) for the US capital market. Rosenberg et al. (1985) showed that the stocks of companies with high book-to-market ratios earn higher returns than those predicted by CAPM. Also, the stocks of companies with high book-to-market ratios earn higher returns than those with low ratios. The results of Rosenberg et al. (1985) are confirmed by Fama and French (1992) and Lakonishok et al. (1994) for the US capital market. Chan et al. (1991) observed a positive relationship between the average return of stocks and measures as earnings-to-price-ratio and book-to-market-ratio in the case of Japan. Moreover, Chan et al. (1991) found a positive relationship between return and the cash flow-to-price ratio. Capaul et al. (1993) observed a value effect in the case of four capital markets from Europe and for the Japanese capital market.

The size effect. The size effect refers to the negative relationship between returns of listed companies and their market capitalization. More specifically, Banz (1981) observed that the stocks of companies with small market capitalization earn higher returns than those predicted by CAPM on the US capital market. Moreover, Banz (1981) noted that the relationship between return and market capitalization is negative. In other words, the stocks of companies with small

market capitalization earn higher return than those of big market capitalization. Reinganum (1981), Fama and French (1992) confirmed the results of Banz (1981). Chan et al. (1991) found a negative relationship between stock returns and market capitalization for the Japanese market. Schwert (2003), reanalyzing the presence of size effect for the US capital market, concluded that this anomaly seems to disappear. The discovery of this anomaly on the US capital market was confirmed also for other capital markets all around the world (for more details, see, van Dijk, 2011).

The momentum effect. The momentum effect refers to the positive relationship between prior returns and future stock returns. According to the momentum effect, the stocks with prices on an upward trajectory over a prior period of three to 12 months have a higher probability of continuing on that upward trajectory over the subsequent three to12 months. In the same time, the stocks with prices on a downward trajectory over prior months have a higher probability of continuing on that downward trajectory over the subsequent months. This phenomenon was observed by Jegadeesh and Titman (1993) in the context of capital market from US. Jegadeesh and Titman (1993) showed that a strategy that buys past winners (stocks with prices on a upward trajectory) and sells past losers (stocks with prices on a downward trend) generates a significant abnormal return over a holding period of three to 12 months. Further, the stocks with an upward trajectory of prices appear to be less risky than those with a downward trend according to the measure of risk from CAPM. Rouwenhorst (1998) identified the momentum effect also in the case of some capital markets from Europe. Griffin et al. (2003), expanding the work of Rouwenhorst (1998), identified the momentum effect in forty capital markets. However, the momentum effect was weaker in the Asian capital markets compared with the momentum effect from other capital markets and especially with the effect from European capital markets. The results of Griffin et al. (2003) were confirmed by Chui et al. (2010), which observed the presence of momentum effect for forty one capital markets.

3.2. Evidence of the anomalies' presence on the capital markets from the former communist European countries

International evidence on the presence of anomalies in the capital markets have led over time to a new research direction in the case of capital markets from the former communist European countries. However, the results of investigations carried out to identify anomalies, such as those presented in the previous section, have been published in recent years, representing fresh evidence on the presence or absence of these anomalies in the capital markets, which have opened or reopened their doors after the removal of the communist regime that considered inappropriate the presence of capital market in the national financial system.

The value effect. Barry et al. (2002) examined the presence of some anomalies in the context of thirty five emerging capital markets which included four markets from the former communist European countries (Poland, Czech Republic, Slovakia, Hungary). Using a sample of 2,000 companies this study observed the presence of value effect. More specifically, the stocks of companies with high book-to-market ratios earn higher returns than those of companies with low book-to-market ratios. For Bulgaria, Matteev (2004) analyzed the presence of value effect for a sample of 160 stocks in the period 1998-2002. Contrary to the results for the US capital market and not only, Matteev (2004), using the methodology of Fama and MacBeth (1973), did not find a relationship between return and book-to-market-ratio. In the case of Bucharest Stock Exchange, Tudor (2009) performed a study for the period 2002-2008. The goal was to test the relationship between return and different variables as volatility coefficient, market capitalization, book-to-market ratio and earnings-to-price ratio. In accordance with the results obtained by Barry et al. (2002), the study concluded that the book-to-market ratio and earnings-to-price ratio are two important indicators which explain the differences in average stock returns. In a recent study, Borys and Zemčik (2011) examined the presence of value effect on the capital markets of Poland, Czech Republic, Slovakia and Hungary. The results confirm the presence of value effect for all four markets and the presence of a regional value effect. The results obtained by Borys and Zemčik (2011) are confirmed by Lischewski and Voronkova (2012) for the Polish capital market. The stocks of companies with high book-to-market ratios earn higher returns than those of companies with low book-to-market ratios. Lieksnis (2010), analyzing the presence of value effect on the capital markets situated in the Baltic countries (Estonia, Latvia and Lithuania), reached similar results to those of Barry et al. (2002). Stocks of companies with high book-to-market ratios prove more profitable than those of companies with low book-to-market ratios at a regional level. Minovici and Živković (2012) noted that stock of companies with high book-to-market ratios earn lower return than those of companies with low book-to-market ratios. This result is contrary to the evidence from developed capital markets and not only.

The size effect. Barry et al. (2002) although observed the value effect in the context of emerging capital markets, the size effect it was found not to be so robust as the value effect. The average return of companies with small market capitalization is greater than the average return of companies with big market capitalization, but removing the outliers from the time series of returns led to the disappearance of size effect while the value effect is still present. Matteev (2004), contrary to the results obtained for developed capital markets, did not identify any relationship between return and market capitalization. Tudor (2009) obtained results consistent with those of Matteev (2004), the size effect is not present on

the Romanian capital market. Borys and Zemčik (2011) examined the presence of size effect in the context of four capital markets from the former communist European countries (Poland, Czech Republic, Slovakia and Hungary) and confirmed the results obtained for the US capital market. The size effect is confirmed for each capital markets and in addition the size effect is present at a regional level. Lischewski and Voronkova (2012) confirmed the results obtained by Borys and Zemčik (2011) for the Polish capital market. The stocks of companies with small market capitalization earn higher returns than those with big market capitalization. In the context of capital markets situated on the Baltic countries (Estonia, Latvia and Lithuania), Lieksnis (2010) obtained similar results to those of Barry et al. (2002). The value effect is more robust than the size effect. However, the average returns of companies with small market capitalization exceeded the average returns of companies with big market capitalization on a regional level in the period 2002-2010. Contrary to the results for the US capital market, Minovici and Živković (2012) noted that the average return of companies with big market capitalization tends to be higher than the average return of small market capitalization companies in the case of Serbian capital market.

The momentum effect. Avižinis and Pajuste (2007) examined the presence of momentum effect for seven capital markets from the former communist European countries (Croatia, Estonia, Latvia, Lithuania, Poland, Slovenia and Hungary) in the period 2002-2006. For each market, the stocks that registered an upward trend of prices in the prior three to12 months tend to continue this upward trend and the stocks with a downward trajectory of prices tend to follow this trend in the coming months. Chui et al. (2010) examined the momentum effect for forty one capital markets. The Polish capital market was the only market from the former communist European countries. The results confirmed the presence of momentum effect on these markets. Moreover, a strategy that buys past winners (stock with prices in an upward trajectory) and sells past losers (stocks with prices in a downward trend) generates the higher abnormal return in the Polish capital market. Lieksnis (2010) performed a study to identify the momentum effect for a sample of companies from the three Baltic States: Estonia, Latvia and Lithuania. For the period 2002-2010, at the regional level, the presence of momentum effect is confirmed.

4. International anomalies versus anomalies on the capital markets from the former communist European countries

The identification of some anomalies like value effect, size effect and momentum effect represents important evidence against the validity of the CAPM. The value effect, the size effect and the momentum effect were discovered at the beginning in the case of US capital market. Further, the presence of these anomalies was confirmed for other capital markets from all around the world. The discovery of anomalies on the US capital market led to the development of the most important competitor of the CAPM, the three factor model of Fama and French (1993) which eliminate the anomalies caused by market capitalization and book-to-market ratio. Nevertheless, the discovery of momentum effect by Jegadeesh and Titman (1993) was a new challenge for the world of asset pricing models as long as the model with three factors, proposed by Fama and French (1993), fails to fully explain the average returns of stock portfolios sorted according to their past performance. The solution came with the study of Carhart (1997), which proposed to extend the three factor model of Fama and French (1993) with an additional factor to eliminate the momentum effect present in the data.

The main conclusion is that all these anomalies identified led to the construction of new asset pricing models that show their applicability often in the US capital market. However, the applicability of these models for the capital markets from the former communist European countries is questionable. Compared with the results on the capital market from US, the size effect is present in some capital markets from the former communist European countries, absent or reverse for others. These results reveal the specificity of some capital markets from the former communist European countries. The value effect is perhaps the most important anomaly identified in the capital markets from the former communist European countries. However, for some markets the value effect is identified and for others the value effect was absent or it is reverse. Again, the results reveal the specificity of some markets situated in former communist countries. The momentum effect was discovered for all analyzed capital markets from the former communist European countries. Interesting is that Chui et al. (2010) observed that a strategy that buys past winners (stock with prices in a upward trajectory) and sells past losers (stocks with prices in a downward trend) generates the higher abnormal return in the Polish capital market.

However, the examination of anomalies in the case of capital markets from the former communist European countries is limited. The number of studies that investigated the presence of value effect, size effect and momentum effect for the capital markets from the former communist European countries is low. This phenomenon is in many times correlated with the lack of required financial data to

conduct detailed analysis on this topic. The capital markets from the former communist European countries have opened or reopened their doors for a short period of time. As such, the historical data are available for short periods with a direct impact on the implementation of methodologies designed to identify the size effect, value effect or momentum effect. Compared with the developed capital markets, the capital markets from the former communist European countries are affected by a lack of liquidity, questioning the relevance of the empirical results.

The test of CAPM and the examination of various indicators as sources of differences in expected returns are based on the realized returns of financial assets. This is perhaps the most important issue in the empirical testing of CAPM because studies implicitly assume a perfect coincidence between realized and expected return. This observation is very important and is suggested by various studies as Pettengill et al. (1995) and Elton (1999).

Although the models with three factors and four factors are important competitors for the CAPM, the lack of theoretical foundation question their use in various financial applications such as determining the cost of equity, assess the performance of a portfolio manager or their use in event studies. According to Fama and French (1992) the market capitalization and the book-to-market ratio measure the sensitivity of financial asset return to variation in other two important factors that are not included in the CAPM and have a systematic impact on the return of financial assets. The stocks of companies with small market capitalization and high book-to-market ratio are riskier than those of companies with big market capitalization and low book-to-market ratio, their average return being higher. The low book-to-market ratio is characteristic of companies which generated high earnings and cash flows in the past and paid low dividends, because they identified sustainable investment opportunities. The high book-to-market ratio is characteristic to companies with poor performance in the past. However, Lakonishok et al. (1994) showed that the stocks with high book-to-market ratios are not riskier than those with low book-to-market ratios. Moreover, if investors will consider that the past performance of companies will continue in future, the higher return of stocks with high book-to-market ratios compared with those of low book-to-market ratios may be a result of misjudgments (because investors consider the past performance repeatable in the future). If these judgment errors are eventually corrected, what we observe based on the historical data is the presence of value effect.

5. Conclusions

The aim of this article was to inventory the results of the paper that examined the presence of some anomalies like value effect, size effect and momentum effect in the context of the capital markets from the former communist European countries. Initially, these anomalies were discovered in the case of capital market from US, but confirmed for other capital markets all around the world. The presence of these anomalies on the capital market has implication for the validity of the CAPM and also led to the development of multifactor asset pricing models.

Compared with the results on the capital market from US, the size effect is present in some capital markets from the former communist European countries, absent or reverse for others. The value effect is perhaps the most important anomaly identified in the capital markets from the former communist European countries. However, for some markets the value effect is identified and for others the value effect was absent or it is reverse. The momentum effect was discovered for all analyzed capital markets from the former communist European countries. These results highlight the specificity of capital markets from the former communist European countries, the anomalies were found in some markets, absent or reverse in others.

The presence of value effect, size effect and momentum effect for some capital markets from the former communist European countries is fresh evidence that the CAPM failed to include other important factors with a systematic impact on the return of financial assets. In this condition, the presence of size effect, value effect or momentum effect on the capital markets from the former communist European countries make the CAPM an inappropriate model used to estimate the cost of equity or to assess the performance of a portfolio manager that operates in the capital markets from the former communist European countries.

Nevertheless, the examination of anomalies in the case of capital markets from the former communist European countries is limited. The number of studies that investigated the presence of value effect, size effect and momentum effect for the capital markets from the former communist European countries is low. This phenomenon is in many times correlated with the lack of required financial data to conduct detailed analysis on this topic. The capital markets from the former communist European countries have opened or reopened their doors for a short period of time. As such, the historical data are available for short periods with a direct impact on the implementation of methodologies designed to identify the size effect, value effect or momentum effect. Compared with the developed capital markets, the capital markets from the former communist European countries are affected by a lack of liquidity, questioning the relevance of the empirical results.

Acknowledegments

This work was cofinaced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/107/1.5/S/77213 „Ph.D. for a career in interdisciplinary economic research at the European standards".

References

Avižinis, P. Pajuste, A. (2007). "Momentum Effect in Central and Eastern Europe Stock Exchange Markets", *NeuroPsychoEconomics Conference Proceedings*

Ball, R. (1978). "Anomalies in relationships between securities' yields and yield-surrogates", *Journal of Financial Economics*, 6(2-3), pp. 103-126

Banz, R.W. (1981). "The relationship between return and market value of common stocks", *Journal of Financial Economics*, 9(1), pp. 3-18

Bark, H-K.K. (1991). "Risk, Return and Equilibrium in the Emerging Markets: Evidence from Korean Stock Market", *Journal of Economics and Business*, 43(4), pp. 353-362

Barry, C.B., Goldreyer, E., Lockwood, L., Rodriguez, M. (2002). "Robustness of size and value effects in emerging equity markets, 1985-2000". *Emerging Markets Review*, 3(1), pp. 1-30

Basu, S. (1977). "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Markets Hypothesis", *Journal of Finance*, 32(3), pp. 663-682

Black, F. (1972). "Capital Market Equilibrium with Restricted Borrowing", *Journal of Finance*, 45(3), pp. 444-455

Borys, M.M., Zemčík, P. (2011). "Size and Value Efects in the Visegrad Countries", *Emerging Markets Finance and Trade*, 47(3), pp. 50-68

Capaul, C., Rowley, I., Sharpe, W.F. (1993). "International Value and Growth Stock Returns", *Financial Analysts Journal*, 49(1), pp. 27-36

Carhart, M.M. (1997). "On Persistence in Mutual Fund Performance", *Journal of Finance*, 52(1), pp. 57-82

Chan, L.K.C., Hamao, Y., Lakonishok, J. (1991). "Fundamentals and Stock Returns in Japan", *Journal of Finance*, 46(5), pp. 1739-1764

Chui, A.C.W., Titman, S., Wei, K.C.J. (2010). "Individualism and Momentum around the World", *Journal of Finance*, 65(1), pp. 361-392

Claessens, S., Dasgupta, S., Glen, J. (1995). "The cross-section of stock returns: Evidence from the emerging markets", *Working paper*, International Finance Corporation

Elton, E.J. (1999). "Expected Return, Realized Return, and Asset Pricing Tests", *Journal of Finance*, 54(4), pp. 1199-1220

Fama, E.F., MacBeth, J.D. (1973). "Risk, Return, and Echilibrium", *Journal of Political Economy*, 81(3), pp. 607-633

Fama, E.F., French, K.R. (1992). "The Cross-Section of Expected Stock Returns", *Journal of Finance*, 47(2), pp. 427-465

Fama E.F., French, K.R. (1993). "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, 33(1), pp. 3-56

Fama, E.F., French, K.R. (2004). "The Capital Asset Pricing Model: Theory and Evidence", *Journal of Economic Perspectives*, 18(3), pp. 25-46

Goyal, A. (2012). "Empirical cross-sectional asset pricing: a survey", *Financial Markets and Portfolio Management*, 26(1), pp. 3-38

Griffin, J.M., Ji, X., Martin, J.S. (2003). "Momentum Investing and Business Cycle Risk: Evidence from Pole to Pole", *Journal of Finance*, 58(6), pp. 2515-2547

Jegadeesh, N., Titman, S. (1993). "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency", *Journal of Finance*, 48(1), pp. 65-91

Jensen, M.C. (1968). "The Performance of Mutual Funds in the Period 1945-1964", *Journal of Finance*, 23(2), pp. 389-416

Lakonishok, J., Shleifer, A., Vishny, R.W. (1994). "Contrarian Investment, Extrapolation, and Risk", *Journal of Finance*, 49(5), pp. 1541-1578

Lieksnis, R. (2010). "Multifactor Asset Pricing Analysis of the Baltic Stock Market", *Ekonomika*, 89(4), pp. 85-95

Lieksnis, R. (2011). "Momentum in Baltic Stock Market", *Economics and Management*, 16, pp. 1164-1169

Lintner, J. (1965). "Security Prices, Risk, and Maximal Gains From Diversification", *Journal of Finance*, 20(4), pp. 587-615

Lischewski, J., Voronkova, S. (2012). "Size, Value and Liquidity. Do they really matter on an emerging stock market?", *Emerging Markets Review*, 13(1), pp. 8-25

Matteev, M. (2004). "CAPM Anomalies and the Efficiency of Stock Markets in Transition: Evidence from Bulgaria", *South Eastern Europe Journal of Economics*, 2(1), pp. 35-58

Minović, J., Živković, B. (2012). "The Impact of Liquidity and Size Premiun on Equity Price Formation in Serbia", *Economic Annals*, 58(195), pp. 43-78

Modigliani, F., Pogue, G.A., Solnik, B.H. (1973). "A test of the capital asset pricing model on European stock markets", *Working Paper*, Massachusetts Institute of Technology (MIT), Sloan School of Management, pp. 667-673

Mossin, J. (1966). "Equilibrium in a Capital Asset Market", *Econometrica*, 34(4), pp. 768-783

Novak, J., Petr, D. (2010). "CAPM Beta, Size, Book-to-Market, and Momentum in Realized Stock Returns", *Czech Journal of Economics and Finance*, 60(5), pp. 447-460

Pettengill, G.N., Sundaram, S., Mathur, I. (1995). "The Conditional Relation between Beta and Returns", *Journal of Financial and Quantitative Analysis*, 30(1), pp. 101-116

Reinganum, M.R. (1981). "A New Empirical Perspective on the CAPM", *Journal of Financial and Quantitative Analysis*, 16(4), pp. 439-462

Rosenberg, B., Reid, K., Lanstein, R. (1985). "Persuasive Evidence of Market Inefficiency", *Journal of Portfolio Management*, 11(3), pp. 9-16

Rouwenhorst, K.G. (1998). "International Momentum Strategies", *Journal of Finance*, 53(1), pp. 267-284

Schwert, G.W. (2003). "Anomalies and market efficiency", in G.M. Constantinides, M. Harris, Stulz, R. (eds.), *Handbook of the Economics of Finance* (Elsevier Science B.V.)

Sharpe, W.F. (1964). "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance*, 19(3), pp. 425-42

Tudor, C. (2009). "Price Ratios and the Cross-section of Common Stock Returns on Bucharest Stock Exchange: Empirical Evidence", *Romanian Journal of Economic Forecasting*, 10(2), pp. 132-146

van Dijk, M.A. (2011). "Is size dead? A review of the size effect in equity returns", *Journal of Banking and Finance*, 35(12), pp. 3263-3274

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 117-126

Prerequisites for modeling price and return data series for the Bucharest Stock Exchange

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Abstract. *Time series data from the capital market exhibits certain qualities which invalidate the hypotheses necessary for obtaining meaningful results from statistical modeling. This paper presents some of these qualities by looking at the time series for prices and returns on the Romanian Stock Exchange. The examples are based on the price time series and return time series of the Antibiotice securities and the BET-C index. The choice of a certain security and of the stock exchange index has been made with the intention of analyzing, in the future, the correlation between these two variables, and drawing significant conclusions which can be used for forecasts.*

Firstly, we will identify the empirical proprieties of the capital market, as they are described in the field research. Secondly, we will investigate the prerequisites for modeling chronological data series; these are stationary mean and variance. In the paper, the three methods are used: graphical representation, autocorrelation and the ADF test (Augmented Dickey-Fuller). For the frequent cases where the mean is not stationary, we will present the time series differentiation method, which can be used to obtain stationary values.

Lastly, we will investigate the normality of the time series through the skewness and kurtosis methods, and through the Jarque-Bera statistic. We find out a characteristic for the capital market, in that the majority of the time series for securities have non-normal distributions.

Keywords: statistical proprieties; stationarity; autocorrelation; ADF test; differentiation; skewness; kurtosis; Jaques-Bera statistic.

JEL Classification: C12, C58, E44.
REL Classification: 11B, 11E.

Introduction

The statistical analysis leads to meaningful results only if some prerequisites are satisfied, such as the normality of the data distributions, the stationarity of the mean and the variance, independence between variables, the absence of autocorrelation in residuals, etc. In the most frequent cases, the time series do not meet these conditions, and more so by the time series from the capital market. Moreover, the time series from the capital market have specific proprieties with other time series found in the economics domain.

Consequently, in order to run statistical modeling on these time series, these problems need to be corrected. To interpret correctly the evolution and the correlations between the analyzed variables, we proceed to enforcing stationarity, normality and the elimination of autocorrelation in the residuals.

In this paper we will show the proprieties of time series from the Romanian capital market, and the correction of the stationarity propriety for the security prices. The two actions (illustrating the proprieties and correcting the stationarity) will be exemplified on the security price for the company Antibiotice, and for the BET-C composite stock exchange index.

The conclusions are valid for the other Romanian security prices and indexes. In a future article we will continue investigating the statistical proprieties of the correlations between the capital markets' variables, and we will explore the necessary adjustments in order to run an adequate statistical model.

Empirical proprieties of security prices and returns

For the illustration of these proprieties we will use the series of daily prices and returns for the security of Antibiotice (a company traded on the Romanian Stock Exchange) and BET-C (a composite index), between 17.08.2004 and 10.03.2012. Generally, the time series from the capital market is characterized by common statistical properties of stock prices and returns.

The amount of scientific research in this area is vast, starting almost half a century ago. The most notable results belong to Fama (1965), Blattberg and Gonnedes (1974), Kon (1984), Bollerslev et al. (1992), Pagan (1996), Cont (2001), Christoffersen (2003) and many others.

The empirical proprieties have been thoroughly illustrated by Cont (2001), who concludes that, in the majority of the cases, the evolution of security prices and stock exchange indexes are explained by the impact of economic and political events. This research shows that the evolution of security prices has similar proprieties regardless of the value or the period for the studied item.

According to Cont (2001) and Christoffersen (2003), the main properties of price and return time series are as follows:

1. The absence of autocorrelations (efficient markets in weak form).
2. Thick tails for the distributions, with large values for extreme values, compared to the normal distribution.
3. Negative skewness for the distribution of returns: negative returns have larger vales than positive returns.
4. Aggregated normalization, such that the distribution of returns during longer periods better matches the normal distribution; for example, the monthly distribution of returns match the normal distribution better than the weekly returns, which, in turn, are closer to the normal distribution than the daily returns.
5. Intermittence, which means irregular explosions in the time series of volatility.
6. Volatility clustering, denoting positive autocorrelation of volatility along several time periods; very volatile items tend to cluster together.
7. Conditional thick tails, which appear even after the correction of clustering in volatility using GARCH models. However, these tails are less thick than those found in the unconditioned distribution.
8. Gradual drop in the autocorrelations of net returns determined by the time lag, which can be expressed as an exponential function, with the exponent taking values between 0.2 and 0.4.
9. Leverage effect, such that the volatility of a financial asset is generally negatively correlated with the return of that asset.
10. Positive correlation between volatility and transaction volume.
11. The mean of the daily returns is statistically insignificant because it is dominated by the standard deviation.
12. Correlations between assets vary in time, growing when the market falls, and taking extreme values during market crash.

We will illustrate these statistical proprieties, as they are useful for comparing the price time series with the returns time series.

Data and methodology

In our analysis we use daily observations of the security price for Antibiotice SA and for the market index BET-C. The time period considered (between 17.08.2004 and 10.03.2012) contains 2,122 data points. In order to run forecasts, we need to allocate data points for the forecast period. Thus, it is recommended that the range specified is greater than the number of available observations.[(1)]

Starting from the price time series, we will investigate the series of daily returns, calculated as continuous returns as first difference of the natural logarithm for prices:

$$\text{DL } R_{i,t} = \ln(P_t) - \ln(P_{t-1}) = \ln(\frac{P_t}{P_{t-1}}),$$

where:
R = effective return of the security or index "i" in day "z";
$\ln(P_t)$ = natural logarithm of the price of the security or index during day "t";
$\ln(P_{t-1})$ = same, for day "t-1".

Modeling these two time series involves the stationarity analysis of the two time series of prices and returns.

Stationarity

Stationarity describes the stability in time for the average and the variance. In a forecast, we assume that the mean and the variance have been constant in the past, and that we expect to find these values in the future.

The stationarity is proven through: 1) graphical analysis, 2) testing serial autocorrelation using correlograms, 3) testing the existence of an unit root in the time series (ADF test).

1. The graphical representation of the analyzed time series can identify a trend and consequently, the stochastic process which generates the series is non-stationary.

Figure 1. *Graphical evolution of the ATB and BET-C prices*

Both price time series (ATB and BET-C) have an increasing and decreasing trend, and thus are non-stationary. It is remarkable, however, that the evolution of the two price time series is almost identical.

2. The autocorrelation function is equal to $\rho_k = Cov(Y_t , Y_{t-k})/Var(Y_t)$ and it should have $\rho_k \approx 0$ for all lags, if the series is stationary.

- The daily price series for ATB has the following results for the serial autocorrelation test:

Table 1. *Correlations for the ATB price time series*

Date: 10/20/13 Time: 09:20
Sample: 8/17/2004 10/03/2012
Included observations: 2122

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|*******	|*******	1	0.998	0.998	2118.6	0.000
|*******	| |	2	0.997	-0.039	4231.4	0.000
|*******	| |	3	0.995	0.013	6338.5	0.000
|*******	| |	4	0.994	-0.005	8439.8	0.000
|*******	| |	5	0.992	0.025	10536.	0.000

. . .

- The series of daily values BET-C has the following results of the same test serial autocorrelation:

Table 2. *Correlations for the BET-C value time series*

Date: 10/20/13 Time: 09:53
Sample: 8/17/2004 10/03/2012
Included observations: 2122

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|*******	|*******	1	0.998	0.998	2117.1	0.000
|*******	| |	2	0.996	-0.056	4226.4	0.000
|*******	| |	3	0.994	-0.003	6327.8	0.000
|*******	| |	4	0.992	-0.015	8421.2	0.000
|*******	| |	5	0.990	0.019	10507.	0.000

. . .

In both series (ATB and BET-c) we encounter autocorrelations with large values of 0.998 for the first lag, with decreasing values (but still very big) for the next lags (for example, 0.998 for the fifth lag). Thus, the series are not stationary. The values for the partial autocorrelations are very large for the first lag (0.998), leading to the conclusion that the series are not stationary, either. The Q-Stat test has very large values for all the lags, confirming that the price series exhibit

autocorrelation and thus represent a random process without white noise in the residuals.

- The return time series DLATB has the following results for the serial autocorrelation test:

Table 3. *Correlation for DLATB returns*

Date: 10/20/13 Time: 10:00
Sample: 8/17/2004 10/03/2012
Included observations: 2121

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.077	0.077	12.565	0.000
| |	| |	2	0.004	-0.002	12.593	0.002
| |	| |	3	-0.025	-0.025	13.914	0.003
| |	| |	4	-0.054	-0.050	20.034	0.000
| |	| |	5	0.048	0.057	24.996	0.000

. . .

- The return time series DLBET-C has the following results for the same serial autocorrelation test:

Table 4. *Correlation for DLBET-C returns*

Date: 10/20/13 Time: 10:02
Sample: 8/17/2004 10/03/2012
Included observations: 2121

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.087	0.087	15.909	0.000
| |	| |	2	0.005	-0.002	15.963	0.000
| |	| |	3	-0.032	-0.032	18.085	0.000
| |	| |	4	-0.012	-0.006	18.376	0.001
| |	| |	5	0.018	0.020	19.103	0.002

. . .

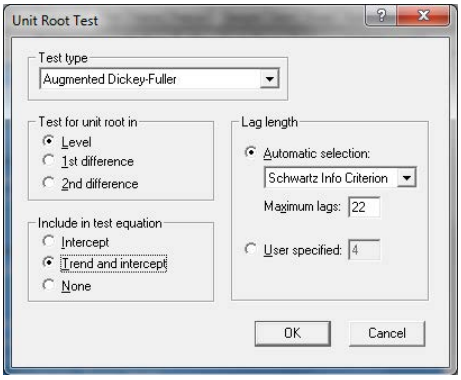
In the return time series, after differentiating the returns (BLATB and DLBET-C), after the differentiation of the logarithmic series variables, the autocorrelation coefficients are close to zero for all the lags, which leads to the conclusion that these returns time series are generated by a random process (random walk, RW), and that they are, most probably, stationary.

3. For the ADF test (Augmented Dickey-Fuller test statistic) it is very important to specify whether the series have a constant average and trend, which can be determined with the help of the graphical representations:

- The price time series has a constant and a trend,
- The return time series has neither constant nor trend.

- The ATB price time series has the following results for the ADF test:

Table 5. The ADF test for the ATB price time series, with constant and trend

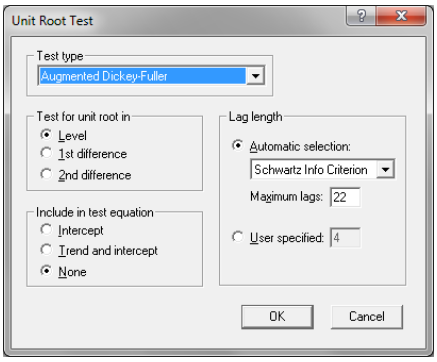


Null Hypothesis: ATB has a unit root		
Exogenous: Constant, Linear Trend		
Lag Length: 0 (Automatic - based on SIC, maxlag=25)		
	t-Statistic	Prob.*
ADF test statistic	-2.029627	0.5842
Test critical values:	1% level	-3.962374
	5% level	-3.411928
	10% level	-3.127864
*MacKinnon (1996) one-sided p-values.		

ADF test is = – 2.029627 and is smaller in absolute value than the critical values for the usual significance levels (1% 5% 10%), which shows that the ATB price time series has a 58.42% probability to be non-stationary and possess an unit root. In order to stationarize it, we applied differentiation, which we did through logarithmic prices differentiation and obtained returns time series ATB.

- The DLATB return time series has the next results for the same ADF test:

Table 6. The ADF test for the ATB price time series (without constant and trend)



Null Hypothesis: DLATB has a unit root		
Exogenous: None		
Lag Length: 0 (Automatic - based on SIC, maxlag=25)		
	t-Statistic	Prob.*
ADF test statistic	-42.60700	0.0001
Test critical values:	1% level	-2.566053
	5% level	-1.940973
	10% level	-1.616599
*MacKinnon (1996) one-sided p-values.		

The ADF is – 42.607 and it is greater, in absolute value, than the usual significance levels of 1%, 5% and 10%, and the p-value = 0, which shows that the DLATB return series is stationary and it does not possess an unit root.

We obtain similar results for the value and return time series of the BET-C index.

Table 7. *The ADF test for the BET-C value time series and DLBET-C time series returns*

Null Hypothesis: BET_C has a unit root		
Exogenous: None		
Lag Length: 1 (Automatic - based on SIC, maxlag=25)		
	t-Statistic	Prob.*
ADF test statistic	-0.213615	0.6094
Test critical values:	1% level	-2.566053
	5% level	-1.940973
	10% level	-1.616599
*MacKinnon (1996) one-sided p-values.		

Null Hypothesis: DLBET_C has a unit root		
Exogenous: None		
Lag Length: 0 (Automatic - based on SIC, maxlag=25		
	t-Statistic	Prob.*
ADF test statistic	-42.20244	0.0001
Test critical values:	1% level	-2.566053
	5% level	-1.940973
	10% level	-1.616599
*MacKinnon (1996) one-sided p-values.		

While the BET-C value time series is not stationary and has a unit root, the DLBET-C has become stationary (through differentiation) and it does not have a unit root.

With the stationarized data series we can proceed to the statistical modeling of the correlation between these variables. The results of these statistical analysis must be checked for the normality of the data series and the absence of autocorrelation between the residuals of the regression model DLATB ~ DLBET-C.

Normality

The Jarque-Bera test investigates the normality of the time series which must have skewness = 0 and kurtosis = 3 and Jarque-Bera statistics values must be very small and with p > 0. These values confirm that the series have normal distribution. To investigate the normality of the time series, we run a statistical analysis of the two price time series (ATB and BET-C), and of the returns time series resulting from these prices (DLATB and DLBET-C).

Table 8. *Statistical values for price series (ATB and BET-C) and returns (DLATB and DLBET-C)*

Statistics	**ATB**	**BET-C**	**DLATB**	**DLBET-C**
Mean	0.570053	5838.796	0.000305	0.000179
Median	0.396000	5365.750	0.000000	0.000000
Maximum	1.320600	10813.59	0.264304	0.105645
Minimum	0.185600	1887.140	-0.162519	-0.131168
Std. Dev.	0.316897	1914.342	0.025940	0.018453
Skewness	0.811889	0.433870	0.432202	-0.600725
Kurtosis	2.129146	2.580828	**15.20034**	9.711040
Jarque-Bera	300.1784	82.11072	**13220.50**	4107.806
Probability	0.000000	0.000000	0.000000	0.000000

From the previous table, we conclude that all the distributions of the analyzed time series exhibit positive asymmetry (skewness > 0, except for the return series of BET-C which has skewness < 0). The price distributions of ATB and BET-C are slightly platykurtic, having kurtosis < 3. However, the distributions of returns are significantly leptokuritc, having kurtosis > 3, with the series of DLATB returns exhibiting the greatest deviation from normality.

The Jarque-Bera test confirms the above: the four time series do not have normal distributions, with large values for the Jarque-Bera statistic, and thus zero probabilities for accepting the hypothesis of data distribution normality. The Jarque-Bera value for DLATB is the largest, and in consequence the series exhibits a distribution fundamentally different from the normal distribution.

The majority of the securities exhibit distributions similar to those described above. In a leptokurtic distribution, the probability of an extreme event is greater than in a normal probability (the reverse also holds). It follows that models for forecasting prices and returns will generate errors if we start from the hypothesis that their distribution is normal. Since we cannot correct the normality of these data sets, we have only to interpret the results of statistical analysis and modeling of precautionary specifying where there is an overestimation or an underestimation of the actual data.

Conclusions

1. Researches in the scientific literature have identified a number of empirical proprieties, specific to the capital market; these are: the lack of autocorrelations with a gradual decrease in time, thick and conditional tails of the distributions, negative asymmetry, aggregated normalization, closer to the normal distributions for the series of monthly data compared to weekly data, intermittency and clusterization of volatility, negative correlation between volatility and returns, positive correlation between volatility and transaction value, and insignificance of the daily average returns and correlations between securities which vary in time during financial crises.
2. The evolution of security prices and returns exhibits these properties regardless of the value of the securities or the time period studied.
3. The time series of security prices, as well as those of the stock exchange indexes, have a constant and a trend (ascending or descending), and are thus not stationary, in all cases. We checked for stationarity through 1) graphical analysis, 2) testing for serial autocorrelation, 3) testing for the existence of a unit root (the ADF test).

4. The stationarization of the time series is realized by differentiation on first or second degree. The differentiation of the natural logarithm of prices leads to finding out the returns, which are, generally, stationary time series.
5. Most of the securities have non-normal distributions. Because we cannot correct the non-normality of these series, we can only interpret the results of the statistical analysis and models of precautionary specifying where there is an overestimation or an underestimation of the actual data.

Note

(1) The specific interval in EViews would be of 2,500 observations.

References

Blattberg, R., Gonnedes, N. (1974). "A comparison of stable and Student distributions as statistical models for stock prices", *Journal of Business*, Volume 47, Issue 2, pp. 244-280

Bollerslev, T., Chou, R.C., Kroner, K.F. (1992). "ARCH modeling in finance", *Journal of Econometrics*, 52

Cont, R. (2001). "Empirical properties of asset returns: stylized facts and statistical issues", *Quantitative Finance*, Volume 1, Issue 2, pp. 223-236

Christoffersen, P. (2003). *Elements of Financial Risk Management*, San Diego, CA: Academic Press

Fama, E.F. (1965). "The Behavior of Stock-Market Prices", *The Journal of Business*, Volume 38, Issue 1, pp. 34-105

Iorgulescu, F. (2012a). "The Stylized Facts of Asset Returns and their Impact on Value-at-Risk Models", *Volumul celei de a 19-a conferințe internaționale "The Persistence of the Global Economic Crisis: Causes, Implications, Solutions IECS 2012", Sibiu*, pp. 447-455

Kon, S. (1984). "Models of stock returns: a comparison", *Journal of Finance*, 39

Pagan, A.R. (1996). "The econometrics of financial markets", *Journal of Empirical Finance*, Volume 3, Issue 1, pp. 15-102

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 127-146

Between fiscal discipline and economic recovery. The solutions problem

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Abstract. *In this study we proposed a comparative analysis of the effect of the measures taken in seven European countries, which were aimed the fiscal consolidation, in correlation with monetary policy and economic recovery.*
The selected countries have been systematized into two groups: first group includes states that have signed agreements with international financial institutions (Romania, Ireland, Greece and Portugal) and the second group contains countries which, even if not directly assisted in the international funding programs, have take a several adjustment measures (Italy, Spain and France). In the same time, we keep in mind during the analysis the trade-off between fiscal discipline and sustainable economic recovery.

Keywords: fiscal consolidation; economic recovery; adjustment measures; monetary policy; international funding.

JEL Classification: E20, E32, E52, E60, E62, E65, H12, H61, H62.
REL Classification: 8I, 8K.

1. Introduction

At the end of 2012 and at four years after the eruption of the financial crisis, developed economies of the world continue to face the persistence of several negative effects, while developing countries, which have been for a long period of time the major source of growth for the global economy, began to be visible affected by lower export demand as the global demand started to decline.

Amid historical level of public debts of the United States, Japan and especially the European Union (EU), the fiscal adjustment affects economic growth and, in the case of Romania, the convergence and the catching-up process.

The severe recession, significant interventions in financial markets and fiscal stimulus measures have increased public debt at levels that have not been seen since the end of World War II. Decreasing public debt ratio at more "confortable" levels in terms of sustainability requires a broad and sustained adjustment, which is expected to reduce the aggregate demand in the coming years and, therefore, adversely affect GDP growth. In the US and Japan, conventional monetary policy support for fiscal consolidation is limited by the fact that interest rates are already at levels close to zero, while the aging population and the trend of weak growth provides a small space in absorption of falling demand. Also, as most advanced economies are in the process of adjustment, export demand will provide a little support to growth prospects in US, EU states and Japan.

On the other hand, consolidation can not be postponed indefinitely, states (even more important countries, such US and Germany) being under pressure from international rating agencies. In the Euro zone, although so far the largest debt increases have been recorded by few countries (Greece, Portugal, Ireland, Spain and Italy), they are considered a high risk for the Eurozone due to the potential contagion effects. Therefore, if in this fragile countries consolidations are avoided, there is a real risk of ratings downgrades or even default. Automatically, we can ask about what pace of fiscal consolidation is needed in these countries so that necessary adjustments be effective, but to preserve the growth prospect.

2. Literature review

Delong (2012) and Rendhal (2012) highlight a key issue, that in a liquidity trap period the duration and depth of the current recession are not exogenous, but depend on the extent to which the dynamic of current aggregate demand affects economic activity. Thus, given that states are facing fiscal consolidation measures

(tax increases and/or reduction of government spending), which in short-term generates a reduction in aggregate demand, a sharp rise in unemployment and under-utilization of capital, driving to adverse developments or unfavorable expectations about the future economic situation. The authors state that, as a low unemployment in the present increase the likelihood of a low unemployment in the future, a loss of jobs in the present do individuals anticipating lower revenues in the future, that make them to reduce their consumption both now and in the future. This vicious circle – where a reduction of the number of jobs generate expectations of a low employment in the future and, therefore, leading to lower consumer demand and a greater job loss in present – is a powerful and dangerous mechanism. The same idea is also supported by Trașcă, Popa and Dudian (2011), who consider that the challenge for the European economy is the way out from the vicious circle of unsustainable public debts, financial markets concerns and declining growth and jobs in some member states.

Giavazzi and Alessina (2012), who followed in their study the fiscal adjustments in the OECD countries in the last 40 years, have shown that:

- adjustments achieved through spending cuts are less recessionary that those made by tax raising;
- consolidation achieved by lowering spendings, accompanied by the right macroeconomic policies tend to be less recessionary or has a positive impact on future growth. Among the policies that could accompany fiscal consolidation may include: monetary easing, liberalization of goods and labor markets and other structural reforms;
- only spending based adjustments led later to a permanent consolidation of the government budget, at least in terms of stabilizing the public debt if not by reducing its share in GDP.

Devries et al. (2011) reached same conclusions in their study. If we compare the effects of different "types" of fiscal adjustments over the production and "confidence" of investors, it seems that adjustments made on the tax side not only did not achieve the proposed goals, but was unable to stop increasing the share of public debt in GDP. When the tax measures are announced, the confidence of entrepreneurs is sharply reduced, this fact being reflected in lower production.

Another reason for avoiding the adjustment measures on the tax (revenues) side is that countries with shares of revenues in GDP around or above 50% can not use such an instrument, being close to the Laffer's curve point of inflection. A study by Harald Uhlig and Mathias Trabandt (2012) shows that many European countries are sufficiently close to this point and any further increase in taxes will

lead to a relative reduction in tax revenues that will deepen even more the recession.

Also, Hall (2009), Woodford (2011), Christiano et al. (2011), Ahrend and others (2006) show that monetary policy position is an important determinant for the fiscal multipliers. The mechanism of financial crises and the contagion effects were analyzed and by Moldovan, Adam and Hudea (2010) in a study published in "Challenges of the Knowledge Society" review.

A study belonging to Batini, Callegari and Melina (2012), which focuses on the US, Euro area as a whole (customizing analysis and on two major countries from the European monetary union who need fiscal adjustments, France and Italy) and Japan, using autoregressive vectors methodology, shows that spending multipliers are significantly higher during on downward economic phase than in a growth phase (presented as increase/decrease rate of GDP). They also showed that spending multipliers (where spendings are defined only as public consumption and public investment) are significantly higher than fiscal multipliers (taxation is defined as the net taxes, namely the difference between gross taxes and transfers) during recession. Moreover, authors concludes that monetary policy does not seem to have a strong effect to offset the economic downturn, possibly because the reduction of interest rate wasn't very significant or fast enough in the analyzed timeframe to counteract the production decrease during periods of fiscal consolidation.

Other conclusions of the authors: the greatest effect of fiscal consolidation on production is observed in the first year after the shock and the implementation of fiscal consolidation during periods of positive output increases significantly reduce the impact on production. Evolution of public debt in the Euro area was analyzed and by Hrebenciuc (2010), his conclusion being that the region needs a better coordination in terms of public policy.

Our scientific approach starts from the analysis of the effects that austerity measures could have on economic growth in Romania and in two groups of countries from the Euro area. In the first group we analyzed Ireland, Greece and Portugal, three countries that because of financial and economic imbalances had to ask international aid from European Central Bank, International Monetary Fund and European Commission, and the second group includes Italy, Spain and France, countries that, even without an international aid, have taken severe fiscal consolidation measures to restore market confidence and to recover losses in competitiveness (Figure 1).

States that ask for international aid from international financial institutions:

- Romania - 20 billions euro (EC, IMF, WB)+ 2"precautionary" agreements
- Greece - 80 billions + 130 billions euro (CE, IMF, ECB)
- Ireland - 85 billions euro (EU, IMF)
- Portugal - 78 billions euro (EC, ECB, IMF)

States that have implement consolidation measures without being under international aid:

- France
- Italy
- Spain

Source: European Commission(1).

Figure 1. *Groups of analyzed countries*

When the European fiscal compact was signed by 25 states of EU (without Czech Republic and United Kingdom), 14 of 17 Eurozone member states were under Excessive Deficit Procedure (EDP). Just Estonia, Finland and Luxembourg had a deficit below 3% in that moment. Also, the other countries take the commitment to reduce fiscal deficit below 3% of GDP until the end of 2012 (Belgium and Cyprus) or 2013 (the rest of 12 states).

As the budget deficit reduction occurs in a bad time of consolidation with small space for fiscal policy, there are significant impediments to fiscal discipline. Also, the situation is complicated by the fact that the current sovereign debt crisis makes that indebted states not be able to refinance debts as they had planned and the financial markets are reluctant to borrow governments at "reasonable interest rates". Desire of concomitantly economic growth and fiscal discipline is a challenge that governments have not been able to solve so far.

3. Diagnostic analysis of countries included in the two groups

Spain – Spanish economic expansion lasted about a decade, from de middle of 90s to 2007. Subsequently, growth began to slowdown and, after 2007, boosted by the global economic crisis, internal and external vulnerabilities of Spanish economy have emerged to the surface. The state entered in a spiral of indebtedness, economic decline and skepticism about his capacity to recover. At the same time, high unemployment rate has been fueled by the fired workers from the construction sector and the banking system was badly shaked by disappearance of

euphoria from the real estate sector. Banking sector crisis led to the financial aid[(2)] requested from the Eurozone leaders, in the summer of 2012. At the EU summit, on 28-29 June this year, it was also decided relaxing the loan conditions for Spain and Italy, a decision that was received positively by the markets and can provide time for these two countries to adjust imbalances accumulated in the last decade.

Spanish growth model was based mostly on stimulating the domestic demand, especially construction and real estate sector, a model which, ultimately, proved to be unsustainable, being the premise of Spanish macroeconomic imbalances augmentation. Joining Euro area generated a significant reduction of the country risk premium, which produced two effects: on the one hand, the Spanish interest rates fell strongly and, on the other hand, capital inflows increased, slightly solving the problem of external financing for Spanish economy. Another important factor, in terms of public debt, is the government deficit, including the need for measures and instruments to help banks and several regions.[(3)]

Low capital cost, combined with several factors that have increased the demand for housing, and population growth due to immigrants who came to Spain led to a housing bubble that caused a sharp increase of prices and housing construction.[(4)]

Challenges in the banking sector, which emerged with the global crisis, continues to depress the economy through a number of channels, including financing costs and reducing the credit flow to non-financial sector. In particular, high exposure of the banks to construction and real estate sectors eroded the confidence of consumers and investors.

At the same time, foreign capital inflows and strong domestic demand pushed wages and prices, contributing to a steady deterioration in the competitiveness of Spanish economic. According European Commission, the difference between the wage growth (3.2%, annual average rate over the period 1996-2007) and low growth of productivity (0.4%, annual average over the same period) generated an increasing in unit labor costs (2.8% from 1996 to 2007, twice higher than the Euro area average). Furthermore, real exchange rate, based on the unit labor cost, strengthened between 1999 and 2009 by 16%, which negatively affected Spanish exports.

Portugal – Before financial crisis, during 2001-2008, annual average growth rate of real GDP of Portugal was only 1% per year, the second lowest growth rate in EU-27 after Italy (with a annual average growth rate of real GDP of 0.4% in same period). Comparatively, annual average growth rate during 1991-2000 was approximately 3% per year.

Moreover, potential GDP has been on downward trend since the late of 90s. In average, contribution of all potential GDP components (capital, labor and total factor productivity) decreased, the fastest decline being in terms of total factor productivity. Then, after 2005, there is a negative contribution of labor, a decline which has not been offset by an increase in capital factor or total factor productivity. A low labor participation highlights the issues of Portuguese labor market, the latter being in center of adjustments programs established with international financial institutions.

In terms of foreign trade, Portugal has lost export market share, especially in markets where are traded labor intensive goods (e.g. textiles). On these categories of goods Portugal was exceeded by emerging economies from Asia and Eastern Europe, countries with lower labor costs as main comparative advantage. Furthermore, as exports were mainly concentrated on a relatively small number of Euro area countries, the economic downturn of Eurozone generated a lower export demand from trading partners in region.

Another important element is the exports structure, dominated by sectors with low added value. From this point of view (the technological intensity of products), Portugal was exceeded by other eurozone countries, like Italy and Spain, and even some countries from Eastern Europe.

In the banking system, Portuguese banks coped well in first phase of economic and financial crisis, with a low exposure to toxic assets. An important element was the fact that Portugal has not experienced the housing boom that had, for example, Spain. However, since 2011, amid Europe's sovereign debt crisis, banks started to have financing difficulties from external markets, the cost rising significantly alongside the country risk premium.

From the perspective of public finances, public debt of Portugal has increased constantly. According European Commission, after joining Eurozone, government deficit was usually above the limit of 3% of GDP imposed by the Treaty, and the share of public spending in GDP increased during 1999-2010 by almost eight percentage points. Large structural budget deficits and low economic growth lead to an increase of public debt as share of GDP from 60% in 2004 to about 108% in 2011, and is expected to rise at 119% in 2012.

Italy – Italy's situation was similar to Portugal in pre-crisis period, Italian economy growing in average with 1.2% during 1999-2008, below the average growth rate of Euro area, pointing out the low rate growth of labor productivity and total factor productivity. The latter is on a downward trend since the late of

90s, indicating the failure of Italy in absorbing new technologies and the low ability of companies to innovate.

Probably the Italy's biggest problem is the high level of public debt, that exceeded 120% of GDP at the end of 2011, and is projected to reach 126.5% in 2012, the highest share in GDP among large states of the European Economic and Monetary Union. High public debt can have many negative consequences on economic evolution, the correlation between high public debt an low growth rates being strong. Likelihood that government will use tax increases or spending cuts, trying to reduce the debt ratio is very high, and this will reduce consumer demand at aggregate level. However, premium risk of a country with high public debt determines an increase also in the cost of capital for private sector. Banking system and credit conditions are also affected in a negative way.

Italian banks coped well than other European banks during financial crisis, thanks to prudent business model and the absence of excessive euphoria in real estate sector. However, amid a generalized increase of risk aversion and the deepening of sovereign debt crisis, Italian banks ability to have access on financial markets has been reduced due to higher financing costs.

Loss of competitiveness was the main factor behind de decline of Italian economy in terms of trade balance. After 1998, the balance of trade in goods and services has deteriorated significantly compared with other partners from the Euro area. According to the European Commission, between 1999 and 2011, nominal labor cost (ULC) rose on average with 2.3%, significantly higher than similar costs in countries such as Germany (+0.5%) or France (+1.9%). In Euro area, ULC rose by 1.6% during the same period. These differences, achieved in the evolution of ULC after adoption of the Euro currency, largely explain the profit rates reduction of Italian firms relative to the rest of Euro area, particularly in manufacturing sector, despite the fact that the development of production prices was relatively similar.

In the last decade, sectorial specialization of Italian exports remained stable and mainly focused on goods with a medium-low technology (textiles, metals, plastics). According to European Commission (2012), in this category of goods, the share of Italian exports on world exports has decreased considerably in 2000s. At the same time, the fact that only a small fraction of exports are focused to emerging markets (usually, only largest Italian companies have become more competitive on these markets), has adversely affected the share of Italian exports in total world exports. Thus, Italy is strongly dependent on markets from Euro

area and failed to benefit from powerful growth of emerging markets, especially those from East Asia, mainly due to the relatively small size of Italian firms which hinder their ability to cover higher entry costs related to the creation of new distribution networks and investing in intangible assets, such as patents and brand reputation.

According to data from the Italy's national statistical institute, in 2011, 42.6% of exports were directed towards the Euro area (56% to EU-27 member states) and 44% to states outside the EU (including North America – 6.8%, Middle East – 4.9%, North Africa – 2.9% and China – 2.7%).

Ireland – Ireland was considered a model for real convergence in the Euro area, gross national income per capita(6) increasing from 83% of the EU-15 average in 1996 to 113% in 2006. This increase was mainly driven by strong inflows of foreign direct investment, the significant increase of exports and improving labor productivity. Also, amid the expansion of domestic demand (especially construction sector), the participation rates rose and unemployment rates declined.(7) Despite these positive developments, the strong growth of Ireland in the pre-crisis period was based on unsustainable engines. Successful experience starting in the mid of 90s, in terms of growth and catching-up to the EU average, have contributed to an underestimation of risk, with fueled over-lending, overinvestment in physical capital and excessive growth of asset prices and consumption expenditures.

In this context, low real interest rates and relatively easy access to credit contributed to increasing real estate prices, while the indebtedness of households and companies rose sharply before the crisis, among the highest from entire European Union. Construction, particularly housing, were in the center of domestic lending boom, and between mid-90s and 2006 the growth rate of housing prices was one of the highest in the EU. The real estate boom was also sustained by other factors, such as favorable demographic trends, high rate of employment and strong wage growth, fiscal incentives for investment in housing and the rapid expansion of lending through banking sector.

However, external competitiveness worsened significantly during the domestic boom. According to the European Commission, the real effective exchange rate (calculated on the basis of unit labor cost) has appreciated by about 16% between 2003 and 2008, due to the higher wage growth rate compared to labor productivity.

Amid the international financial crisis, the consequences of sudden adjustments in the housing market spread then rapidly in the whole economy. From early 2007 until late 2010, house prices fell by 38% and transactions were frozen, GDP declined between 2008 and 2010 by 11% in real terms and by 17% in nominal terms, while the employment rate fell by almost 14% from its peak in the third quarter of 2007. The unemployment rate rose from 4.5% in 2007 to 13.5% in 2010, and the construction sector accounted about half of the decline in employment. The bubble burst affected most banking sector, where the government injected by 2011 over 46 billion Euro (29% of GDP).(8)

Full impact of financial sector support measures over de general government deficit was 22.7% of GDP in 2009-2010. In November 2010, the Irish authorities have requested financial assistance from IMF and EU, after markets looked distrustful to the government ability to manage internal imbalances. Thus, the government published the National Recovery Plan 2011-2014, which represented the starting point in negotiations of financial assistance program worth 85 billion Euro, from European Commission, European Central Bank and International Monetary Fund for the period 2010-2013. The key objective of the program was to restore financial markets confidence in the Irish banking sector and in Irish government.

France – For France, the second largest economy in the Euro zone, rapid losses in terms of market share in recent years have increased the current account deficit. From a surplus of 3.1% of GDP in 1999, the current account deficit has increased since 2005, reaching 2.2% in 2011. Balance of trade in goods is the largest part of the deficit; the market share of French exports was reduced by 19.4% between 2005 and 2010, one of the largest reductions in the EU.

Both cost-competitiveness and the non-cost competitiveness contributed to the deterioration of French export performance after 2000. Although the specialization of products and geographical orientation of exports had a negative impact, performance of French exports from costs perspective decreased. Compared with its trading partners, relatively rapid growth of nominal wages in France in the last decade, higher than productivity growth, led to a decrease of cost competitiveness of firms. However, most of the damage comes from the competitiveness of non-priced, especially the lack of innovation in the private sector compared to its main competitors. Another factor is the limited number of exporting firms.

Although several measures have been taken by the French authorities to counteract adverse developments both in terms of competitiveness through cost

and non-cost, there is little evidence of their impact on export performance. Policies have been implemented to limit the increase in labor costs, to support innovation and help exporting companies. In particular, initiatives to shift taxation from labor towards less distortionary sources, extending the tax credit on expenditure on research and efforts to develop links between research and industry (especially the competitiveness poles) are considered steps taken toward correct direction.

Public debt ratio deterioration over the past decade was due to persistently high deficits, reflecting the action of structural factors (including pension costs). The budget deficit remained above the three percent between 2002 and 2008, including an extended period in which the country has been in excessive deficit procedure, while growth in the period 2004-2007 would have allowed a significant adjustment in structural terms. According to European Commission (2012), the structural budget deficit fell by just 1% of GDP in this period.

Country's fiscal and budgetary position deteriorated during the crisis due to the action of automatic stabilizers and incentives decided by the government. Along with the decline in economic growth, these factors have pushed the deficit to over 7% of GDP in 2009-2010, and authorities began fiscal and budgetary consolidation in 2011. However, the country's public debt will continue to rise to 85.8% at end of 2012.

French households are less indebted than other EU countries. Debt dynamics in recent years was mainly due to housing market dynamics. At the same time, rising unemployment, which already puts pressure on household income and creditworthiness, is not expected to decline before 2013.

The unemployment rate, which fell between 2006 and 2008, began to grow in Q1 of 2008, leaving in 2010 and 2011 under the symbolic threshold of 10%. In terms of solvency, a high unemployment rate means, on the one hand, lower income households and, on the other hand, a lower bargaining power in wage bargaining context. Even though the unemployment rate in France is below the euro area average, the labor market is an important target for the government. French labor market segmentation has led to high risk occupation for “extreme categories' (workers with temporary contracts, young and low-skilled) in times of rising unemployment and reduced incentives for firms to hire when the economy recovers. Measures were taken to improve labor market flexibility.

Greece – Between 2000 and 2009 the average annual increase in real GDP of Greece was 4%, due to stronger domestic demand, especially consumption and

residential investment. The increase in real wages and the increase in lending – the latter being supported by financial sector liberalization and low real interest rates associated with the Euro – and the easing of fiscal policy contributed to economic growth. However, during the same period foreign trade contributed negatively to growth, the share of exports in GDP narrowing from 25 to 19%.

Like the other countries analyzed in this paper, real wage growth exceeded productivity gains over the past decade, reflecting in part the effects of increasing government wages. Therefore, the increase in unit labor costs eroded the country's external competitiveness. In the context of expanding domestic demand and deteriorating external competitiveness, current account deficit widened, reaching a maximum of 14% of GDP in 2008.

Regarding fiscal situation, after 2000 budgetary position of the Greek State has never been below the target of 3% of GDP required by the Treaty. In addition, fiscal targets have been repeatedly missed due to high public expenditures, tax evasion and overestimating revenues from taxes. Size of the government sector increased from 44% of GDP in 2000 to over 50% in 2009, pointing out the increasing social spending about 5% of GDP and tax revenue in the same period fell from 41% to 38% of GDP. Additionally, health and pension systems, unreformed, became a threat to the long term sustainability of public finances. Due to fiscal deficits and external imbalances, public debt and the external one increased significantly. According to Eurostat, public debt as a share of GDP increased from 103.4% in 2000 to 129% in 2009, while net external debt increased to 100% of GDP, from 45% in 2000. Note that most of the external debt is held by the government.

Romania - Romania recorded since 2000 significant growth rates, rates that later proved to be unsustainable. Although the degree of convergence has increased over the years, there were a number of internal imbalances which have increased over time. For example, although there were wage increases especially in the state sector, uncorrelated with productivity growth, labor market showed some rigidity and participation rate remained low.

Economic boom generated by euphoric domestic demand generated pressure on the trade deficit which widened from to five percent (in 2000) to 14% (in 2007). Economic boom has also been fueled by massive capital inflows, surplus averaging about 17% in 2004-2007 period. The euphoria of the previous years, represents the crisis origins, which permitted the contagion to Romania from global economic crisis when it had a significant budget deficit, inflationary

pressures, a growing and unmanageable current account deficit[(9)] and a lack of structural reforms which were needed to progress.

Although institutions showed no consistent management regarding the arisen crisis challenges, the lack of transparency in the implementation and the anticipation of certain decisions affecting the degree of competition and of efficient investment in the economy. Romania has passed the first part of the crisis relatively well, with a number of progresses in terms of strengthening overall macroeconomic framework.

Once the crisis felt in our country, Government adopted a series of macro stabilizing measures, calling in the same time for the help of the International Monetary Fund. These measures started to be implemented since May 2009 and were targeted especially on macro stabilization rather than structural side. For the beginning the budget deficit was reduced by controversial pro-cyclical measures (VAT increase from 19% to 24%, a spending cut which was not necessarily the equivalent of greater efficiency), the current account deficit was also reduced mainly due to significant decline in domestic demand, inflationary pressures were monitored and the exchange rate recorded low variations etc. Exposure of the main banks towards the banking system was kept at the same level through the Vienna Agreement which was also helpful, avoiding the risk of a banking crisis

The results of implementing a set of measures supported by multilateral programs of the International Monetary Fund, World Bank and European Commission began to be visible in 2011, when registering a growth of 2.2% in real terms sustained growth of exports and the recovery favorable agricultural year. However, the absence of structural measures reflected light made the recovery in 2011 could not be sustained for a longer period of time and prospects this year and next period is not optimistic.

Adjusting severe public sector and private sector double adjustment following adverse international context and domestic economic policy decisions have created hostile conditions to economic recovery phenomenon, a phenomenon found in correlation with austerity measures mentioned above. In a relatively short time horizon, the impact these measures have had an impact on aggregate demand as restricting its. This translates also into a lower tax base and lower tax revenues, which put pressure on the income received from the state budget and determines other measures to rationalize public expenditure.

In the medium term, fiscal consolidation has an effect on the aggregate supply through micro-level channels and structures are reflected in the work motivation,

saving and investing. So the Government decided that reforming the tax administration must become a priority. Are still a number of both internal and external risks regarding Romanian economy in the short and medium term. That internal risks are worth mentioning: political instability and further assuming fiscal and budgetary consolidation process and the adoption of key structural reforms, the upward trend in the number and volume of bad loans, ensuring the efficient financing needs for 2012 as and for the next period; absorption of EU funds, which was far from expected levels, the consequences of a poor agricultural year, corruption, etc.

Regarding external risks should be mentioned decrease in global aggregate demand, contagion in the banking system as a result of diminishing confidence in some banks reluctant to trust in the ability of national governments to access capital markets, etc.

In these circumstances fiscal consolidation and fiscal discipline remains a basic necessity, while sustainable economic growth is rather a wish right now. Measures taken in 2009-2011 aimed at ensuring macroeconomic and financial stability, and since current measures are desirable phenomenon constitutes a sustainable growth engine in the future. Main challenges that remain valid as increasing public sector efficiency and the implementation of structural measures to increase competitiveness and generate then convergence in real terms.

4. Reforms

Spending reforms

Reform of pension expenditure was particularly important part of consolidation efforts in most advanced economies, particularly in Europe. Reforms generally focused on increasing the retirement age and, in some cases, accelerating previous reforms (France, Greece, Ireland, Italy, Spain).

These reforms should support growth by increasing the size of the workforce in the medium term. Reforms have "tightened" also criteria for early withdrawal (Greece, Italy, Spain) have increased taxes levied high pensions (Greece, Ireland, Italy), reduced indexation (Greece, Italy) or have changed the way calculation of basic pension, increasing the period for which the salary is taken into account (Greece, Spain). These reforms have greatly improved the situation in the medium term finances of pension systems. In particular the 2010 reform in Greece is

estimated to have reduced the present value of pension expenditure between 2010 and 2050 by more than 160% of GDP in 2010 (FMI, 2012).

More advanced economies have introduced reforms of health systems, although in most cases they are not expected to have a dramatic impact on long-term spending trends. In Europe, reforms aimed especially pharmaceutical expenditure restraint (France, Germany, Greece, Ireland, Italy, Spain), which is only about 15 percent of total public expenditure on health.

Most governments, especially in countries with the greatest needs adjustment, implemented measures to limit public sector wage bill, an item that was a key component for the fiscal consolidations of the past, countries can be offered as examples in this respect are the Nordic countries (mid 90s).

Most European economies except France and Germany recently announced such measures. Categories of expenditure concerned in this regard were the social benefits, but policymakers seeking to preserve social justice through better allocation of social spending. At the same time, public investment registered large reductions in most economies, such as Italy and Spain. Even though many of these investments were ineffective a sharp decline in capital spending may prove costly in the medium term because of the negative impact on potential GDP.

Revenues reforms

On the revenue side of the budget, advanced economies have tried to focus on less distortive taxes such as indirect taxes and property. Most countries have increased excise duty and took steps to improve the level of tax revenue collection.

In Europe, many countries have increased their revenues either by increasing VAT rates (France, Ireland, Romania, Spain), or by broadening the tax base (Greece, Ireland, Portugal). Many countries have increased property taxes (Greece, Ireland, Italy, Portugal), which are expected to have a relatively limited impact on economic growth. Nevertheless, several countries, especially those needed to implement large adjustment programs, have had to adopt several measures to increase income and increasing taxes on labor and capital.

Increases in personal income taxes took the form of increasing the tax base (Greece, Portugal) and increasing marginal rates (Spain). Several states also increased corporate income taxes (France, Italy, Portugal) and capital gains (Ireland, Italy, Portugal), which may affect private investment (for more details see Annex 1).

Institutional reforms

To enhance their financial credibility, many countries have adopted measures to strengthen fiscal governance. In the European Union, the European Semester was created to facilitate coordination of macroeconomic policies. In several Euro area countries (Austria, Germany, Ireland, Italy, Portugal, Spain), law, even at constitutional level, now required to maintain a balanced structural fiscal positions in the medium.

In many countries there were new institutional arrangements to strengthen implementation and monitoring processes. Greece, Ireland and Portugal created a medium-term budgetary frameworks. Greece adopted a medium-term fiscal strategy, Ireland has established a three-year expenditure ceilings for each ministry, while the stability program of Portugal includes an indicative program spending cap. In addition, many countries have created independent bodies responsible for monitoring the implementation of fiscal policy fiscal rules, paying more attention to tax issues. In Ireland and Portugal fiscal councils were created in 2011.

Further analysis performed and watched a few key indicators to observe the effects of measures taken by elected governments (Spain, Portugal, Italy, Greece, Ireland and France), such as the growth rate of GDP, annual growth rates of exports and imports, unemployment rate, the growth rate of unit labor cost, public debt as a share of GDP structural deficit and budget deficit, the annual growth rate of domestic demand and the growth rate of investment. The table below summarizes the forecast by the European Commission by the end of 2012 of these macroeconomic indicators:

Table 1. *European Commission forecasts for 2012 regarding analyzed countries*

Indicator	GDP growth rate	Exports growth rate	Imports growth rate	Unemployment rate	ULC growth rate	Public debt (%GDP)	Structural government deficit (%PIB)	Government deficit (%PIB)	Domestic demand growth rate	Investment growth rate
Euro area	-0.4	2.5	-0.5	11.3	1.4	92.9	-2.2	-3.3	-1.8	-3.5
UE27	-0.3	2.2	0.1	10.5	1.9	86.8	-2.7	-3.6	-1.3	-2.2
Spania	-1.4	2.1	-6.3	25.1	-2.7	86.1	-6.3	-8	-4	-9
Portugalia	-3	4.3	-6.6	16.5	-4	119.1	-4.1	-5	-7.1	-14.1
Italia	-2.3	1.1	-7.2	10.6	2.2	126.5	-1.4	-2.9	-3.8	-8.1
Grecia	-6	0.8	-10	23.6	-8.6	176.7	-1.5	-6.8	-9	-14.4
Irlanda	-0.4	2.8	0.3	14.8	-0.9	117.6	-7.9	-8.4	-2.2	-4
Franța	0.2	2.6	0.8	10.2	1.6	90	-3.4	-4.5	0.4	0.3

Source: Autumn forecasts of European Commission, November 2012.

Thus, due to the measures decided by national governments, government spending cuts or tax increases, there is a sharp decline in domestic demand, especially in Portugal, Greece and Italy. In the EU-27 domestic demand (private consumption and government consumption) will decrease by more than one percent, while at the 17-nation Eurozone will be more pronounced decrease of 1.8% compared with 2011. In Greece, private consumption is estimated to be reduced by 7.7% to 6.2% and the government. Another State for the European Commission forecasts sharp drop in domestic demand of over 7% is Portugal. The only country that is projected a slight increase in domestic demand is France (+0.4%). Contraction in domestic demand is explained by high rates of unemployment in these countries to meet (25.1% predicted value for Spain, 16.5% in Portugal, 23.6% in Greece and 10.6% in Italy), leading the contraction of private consumption demand, and then the government announced spending cuts during 2012.

5. Conclusions

To lower public debt to GDP ratio will be required fiscal adjustments, which need to be maintained for a long time from now on. The main compromise is to ensure a fair distribution of the economic consolidation effects, in order to avoid tensions which are hard to manage, especially in terms of social component, or distortions that prevent economic recovery.

Fiscal policy, correlated in an appropriate way to monetary policy can create a balance between inequality and growth management if they are considering some future impact variables such as education system and the labor market as a whole.

Notes

(1) European Commission website – Financial assistance in EU Member States http://ec.europa.eu/economy_finance/assistance_eu_ms/index_en.htm.

(2) Spain requested financial assistance in June-July 2012 to support its banking system, which may rise up to 100 billion Euro.

(3) Spanish government created a liquidity fund up to 18 billion Euro to help indebted regions.

(4) According European Commission (EC), between 1996 and 2009, in Spain was created above 6.5 millions of new housing and prices almost have tripled between 1997 and the beginning of 2008. Therefore, the share of investment in construction sector in GDP reached 22% in 2006-2007, from de 15% in 1995, this sector accounting 14% of total employment in 2007, compared with 9% in the period before the expansion.

(5) Anglo-Irish Bank was nationalised in January 2009 (29,3 billion Euro), Allied Irish Bank received 7.2 billion Euro, Bank of Ireland 3.5 billions, Irish Nationwide Building Society 5.4 billions and EBS Building Society 0.9 billion euro.

(7) According Eurostat, between 1996-2007, employment rate raised from 62% to 73.8%, while unemployment decreased from 11% to 4.9%.

(5) Unit Labor Cost (ULC) represent raport between growth rate of wages and growth rate of labor productivity.

(6) Regarding Ireland economy, is important to note that, although economic growth is traditionally cuantified in terms of Gross Domestic Product (GDP), for this country Gross National Income (GNI) is more appropriate to measure economic growth. The difference between GDP and GNI is that, while GDP reflect economic activity in a particular territory, GNI measure the activity of national economic agents, regardless of their location. GNI represent GDP adjusted by the difference between income inflows from the external activities of national production factors and income outflows of internal activity of foreign production factors (for more details http://www.ipe.ro/RePEc/WorkingPapers/cs18_1.pdf, page 6). For Ireland case, this difference is significantly negative because of profit repatriations from multinationals. Thus, GNI is about 20% smaller than GDP and is more useful to measure the living standards in Ireland.

(9) Fueled by the expansion of credit to households.

References

Ahrend, R., Catte, T., Price, R. (2006). "Interactions Between Monetary and Fiscal Policy: How Monetary Conditions Affect Fiscal Consolidation", *OECD Economics Department Working Papers*, No. 521

Batini, N., Callegari G., Melina G. (2012). "Successful Austerity in the United States, Europe and Japan", *IMF Working paper*, July

Buti, M., Turrini, A. (2012). "Slow but steady? Achievements and shortcomings of competitive disinflation within the euro area", European Commission, *ECFIN Economic Brief*, Issue 16, November

Centre for Economic Policy Research (2012). "Austerity: Too Much of a Good Thing?- A VoxEU.org eCollection of views by leading economists", London

Christiano, L., Eichenbaum M., Rebelo, S. (2011). "When is the government spending multiplier large?", *Journal of Political Economy*, 119(1), pp. 78-121

DeLong, B., Summers, L. (2011). *Fiscal Policy in a Depressed Economy*, Spring, Brookings Panel

Devries, P., Guajardo, J., Leigh, D., Pescatori, A. (2011). "A New Action-Based Dataset of Fiscal Consolidation", *IMF Working Paper*, No. 11/128

European Commission (2012). *European Economic Forecast. Autumn 2012*. Directorate General for Economic and Financial Affairs, November

European Commission (2012). "Economic Adjustment Programme for Ireland. Summer 2012 Review", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 115, September

European Commission, "Macroeconomic imbalances – Italy", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 107, July

European Commission (2012). "Macroeconomic imbalances – France", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 105, July

European Commission (2012). "The Economic Adjustment Programme for Portugal. Fifth review -Summer 2012", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 117, October

European Commission (2012). *Tax reforms in EU Member States 2012. Tax policy challenges for economic growth and fiscal sustainability*, Directorate General for Economic and Financial Affairs, Directorate General for Taxation and Customs Union

European Commission (2012). "The Financial Sector Adjustment Programme for Spain", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 118, October

European Commission (2012). "The Second Economic Adjustment Programme for Greece", Directorate General for Economic and Financial Affairs, *Occasional Papers*, No. 94, March

Hall, R.E. (2009). *By How Much Does GDP Rise If the Government Buys More Output?*, Brookings Papers on Economic Activity, Fall, pp. 183-231

Hrebenciuc, A. (2010). "Public Debt Evolution in the Eurozone and the Need of Policy Coordination", *Theoretical and Applied Economics*, Vol. XVII

International Monetary Fund (2012). *Fiscal Monitor: Taking Stock. A Progress Report on Fiscal Adjustment*, October

International Monetay Fund (2012). *World Economic Outlook: Coping with High Debt and Sluggish Growth*, October

International Monetary Fund (2010). *World Economic Outlook*

Moldovan, I., Adam, A., Hudea, S. (2010). *Financial Crisis Mechanism and Contagion Effect*, Challenges of the Knowledge Society

Trabandt, M., Uhlig, H. (2012). "How Do Laffer Curves Differ Across Countries?", *NBER Working Paper*, No 17862, 2012

Traşcă, D., Popa, R., Dudian, M. (2011). "Romanian companies convergence challenges in the perspective of the "Europe 2020" Agenda", *Revista de teorie şi practică economică-financiară*, Sibiu

Woodford, M. (2011). "Simple Analytics of the Government Expenditure Multiplier", *American Economic Journal: Macroeconomics*, 3(1), p. 135

Eurostat database

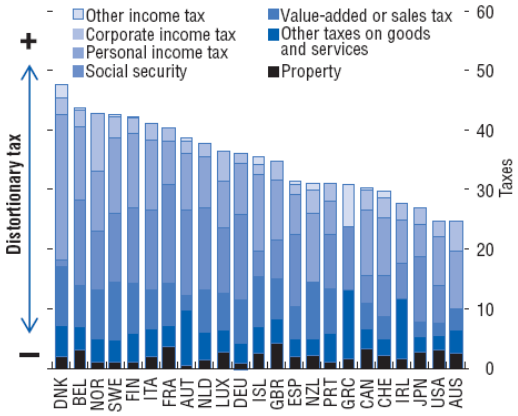
Annex 1

Decided measures on revenues and expenditures side starting 2009

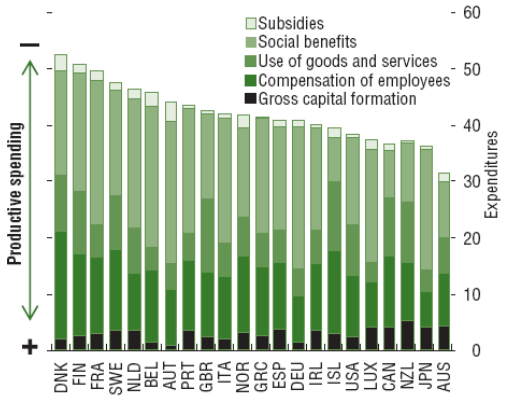
	Expenditure Measures							Revenue Measures							
	Public wage freeze/ reduction	Control of the size of civil service	Savings from pension-related spending	Savings from health care–related spending	Reduction in social benefits[1]	Reduction in public investment	Other expenditure measures	Increase in personal income tax	Increase in corporate income tax	Increase in capital gains tax	Increase in social security contribution rates	Increase in value-added or sales tax	Increase in excises	Increase in property tax	Improvement in tax compliance
Canada	✓	✓	✓			✓	✓[2]	✓			✓		✓		
France		✓	✓	✓			✓	✓	✓		✓	✓	✓		
Germany					✓				✓						
Greece	✓	✓	✓	✓	✓	✓	✓[2]	✓			✓	✓	✓	✓	✓
Ireland	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓	✓	✓[2]	✓	✓	✓	✓	✓	✓	✓	✓
Japan	✓	✓				✓	✓	✓			✓		✓		✓
Korea															✓
Portugal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Spain	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
United Kingdom	✓	✓	✓	✓	✓	✓	✓[2]	✓		✓	✓	✓	✓		✓
Romania	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓		✓
Poland	✓	✓	✓		✓			✓		✓	✓	✓	✓		

Source: European Commission, IMF Report.
[1]Excluding pension and health care benefits.
[2] Savings from spending efficiencies.

Tax categories classified according to the degree of distortion



Tax categories classified according to the degree of multiplication



Source: IMF, Fiscal Monitor, October 2012.

Theoretical and Applied Economics
Volume XX (2013), No. 11(588), pp. 147-164

Origin of the product and the buying decision

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Abstract. *This article is arguing that Conjoint analysis may offer a solid framework, able to determine the influence of the origin of the product in the consumption decisions. After a research of this framework, an empirical research on wine is conducted. Research is suggesting that there is, for the wine, a certain influence of the origin of the product in the buying decision. Even more, it is not the real origin that counts but the perceived one. The way the consumers perceive a certain region, or country matters and Wine sellers should focus on this influence in their branding strategies.*

Keywords: structure of preferences; origin of the product; wine; branding; Conjoint analysis.

JEL Classification: D12.
REL Classification: 7B, 14E.

Introduction

The global competition generated by the European Union extension and by the permanent trade liberalization has also caused a higher pressure on each separate enterprise in the wine industry (Bröckmeier, 1993, p. 98).

The benefits of this competition are mainly reflected in the high quality, products manufacturing and presentation manner, but also in determining the price that can be obtained by the bidders (Palloks, 1995, pp. 119-121).

Due to the market condition, the enterprises of various fields are attempting to strengthen their market positioning. Furthermore, more and more new and or modified, re-branded products emerge on the market (Palloks, 1995, pp. 119-121).

This is the case of Romanian winegrowing-viticultural enterprises, which are trying to enter the European Union markets and in particular the German market.

For an enterprise, the market entry of an innovative product (even of a slightly modified product, of similar products thereof or of a replica thereof Köhler, 1989, p. 223), represent, on one hand, a growing and stability potential, and, on the other hand, a risk related to the market reaction to a novelty.

In case of a failure, under the current market conditions, this can be quite severe and can automatically generate significant financial loss. This risk was in the focus of the economical specialists permanently in the last 35 years. That's we can find similar conclusions in older publications, like the ones of Urban and Hauser (Urban, Hauser, 1980, p. 2, p. 42).

The innovation specific problems can be found in the high rate of failures of the German food products trade, which, in 1995, has been of 45%, and in 2010 of 56% (Scharf et al., 2011, p. 26).

Among the main reasons of failure related to new products we could mention the inappropriate orientation, compared to the consumer's desires and needs, as well as the limited differentiation between products (Becker, 1988, p. 492).

In order to mitigate the number of errors, namely in order to increase the success rate, we recommend the integration of consumer – and competition –related information, from the very beginning, from the first product design and development stages (Urban, Hauser, 1980, p. 27).

In order to analyze the effect of certain product model preferences on the consumer, the practice often uses the Conjoint analysis method. This analysis method enables one to correctly evaluate the resulting utility in case of certain alternative product concepts and thus to support the Marketing Management in passing the decision

related to a product development or the design of a new concept, during a product best development stage (Mengen, Simon, 1996, p. 229).

In his article, we have selected the analysis method as perception research and preferences analyzing tool.

Conjoint method of analysis

Arzheimer defines the Conjoint analysis as a general term for the entire class of statistical methods, enabling one to split certain globally classified preferences (Arzheimer, Klein, 1998, p. 56).

The concept of items can include products, services, various investment funds products or political parties programs, all these characterized by a series of attributes (features). Such items are referred to in a global manner, due to the fact that these are evaluated by interviewees as a whole.

In fact, the concept of classified preferences means here stating a hierarchy based on which the interviewee is ranking the evaluation-related items. This means that the sequence of preferences takes place empirically. Based on these classified global preferences, the Conjoint analysis attempts to determine, for each interviewed person, which is the contribution of each item feature in determining the overall utility – thus, the method proving itself as a decomposing one. The Conjoint method aims at reconstructing the interviewed person's preferences development. The interviewed persons are not requested to weight and assess each separate feature, and consequently are not requested to decompose the products (Hair, 1998, p. 392).

In the Conjoint analysis, the items features represent independent variables, while the utility decisions of a set of items represent the dependent variables. A special element of the Conjoint analysis consists of the fact that the independent variables and features thereof are systematically changes by the researcher, in line with the method, and the interviewees solely decide the value assigned to dependent variables. Based on the research form (design), the Conjoint analysis is in fact an experimental method (Arzheimer, Klein, 1998, p. 1).

The Conjoint analysis is a method used mainly in order to assess the preferences, the opinions, as well as in order to develop buying intention forecasts (Sattler, 1991, p. 99).

By means of this method, one can evaluate the consumers' preferences, based on which certain "A posteriori" segmentations can be determined, to the extent accompanied by competition-related information, and certain statements related to trends and alternative marketing strategies success odds can be drafted. An

important benefit of the Conjoint analysis consists of noticing that this methods enables one to analyze the individual preferences of the interviewed person (Sattler, 1991, p. 100).

By means of Conjoint analysis, one attempts to identify the interdependencies between the preferences features and the features sub-features.

This is where the contribution of certain sub-features in the overall evaluation of a product is taking place. The aggregate and partial utility are measured at the same time and are additively connected (Schubert, 1991, p. 17).

"The Conjoint analysis is, in essence, an analysis of individual utility perception. Generally, we are interested in the utility structure of several persons" (Backhaus; 2005, p. 545).

In order to determine the preference of several consumers, an addition of individual results is required.

The main features of the Conjoint analysis are as follows:
- Approaching method: decomposition;
- Decisions related to several attributes (features) are required;
- The general evaluation is the result of partial decisions additive combination;
- The dependent variables may have a metric, ordinal or nominal scale;
- The evaluated parameters (utility values) normally (approximately) show a range scale;
- With respect to items, one can determine aggregate utility values, useful for the market share and options ratio forecasts (Hair, 1995, p. 558).

The main stages of Conjoint analysis are (Backhaus; 2005, p. 547):
- Features and sub-features determination;
- The analysis design;
- The stimuli evaluation;
- The utility values evaluation;
- The utilities values addition.

The first three steps are related to data collection, and the last two are related to data evaluation.

1. Selecting the features and sub-features thereof

The products are defined as a cluster of characteristics/features, gathered by an offeror in order to meet the desires and needs of its existing and potential customers (Brockhoff, 2003, pp. 464-481).

The features and sub-features should meet seven primary premises.

These premises are as follows (Backhaus, 2005, pp. 548-549):

1. No eliminatory criteria (K.O. criteria – as in boxing) should exist with respect to features and sub-features, respectively. The eliminatory criteria occur whenever one of the sub-features is mandatory for one of the interviewed persons.
2. A compensatory relation between the sub-features:

A negatively evaluated sub-feature can be replaced by the positive evaluation of another sub-feature.

This analysis is based on the assumption of an unidimensional decision-making process, meaning that all sub-features simultaneously become subject to the evaluation process.

3. Features independence: meaning that the utility of a sub-feature cannot be influenced by other features.
4. Limitation of the features and sub-features number: generates an exaggerated effort of the interviewed person.
5. The influencing degree: the possibility to change features (for instance, with respect to the product development).
6. The achieving possibilities: the manufacturer's product performance technical possibilities.
7. Relevance: should be selected features assumed as relevant for the buying decision, namely relevant for the aggregate utility evaluation.

2. Analysis design

"The stimuli represent a combination of sub-features, presented to the persons interviewed for evaluation purposes"(Backhaus, 2005, p. 550).

A complete or limited evaluation design may be selected, and the stimuli can be developed based on the profile or two factors method.

The two factors method is also known as the Trade–Off hypothesis. It is based on a systematic comparison two competing features. As evaluation stimuli, the features sub-features are being combined in the so-called Trade–Off matrixes.

In case of the profile hypothesis, the interviewed persons evaluate complete product concepts, which include all relevant product features. The test stimuli development basis consists of factorial experimental plans (factorial design), to which an incomplete fractional design generally applies (Perrey, 1996, p. 106).

This takes place amply, by taking into consideration features and sub-features of the products, fact that significantly contributes to the closeness thereof to reality, but this benefit based on partial data validity is inversely proportional with the possibility of evaluating the results. This is due to the fact that, for technical reasons related to data collection, in the Conjoint analysis, the number of stimuli

to be evaluated increases over-proportionally, and the interviewed person is overwhelmed by the information overload (Thomas, 1983, p. 313). The postulate stating that we should limit to relatively few features, but select characteristics relevant for the analyzed concept is directly connected with this.

The decision related to relevance and features selection should be taken, in addition to the beneficiary, who is generally interested in the effect of preferences on suggestible factors (that can be changed) within the concept, by some potential buyers, "because the companies often perceive their products differently than their customers" (Mengen, Simon, 1996, p. 234).

If we would compare the profile and the Trade-Off methods, we would note that it is easier for the interviewed persons to simultaneously compare only two factors at a time. That is why the "Trade-Off" method does not imply an individual in charge with the interview. However, during an actual decision-making process, complete products are generally being compared, regarding which the profile method provides a design closer to reality, and the stimuli may be presented by means of images or items. With respect to the time schedule, the profile method requires a longer period of time, implying a complete design (Backhaus, 2005, pp. 551-552).

With respect to the stimuli form of presentation, the decision is taken based on the product performance concept. In this case, we are mainly interested in the form taken by the evaluated products, when presented to the interviewed persons. The decision related to stimuli presentation form is strongly influenced by the data sampling method. With respect to the profile evaluation method, one may select a verbal, a visual or a physical presentation. Such forms may also be combined.

Due to the fact that the number of stimuli, in case of the profile method, exponentially increases with the number of features, a limited design is often required. This attempts to identify that part of stimuli that better represent the complete design. The design may be symmetrical or asymmetrical. A symmetrical design is the "Latin square" (namely three features, each with three sub-features, meaning 27 stimuli).

3. Stimuli evaluation

The interviewed persons should arrange the stimuli in hierarchical order, reflecting their perception on utility. Generally, each stimulus receives a score and is thus classified (Backhaus, 2005, p. 556).

4. Utility values estimation

From a methodical point of view, we are facing the issue of selecting the measurement elements that represent the primary variables basis. The estimation

of such dependent variables (total preference, buying probability, etc.) implies the use of certain measuring scales, able to translate the test stimuli features into values, based on preset rules.

The data, with the consumers' global ratings, may be measured both on the metric scale (range) and on the ordinal scale (Schubert, 2006, pp. 109-117).

The selection of the best parameters estimation method (of the partial utility value) depends on the measurement model and on the implied measurement levels (Schubert, 2006, pp. 109-117).

5. Utility values addition

The individual evaluations obtained by means of the Conjoint method have a secondary value in practice, due to the large differentiation thereof. In order to support the marketing management in identifying a solution regarding the development of a new product or in orienting the performance of a product concept, specific segment evaluations, representative for such segment are required. To this end, the data gathering/aggregation procedures should take into consideration both the general Conjoint analysis and the individual analyses (Thomas, 1983, p. 332).

In conclusion:

Due to the fact that, based on the Conjoint analysis results, the operational and strategic goals of an enterprise are being influenced, the estimated values should be valid and should enable an accurate interpretation.

Despite the fact that the Conjoint analysis ensures that the features preferred and defined by the customer represent, through its features, the product development starting point and target, the beneficiary of a Conjoint analysis (generally an enterprise) should not forget that this is an artificial testing circumstance required in order to evaluate the product concepts, which cannot perfectly reflect a real evaluation process. This issue should be considered in all Conjoint analysis application fields.

The Conjoint analysis method drawbacks become more and more insignificant due to the use in the market research practice of more and more modern procedures that solve traditional problems. Thus, by using, for instance, the adaptive method supported by computer software, one could develop a realistic stimuli concept, generating a higher validity of data and consequently test results closer to reality (Scharf et al., 2001, p. 28).

Conjoint analysis benefits

Undoubtedly, the Conjoint analysis is an analysis of the future, which, compared to the usual methods of a scale of values, shows several benefits, such as:

1) The products, offers, images, etc. are no longer decomposed into several components, re-summed during the analysis. The analysis focuses on the whole, and not solely on parts thereof.
2) This method is based on actual selection opportunities and generates an information overburden; consequently, the results are reflecting an actual buying circumstance.
3) The answers dissipation, for instance by means of certain social desires, is highly mitigated, due to the large volume of the issue presented to the interviewed persons who are more concerned about solving the problem.
4) The Conjoint analysis results enable progress, meaning that several combinations of features can be analyzed based on the buying attractiveness thereof, and generates data concerning the positioning odds, the price level, the offer improvement method, etc.

The Conjoint analysis shall not replace the scales development methods, but, in addition to the said methods, represents an extremely interesting and eloquent market research instrument (Beutelmeyer, 1986, p. 4).

Empirical research

In order to select the characteristics and the characteristics features, we have previously reviewed specialized magazines (such as: Weinwirtschaft – the economy of wine, Wein & Markt – wine and market, Lebensmittelzeitung – food products magazine), we have gathered information from certain marketing experts in the wine industry (such as: Gerd Adolph, Wolfgang Fehse, Dr. Hepp, Dr. Binder, Dr. Seiler) and from retail experts (such as: Adolf Czech, Gerhard Mayer, Ludwig Wengenmayer), and we have also questioned certain wine traders.

From my discussions with the experts, as well as from my survey performed between 2004-2012, started at Stuttgart Hohenheim, it results that the wine price, taste, color and origin represent important characteristics for the consumer, and are considered when buying wine.

The wine traders have been questioned in writing, by means of direct questions related to their wine buying criteria. Over 500 wine traders have received the questionnaires, and 58 have provided answers.

First question: “What requirements should be met by a wine in order to be included in your program?”

Summarizing, the wine traders have provided the following answers:

- The best price/performance ratio should be ensured.
- The package should be of high quality – an appropriate bottle presentation.
- Appropriate service – for instance, the smooth delivery is a requirement.
- Advertising support and high stock turnover required.
- The wine should meet the consumer's taste and should be of extremely high quality.
- During the tasting, the wine should convince me through a remarkable (excellent) taste, should not be a table product.
- The exclusivity of sale through specialized trade should be ensured. Unknown – yes, but en vogue (voguish).
- Handcraft manufacturing – not a consumer product.
- Should be a quality wine with set out origin – classification is important.
- The consumer is looking for grape categories and is interested in the growing region.
- The bottled wine should have a good maturation potential.

The second question is: "Which are the best sold wines?"

By means of this question, we intended to find out the requirements a wine should meet in order to be interesting for the trader.

The questioned traders have mentioned an average price segment between EUR 5.00 and 7.90.

A trend for red wine has been highlighted, as well as a reminder of traditional winegrowing regions and the orientation towards dry wine.

Being known that consumers have less time, and the offer gets bigger and bigger, one might ask: "How are you structuring your wine-related program?"

In addition too direct counseling, the traders are also attempting to satisfy their customers by means of a large assortments offer. The wine program is maintained attractive by means of the growing regions, countries of origin, price categories and actions subject to permanent change.

Due to the fact that this article mainly addresses origin, the forth question is related to the most appreciated, relevant winegrowing regions, namely the countries from where the most sold wine originates.

Most manufacturers have mentioned the following countries: Germany, France, Italy and overseas countries – mainly Chile. For France, the winegrowing regions have been mentioned directly. And, as we all know, the wine traders are trying to display a large range of assortments, but they cannot provide all.

That is why the fifth and the last question was: "From which countries you have no wines in your program?" Most wine traders failed to include in their offer wine

from East European countries. We refer to wine from Romania, Bulgaria, Albania etc.

“For the consumer, Hungary no longer belongs to Eastern Europe”, has stated one of the traders. And the Greek wines have earned their place on the shelves.

“The other wines have an image problem” said the wine trader Regina Bröse from Kiel.

In the empiric survey performed with consumers, 260 persons have been requested to rank 25 product profiles, based on their individual preferences.

The product profiles showed the following characteristics:

i. The country of origin (origin)
ii. The price category (price)
iii. The favor (taste)
iv. The wine color (color).

Table 1. *Features of the characteristics considered in the wine survey*

Characteristics	Characteristic expression
Country of origin	Germany
	France
	Italy
	Romania
	Chile
Price categories	Below EURO 1.99
	Between EURO 2.00 and 3.49
	Between EURO 3.50 and 4.99
	Above EURO 5.00
Taste (flavor)	Dry
	Demi-sweet
Wine color	Red
	white

Source: Own research.

Based on the performed research and the questionnaire results, the product description is ensured by means of the below mentioned objective characteristics and set of characteristics.

We have tried to focus on as few characteristics and sets of characteristics as possible, in order to avoid the questioned person’s overburden and to perform an analysis as close to reality as possible.

From the discussion with experts, examination of the specialized trade, as well as from the market survey performed by Professor Hoffmann, “origin” has proved itself as an important characteristic.

While at the discount stores the customers spend less than 30 seconds in front of the wine shelves, at the specialized trade premises the situation is completely different.

At a discount store, the customer buys the wine he is already familiar with, or the wine that benefits from strong advertising.

The discount store itself and the customers thereof are not our target group. The discount store often has “already sold” products.

The questioned wine importers explain that, in the food trade, Romanian wines have managed to earn their place solely based on price. We are talking about more than 95% of the wines examined in Germany. Thus, Romania can be easily replaced, and due to the low price, which also includes simple qualities, it gets a bad image. Consequently, Romanian wines, the Romanian original wines remain unknown by consumers. The experienced wine drinker or the customer expecting guests or who intends to give a bottle of wine as present, the counseling provided by the specialized trader is welcome. Here, in the specialized store, we can find customers spending more time in order to choose a wine, customers willing to live new experiences and keen to find something new. These customers are not only looking for a simple bottle of wine, but they intend to gain the others’ recognition for the quality of consumed products.

The specialized stores are arranged so that the customer is able to read the wine origin (country of origin) on the shelves. Statistics show that more than half of the wines consumed in Germany originate from abroad. Germany is also the largest wine import market and thus extremely interesting for the wine manufacturing countries. Italy and France are still fighting for the first place. Due to the importance of these countries characteristics, such as origin, have been selected for the set of products. Statistics show, on one hand, the explosive development of new countries, and, on the other hand, why one of the sets is called Chile. The basis of this analysis is the set Romania. Due to the questioning location and to the sold quantity, the set “Germany” is natural. Of course, other origins would also be interesting, but the goal of this paper consists of a better positioning of Romanian wines. The next characteristic is price, and here we have determined four sets (pricing classes) which, based on volume, are covering 90% of the sale of wine.

The next characteristic is the wines taste/flavor. Officially, the Wines Act - EU (comp. Law No. 494 on vineyard and wine) sets out the taste classification (dry, demi-dry, demi-sweet, sweet).

These are limited based on sweetness (quantity of sugar in wine g/l).

But, in practice, a consumer often refers to a less acid dry wine as demi-dry wine or to a more acid demi-dry wine as dry wine. Due to this reason, and in order to simplify the research, the taste/flavor characteristic shall only contain two sets, namely dry and demi-sweet.

The last characteristic is the wine color. Here, the nature has limited the selection options, the sets being red and white. The ratio of rose wines in the total quantity of sold wines has an average of approximately 7%.

That is why rose wines have not been considered in this survey.

Determining the preference pattern

The considered sets of characteristics are based on the fact that, for most of the questioned persons, a compensatory decisional rule applies. Although consumers often buy a certain wine, of a certain origin, with a certain price, certain taste and certain color, the research and the pre-survey results have suggested that most questioned persons would rather switch to a different wine with sets of characteristics less wanted, compared to the wine they usually buy, than to no longer buy any wine (as it would happen in case of non-compensatory decisional rules). Furthermore, it is considered that most questioned persons are evaluating characteristics independently one from another, so that the preferences pattern should not consider an interaction between characteristics, but could apply a cumulative association. This presumption is also supported, among others, by the fact that, for wine varieties, we can notice a certain variability of the expressions of characteristics combinations for each separate product considered by the questioned person for buying purposes, and thus familiar with. For instance, the red wines are often packed in Bordeaux bottles of the same color, mostly brown, and the white wines in green or white Rhin type bottles. For all characteristics, the partial benefit pattern is being used as evaluation function. No characteristics redundancy applies. The use of cumulative partial benefit pattern for the preferential pattern is supported by the fact that, in case of the cumulative partial benefit pattern, which is a robust and flexible pattern, which represents the dominant preferential pattern in the Conjoint analysis, all required premises are being met.

Data research structuring

In the Conjoint analysis, the used data structuring method consists of the global profile method. Typically, the Conjoint analysis uses the global profile method, which is much closer to reality than the two factors (bifactorial) method (Albrecht, 2000, p. 60).

In the previous paragraphs we have explained the preferential pattern selection as being the cumulative partial benefit pattern, which solely contains primary effects, with no interaction effects. That is the reason why, in order to systematically determine the type and number of stimuli, we are using an orthogonal design with primary effect. Due to the fact that various products, wines, are described by means of four characteristics, out of which: one with five features, another with four features, and by means of two characteristics, each with two features, the SPSS statistics software is being used for the orthogonal plan (Backhaus, 2005, p. 521).

After several permutation attempts, the 25 stimuli result and are consecutively presented to the interviewed persons, as cards, each describing a potential product. We are talking about an asymmetric design (5x4x2x2). The research design is developed based on the profile method. In case of a complete design, namely one that considers all possible combinations of characteristics' features, one would obtain (5x4x2x2) = 80 fictive products, called stimuli. The evaluation of all these 80 stimuli would definitely overburden the questioned persons, and consequently there has been decided to develop a narrower design. By means of SPSS, the ortho-plan procedure enables us to develop narrower designs (orthogonal arrays) (Backhaus, 2005, p. 570). Currently, the ortho-plan procedure operates based on Adelman plan. Through the orthogonal design, the 80 stimuli (5x4x2x2) of the complete design are reduced to 25 product profiles, which must be evaluated by the questioned persons. The ratio between the stimuli to be evaluated and the preferential pattern parameters to be estimated is of 1:3.

Setting out the decisions

The Conjoint analysis uses the buying intention and decisional criterion, due to the fact that it requires determining the structure of preference, which is the basis of the actual buying decision. In order to avoid the questioned persons' overburden and to reduce the survey size, the questioned persons are requested to arrange the stimuli, on a hierarchical scale, based on the buying intention. First of all, the questioned persons need to divide the 25 stimuli into five different categories, based on the buying intention, and, within each group, to create a hierarchical scale, prior to ranking all product profiles. This procedure has been selected in order to obtain a more intense

confrontation of the questioned persons with each set of characteristics, on one hand, and, on the other hand, in order to avoid the questioned persons' overburden caused by the immediate ranking of all 25 product profiles. The personal verbal questioning has been used as questioning form. It is essential that this survey, where the influence of several factors on the measurement of the structure of preferences is evaluated by means of the Conjoint analysis, shall not allow any other questioning form. In addition, it is considered that most of the questioned persons are not familiar with he evaluation tasks implied by the Conjoint analysis and, consequently, require support.

Developing the presentation form

This article uses the same presentation form for questioning the procurement agents of the food trade, specialized trade, consumption at the Romanian stand, as well as for consumer with no connection to Romania whatsoever. A mixed form has been selected as presentation form, where the bottle of wine has been figuratively illustrated, the origin has been highlighted, and the other characteristics have been illustrated by means of key words, based on the printed cards description.

Each questioned person, irrespective of his/her Cluster group, shall receive the same cards.

The 25 product profiles of the Conjoint analysis are mentioned on printed cards, namely one card for each product profile.

Each questioned person will be asked to arrange these cards based on his/her buying intention.

The questioning results are entered in a table for each questioned person, where the columns represent the product profiles, and the rows contain the hierarchical data of the questioned persons.

A table is drafted for each of the four Cluster groups, resulting four times four results, and at the end the results are being analyzed and compared.

Evaluation of the preferential pattern parameters

In this article, the decision concerning the hierarchical order is being evaluated by means of the Conjoint analysis of SPSS software.

The procedure can be briefly characterized as follows:

Table 2. *Input and output in the CONJOINT SPSS procedure*

INPUT	CONJOINT SPSS Procedure	OUTPUT
Characteristics: Sets of characteristics	Performance: Orthogonal design	Ortho Plan
Preference hierarchical order: pro subject person.	Data – file	Printed cards Partial benefit Relative importance of the characteristic Quality measure

The input consists of the characteristics and characteristics features considered by the survey, and the output thereof consists of the printed cards generated by SPSS within the orthogonal design. These will be evaluated by the questioned persons.

The next input consists of entering the product profiles-related preferences hierarchy set out by the questioned persons. Based on such data, the preferential pattern parameters are being estimated for each questioned person.

The output consists of the partial benefits, relative importance of the characteristics and a quality measure, which highlights the quality of obtained parameters.

Determining the aggregate results

The aggregate results have been obtained for each separate Cluster group (food trade, specialized trade, consumers with no connection to Romania whatsoever, consumption at the Romanian stand). For the food trade buyer, price has played the most important role. The relative importance of the price characteristic has exceeded 63%. This proves once again that the German consumer is looking for products at the best price. This result is also consistent with the information gathered from statistics, concerning the large quantity of wines bought from discount stores.

The discount stores have proved to the consumer that famous wines can also be bought at low prices. Based on the low margin of the discount stores and on the extremely large quantity of wine acquired directly from producers, such stores benefit from a different computation system than the specialized store trader.

The German consumers are trying to make savings wherever they can. Advertising logos such as “Geiz ist geil (avarice is cool)” have motivated ladies with convertibles to buy from Aldi. The wine producers all over the world are offering wine at more and more advantageous prices. Initially, the overseas countries were obtaining EURO 6.00 per bottle, and nowadays are offering bulk

wine for EURO 0.20/liter. Even the trade with French wines has been affected by the easy drinkable wines, with low acidity and tannin content imported from the overseas countries.

Even the French must lower their prices this year. From the East European countries, Hungary, as EU member state, is the first SOE country that has managed to maintain its positioning on the German market and, furthermore, to also create an image on external markets.

One of the less benefic liberalization outcomes, including for the Hungarian domestic wine market, consisted of the fact that the wine producers have been forced to adjust their prices, in line with the competition, which, in fact, has meant a severe decrease of the wine pricing.

These experiences faced by our neighbors should also represent a warning signal for our producers, which are currently obtaining on Romanian market prices other producers from different countries would not even dream to obtain on European markets.

A country with no image cannot face the harsh competition on the international wine market. The performed analysis is clearly showing that, after price, the brand, namely the origin, represents the second important characteristic for the food trade buyer.

The relative importance of the origin characteristic is around 29%.

The food trade buyer is looking for wines which, due to advertising, verbal propaganda and high notoriety, acquire a large turnover.

The taste and color features are also important for the buyer, but due to the large offer variety have not been the main focus.

Based on the analysis performed at the specialized trade segment, the price and origin characteristics are sharing the same place. In this case, the wine flavor has a relative importance of 11%. We can clearly see a preference for dry wines. Despite all massive advertising and the above mentioned trends, the white wines register more than half of the total consumption.

Here, in the specialized trade, Romania has the opportunity to create a name, because, according to the analysis, in the discount trade pricing is crucial.

The results of the analysis performed on consumers not connected to Romania in any way are similar to those obtained when questioning the food trade and discount store buyers. These results also represent an evidence regarding the relevance of the performed analyses, because part of consumers are buying from food and discount stores, and part of them from the specialized trade segment.

It is interesting to notice the large difference of the results of analyses performed on consumers visiting the Romanian stand or of those somehow related to Romania. Here, the consumers mostly focus on taste than origin. We could hear often, during the interview: “the wine must be tasty and must have a good pricing, and we will buy it”. This statement represents a reaction of sympathy and kindness, in response to the hospitable welcome at the Romanian stand.

The survey performed by Meiniger Publishing House and signed by Professor Hoffmann shows us how little time the consumers are spending in front of the wine shelves, reason for which they are buying already (pre-) sold products.

Consequently, Romanian wines are positively perceived by consumers, based on quality and price, following a prior tasting, but for most consumers such wines remain unknown. It is even more severe when a consumer says: “oh, yes, I know Romanian wines, they are sticky, sweet and cheap. You definitely get a headache from these.” Or, other Eastern Germany consumers, refer to these wines as: “grandpa’s wines”.

Conclusions

Through the specialized stores, Romanian wine producers would benefit from a specialized consultant, who would enable the consumer to become familiar with the product and to trust such product.

For an unknown product, with no positive image in the consumer’s mind, it is extremely hard to sell otherwise than based on pricing.

The strategy of the lowest pricing is the wrongest solution for Romanian wines, which fail to exist in excess and must be sold despite any sacrifice.

Romanian wines require a story, a sign of recognition, a brand, in order to position them in the mind of the German consumer, for example, in the place they belong to be.

From the performed research, it results that Romanian wines need to be introduced on the market, to be subject to tasting campaigns and to be compared with other products of the same pricing category.

Romanian producers should stop neglecting the expert markets, which, strictly economically, are not yet interesting, just because the domestic market provides better prices, and should start creating, slowly, but safely, a positive image on the export markets.

Acknowledgements

This research material has been performed with the support of Professor Dr. Ioan Namolosanu from the University of Agricultural Sciences and Veterinary Medicine and has been financed from private funds.

References

Albrecht, J. (2000). "Präferenzstrukturmessung. Ein empirischer Vergleich der Conjoint-Analyse mit einer kompositionellen Methode", *Disertaţie,* Editura Peter Lang, Frankfurt

Arzheimer, K., Klein, M. (2000). *Die Conjoint-Analyse als Instrument der Empirischen Wahlforschung*, Editura Van Deth, Opladen: Leske und Budrich

Aust, E. (1996). *Simultane Conjointanalyse, Benefitsegmentierung, Produktlinien-und Preisgestaltung*, Frankfurt am Main

Bachhaus, K. et al. (2005). *Multivariante Analysenmethoden. Eine anwendungorientierte Einführung*, ediţia a 11-a revizuită, Editura Springer, Berlin

Becker, T., Benner, E. (2000). "Zur Problematik der Herkunftsangabe im regionalen Marketing, Rapoartele de lucru agro-economice ale Universităţii Hohenheim", *Raportul de lucru Nr. 1, Stuttgart*

Beutelmeyer, W., Mühlbacher, H. (1986). *Standardisierungsgrad der Marketingpolitik transnationaler Unternehmungen*, Viena

Brockhoff, K. (2003). "Customers perspectives of involvment in new product development", *International Journal of Technology Management,* pp. 464-481, Vol. 26, nr. 5-6/2003, Inderscience Publishers, Germania

Brockmeier, M. (1993). "Ökonomische Analyse der Nahrungsmittelqualität", *Agrarökonomische Studien, volumul 17,* Kiel

Hair, J.F. et al. (1998). *Multivariate Data Analysis*, 5th Ed. Upper Saddle River, NJ: Prenetice Hall

Köhler, D.J. et al. (1996). *Confidence and Accuracy*, in *Trait Inference: Judgment by Similarity, Acta Psychologica*

Mengen, A., Simon, H. (1996). "Produkt-und Preisgestaltung mit Conjoint Measurment", *Das Wirtschaftslexikon, 25. Jg.*, pp. 229-236

Palloks, M. (1995). "Kundenorientierung und Kostenmanagement", *Marktforschung und Management, Jg. 39, broşura 3*, pp. 119-124

Perrey, J. (1996). "Erhebungsdesign - Effekte bei der Conjoint – Analyse", *Marketing Zeitschrift für Forschung und Praxis, 18. Jg. (2),* pp. 105-116

Sattler, H. (1991). "Herkunfts- und Gütezeichen im Kaufentscheidungsprozess", *Metzler und Poeschel (M&P) Verlag für Wissenschaft und Forschung*, Stuttgart

Scharf, A. et al. (2011). *Einführung in die Theorie und Praxis*, ediţia a 3-a, Editura Schäffler – Poeschel, Suttgart

Schubert, B. (2006). Conjoint – Analyse, Handelsblatt, Wirtschaftslexikon, volumul 2, pp. 109-17

Schubert, B. (1991). *Entwicklung von Konzepten für Produktinovationen mittels Conjoint – Analyse*, Editura Poeschel, Stuttgart

Thomas, L. (1983). *Der Einfluss von Kindern auf Produktpräferenzen ihrer Mütter*, Duncker & Humboldt, Berlin

Urban, Glen L., Hauser, J.R. (1980). *Design and Marketing of New Products*, Englewood Cliffs N.J.: Prentice Hall, New York