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REVERSE BONUS CERTIFICATE DESIGN AND VALUATION USING PRICING BY DUPLICATION METHODS

Martina BOBRIKOVÁ[*], Monika HARČARIKOVÁ[**]

Abstract

In this paper we perform an analysis of a capped reverse bonus certificate, the value of which is derived from the value of an underlying asset. A pricing formula for the portfolio replication method is applied to price the capped reverse bonus certificate. A replicating portfolio has profit that is identical to profit from a combination of positions in spot and derivative market, i.e. vanilla and exotic options. Based upon the theoretical option pricing models, the replicating portfolio for capped reverse bonus certificate on the Euro Stoxx 50 index is engineered. We design the capped reverse bonus certificate with various parameters and calculate the issue prices in the primary market. The profitability for the potential investor at the maturity date is provided. The relation between the profit change of the investor and parameters' change is detected. The best capped reverse bonus certificate for every estimated development of the index is identified.

Keywords: capped reverse bonus certificate, underlying asset, replicating profit, vanilla option, up-and-out option

JEL classification: G11, G13

1. INTRODUCTION

Nowadays the structured products continue to be an attractive and interesting business segment for many financial institutions. Therefore financial institutions are still creating new types of these sophisticated products according to requirements of the investors.

Swiss Structured Product Association (SVSP, 2015) defines the structured products as innovative and flexible investment vehicles based on derivatives, which provide an attractive alternative to direct financial investments such as a share in a company, a basket of shares, an entire index, commodity or currency. Investors can have an access to asset classes through structured products that are difficult and expensive to invest in. For example studies like Benet *et al.* (2006), Bluemke (2009), Rossetto and Bommel (2009) deal with the structured products. They can be created for every risk-return profile with various levels of capital protection or without protection, but with determination of the maximum potential

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loss to the initial invested amount. Therefore they are ideal additions to any portfolio. The role of structured products in behavioural portfolios is studied in works like Breuer and Perst (2007) or Das and Statman (2013).

The biggest part of the structured products introduces investment certificates. Investment certificates became popular in Europe in the 1990s during a period of low interest rates. Nowadays, they are the fastest growing retail financial products in the capital markets around the world.

Investment certificate is a security, the value of which is derived from the value of an underlying asset. The underlying asset is usually a share in a company, a basket of shares or an index. There is a suitable kind of certificate (linear, guaranteed, airbag, discount, outperformance, turbo, bonus etc.) for every estimated development of an asset (growth, fall or stagnation) or for every attitude to risk (conservative or aggressive investor). Investment certificates are created through the process of financial engineering as a combination of the underlying asset with derivatives, often an option (vanilla and/or exotic option). Outperformance certificate is examined by Šoltés (2010b) and Hernandez *et al.* (2013). Hernandez *et al.* (2011) and Gordiaková and Younis (2013) analyse the various types of investment certificates creation. The construction of the investment certificates through the option strategies is investigated in papers like Šoltés (2010a, 2012) and Šoltés (2011).

Valuation of every investment certificate is based on pricing by duplication methods. The value of the investment certificate is identical to the value of the replicating portfolio. The replicating portfolio is created as a combination of the position in the underlying asset together with the option position. Papers like Burth *et al.* (2001), Wilkens *et al.* (2003), Grunbichler and Wohlwend (2005), Stoimenov and Wilkens (2005), Henderson and Pearson (2011) deal with the issue of the valuation. Wilkens and Stoimenov (2007) and Baule and Tallau (2011) provide the empirical research of the pricing for investment certificates in the German market. Hernandez and Liu (2014) analyse the pricing of exotic bonus certificates.

Options are the basic part of every investment certificates. Due to options, the specific risk-return profile of investment certificates is secured. Hull (2012) defines vanilla option as a financial contract granting its holder (the buyer) the right, but not the obligation, to buy (call option) or sell (put option) a given underlying asset at a predetermined price (the strike price or the exercise price) of the option at any time within a specified expiration period of option (American style) or at the time of expiration of option (European style). For this right the option premium is paid to the option seller (the writer). Exotic options have some different characteristics compared to vanilla options, however the essential features are the same. Probably the most popular type of exotic option is barrier options. Barrier options are new generation of options, which contain the second strike price, referred as the barrier level according to Taleb (1997). Exceeding the barrier level during the option life means activation (knock-in) or deactivation (knock-out) of option. The barrier may be over (up) or below (down) the actual price of the underlying asset at the time of closing option contracts. More detailed descriptions of classic vanilla and barrier options exist in the literature (Nelken, 1996; Zhang, 1998; Haug, 2007).

Profit functions in the analytical form of options and options strategies allow for expressing the trading and hedging option position. The optimal algorithm for vanilla option trading strategies is presented in the paper by Šoltés (2001). Hedging by means of options strategies using barrier options is discussed in several works (Šoltés and Rusnáková, 2013; Gordiaková and M., 2014; Lalić and Szabo, 2014). This approach can be also used in investment certificate formation. In other papers (Younis and Rusnáková, 2014; Rusnáková

et al., 2014, Gordiaková and M., 2014; Šoltés and Harčariková, 2015) authors create the replicating portfolio to investment certificates using an analytical form of profit functions. Following the mentioned studies we provide our certificate analysis.

The aim of this paper is to perform an analysis of a capped reverse bonus certificate. We apply portfolio replication method to price the capped reverse bonus certificate. The replicating portfolio has a profit function that is identical to the profit function from a combination of position in the underlying asset and positions in options. The application to the Euro Stoxx 50 index is provided. Note that this method is robust for various types of the underlying asset. In this paper, market European vanilla call/put option prices are taken from Bloomberg database. Market barrier option data are not available, therefore the values of the position in European style of barrier options are calculated by Bloomberg. Based on the data set, we design the capped reverse bonus certificate with various parameters. We provide the profitability analysis for the potential investor at the maturity date. The design of investment certificates is highly complicated and difficult to understand for average investor. Therefore our findings should help all investors to understand the structure of this product with the ability to choose the best product according to the expectations in the market.

The paper is organized on the following sections. In the first part a capped reverse bonus certificate description is presented. This is followed by the application to the Euro Stoxx 50 index. The capped reverse bonus certificates with various parameters are designed and compared. The final section contains the conclusions.

2. CAPPED REVERSE BONUS CERTIFICATE

The capped reverse bonus certificates are appropriate investment tools for declining market of some underlying asset. The profit profile depends on breaking a barrier. The barrier (B) is a limit above the actual spot price of the underlying asset. If the barrier is not reached during the time to maturity (t), the investor will be paid at a minimum the bonus level (B_L). The profit can be limited by a cap. The cap (C) is the maximum value which the investor can get from the certificate at the maturity date. If the underlying asset value rises above the barrier during the time to maturity, then this protection is cancelled and the investor participates in the loss in full. One of the key factors is a multiplier (p) (usually 0.01 or 0.001). For example, if the underlying asset has a value of 100 units and the subscription ratio is 0.01, the certificate will have a value of 1 unit. This makes the certificates suitable for every investor. Other basic parameters are the issue date (T_0) and the maturity date (T) of the certificate.

Let us denote the price of the underlying asset at the issue date with S_0 and the price of the underlying asset at the maturity date with S_T. The profit function of the capped reverse bonus certificate at the maturity date is as follows:

$$P_{IC}(S_T) = \begin{cases} -p*C + k_0 & \text{if } S_T < C, \\ -p*S_T + k_0 & \text{if } C \le S_T < B_L, \\ -p*B_L + k_0 & \text{if } \max\limits_{0\le t\le T}(S_T) < B \wedge B_L \le S_T < 2*S_0, \\ -p*S_T + k_0 & \text{if } \max\limits_{0\le t\le T}(S_T) \ge B \wedge B_L \le S_T < 2*S_0, \\ -2*p*S_0 + k_0 & \text{if } \max\limits_{0\le t\le T}(S_T) \ge B \wedge S_T \ge 2*S_0. \end{cases} \quad (1)$$

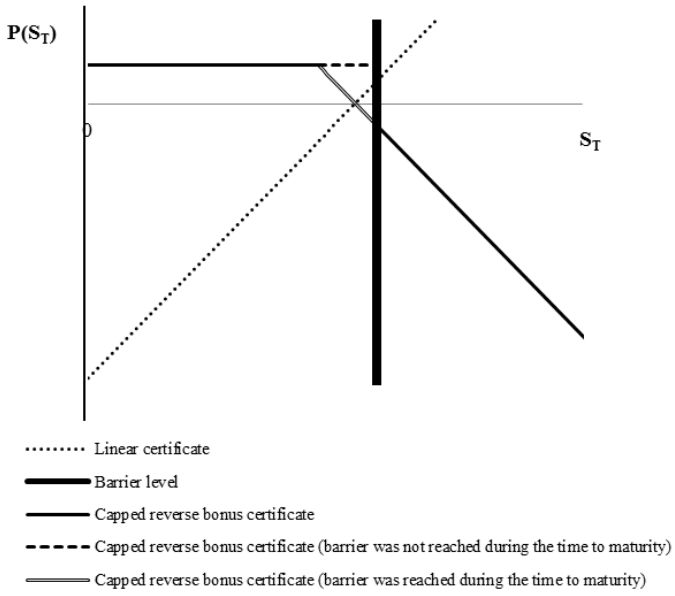
The profit function of the capped reverse bonus certificate is shown in Figure 1. If the underlying price during the time to maturity does not grow above the barrier and:

1) it is lower than the cap level at the maturity date, than the investor in the capped reverse bonus certificate obtains the higher fixed profit ($-p*C+k_0$);
2) it is between the cap and the bonus level at the maturity date, than the investor obtains the profit ($-p*S_T+k_0$);
3) it is the higher than the bonus level at the maturity date, than the investor obtains the lower fixed profit ($-p*B_L+k_0$).

If the underlying price during the time to maturity grows above the barrier and:

1) $S_T<C$, then the profit from the capped reverse bonus certificate is ($-p*C+k_0$);
2) $C \leq S_T<2*S_0$, then the profit from the capped reverse bonus certificate is ($-p*S_T+k_0$);
3) $S_T \geq 2*S_0$, then the profit from the capped reverse bonus certificate is ($-2*p*S_0+k_0$).

There is an inverse relation between the profit of the capped reverse bonus certificate and the profit of the linear certificate (i.e., a long underlying position).



Source: own design

Figure no. 1 – Profit function of capped reverse bonus certificate

Let us propose an alternative investment which is engineered from a combination of four positions, i.e., a short position in the underlying asset with the price at the issue date S_0 and price at the maturity date S_T, a short position in put options with the lower strike price (the cap level), a long position in up-and-out call options with a higher strike price (the bonus level) and a long position in call options with the highest strike price in the amount of $2*S_0$. The profit function of short position in the underlying asset at the maturity date is:

$$P_1(S_T) = S_0 - S_T. \tag{2}$$

The short position in put option represents an obligation to buy an underlying asset for a given strike price. The profit function of short put position is:

$$P_2(S_T) = \begin{cases} S_T - C + p_S & if\ S_T < C, \\ p_S & if\ S_T \geq C, \end{cases} \tag{3}$$

where p_S is a premium for an option.

The long position in up-and-out call option represents a right to buy an underlying asset for a given strike price if the barrier level is not exceeded over the time to maturity. The profit function for long position in up-and-out call option has the following form:

$$P_3(S_T) = \begin{cases} -c_{BUO} & if\ S_T < B_L, \\ S_T - B_L - c_{BUO} & if\ \underset{0\leq t\leq T}{max}(S_T) < B \wedge S_T \geq B_L, \\ -c_{BUO} & if\ \underset{0\leq t\leq T}{max}(S_T) \geq B \wedge S_T \geq B_L. \end{cases} \tag{4}$$

where c_{BUO} is a premium for an option.

The long position in call option is a right to buy an underlying asset for a given strike price. The profit function of long call position is:

$$P_4(S_T) = \begin{cases} -c_B & if\ S_T < 2 * S_0, \\ S_T - 2 * S_0 - c_B & if\ S_T \geq 2 * S_0, \end{cases} \tag{5}$$

where c_B is a call option premium.

The profit function from alternative investment at the multiplier p expressed as the sum of the individual functions (2), (3), (4) and (5) is:

$$P_{RP}(S_T) = \begin{cases} -p * C + k_0 & if\ S_T < C, \\ -p * S_T + k_0 & if\ C \leq S_T < B_L, \\ -p * B_L + k_0 & if\ \underset{0\leq t\leq T}{max}(S_T) < B \wedge B_L \leq S_T < 2 * S_0, \\ -p * S_T + k_0 & if\ \underset{0\leq t\leq T}{max}(S_T) \geq B \wedge B_L \leq S_T < 2 * S_0, \\ -2 * p * S_0 + k_0 & if\ \underset{0\leq t\leq T}{max}(S_T) \geq B \wedge S_T \geq 2 * S_0. \end{cases} \tag{6}$$

Assuming the following condition:

$$k_0 = p * S_0 + p * p_S - p * c_{BUO} - p * c_B, \tag{7}$$

the profit function of the replicating portfolio is the same as the profit function of the capped reverse bonus certificate. Using these alternative investment positions we derived the profit profile of the capped reverse bonus certificate.

3. APPLICATION TO THE EURO STOXX 50 INDEX

In this section, we will propose the capped reverse bonus certificates on the Euro Stoxx 50 index and perform the analysis of their profitability. We examine the profitability from the certificates of the investor at the maturity date. We are going to show which parameters the investor should pay attention to when deciding to invest into the given investment certificate. We will use European style vanilla and barrier options on the Euro Stoxx 50 index in the creation of investment certificates.

3.1. Data description

The Euro Stoxx 50 index is a blue-chip index for the Eurozone. The index value on December 1, 2014 was 3,232.91 EUR. European style vanilla and barrier call/put option prices on the Euro Stoxx index 50 with various strike prices and the barrier levels are obtained from Bloomberg. We considered options with the issue date December 1, 2014 and the maturity date September 18, 2015. The strike prices of the barrier options are similar to the vanilla prices. The barrier levels are selected by authors. The higher the barrier level, the higher the option premium and vice versa. Therefore we have not selected very high levels. The dataset used in our application can be provided upon request. The common key data for the proposed certificates are presented in Table 1. The multiplier is selected by authors as 0.01.

Table no. 1 – Common data about capped reverse bonus certificates

Key data	
Underlying	Euro Stoxx 50
Underlying price (S_0)	3,232.91EUR
Issue date (T_0)	1/12/2014
Maturity date (T)	18/9/ 2015

Source: own design

3.2. Proposal of capped reverse bonus certificate

Let us propose the capped reverse bonus certificate as a combination of a short position in Euro Stoxx 50 with actual price 3,232.91 EUR, a short position in put option on Euro Stoxx 50 with the cap level 2,800, premium 89.15 EUR for an option, a long position in up-and-out call option on Euro Stoxx 50 with the bonus level 2,900, the barrier level 3,500, premium of 37.59 EUR for an option, and a long position in call option on Euro Stoxx 50 with the strike price 6,465.82, premium of 0.002 EUR for an option. The profit function of the capped reverse bonus certificate at the maturity date using the replicating portfolio formula (6) is represented by the following equation:

$$P(S_T) = \begin{cases} 4.84 & \text{if } S_T < 2{,}800, \\ -0.01 * S_T + 32.84 & \text{if } 2{,}800 \le S_T < 2{,}900, \\ 3.84 & \text{if } \max\limits_{0 \le t \le T}(S_T) < 3{,}500 \wedge 2{,}900 \le S_T < 6{,}465.82, \\ -0.01 * S_T + 32.84 & \text{if } \max\limits_{0 \le t \le T}(S_T) \ge 3{,}500 \wedge 2{,}900 \le S_T < 6{,}465.82, \\ -31.81 & \text{if } \max\limits_{0 \le t \le T}(S_T) \ge 3{,}500 \wedge S_T \ge 6{,}465.82. \end{cases} \quad (8)$$

The fair value of this certificate based on (7) can be calculated as:

$$0.01*(3{,}232.91+89.15-37.59-0.002)=32.84 \tag{9}$$

Any issue price above the fair value 32.84 is the gain of the certificate issuer.

Let us propose the capped reverse bonus certificate as a combination of a short position in Euro Stoxx 50 with actual price 3,232.91 EUR, a short position in put option on Euro Stoxx 50 with the cap level 2,800, premium of 89.15 EUR for an option, a long position in up-and-out call option on Euro Stoxx 50 with the bonus level 2,900, the barrier level 3,600, premium of 66 EUR for an option, and a long position in call option on Euro Stoxx 50 with the strike price 6,465.82 premium 0.002 EUR for an option. The profit function of the proposed capped reverse bonus certificate at the maturity date is as follows:

$$P(S_T)=\begin{cases} 4.56 & if\ S_T<2{,}800, \\ -0.01*S_T+32.56 & if\ 2{,}800\le S_T<2{,}900, \\ 3.56 & if\ \max\limits_{0\le t\le T}(S_T)<3{,}600\wedge 2{,}900\le S_T<6{,}465.82, \\ -0.01*S_T+32.56 & if\ \max\limits_{0\le t\le T}(S_T)\ge 3{,}600\wedge 2{,}900\le S_T<6{,}465.82, \\ -32.10 & if\ \max\limits_{0\le t\le T}(S_T)\ge 3{,}600\wedge S_T\ge 6{,}465.82. \end{cases} \tag{10}$$

The fair value of this certificate is EUR 32.56.

The profit from the proposed capped reverse bonus certificate with the barrier 3,500 and the capped reverse bonus certificate with the barrier 3,600 depending on the development of the Euro Stoxx 50 index at the maturity date of the certificates is showed in Table 2. We compare the profit of the certificates at possible future scenarios of underlying price development.

Table no. 2 – Profitability analysis of the proposed capped reverse bonus certificates with the barrier 3,500 and 3,600

Barrier level 3500	**Barrier level 3600**	**Intervals of Euro Stoxx 50 values at the maturity date**	**Profit of certificate with barrier 3500**		**Profit of certificate with barrier 3600**	
			Min	**Max**	**Min**	**Max**
		$S_T \le 2{,}800$	**4.84**	**4.84**	4.56	4.56
		$2{,}800 \le S_T \le 2{,}900$	**3.84**	**4.84**	3.56	4.56
not reached	not reached	$2{,}900 \le S_T \le 2{,}928$	**3.84**	**3.84**	3.56	3.56
reached	not reached	$2{,}900 \le S_T \le 2{,}928$	**3.56**	**3.84**	3.56	3.56
reached	reached	$2{,}900 \le S_T \le 2{,}928$	**3.56**	**3.84**	3.28	3.56
not reached	not reached	$2{,}928 \le S_T \le 3{,}600$	**3.84**	**3.84**	3.56	3.56
reached	not reached	$2{,}928 \le S_T \le 3{,}600$	-3.16	3.56	**3.56**	**3.56**
reached	reached	$2{,}928 \le S_T \le 3{,}600$	**-3.16**	**3.56**	-3.44	3.28
		$3{,}600 \le S_T \le 6{,}465.82$	**-31.81**	**-3.16**	-32.10	-3.44
		$6465.82 \le S_T$	**-31.81**	**-31.81**	-32.10	-32.10

Source: own calculations

Considering the results of the profitability analysis we have the following findings. If the Euro Stoxx 50 value during the period to maturity grows above the barrier 3,500 but does not grow above the barrier 3,600 and it belongs to the interval [2,928; 3,600] at the maturity date, then the capped reverse bonus certificate with the barrier 3,600 is the best variant, otherwise, the capped reverse bonus certificate with the barrier 3,500. The capped reverse bonus certificate with the higher barrier ensures the higher profit if the investor expects low volatility of the underlying. Further, we can conclude that the certificates with the lower barrier levels are more expensive when compared with those having the higher barrier level. This is due to the fact that the risk of breaking the barrier is higher in the first case.

Let us propose the capped reverse bonus certificates on Euro Stoxx 50 with various parameters, specifically the bonus levels and the capped levels. These parameters impact on the profit of the potential investor. Table 3 shows the proposed capped reverse bonus certificates for further analysis. The chosen certificates are certificates with the barrier levels 3,500, different bonus and cap levels.

Table no. 3 – Parameters of the proposed capped reverse bonus certificates on Euro Stoxx 50

Denotation	Barrier level	Cap level	Put premium	Bonus level	Up-and-out call premium	Issue price
I_1	3,500	2,700	72.06	2,700	85.23	32.46
I_2	3,500	2,700	72.06	2,900	37.59	31.98
I_3	3,500	2,800	89.15	2,800	58.69	32.02
I_4	3,500	2,800	89.15	2,900	37.59	32.84

Source: own design

Using the replicating formula (6) we calculate the issue prices of each certificate. The issue prices are shown in Table 4.

Table no. 4 – Parameters of the proposed capped reverse bonus certificates on Euro Stoxx 50

Denotation	Issue price
I_1	32.46
I_2	31.98
I_3	32.02
I_4	32.84

Source: own calculations

We evaluate the profitability of the capped reverse bonus certificate I_1 with the bonus level 2,700 and the capped reverse bonus certificates I_2 with the bonus level 2,900 from the investor's point of view (see Figure 2 and Figure 3). If the value of Euro Stoxx 50 index during the time to maturity does not grow above the barrier 3,500 and it is lower than 2,747 at the maturity date, then the capped reverse bonus certificate I_2 is the best variant, otherwise the capped reverse bonus certificate I_1 is the adequate choice. If the value during the time to maturity grows above 3,500, then the capped reverse certificate, I_2 ensures the highest profit for the investor. The results indicate that the capped reverse bonus certificate I_1 as well as the capped reverse bonus certificate I_2 may generate the maximum profit. Therefore, it is important to select the certificate with the most appropriate parameters based on investor's expectation of underlying price development.

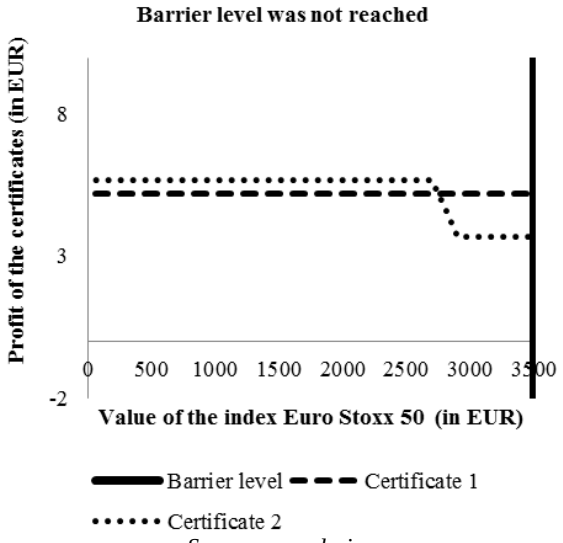


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Figure no. 2 – Profit of the capped reverse certificates I_1 and I_2

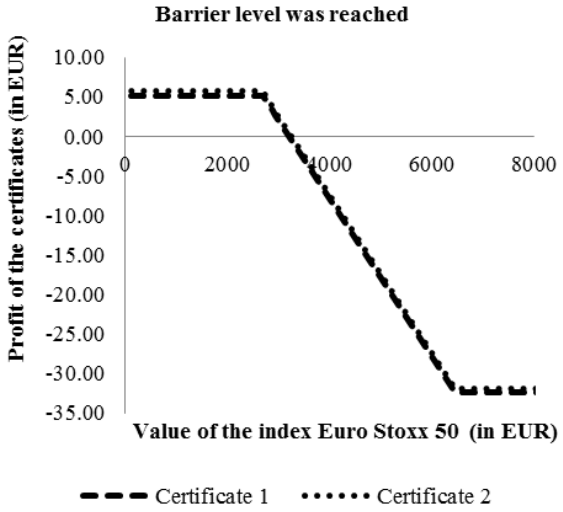

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Figure no. 3 – Profit of the capped reverse certificates I_1 and I_2

The profit from the capped reverse bonus certificate I_2 with the cap level 2,700 and the certificate I_4 with the cap level 2,800 are shown in Figure 4 and Figure 5. If the value of Euro Stoxx 50 index is lower than 2,783 at the maturity date, then the capped reverse bonus certificate I_2 ensures the highest profit for the investor. If the value of Euro Stoxx 50 index is higher 2,783 at the maturity date, then the capped reverse bonus certificate I_4 is the best variant.

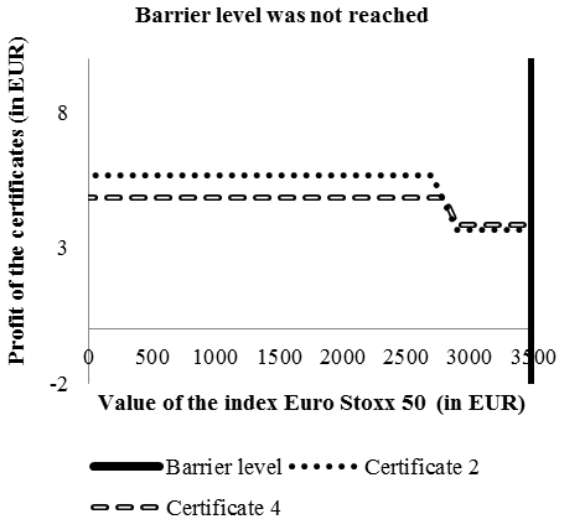

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Figure no. 4 – Profit of the capped reverse certificates I_2 and I_4

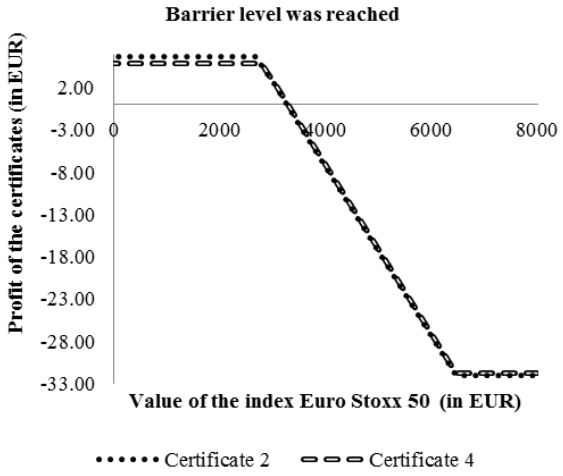

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Figure no. 5 – Profit of the capped reverse certificates I_2 and I_4

Profitability analysis of the proposed certificates for the selected intervals of Euro Stoxx 50 value at the maturity date is displayed in Table 5 (the barrier level was not breached during the time to maturity) and Table 6 (the barrier level was breached during the time to maturity).

Table no. 5 – Profitability analysis of the proposed capped reverse bonus certificates if the barrier level 3,500 was not reached during the time to maturity

Investment certificate	**I_1**		**I_2**		**I_3**		**I_4**	
Intervals of Euro Stoxx 50 values at the maturity date	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
$S_T \leq 2{,}700$	5.20	5.20	**5.67**	**5.67**	4.63	4.63	4.84	4.84
$2{,}700 \leq S_T \leq 2{,}747$	5.20	5.20	**5.20**	**5.67**	4.63	4.63	4.84	4.84
$2{,}747 \leq S_T \leq 2{,}800$	**5.20**	**5.20**	4.67	5.20	4.63	4.63	4.84	4.84
$2{,}800 \leq S_T \leq 2{,}900$	**5.20**	**5.20**	3.67	4.67	4.63	4.63	3.84	4.84
$2{,}900 \leq S_T$	**5.20**	**5.20**	3.67	3.67	4.63	4.63	3.84	3.84

Source: own calculations

Table no. 6 – Profitability analysis of the proposed capped reverse bonus certificates if the barrier level 3,500 was reached during the time to maturity

Investment certificate	**I_1**		**I_2**		**I_3**		**I_4**	
Intervals of Euro Stoxx 50 values at the maturity date	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
$S_T \leq 2{,}700$	5.20	5.20	**5.67**	**5.67**	4.63	4.63	4.84	4.84
$2{,}700 \leq S_T \leq 2{,}783$	4.37	5.20	**4.84**	**5.67**	4.63	4.63	4.84	4.84
$2{,}783 \leq S_T \leq 2{,}800$	4.20	4.37	4.67	4.84	4.63	4.63	**4.84**	**4.84**
$2{,}800 \leq S_T \leq 6{,}465.82$	-32.46	4.20	-31.98	4.67	-32.02	4.63	**-31.81**	**4.84**
$6{,}465.82 \leq S_T$	-32.46	-32.46	-31.98	-31.98	-32.02	-32.02	**-31.81**	**-31.81**

Source: own calculations

Based on the performed profitability analysis and the comparison of the proposed capped reverse bonus certificates, we report the following findings. If the index value during the time to maturity does not grow above the barrier level 3,500 and it is lower than 2,747 at the maturity date, then the capped reverse bonus certificate I_2 is the best variant, otherwise, the capped reverse bonus certificate I_1. If the index value during the time to maturity grows above 3,500, then:

1) the capped reverse bonus certificate I_2 ensures the highest profit for the price lower than 2,783;

2) the capped reverse bonus certificate I_4 for the price higher than 2,783.

4. CONCLUSIONS

In this paper we focused on the capped reverse bonus certificate. We presented the review of the literature dealing with this type of certificate and presented its profit function. On the basis of the existing empirical studies, the scientific problem of our paper was to examine the nature of this investment certificates creation using the portfolio replication method. We demonstrated that the profit of the capped reverse bonus certificate can be replicated by the combination of a short position in some underlying asset, a long position in put options with cap level, a short position in up-and-out call options with the bonus level and short position in call options.

Our empirical approach is applied on the Euro Stoxx 50 index. Based upon the theoretical option pricing models, the replicating portfolio for capped reverse bonus

certificate on the Euro Stoxx 50 index is engineered. We proposed the capped reverse bonus certificates with various the cap and the bonus levels. We performed profitability analysis of the proposed certificates to the investor, showing which parameters the investor should focus and are significant for the profit profile.

We also identified the best certificates for the potential investor. If the investor expects low volatility of the underlying value, he should choose the certificate with lower bonus level. If the investor expects bigger decreases in the underlying value, he should choose the certificate with lower cap level. The relation between the profit change of the investor and parameters' change (the bonus and/or the cap level) was detected using the proposed certificates, but the results are generally valid considering the same change of the parameter.

Further, we can conclude that the certificates with lower cap levels are more profitable when the investor does not expect breaking the barrier during the time to maturity. If the investor expects breaking the barrier during the time to maturity, then he decides between the capped reverse bonus certificate with higher bonus level and lower cap level and the capped reverse bonus certificate with higher bonus and higher cap level.

In general, investment certificates are investment products, which contain more complex structures combining different components, in order to implement certain investment strategies. This paper has given a new approach integrating the design of the investment certificates using the option pricing by duplication methods. The main aim was to perform an analysis of the capped reverse bonus certificate creation through the analytical expression of the replicated profit profiles. From the methodological point of view, our methodology can serve as a model for an analysis of other structured products.

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THE TENDENCY TOWARDS SECONDARITY IN MANAGING GLOBAL IMBALANCES‡

Lucian CROITORU*

Abstract

In this study, we analyse the factors that have led to the fall of real interest rates on the long term. We show that this tendency, i.e. the fall in real interest rates, which began three decades ago in developed countries is well explained by the emergence and growth of the global saving glut. We formulate the hypothesis according to which the increase in the global excess saving is mostly the result of a process whereby countries place themselves on a secondary position vis-à-vis the US (i.e. secondarity) with regard to taking and managing risks which occur after a crisis. The ensuing peculiarity of global excess saving is that it is generated in an increasing number of countries or economic areas, with the overwhelming part located in a few of them, while the overwhelming part of the global deficit of savings is located in the US.

Secondarity is caused both by governments, which have sought to move to excess saving, as was the case of Asian countries (Bernanke, 2005), or to capping budget deficits, as it happened in the Eurozone and in the EU, and by the free choice of every economic agent in the private sector. Secondarity represents a major cause for a vicious circle in which the decline in interest rates to ever lower levels has led to the emergence of financial bubbles, whose bursting requires the further reduction of interest rates, thus generating new bubbles and so on and so forth. Misinterpreted in real time as the "Great Moderation", this vicious circle went unobserved.

Keywords: Global saving glut; global imbalances; secondarity; current account balance; natural interest rate; real interest rate trends; monetary policy; yield curve; liquidity trap; debt trap; Romanian conundrum; interest rate dilemma

JEL classification: E43, E58, E52, F32, G12.

1. INTRODUCTION

In developed countries, real interest rates have witnessed a downtrend during the last three decades. With every major recession, interest rates fell in order to support the economy and then increased relatively rapidly, generally without regaining the pre-fall levels. However, the 2008 recession illustrated an exception to the rule. In 2015, more than

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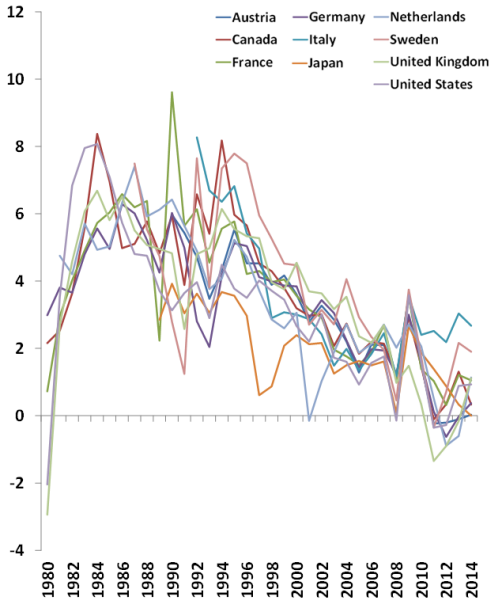
six years after entering recession, real interest rates in some developed countries were either still negative or very low (Figures 1 and Figure 2), while output in developed economies was still below potential and continued to increase at relatively low rates, particularly in the Eurozone[1]. The slow-in-coming return of interest rates to higher or positive levels reflects to a very small extent the reduction of monetary policy rates to zero and the quantitative easing rounds aimed at jumpstarting production and avoiding deflation.

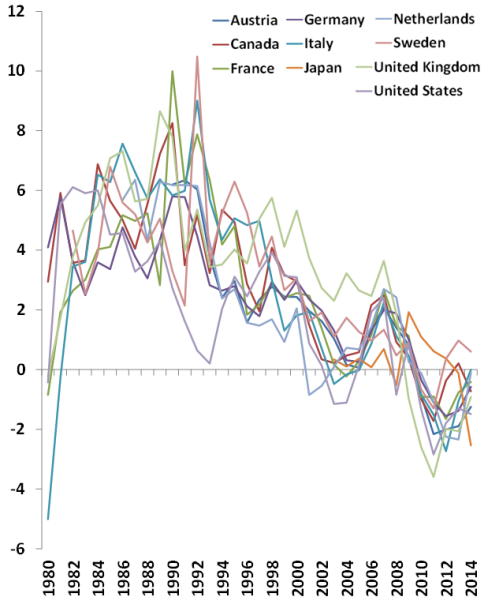
Monetary policy rates have only a temporary and limited bearing on long-term real interest rates. In this paper, we discuss the factors which have led to the falling trend in long-term real interest rates in developed countries, focusing on the special role played by the global saving glut. The purpose of our analysis is to evaluate (i) the consequences for Romania of the extended period in which the monetary policy rates of major central banks stay close to zero and (ii) whether long-term real interest rates will embark on a downtrend sooner rather than later.

In Romania, output is still below potential, although economic growth has returned to relatively high levels in the last two years; moreover, the prevailing view is that had the VAT rate not been reduced starting 1 June 2015, inflation would have probably reverted close to the central target at the end of 2015. However, it might be necessary for the National Bank of Romania (NBR) to lower the monetary policy rate further.



Source: OECD

Figure no. 1 – Long-term real interest rates (%)



Source: OECD

Figure no. 2 – Short-term real interest rates (%)

This necessity does not derive from the VAT rate reduction, which will temporarily lead to deflation. At a deeper level and for a longer period of time, it might derive quite soon from the trade and financial relations between the Romanian economy and those economies where interest rates are expected to remain low for several years to come (for example, in the Eurozone and Japan). Thus, even in the absence of the VAT rate reduction, the low

policy rates worldwide exert pressure to reduce the monetary policy rate in Romania[2]. Given these low rates, an insufficient reduction of the monetary policy rate by the NBR would result in the leu appreciation[3]. At the current juncture, this appreciation would add to the deflation generated by the VAT rate reduction, entailing the risk of turning inflationary expectations into deflationary ones and slowing down economic growth.

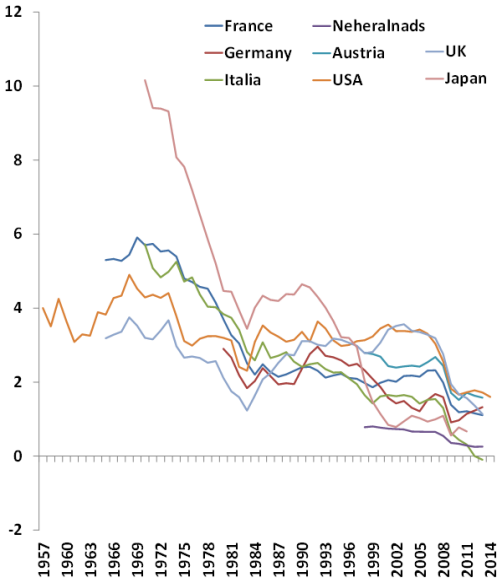
What about the longer term? Will long-term real interest rates in Romania also witness a downtrend towards the relatively low levels seen in developed economies? Will our economy join the group with excess saving or will it return to relatively wide current account deficits? And finally, will economic growth rates embark on a downward path, as in developed countries, relatively soon or at the longer horizon? Given the trade and financial links between the Romanian economy and the advanced ones, these questions cannot be answered without a thorough understanding of the underlying causes of those particular trends in the developed countries.

The paper is structured as follows: the following section analyses the factors which have led to the fall of long-term interest rates and shows the reverse relation between the global saving glut and the real interest rate. The third section describes the combination of elements that allowed the global saving glut to emerge and grow. In the fourth section, we demonstrate that there is a tendency among countries to place themselves in a secondary position vis-à-vis the US (the process of secondarity) with regard to risk-taking and managing the consequences in the aftermath of a crisis. The result of this process is that global saving gluts expand and spread to an increasing number of countries, while the overwhelming part of the global saving deficit tends to occur in the US. In the fifth section, we show that the global saving glut influences the whole yield curve both directly and indirectly, being one of the drivers of a vicious circle where the persistent downtrend in interest rates has come to lead, due to the low interest levels, to the emergence of financial bubbles, whose bursting requires the further reduction of interest rates, thus generating new bubbles. To the extent to which it explains the expansion of the global saving glut, secondarity also explains the negative feedback loop of interest rates. The sixth section discusses the short- and long-term prospects of global imbalances. The seventh section answers the questions above and draws conclusions for Romania.

2. WHY DO INTEREST RATES FALL – AN EXPLANATION BASED ON FUNDAMENTALS

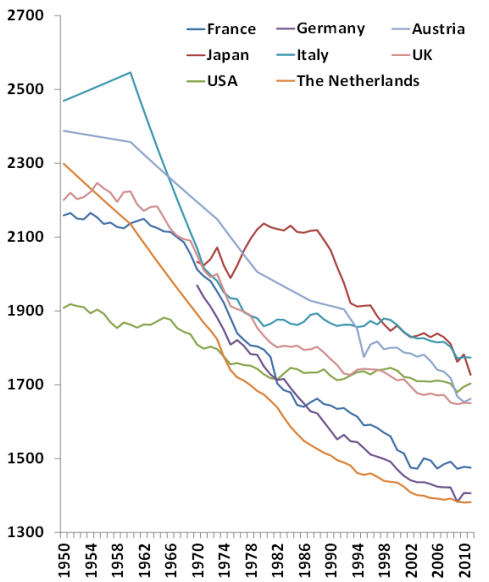
On the long term, the interest rate is determined by technology, which directly affects total factor productivity, by the rise in workforce, as well as by the time preference rate (Woodford, 2003)[4]. The first two are also direct drivers of economic growth. Practically, assuming that output is given by a Cobb-Douglas function in which capital elasticity is zero, economic growth is the sum of the growth rate of total factor productivity and workforce dynamics. Economic growth prospects affect investment demand and hence the interest rate[5].

The other factor, i.e. the time preference rate, shows people's impatience to consume now compared to an upcoming period. The greater the impatience, the greater the compensation (interest) an economic agent needs to delay consumption, i.e. to save. On the short term, the three factors may deviate from the stable condition, triggering interest rate variations[6].



Source: FRED, OECD

Figure no. 3 – Real rates of GDP growth in developed countries (10-year moving averages of annual rates, %)

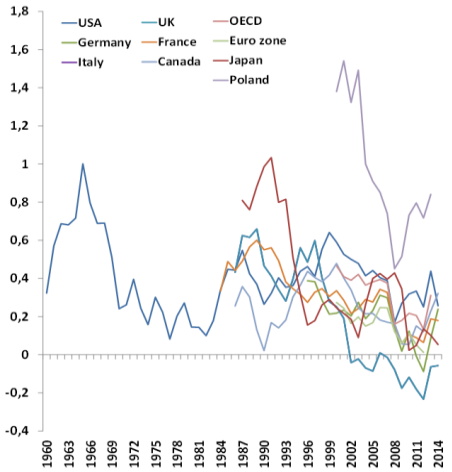


Source: FRED

Figure no. 4 – Annual numbers of hours worked by an employee (%)

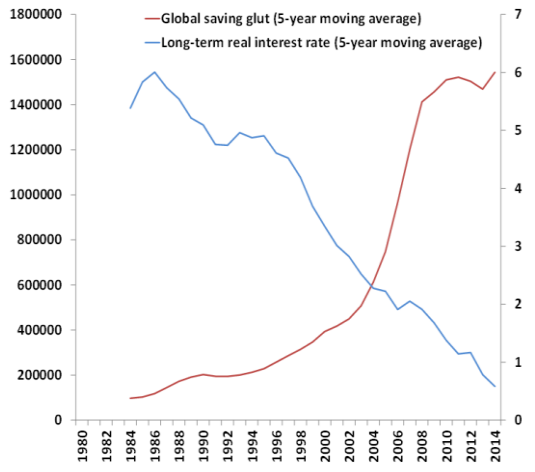
Figure 3 shows that economic growth rates in developed countries embarked on a downward path at the beginning of the ’70s, thus partly explaining the downtrend of long-term interest rates. In turn, the economic slowdown is explained by the reduction in the number of hours per year worked by an employee, which is a form of workforce measurement (Figure 4), and by the downtrend in labour productivity growth rates (Figure 5). However, comparing the trends in real interest rates (Figure 1 and Figure 2) and the GDP growth trend (Figure 3) shows that real interest rates began to fall almost 20 years later than economic growth rates. This means that in those 20 years, the other factor, i.e time preference, exerted a sufficiently strong opposite impact to offset the influence of the declining economic growth rates on interest rates. In that period, the time preference rate was relatively high, favouring consumption to the detriment of saving (which remained relatively low as a share in income).

As stated in the beginning, our analysis will focus on the role played by the global saving glut. Just like the US current account deficit, the global saving glut emerged in the early 80s. Until then, *desired* saving tended to equal *desired* investment. The countries with large current account surpluses/deficits today witnessed current account equilibria until the mid-70s, when relatively slight deviations started to be recorded.



Source: FRED

Figure no. 5 – Annual rates of labour productivity growth (%)



Source: author's calculations based on OECD and UNCTAD data

Figure no. 6 – The global saving glut (USD mill.) and long-term real interest rates in some developed countries (%, rhs)

The global excess saving and the US excess investment (current account deficit) increased gradually beginning in the late 80s[7]. This means that, during the said period, in some countries, *desired* saving began to exceed *desired* investment, which finally led to increased individual saving gluts. As the global saving glut widened, long-term real interest rates went down. Figure 6 illustrates the clear reverse correlation between the expansion of the global saving glut and the fall in the long-term real average interest rate calculated for the countries listed in Figures 1 and 2.

3. WHY DID THE GLOBAL SAVING GLUT OCCUR

The global saving glut would not have occurred in the absence of two conditions[8]. The first refers to free capital movement. Capital flow liberalization was achieved gradually after the fall of the Bretton Woods monetary system in 1971. It would have been senseless for countries to save without enabling the migration of saving to countries which needed them and which could have turned them to better account in order to fund the glut of investment over saving (current account deficits). Nevertheless, free capital movement was merely a necessary, but not sufficient condition for the occurrence of global excess saving.

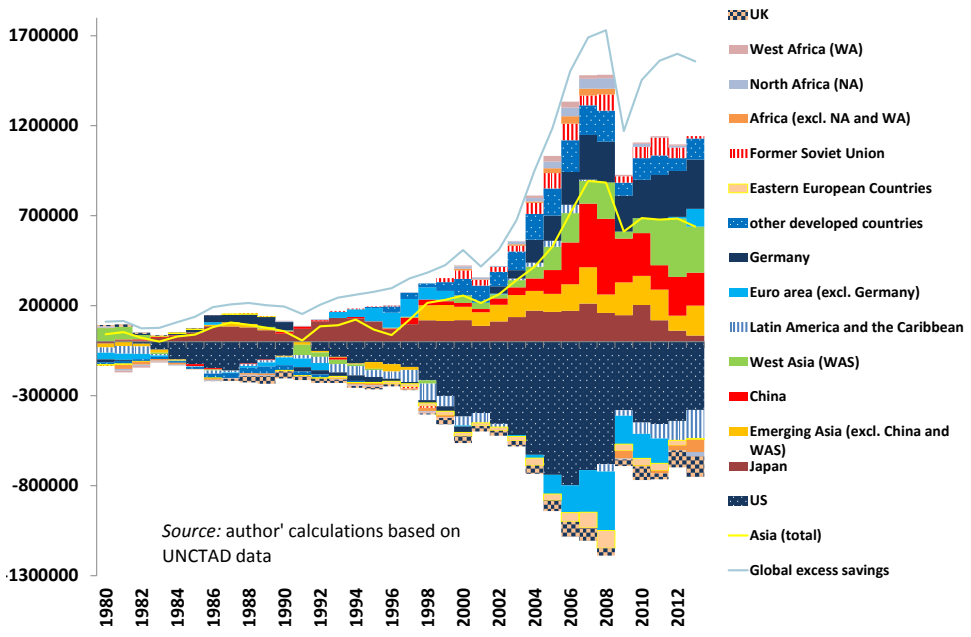
The second condition is the prevalence of relatively low and stable inflation rates. Saving further holds a low share in income and *desired* saving cannot be higher than *desired* investment if inflation is high and volatile. Given these features, the money illusion and other factors make it so that inflation is systematically higher than nominal interest rates, thus acting as an incentive for stepped-up consumer spending. Consequently, economic agents' increased concern to spend before inflation erodes the real value of money prevents the emergence of the desire to save more than invest or reduces the rate of desired saving.

A reduction of the desired saving rate should lead, ceteris paribus, to an increase in real interest rates as a consequence of the additional pressure on available resources. For

example, in the US, the high inflation in 1975-1981 was accompanied by an increase in the real interest rate[9], which signals a reduction in the desired saving rate for that period. In the 70s, the conceptions and theories regarding monetary policy were rather confused and inflation was relatively high and volatile in many developed countries, preventing saving but also stymieing economic growth. Also in the 70s, oil price increased as a consequence of production limitations in Organization of the Petroleum Exporting Countries (OPEC), which contributed to the pick-up in inflation. Figure 3 illustrates that economic growth rates in the 70s witnessed the steepest downward slope, which is consistent both with the supply shock caused by the oil price hike and with the increase in the real lending rate.

It was only in 1979 that an efficient policy to tackle inflation was adopted in the US[10]. Consequently, the inflation rate began to reach relatively low levels as late as 1984. It was precisely the time when the global saving glut became significant. In the context of low inflation, people's behaviour characterized by the tendency to spend as fast as possible in order to avoid the erosion of the value of money, as seen during the Great Inflation, changed and the saving volume as well as the desired saving ultimately began to increase. This explains why interest rates began to fall almost 20 years later than economic growth rates in developed countries.

The profound cause of the increase in saving relates to the aging population in developed economies and the prevalent distribution of the global product to these countries. Old and relatively well-off people save more than the rest of the population, thus contradicting the life cycle hypothesis. In developed countries, the ratio of pensioners to employees began to increase around the mid-70s, which led to an increased propensity for saving of these countries' population. At the same time, the capital-to-labour ratio began to increase and entailed a lower investment yield.



Source: author's calculations based on UNCTAD data

Figure no. 7 – History of savings-investment imbalances across major countries and regions (USD mill., current prices)

Theoretically, saving gluts occurring in developed countries should migrate to finance developing countries and emerging markets. In the latter economies, the labour force increases more rapidly and the capital-to-labour ratio is relatively low, resulting in higher yields.

However, as shown in Figure 7, the data for the last 35 years contradict this basic economic logic. The data illustrate two major tendencies. The first is the saving glut migration mainly towards developed countries, particularly the US. As we will show in the next section, the US displays five features conferring attractiveness over other economies as an investment destination. The second tendency is the countries' move, irrespective of their development level, towards the excess saving group, with some exceptions of which the US is the most notable. This tendency is more readily noticeable when looking at the breakdown by country of the global saving glut after each crisis (recession).

The first countries witnessing excess saving were the major oil exporters in West Asia. The sharp oil price increase of 1973-1982 helped these countries become net exporters of financial capital. Following the 1982 crisis, Germany and Japan joined the excess saving group of countries[11]. After the 1991 global recession, countries that were to become Eurozone members also joined the saving glut group of countries. Following the 1997 crisis, Asian countries and the group of developed economies (other than the US, Japan, euro area countries and the UK) did the same thing. The 1999 crisis in Brazil and the 2002 Argentine crisis brought about excess saving in 2003-2007 in the Latin America and the Caribbean group of countries (which became net exporters of financial capital). Also in 2003, the group of Eurozone countries (defined by excluding Germany) returned to a saving deficit, thus turning into net importers of financial capital; however, in 2013, they re-entered the saving glut group of countries. It is noteworthy that countries in the Eastern European group[12] have never been net exporters of capital after 1990; however, after the 2008 crisis, and particularly beginning in 2012, these countries have massively reduced their current account deficit (investment surplus).

The second tendency we described above is a generalization of Bernanke (2005) idea according to which financial crises are an important factor in changing the current account position in emerging economies, together with higher oil prices and precautionary saving. He shows that, in response to these crises, Asian emerging economies have deliberately chosen or had to choose to give up the financial capital net importer position and thus become net exporters. Among the underlying factors were the significant decline in investment and the changes in economic policies (Bernanke, 2007), warranted by the need to better manage the instability of capital inflows and of exchange rates and to reduce external debt.

4. SECONDARITY: A MAJOR DETERMINANT OF GLOBAL IMBALANCES

The data in Figure 7 show, however, that we are dealing with a more complex process than the one suggested by Bernanke (2005). Our assumption, based on these data, is that countries change their financial capital net importer/ exporter position so that the risks materializing when a financial crisis hits are located in the countries that can best accommodate them. We define these position changes as the *secondarity of excess saving countries in relation to the US*.

Before explaining the concept of secondarity in more economic detail, we take first a wider perspective, by drawing a parallel with "secondarity" as a civilizing process. The concept was introduced by Rémi Brague to explain the role of Rome in shaping the European culture: "To say that we are Roman is entirely the contrary of identifying ourselves with a prestigious ancestor. It is rather a divestiture, not a claim. It is to recognize

that fundamentally we have invented nothing, but simply that we learned how to transmit a current come from higher up, without interrupting it, and all the while placing ourselves back in it" (Brague, 2002, p. 91). In other words, Rome, the conqueror of Ancient Greece, aware of its cultural inferiority to Greece, created a mechanism to „transport" Greek culture to Rome.

In a lecture on modernity, having Brague as starting point, Patapievici (2015) mentions three conditions for "secondarity" to act as a civilizing process of an entity: (i) to understand that the entity does not have the wisdom it is seeking; (ii) to understand that others have this wisdom; and (iii) to have the capacity to assimilate it. Referring to Brague's work, Shiffman (2005) states that "secondarity" is "the consciousness that one's cultural origins and points of reference do and ought to have their source in another culture". In our approach to global imbalances, countries with excess saving place themselves in a "secondary position" in relation to the US.

The countries which do not have the US features to act as "borrower of last resort", which we will mention later in this section do display however the following characteristics: (i) they seek the "wisdom" (i.e. knowledge, instruments, institutions and the synergy among all these) on managing risks; (ii) they understand that this "wisdom" exists primarily in the US; (iii) they have the capacity to acquire "wisdom", but this takes time and hence the "transport" of risks stemming from global imbalances to the country that can best accommodate them , i.e. the US. "Transport" means the creation of excess saving which, at the same development level, entails lower risks as well as lower investment and economic growth opportunities.

Behind this process stand both governments, which sought to move to excess saving, as was the case of Asian countries[13] (Bernanke, 2005) or to limit budget deficits, as in the Eurozone and the EU, and the free choice of every economic agent in the private sector. Obviously, secondarity does not occur directly between each country with excess saving and the US, with the trade relations among countries acting as a go-between.

The US displays several features rendering it best suited to accommodate rapid capital outflows and currency depreciation, abrupt fall of domestic asset prices, the weakening of the banking system and the recession in the aftermath of a crisis. At the core of these features lie: ((i) the US dollar's status as a reserve currency; (ii) increased labour market flexibility compared with other countries; (iii) the increased freedom, the high sophistication and the depth of the country's financial markets, which have available adequate instruments, institutions and investor populations; and, last but not least, (iv) very low political risk and very strong property rights. All these features combine to maintain a powerful competition which leads to adopting new technologies and increasing productivity.

Secondarity is a factor favouring the increase in desired saving in the countries which place themselves on a secondary position, while favouring the reduction of net saving (saving minus investment) in the country towards which the others have assumed secondarity[14]. Therefore, it interferes with the fundamental factors of saving and investment (birth rate, total factor productivity, capital, time preference rate).

In developed countries, the evolution of fundamentals was probably sufficient for *ex ante* (desired) saving to exceed *ex ante* (desired) investment. On the one hand, in these countries, the slower growth of population and of the active labour force or even the decrease in these categories, the emergence of less capital-intensive industries and the slacker growth rate of productivity have led to a fall in investment demand[15]. On the other hand, the aging population has stimulated the tendency towards saving in more and more countries. These tendencies have been virtually present in all developed countries, thus pressing for a saving glut, including in the US. However, the process of assuming secondarity increased the saving glut in the countries which placed themselves in a secondary position and turned it into a saving deficit for the US.

In developing countries, the evolution of fundamentals was probably not sufficient in itself to determine the occurrence of saving gluts. Nevertheless, the process of assuming secondarity, driven by reasons relating to the risk management capacity, led to an increase in the tendency towards saving, resulting in the emergence of saving gluts in these countries as well. Thus, given the virtually open nature of world economies, an increasing number of countries faced saving gluts, which are exported to economies with saving deficits, particularly to the US[16].

According to the view described in this section, the global saving glut is explained by the changes in fundamentals and by the process of assuming secondarity, taken together. Nevertheless, fundamentals play a secondary role in explaining the fact that the global saving glut tends to occur in more and more countries, while the overwhelming part of the global saving deficit tends to occur in the US. This imbalance is primarily explained by the process of assuming secondarity, which leads to a higher propensity for saving (desired saving) in countries placing themselves in a secondary position, regardless of their development level, and to an increase in net investment in the country towards which the others have assumed secondarity.

5. SAVING GLUT, MONETARY POLICY RATES AND THE YIELD CURVE

This section deals primarily with the manner in which the global saving glut influences each component of the yield curve. Risk-neutral long-term interest rates comprise three components: expected inflation, expectations regarding the future real short-term rates (and hence future changes in monetary policy) and the unobservable term premium. The latter refers to the "extra return that lenders demand to hold a longer-term bond instead of investing in a series of short-term securities" (Bernanke, 2015).

Each of the three components has a series of determinants but here the focus is on the global saving glut. Starting from the structure of the yield curve for risk-neutral rates, the other interest rates reflect in addition the credit, market and liquidity risks, as well as the demand and supply for each financial asset[17].

The saving glut directly influences both the shorter and the longer end of the yield curve. The influence on short-term rates occurs due to the fact that, by definition, *the saving glut influences the natural interest rate* – the rate at which desired saving are equal to desired investment at the potential level of output. As the saving glut expanded, the real (natural) global interest rate fell[18]. The drop was more significant in developed countries, with aging population, declining labour productivity growth rate, and a relatively small average number of hours worked by an employee. In global terms, the influence of the saving glut on changes in real interest rates is exerted through the changes that occur in net desired investment in deficit countries, as compared to the changes in desired saving in surplus countries. An increase in net desired investment in deficit countries that exceeds the increase in desired saving in surplus countries leads to a rise in interest rates, and vice versa.

The gradual drop of the natural interest rate called for monetary policy rate cuts, so as to enable central banks to keep inflation at the desired levels. Policy rates have gradually reached lower and lower levels in normal times, particularly in developed countries. Two trends resulted from these developments: on the one hand, the low interest rates fostered the emergence of financial bubbles, whose frequency has increased in the last two or three decades (see Brunnermeier and Schnabel, 2015 for a history of asset price bubbles). On the other hand, with every new crisis, in order to meet the inflation target and potential output once again,

economies needed lower monetary policy rates than the levels required during the previous crises (see Hamilton *et al.*, 2015 for nominal interest rates in 17 countries, and Cúrdia *et al.*, 2015, Barsky *et al.*, 2014 and Laubach and Williams, 2015 for estimates of real natural rates).

Consequently, a vicious circle occurred, in which low interest rates lead to the emergence of financial bubbles, whose bursting calls for the further reduction of interest rates, and so on. Misinterpreted in real time as the "Great Moderation", this negative feedback loop – which showed that developed countries were headed for the liquidity trap – went unobserved. The outcome of this vicious circle, unless it breaks, will be that – during the next recession – an increased number of central banks will not be in the position to properly stimulate growth, since their nominal rates will be too close to zero.

Despite the fall in natural interest rates, inflation targets remained low nonetheless, usually around 2 percent. Thus, as the natural interest rate decreased, the risk emerged that, during a crisis, the natural interest rate might fall to levels which the real monetary policy rate could not reach with conventional approaches.

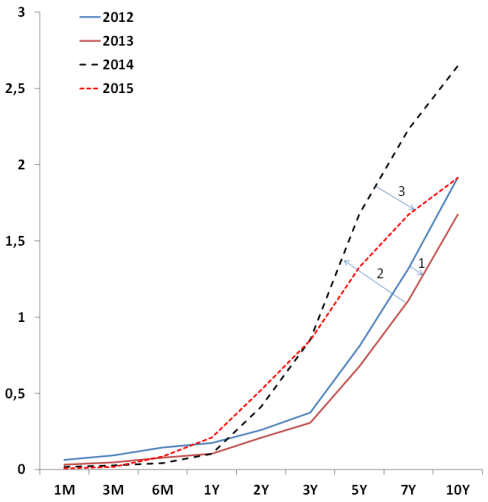
This risk materialized during the current crisis and therefore, in developed countries, monetary policy rates were lowered close to zero. The lesson which can be learned from this experience deals with the inflation target. In order to prevent the natural interest rate from falling to levels which could not be accommodated by the real monetary policy rate, the inflation target should exceed a certain limit, which depends on the natural interest rate (Eggertsson and Mehrotra, 2014; Croitoru, 2015a).

Beside its direct impact on the natural interest rate, *the global saving glut also directly affects the demand for easily salable assets* (the so-called "liquid" or "safe" assets). Bernanke (2015) states that demand for securities depends not only "on their riskiness and expected return", but also on their "easy salability" and/or "ability to satisfy regulatory requirements". The safer the securities, the lower the return lenders demand to invest in such assets. The migration of saving from excess saving countries to deficit countries is associated with keener demand for safe assets. An increased saving glut can trigger a higher demand for such securities, thus contributing to a reduction in their time premium. Quantitative easing, which essentially leads to keener demand for long-term liquid assets, has the same effect.

Finally, beside the two direct effects on the natural interest rate and on the demand for safe assets, *the global saving glut has also had an indirect effect on the expectations regarding the future real monetary policy rates*. In the past few decades, as the monetary policy rate fell in order to remain in line with the natural rate, expectations regarding the future policy rates fell as well, meaning that the time premium added to a relatively low base. In this way, the global saving glut affected directly or indirectly all three components of the yield curve.

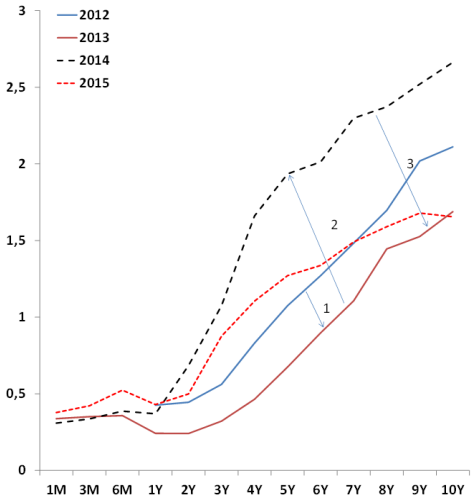
The direct and indirect influences of excess saving were stronger during crises. Bernanke (2015) shows that in the current crisis, all three components – expected inflation, expectations about the future path of real short-term interest rates, and the term premium – "are helping to keep longer-term interest rates low".

Figures 8 to 10 show the yield curves for Eurozone, US and UK bonds in the month of April in the period from 2012 to 2015. A flattening is noticeable 2014 through 2015. Given the stable expectations on inflation and on the short-term real interest rate curve in this period, the flattening must have occurred particularly due to the fall in the time premium, as seen in Figure 11 for the US (Adrian *et al.*, 2013).



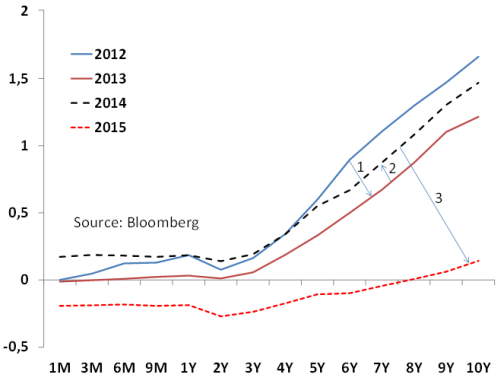
Source: OECD

Figure no. 8 – US - Yield curve for government bonds (%)



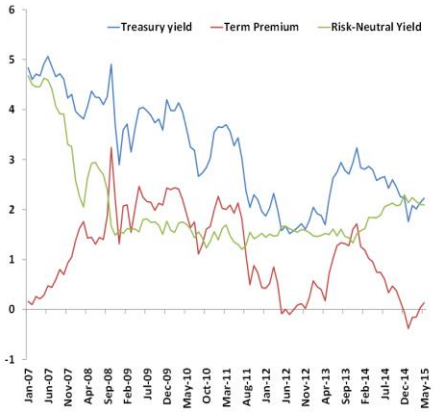
Source: OECD

Figure no. 9 – UK - Yield curve for government bonds (%)



Source: Bloomberg

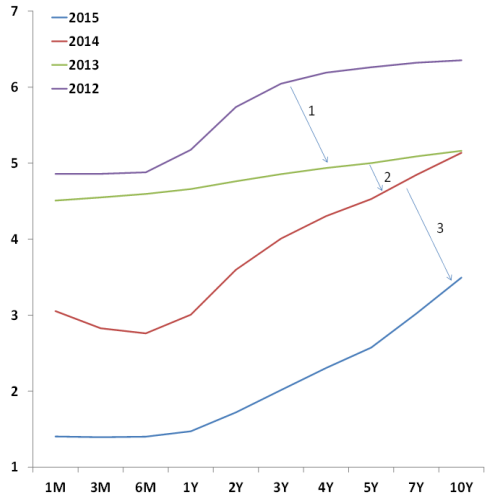
Figure no. 10 – Eurozone - Yield curve for government bonds (%)



Source: Adrian et al. (2013)

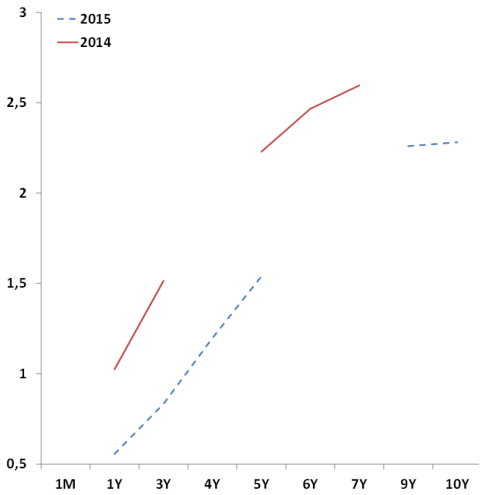
Figure no. 11 – 10-year US Treasury yield decomposition (%)

These developments also influenced Romanian bond yields. The simulations performed based on a VAR model (Radu, 2015) suggest that, for the period from November 2012 to April 2015, the joint impact of a 1 pp change in 10-year US Treasury yields on yields of leu-denominated Romanian bonds over the same maturity was of approximately 0.3 pp. Figures 12 and 13 show the yields on Romanian government bonds in lei and euro respectively.



Source: Bloomberg, NBR estimates

Figure no. 12 – Romania - Yield curve for leu-denominated government bonds (%)



Source: Bloomberg

Figure no. 13 – Romania - Yield curve for EUR-denominated government bonds (%)

6. THE PERSPECTIVES OF GLOBAL IMBALANCES

From a longer term perspective, real interest rates, which have other determinants as well besides excess saving, should decrease sufficiently in surplus countries to eliminate the global saving glut. However, this effect may not occur as long as (a) there are still restrictions on capital flows, (b) some countries intervene on currency markets, aiming at commercial advantages, (c) some countries remain export-dependent, (d) oil prices remain relatively high, facilitating excess saving in oil-exporting countries and, finally, (e) domestic demand in some countries is further constrained by structural factors, so that an interest rate cut would result in currency depreciation and a larger saving glut. Given the above-mentioned restrictions, interest rates will not fall enough to eliminate global imbalances.

A reduction in global imbalances could be possible if the expenditure level began to near the income level in saving glut economies. The economic policy measures which could provide support in achieving this purpose are mentioned by Bernanke (2007). But, as we shall discuss in this section, these chances are, at least in the current conditions, far-fetched for the major economies/areas with excess saving.

Also, some pressure to increase desired saving may occur in the US as population (and potentially labour force) growth slows down. Moreover, the US debt ceiling might be reached at a certain point in time or, the other way round, the surplus countries' capacity to hold US bonds might become saturated, thus generating unsustainable borrowing costs. But, even while taking these possible developments into account, countries remain in the secondarity process, acting either as net exporter or net importer of financial capital, depending on their capacity to manage the consequences of a crisis or of faulty pension schemes, as is the case in some Asian countries like China, for example.

If the hypothesis of taking up secondarity, as described and discussed in this paper, proves right, assuming the US could no longer play its role in the secondarity process, other developed economies will be identified to play, alongside the US, the role that the latter still

plays by itself in the process. Consequently, the widening trend of global imbalances and the effects of lower real interest rates might continue.

For the time being, there is no need to identify another economy to play the role of the US. On the contrary, the Eurozone is among the entities which have recently migrated towards the group of surplus countries. It remains to be seen whether this change was triggered by cyclical factors, reflecting the recession at the euro area periphery, or by structural ones, indicating a strategic move of those particular countries taking up the secondary position, as we assumed in this paper.

On the short term, the factors of influence are different, but act in the same direction. As illustrated in Figure 7, the financial crisis brought about a significant reduction in global current account imbalances in 2009, but these imbalances re-emerged in part as of 2011.

The conditions are in place for these imbalances to widen in the upcoming years (Wolf, 2015; Croitoru, 2015b). On the one hand, in the Eurozone, China and Japan – the area/countries with the largest saving gluts – the chances for domestic demand to grow significantly are rather slim. The Eurozone still faces strong reluctance to spend, to which add the large volume of debt and the lack of fiscal expansion. China's credit-backed investment boom has grown to unsustainable levels, while Japan's public debt is too high for further fiscal policy easing. For these reasons, until the implementation of structural reforms to speed up domestic demand growth in these countries, monetary policy easing remains the only practical solution to stimulate economic growth. Under the circumstances, monetary policy easing will lead to currency depreciation and hence to an increase in export and excess saving in the respective countries.

On the other hand, the monetary policy easing stage seems to have wrapped up in the US and the UK, while the actual demand conditions might call for monetary policy strengthening, at odds with the loose policies in saving glut countries. Against this background, the USD and the GBP could appreciate versus the currencies of surplus countries, which may widen the saving deficit (current account deficit) in the US and the UK.

7. CONCLUSIONS FOR ROMANIA

Interest rates in the developed countries might stick to very low levels over the next years. The factors that led to decreasing long-term rates – the decline in population and labour productivity growth rates and the increase in the propensity for saving in a rising number of countries – have been acting in this direction for decades and their action at global level is likely to continue.

On this background, fluctuations around the above-mentioned trend are manifest over the short term. One of these fluctuations was the recent crisis which pushed interest rates even lower by squeezing economic growth rates and boosting the propensity for precautionary saving. Using quantitative easing programs to push short-term interest rates to very low levels will inevitably give birth to a new financial bubble.

Thus, given a new asset price bubble, for a while, economic growth and interest rates might increase as compared to the current levels. However, if the long-term trend continues, advanced economies are going to experience, more or less, lower-than-pre-crisis growth and interest rates in the future. Moreover, considering the disruptions generated by instances (a)-(e) mentioned in the previous section and the secondarity process, the global saving glut will augment, due also to new excess savings emerging in the countries still posting a current account deficit, but not playing a similar role to that of the US in the global imbalances.

Aware of this context, we may look at Romania's economy in terms of short- and long-term effects. They originate in the fact that Romania is a small, but relatively well-integrated economy in the global economy both financially and commercially, as well as in the changes to the fundamental factors' behaviour once a certain level of development is reached.

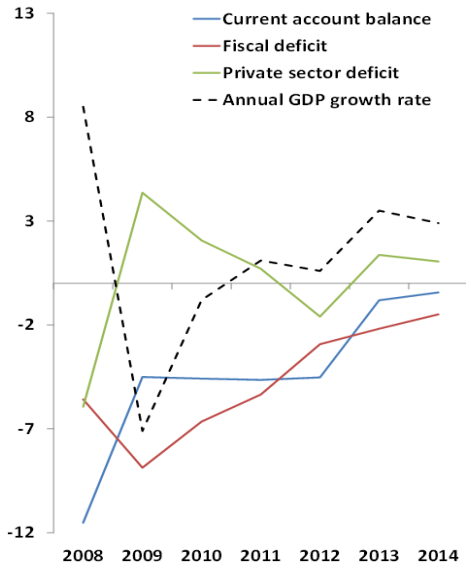
7.1. Short-term effects

The nascent saving glut

One of the short-term effects is that, provided the secondarity hypothesis proves right, Romania might be headed for a saving glut. At present, this hypothesis seems unlikely, but the 2013 saving deficit (excess investment) contraction followed by its halving share in GDP in 2014 came as a complete surprise.

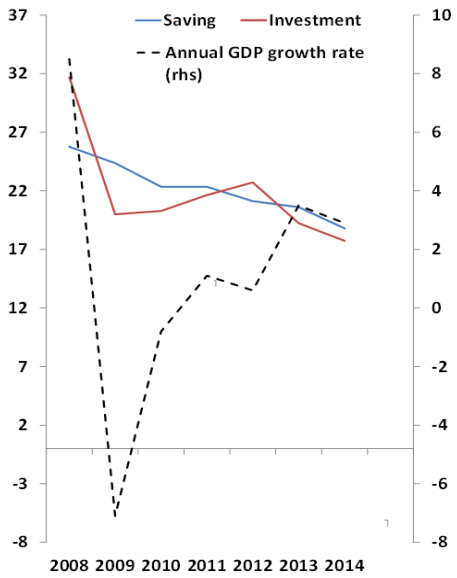
The saving glut that may emerge in the Romanian economy as a whole has already been manifest in the private sector. Except for 2012, the private sector recorded saving gluts from 2009 to 2014 (Figures 14 and 15). This surplus was due to a decline in the share of saving in GDP and an even larger decline in the share of private investment in GDP. In the public sector, the saving deficit was gradually reduced, but it remained larger than the private sector saving surplus.

The increase in public sector savings' share in GDP, which turned positive in 2011, and the decrease in investment's share in GDP (Figure 16) both contributed to the narrowing of the saving deficit in the public sector. The 2014 public budget advance payments for some outlays scheduled for 2015 ultimately caused the economy-wide saving glut to be avoided as early as 2014.



Source: author's estimates based on EUROSTAT, NBR and UNCTAD data

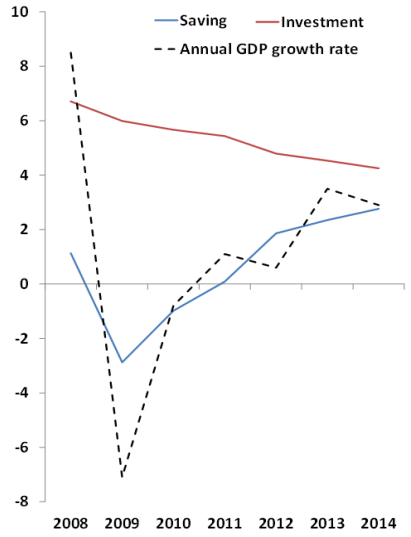
Figure no. 14 – Current account, fiscal, private sector deficits (% of GDP) and the economic growth rate (%)



Source: author's estimates based on EUROSTAT, NBR and UNCTAD data

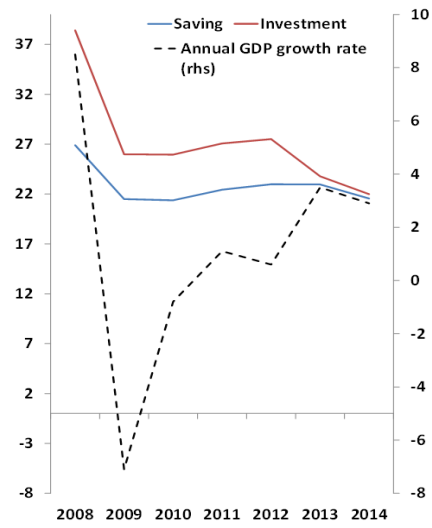
Figure no. 15 – Private sector saving and investment (% of GDP) and the economic growth rate (%)

Perhaps a saving glut will not emerge in Romania in 2015 and 2016, given the tax cuts provisioned in the newly approved Tax Code, which will increase the structural deficit from 1% of GDP, as recorded in 2014, to 3% of GDP in 2016. On the whole, in Romania, the decline in both private and public investment played a major part in the massive reduction of the investment surplus (Figure 17).



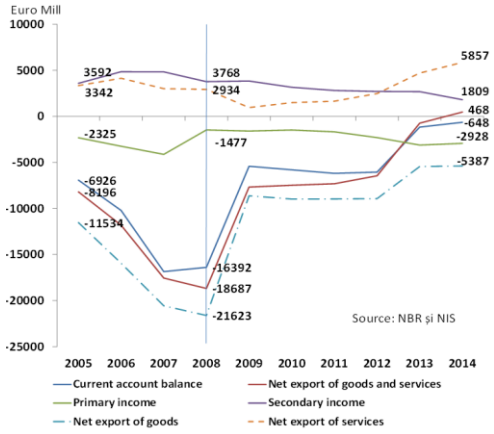
Source: author's estimates based on EUROSTAT, NBR and UNCTAD data

Figure no. 16 – Government saving and investment (% of GDP) and the economic growth rate (%)



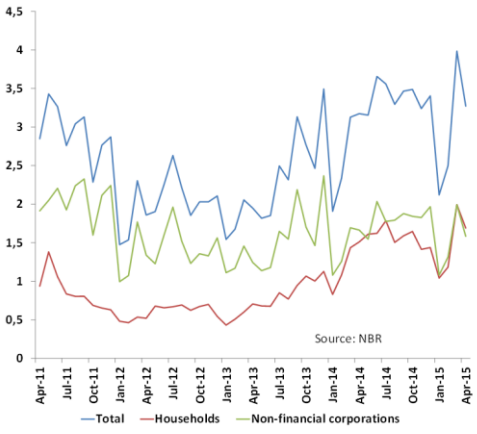
Source: author's estimates based on EUROSTAT, NBR and UNCTAD data

Figure no. 17 – Romania's saving and investment (% of GDP) and the economic growth rate (%)



Source: NBR and NIS

Figure no. 18 – Balance of Romania's current account and component items



Source: NBR

Figure no. 19 – New loans to the private sector on a monthly basis (lei billion)

The conclusion that the current path leads to a saving glut was reached from the saving-investment perspective, but it can be derived as well from the perspective of Romania's foreign trade pattern (Figure 18). Many adjustments which led to the current account deficit narrowing are of a structural, i.e. sustainable[19], nature. The cyclical, or reversible, influence prevailed until as late as 2013, but not any longer.

The signs that Romania is headed for a saving glut became more visible in 2013, when the current account shortfall narrowed to 1.1% of GDP from approximately 4.5% in 2012. The next significant development was the emergence, for the first time in 25 years, of a trade surplus of almost EUR 500 million in 2014 (Figure 18) and of a further decline in current account deficit to 0.5% of GDP in 2014.

The trade balance adjustments were impressive. From EUR -21.6 billion in 2008, the net exports of goods were cut down to EUR -5.4 billion in 2014 and the net exports of services increased from EUR 2.9 billion to EUR 5.9 billion in 2014 (Figure 18). All these developments illustrate the path towards a saving glut.

The Romanian Conundrum

The pick-up in economic growth rates above potential after 2013, together with the saving deficit fall, was seen as a conundrum of the Romanian economy. It was never clear why the current account deficit narrowing in 2013 and 2014 led to an increase in the GDP growth rate[20], estimated in the spring forecast of the National Commission for Prognosis at 3.3% for 2015 and 3.4% for 2016. Exports started rising at a faster tempo as early as 2010, but without an impact on the current account deficit – which reached approximately 4.5% of GDP 2009 through 2012 – and without spurring economic growth.

The conundrum may be explained by starting from the natural interest rate decrease determined by the appearance of a saving glut. In Romania, the fall of the current account deficit near to zero has had an effect similar to the occurrence of a surplus: it determined the rapid reduction of the natural interest rate. Simultaneously, inflation followed a downtrend, thus reflecting positive supply shocks as well as a decline in inflation expectations. Both the reduction of the natural interest rate as well as the fall of inflation generated by the reduction of expectations made it necessary to decrease the actual interest rate, which NBR actually did by lowering it from 5.25% in December 2012 to 1.75% starting in May 2015. Starting 2013, the lower costs associated with leu-denominated loans helped economic growth by diminishing the influence of the balance sheet effect, since the cost of foreign currency loans remained relatively constant (Copaciu *et al.*, 2015).

The combination between the nosedive of the current account deficit, monetary policy rate cuts and liquidity management seems to have pushed the money market rate below the natural interest rate between 2013 and 2015 (stimulative gap). The natural rate is hardly observable and therefore, quite uncertain and, so that uncertainty covers the interest rate gap as well. However, it is only a stimulative interest rate gap that could be consistent with a pick-up in economic growth and a fall in inflation, the latter mostly reflecting the lower inflation expectations, as was the case in the above-mentioned period[21]. Figure 15 sets out that in 2013, once the stimulative interest rate gap has emerged, the monthly volume of loans to the private sector began to increase, which fuelled economic growth.

The interest rate dilemma

On the short term, another relevant effect for Romania might emerge if aggregate demand from advanced economies remains below potential, as is the case of the Eurozone.

In this case, the monetary policy rates in developed countries will continue to remain low. However, as shown above, unlike the Eurozone, in Romania, the actual economic growth rate over the past few years was significantly higher than the potential growth rate, thus speeding up the closing of the negative output gap, likely to be achieved in 2016. This shows that inflation might increase starting 2016.

It is here that a dilemma related to the interest rate in Romania arises. On the one hand, with policy rates remaining low in developed countries, the NBR needs to lower its key rate in order to avoid the appreciation of the domestic currency relative to its equilibrium level. On the other hand, the NBR might need to raise the interest rate with the aim to curb inflationary pressure coming from a positive GDP gap, which, absent shocks, is likely to emerge in 2016, fuelled mainly by the expanding consumption.

During the previous asset price bubble, the NBR dealt with such a dilemma for almost two years. In the period 2006-2008, to curb inflation expectations required upping the interest rate, whereas the capping of capital inflows – which strengthened the currency, but fuelled inflation expectations – required a lower interest rate (Popa *et al.*, 2009; Croitoru, 2014).

Nevertheless, the possible emergence of a saving glut might prevent this dilemma. Unlike during the economic boom, the propensity for saving appears much stronger after the crisis. Once local businesses have reached the conclusion that a saving glut is preferable to a deficit, i.e. secondarity, this trend in saving will be a lasting one and Romania might join the group of saving glut countries. The emergence of a saving glut would lead to a lower natural interest rate, even below the current level, which would make it necessary for the NBR to curtail the policy rate.

The saving glut holds the advantage that it can curb inflation. If the saving glut pushes the natural rate below the monetary policy rate, the central bank can further lower the interest rate in order to prevent the leu from strengthening without overheating the economy. It is as though the saving glut acted as a supplementary monetary policy tool.

Fiscal policy reactions

Finally, another effect is the emergence of fiscal policy changes. Low interest rates and swift economic growth can create the impression that the budget has sufficient steady income and that tax rates can be lowered without causing the budget deficit to widen.

Fiscal policy changes can also be determined by the fact that, *ceteris paribus*, a saving glut may stifle economic growth. Some might say that from the perspective described in this article, the VAT rate cut and other fiscal easing measures planned for 2015-2016 would be welcome since they would entail a wider fiscal deficit that would prevent or at least delay a saving glut in the public sector, which in turn would weigh on economic growth and push interest rates even lower.

Over the very short term, this consequence could be true because it fuels consumption. However, these measures do not address the structural causes depressing economic growth in Romania. For this reason, the fiscal deficit widening by boosting infrastructure expenditure would have been a lot more appropriate. Higher investment spending would have led to both increased consumption and lasting growth of productivity in the private sector and, consequently, of the potential output.

Many analysts believe that the current account surplus registered in the first two months of 2015 will be eroded by the end of the year due to faster economic growth. However, if businesses continue to save, as they had in the last six years, a saving shortfall might emerge in the public sector particularly if the whole of the government-announced fiscal program,

cantered on cutting the VAT rate from 24% to 10%, will be implemented starting January 2016, and another cut to 19% will take place starting January 2017, as planned.

However, as pointed out above, the fiscal deficit widening prevents the emergence of a saving glut which may ultimately prevent the interest rate dilemma. In this case, avoiding the interest rate dilemma remains dependent on when and how fast monetary policy rates will resume the upward path in developed countries.

7.2. Long-term effects

Over the long term, Romania could witness the developments now manifest in developed countries. The population decline that began 25 years ago and the saving glut that might appear will contribute to the slowdown in economic growth and the cut in monetary policy rates. The factors that could counter these influences are the increase in both productivity and the average number of working hours per employee. The latter indicator will nonetheless begin to drop relatively fast once the income per capita has exceeded a certain level, as proved by developments in advanced economies.

In Romania, there are still chances for productivity growth rates to go up and remain relatively high for a long time before they begin falling again. Unlike developed countries, Romania still has some issues which, once they have been dealt with, will remove the current hurdles to productivity growth. It is, first and foremost, about the still disputed property rights and the related rampant corruption. Once these problems have been solved, new mentalities will come up and the resources necessary for new investments (including highways) will be released, which will ultimately entail higher productivity.

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Notes

[1] Deflation occurred temporarily in the US and the Eurozone due to the fall in the oil price and to other supply-side factors. Deflation might not have occurred had actual demand been closer to potential.

[2] In Romania, actual GDP growth rates have been higher than potential GDP growth rates in recent years, prompting a reduction of the demand deficit. However, the latter is still disinflationary, which translates into downward (albeit abating) pressures on inflation.

[3] It is nevertheless unrealistic to imagine a case in which demand in developed countries remains subdued enough vis-à-vis potential to require that monetary policy rates be kept at zero and, at the same time, actual output in Romania exceeds potential, thus calling for an interest rate hike. Such a policy rate increase would strengthen the leu in excess as compared to the appreciation induced by capital inflows, thus contributing even more to the economic growth slowdown. This would lead to

losing the monetary policy tool in Romania, because cooling off large capital inflows and the associated risks would call for a policy rate cut, while inflationary pressures would require an interest rate hike. Some might argue that implementing the measures meant to deter foreign currency lending could, after all, preserve interest rate effectiveness. According to this view, the interest rate increase would continue to determine the leu appreciation, just like before the crisis, but would no longer have as a negative effect the rise in aggregate demand by spurring foreign currency lending. Without this channel, the policy rate hike would lead to the elimination of excess demand and to lower inflation. Regarding this observation, mention should be made that, once the interest rate increase has prompted the significant appreciation of the leu, thus raising markedly the borrowing costs in domestic currency, both banks and the public will jointly find solutions to circumvent the measures which currently lead to capping foreign currency lending.

[4] Woodford (2003) also includes government purchases among the determinants of the real interest rate. Nevertheless, we refer here to fundamentals alone, which do not depend directly on the government. Woodford indirectly refers to the time preference rate, which he includes in a vector illustrating shifts in tastes.

[5] Increased investment demand means that the yields of new investment projects exceed the capital cost. The two are related due to the lack of monetary policy rate arbitrage. Population growth also triggers increased investment demand.

[6] This statement implies that the economy is run according to a general equilibrium model in which the central bank minimizes a loss function, so that the interest rate is set at levels which ensure intertemporal loss minimization. This means that the central bank identifies shocks and addresses them in line with the best-response rule. Alternatively, the bank may have a Taylor function, thus addressing the deviations of inflation from the target and of output from potential (and potentially the exchange rate deviations from an implicitly or explicitly preferred level). In this latter case, the interest rate is no longer set depending on the deviations of the three elements from their stable condition.

[7] In the US, the current account deficit widened in absolute terms until 1987, before gradually narrowing and reaching zero in 1990. This was due to the so-called Plaza Agreement, signed on September 22, 1985 between France, West Germany, the US, Japan and the UK, aimed at forex market interventions to depreciate the US dollar in relation to the Japanese yen and the Deutsche mark.

[8] This is a historical perspective based on the chronological order of events. Obviously, in an ideal world, in which there would be no restrictions on capital movement, no reserve currency and no policies regarding forex reserves, with a fair distribution of energy resources, we would not see major global imbalances as the current ones.

[9] Real lending rates picked up from the 50-year low of -1.5 percent in 1975 to 8.7 percent in 1981 (see www.indexmundi.com).

[10] Inflation targeting, which contributed to lower inflation, without doubt also constituted a factor for boosting confidence in saving. Nevertheless, it cannot be asserted that inflation targeting is a driver of excess saving.

[11] Romania also dealt with a saving glut (current account surplus) between 1982 and 1989 as a consequence of import-reduction policies and forced saving generated by the export of production, although household domestic demand for goods was not met.

[12] Bulgaria, Croatia, Czech Republic, Poland, Romania, Slovakia (until 2009, when it joined the Eurozone), Slovenia (until 2007, when it joined the Eurozone) and Hungary.

[13] The saving glut in Romania in 1982-1989 was also the result of the decision taken by the communist regime of the time.

[14] This means that secondarity does not necessarily affect the tendency towards saving in the country in relation to which secondarity takes place, i.e. the US. Bernanke (2007) claims that the *desired* saving rate in the US did not drop between 1996 and 2004, although net saving (saving less investment) did. Consequently, net desired saving (desired saving less desired investment) increased in countries other than the US and were exported to current account deficit countries, particularly the US.

[15] The slower pace of increase of labor productivity has led to a decline in economic growth prospects, which has in turn depressed investment demand.
[16] In a fantasy world, made up exclusively of closed economies, saving would necessarily equal investment.
[17] Borio and Disyatat (2011) show that, in explaining the decline in interest rates, the focus on the saving glut is logical given the hypothesis that money is neutral on the long term. However, the role of money and finance as well as that of expectations are important and, therefore, interest rates reflect the interaction between the central bank's reaction function and the private sector's beliefs. In their view, the hypothesis according to which money is neutral is unrealistic because successive crises have demonstrated that money and finance can have long-term effects. They have used this view to show that money and financial factors, particularly debt, amplify cyclical fluctuations. For example, the stock of capital can increase during a boom due to favorable financial conditions, which may help constrain inflation and gives the impression that there are no reasons to strengthen monetary policy (Borio and Disyatat, 2014). Once the financial bubble bursts, the large debt stock turns into a "legacy that takes time to resolve", meaning that money is not neutral (this explanation is similar to the one provided by Minsky in 1986 regarding the causes that push an economy into recession following a bust). A consequence of this perspective, explained by Borio and Disyatat (2014), is that "[policies] that do not lean against the booms – but ease aggressively and persistently during busts – induce a downward bias in interest rates over time, and an upward bias in debt levels". From the perspective that interests us here, they conclude that the "trend decline in real interest rates does not just passively mirror changes in underlying macroeconomic fundamentals – it also helps to drive them". Policies (both monetary and fiscal) contribute to the downtrend in interest rates, while low interest rates amplify debt, thus creating a "debt trap" which makes it impossible to up interest rates without damaging the economy. Their view is totally opposed to the "liquidity trap" one (which I share), in which, in some cases, interest rates cannot be lowered to the level of the natural rate in order to jumpstart the economy, as it happened in developed countries during the 2008 crisis.
[18] The factors mentioned in the text – population (labor force, average number of hours worked by an employee), labor productivity and the propensity for saving – are both factors of the real interest rate and of potential output and therefore it was not only the natural interest rate which fell in time, but also the potential growth rate of production. Assuming equal growth rates of the labor force and labor productivity in any two countries, the natural interest rate will be lower in the country with a higher propensity for saving. Nevertheless, since any combination of the three factors is possible, it cannot be stated that countries with excess saving have lower natural rates than those with excess investment.
[19] Among the factors supportive of the massive current account deficit narrowing were the energy efficiency increase and the elimination of some consumers that failed to cope with the natural gas price increase towards the global level, which eventually enabled the reduction of natural gas imports for manufacturing. Moreover, the assimilation of the production (import substitution) of some parts for the exported transport means caused an increase in the value added for the leading export-oriented industry as well as lower imports. Finally, net exports of IT and tourism services grew significantly, resulting in a larger goods and services surplus. A detailed presentation of the structural changes that led to the current account deficit narrowing in Romania is to be found in Iorga (2014). Secondarity and the said structural changes are not contradictory. While secondarity explains these processes from the saving-investment perspective, structural changes illustrate companies' steps to maximize their profits. Secondarity can emerge following any saving and investment change combination having a saving glut as a stable result.
[20] An even sharper fall in saving glut had occurred in 2009. It fell from approximately 13% in 2008 to about 4.5% in 2009 and remained unchanged until 2012, causing a protracted recession to be avoided. From this perspective, things were clear: just like the saving shortfall helps to avoid economic overheating when domestic absorption (demand) is high due to the fact that it places part of aggregate demand abroad by increasing imports, the saving glut helps avoid the recession when domestic demand is weak by increasing exports, i.e. via external demand.
[21] A non-stimulative gap would have led to a slowdown in economic growth and weaker inflation.

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PROPOSED CONCEPT OF SEGMENTATION OF TRADITIONAL JAPANESE EMISSIVE MARKET FOR MANAGING TOURIST PROMOTION OF MEDITERRANEAN COUNTRIES

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Abstract

The concept of segmentation strategy of targeted emissive market is a usable starting point for efficient managing of promotion of receptive tourist destination. Growth in number of competing Mediterranean countries receptive tourist offers, conditions the need for the segmentation of specific emissive markets within the scope of the adjustment in the promotion itself. If this condition is not met, the presence of certain tourist segments may fail to meet the expectations. Segmentation becomes a strategic marketing tool of specialized tourist promotion of the receptive country itself when dealing with the emissive market characterized by the high non-accommodation, self-catering vacation rentals consumption. Promotion in tourism should send clear messages to the sought after, tourist segments regarding what is and how it is being offered. Undifferentiated marketing meant only for specific emissive market, weakens the tourist offers competitiveness and attractiveness. The strategic segments comprised in the process of segmentation, are selected in accordance with both the ability to meet the interests and trends in guests behaviour with available tourist resources of the receptive country. Tourist promotion thus takes over the role of the marketing tool in combining of the supply and demand, always in accordance with the goal strategic segment's standards of the targeted emissive market. For the purpose of this paper the research of Japanese emissive market has been conducted. All tourist segments that can help Mediterranean countries, such as the Republic of Croatia to achieve the growth in tourist consumption and prolong the tourist season, are presented. Research and in-depth analysis showed certain errors in the tourist promotion due to the neglect of the cultural specific quality and historic genesis of the targeted market. The fundamental research question is: there are enough segments on the Japanese emissive market for the efficient promotion of tourist resources of a typical Mediterranean country. All recommendable segments that can be classified as strategic are presented in this paper.

Keywords: promotion, segmentation, emissive market, adjustment

JEL classification: M31, L83

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1. INTRODUCTION

Managing the tourist promotion of specific emissive markets like Japan represents a great research challenge (Hall *et al.*, 2012). It also results in efficient anti-recession performance of national tourist policy of small countries in transition (Avraham and Ketter, 2008). The knowledge of national tourist resources, their selection, together with the adaptability of the tourist offer to strategic targeted guests, is a prerequisite. This approach makes an intangible offer a tangible one, to the targeted tourist segments of selected emissive markets. Lower potential of efficiency of undifferentiated marketing practice in promotion, is very often confirmed on specific cultural emissive tourist markets (Dwyer *et al.*, 2007, p. 27), such as Japan (Gilbert and Terrata, 2001, p. 70). More often than not, the serious segmentation of tourist offers for those markets, fails to be performed (Baxter and Kerr, 2010). Each emissive tourist market is characterized by specific historic and cultural genesis vital for the perception of what and to which segments something is being offered (Šerić, 2014, p. 8). Japanese emissive market is suitable for extending the tourist season of Mediterranean countries, mainly because Japanese tourists travel in periods of autumn or early spring. Conservative and specific Japanese market consists of diverse and specific segments, which means that generalization in the promotion of the tourist offer is not highly recommendable (Pike, 2008). The abundance of cultural, historical, landscape, gastronomical and other resources of Mediterranean countries is a suitable foundation for creating a specialized tourist offer for the Japanese emissive market. The detailed segmentation is necessary, focusing on those tourist segments willing to visit the country judging solely from the available tourist resources (Fennell and Weaver, 2005, p. 373). Despite the fact that the Japanese emissive market is rather attractive (Japanese people in comparison to other nationalities with lower liquidity from theirs, are less demanding) results in business trade are rather oscillating on the Mediterranean national receptive markets (Ladki and El Meouchi, 2013, p. 36). Due to the continuous growth in Japanese tourist demand for the destinations on the Mediterranean (Ma, 2011, p. 11), marketing research concerned with the particularities of that emissive market is crucial, since it is the Japanese tourists who are making a significant impact in tourism of Europe (Hall *et al.*, 2012). This especially goes for small tourist countries (Butler, 2000, p. 109) such as Croatia, since it proved that most of the money in its profit comes from tourism (Šerić, 2014, p. 8).

Research Objectives

The aim of this research is to segment Japanese emissive market and to suggest segments which are appropriate for the promotion of receptive Mediterranean tourist countries in order to prolong the tourist season. The research has been conducted by the case method, analysis and selection of recommended tourist segments of Japanese emissive market for which it is advisable to adjust the promotion of the Mediterranean tourist countries. Synthesis method has been used on the collected data. Segments of Japanese emissive market have been suggested by the deductive method. The analysis method has been performed in combination with personal diary method and in cooperation with the Bluesun hotels in Croatia in order to get to know certain impressions of that population. Small groups of tourists from Japan often stay in those hotels while they visit Croatia. The fundamental research question is: On Japanese emissive market there are more than enough segments for the efficient promotion of Mediterranean countries` tourist resources.

The limitations of this research are related to the relatively small proportion of Japanese tourists in Croatia. Personal diary method is used in order to get more details about behavior, impressions and reactions to the environment during their stay in the Mediterranean countries.

2. RESEARCH: THE POTENTIAL OF JAPANESE EMISSIVE MARKET FOR THE MEDITERRANEAN TOURIST COUNTRIES

Japanese emissive market results are interesting for the research for more than just one reason. We are dealing with the tourist clientele used to traveling by airplane to reach the desired destination (Cheong Jang *et al.*, 2002, p. 367). We are also dealing with the clientele with specific quality of cultural and historic genesis that presupposes coordination of tourist promotion with certain standards, based on which Japanese select a receptive country to visit. It is possible to achieve the repetitive visits from these special but welcome guests, if special needs and expectations are taken into consideration (Ma, 2011, p. 11). It is necessary to promote through all components of potpourri each and every cultural particularity which may seem interesting to Japanese tourists. In doing so, crucial statements from the SWOT analysis (Table 1), obtained from the authors` research, shall therefore be analyzed. A personal diary method and an in-depth interview method (the experts on the Japanese tourist market) were used for this study. The deliberate sample of Japanese tourists who stayed in the Bluesun hotels in Croatia was used in this research. The personal diary method is practical for researchers, because they can obtain a direct feedback on the impressions of the tourists related to the components of the tourist offer (Markwell and Basche, 1998, p. 228). The focus was on the impressions of Japanese tourists by analyzing the data collected from personal diaries (Finn *et al.*, 2000, p. 79). Japanese tourists who had personal i-pads were included in the sample for the pretest research. The personal diary method was carried out through a special blog on the website of the hotel where Japanese tourists stayed (Banyai and Glover, 2011). The personal diary is an anonymous research tool, and the form is shaped according to the research problem. The collected data from personal diaries were analyzed together with the data from in-depth interviews. In this particular case Table 1 is designed.

Table no. 1 – SWOT analysis of the Republic of Croatia receptive market for Japanese tourists

STRENGTHS	WEAKNESSES
UNESCO Site Heritage	Insufficient familiarity with the Japanese emissive market and culture from our tourist representatives and qualified workers, poor knowledge and usage of the Japanese language
Cultural and historic heritage of the Republic of Croatia	Insufficient marketing knowledge and the lack of experience of leading personnel in the field of tourism in the Republic of Croatia, when dealing with specific emissive markets such as Japan
Friendliness and hospitality of locals	Japan does not perceive Croatia as a tourist trademark
Autochthonous gastronomic offer	Lack of any concrete marketing plan for doing business on the Japanese emissive market
Japanese government advises their citizens to travel abroad	Japanese fail to recognize some of the Croatian national souvenirs
Secrecy of the Republic of Croatia on the Japanese emissive market	Undifferentiated marketing approach coming from most tourists subjects in Croatia, even on the national level

STRENGTHS	**WEAKNESSES**
Tourist attractions and program are in accordance with the price for Japanese criteria	Modest and insufficient contacts with Japanese emissive market relevant partners on all levels of communication
OPPORTUNITIES	**THREATS**
Publicity - interest from journalists to write about the particular offers of the Republic of Croatia	Unpredictability of trends in tourism of Japanese emissive market- limited possibility of adjustment
Visiting certain destinations of the Republic of Croatia is incorporated in some European Union programs offered on the Japanese emissive market	Natural and other catastrophes that shook Japan over the past few years, having repercussions on seasonal decrease of Japanese tourists migrations
Growth in interest from Japanese tourists in visiting Europe	Loss in tourism trading if Japanese tourists are lost due to the particularities of an adjusted offer
Continuous process of Japanese population becoming an old nation	Categorization of tourist offer of the Republic of Croatia considered improper due to the safety reasons, eastern ways of doing business and communication

Source: Author research obtained from in-depth interviews and personal diaries with group tourist guides from Japan and agencies` representatives (2012-2013)

Fundamental and strong spots in the case of Japan, when performing promotional potpourri are natural and cultural heritage alongside national gastronomic offer. Tourist workers should be informed and educated on particular ways of dealing with Japanese tourists, even though it is not possible to act proactively on all aforementioned threats, it is important to take them into consideration, and perform accordingly to avoiding them. Since Croatia has become a member of the European Union it is advisable to direct the promotion of tourist offer towards the strengthening of national identity with the goal of differentiating its tourist image from other Mediterranean countries (Ma, 2011, p. 11). This can be achieved by enhancing the quality of polite communication with tourists (Özer and Köse, 2013, p. 10). Japanese are welcome tourists and great spenders (Ma, 2011, p. 11). Differences can be perceived among the segments - clusters of tourists. Therefore it is advisable to perform a detailed segmentation of the target emissive market (Cheong Jang *et al.*, 2002, p. 367).

Data Analysis

General segmentation of Japanese emissive market points out three important clusters which are recognized in the research of Japanese tourists while they are staying in Croatia; *seekers after novelty in tourist offer and nature, vacation seekers, and the representatives of the active vacation.* The tourists in the first cluster are the ones who spend the most, and the Republic of Croatia can offer them a lot, due to Croatian diversity on a geographically small territory. Hence it is clear that the activities in promotional potpourri should aim at this target population of Japanese tourists, not necessarily neglecting the remaining two clusters. In the last couple of years there has been evident growth in interest from Japanese tourists in visiting the Republic of Croatia through contacts with tourist representatives. Growth in interest for visiting Croatia is evident in Table 3, in the number of visits of Japanese tourists. It is now clear from the comparison drawn from the table that Japanese tourists stay in Croatia 3-4 days on average. It can be inferred from the above mentioned that the wide range of tourist attractions failed to be presented on the Japanese emissive market. It has been confirmed from the close contact with Japanese tourist agencies representatives (Bluesun hotels, 2013) that Japanese tourists come here as a part of the program that also

comprises visiting and getting to know the nearby countries. Japanese tourist agents explore the potentials of the Croatian tourist offer based on their personal experience and guests comments. Tourists are not familiar with the tourist attractions (Aziz *et al.*, 2012), since the national tourist promotion of the Republic of Croatia is not appropriately differentiated in the context of the dominant interests and trends of Japanese people when choosing a certain destination. In the Table 2, periods of decrease in number of tourist arrivals is marked in red, which clearly shows that the majority of Japanese tourists after visiting the Republic of Croatia for the first time, still do not show interest in coming back again, to explore other destinations. This indicates the need to improve the promotion of resources and facilities that Japanese tourists prefer.

Table no. 2 – Number of Japanese tourists visiting the Republic of Croatia 2005-2012

	ARRIVALS OF JAPANESE TOURISTS IN CROATIA MONTHLY							
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
January	456	1.040	1.028	2.165	4.199	2.157	2.164	3.326
February	331	817	595	2.559	3.964	2.685	3.081	3.625
March	1.370	3.120	3.221	7.141	5.940	7.177	4.560	8.891
April	3.417	7.039	8.323	13.683	13.792	10.855	9.175	14.201
May	4.206	9.683	10.960	18.360	21.768	19.760	14.297	20.461
June	3.612	6.527	9.483	23.534	20.139	24.898	19.436	21.752
July	2.462	5.072	6.651	11.859	12.786	12.579	12.539	15.107
August	2.781	6.391	9.589	16.170	19.884	18.496	16.415	18.140
September	3.149	7.285	12.007	17.058	18.938	14.944	16.804	15.451
October	6.196	11.695	13.695	18.899	27.537	20.913	21.469	20.113
November	3.470	4.328	7.794	7.943	10.357	8.833	9.051	11.539
December	1.298	1.754	3.058	4.333	3.869	3.822	2.639	2.482

Source: authors` research, Croatian National Tourist Board (2013)

Table no. 3 – Number of Japanese tourists staying in hotels in the Republic of Croatia 2005-2012 (monthly)

OVERNIGHTS OF JAPANESE TOURISTS IN HOTELS OF CROATIA MONTHLY								
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
January	885	1.696	1.462	2.834	4.861	2.790	2.682	4.250
February	583	1.531	959	3.164	4.723	3.299	3.971	4.678
March	2.424	4.396	4.238	8.991	7.305	9.293	6.202	11.435
April	4.895	9.912	11.719	17.818	18.315	14.729	13.046	19.524
May	6.425	14.319	17.412	25.692	28.485	26.627	20.444	27.892
June	6.159	10.526	14.239	34.856	29.219	35.034	27.151	31.657
July	4.690	8.682	11.379	18.164	19.125	19.055	18.468	23.004
August	6.152	11.487	16.967	24.536	29.310	28.533	26.691	30.874
September	5.067	10.803	19.923	24.837	26.089	21.507	24.171	23.151
October	9.602	17.258	19.402	25.146	35.919	27.398	28.376	26.997
November	4.965	6.247	9.619	10.000	12.900	11.169	10.909	13.576
December	1.874	2.553	3.810	5.261	4.751	4.988	3.629	3.461

Source: authors` research, Croatian National Tourist Board (2013)

The continuity in growth was missing in the period from 2010 to 2011 due to the global recession (http://www.germany.travel/media/en/Japan_kurz.pdf). What is interesting is the fact that Japanese tourists come during the entire year, what is the specificity of that emissive tourist market (http://japanexplained.wordpress.com). From the Table 3 it is clear that the significant number of Japanese tourists arrive in months of November and February.

The latest data shows that in the first six months of the 2013 there was a record number of Japanese tourists arriving. Compared to the last year it is a 40% increase. It is interesting to mention that in the same period of that year Japanese visiting China were significantly fewer (even up to 85% in comparison to the previous year). The appreciation of Japanese national currency yen also has its role in the Japanese growing interest for visiting Europe and also the Republic of Croatia (The Tokyo Times, 2013). However, to gain their loyalty and the increase in number of visits, it is necessary to improve the targeted promotion of Japanese emissive market.

Table no. 4 – Average expenditure of predominant emissive tourist Japanese clusters

AVERAGE SPENDITURE (in 10,000 yens)	**CLUSTER 1**	**CLUSTER 2**	**CLUSTER 3**
per person	49,2	37,8	34,9
per person / per night	7,80	6	5,8

Source: The Tokyo Times, 2013 (August)

In communicating with the representatives of Japanese tourist agencies there are certain reasons based on which their agents are expecting the continuous growth in interest from Japanese tourists in Europe (Bluesun hotels, 2013):

- Stabilization and continuity of growth of Japanese market field;
- Japanese government encouraging travelling abroad;
- Increase in number of transportation capacities and air companies;
- Increase in number of Japanese businessmen travelling.

Alongside aforementioned it is worth mentioning some more particularities of the emissive market of Japan that should be implemented in promotional tools (The Tokyo Times, 2013):

- Japanese are curious- due to Japan being isolated and rather closed during the last 250 years after 1868. International travels were prohibited to the Japanese in the period from the Second World War to the 1964;
- Japanese travel in groups- lack of confidence in long distance destinations, foreign customs and habits;
- Japan, in comparison to other countries, is safe and homogenous country. That is the reason why they choose to visit countries with the low criminal rate (inquiring into this before departing);
- Japanese are pacifists- in every situation they prefer harmony to conflict, and rarely choose to visit the countries with aggressive inhabitants.

3. RESULTS OF RESEARCH: SUGGESTIONS ON SEGMENT STRATEGIES OF EMISSIVE JAPANESE MARKET FOR THE TARGET TOURIST PROMOTION

In putting into practice the potpourri for the Japanese emissive market, based on the results inferred from the research, it is crucial to perform the segmentation on a larger number of segments with shared, similar interests. Segmentation should be performed in terms of available tourist resources of the Republic of Croatia and Japanese trends in tourism (Ma, 2011, p. 11). Research analysed in this paper, showed the need for the segmentation of Japanese emissive market for the receptive tourist countries on the Mediterranean. Segmentation should be carried out, not only on the three clusters, mentioned before but on the additional seven relevant tourist clusters:

1. **Family tourism (kazoku ryoko)**
   Family trips include parents and most frequently one child under the age of 12, but recently there has been a trend of family trips including more generations – parents, grandparents and children travelling together. This segment would still choose a destination based on the distance and accessibility rather than the tourist program itself (choosing between Rome and Trogir, they will go for a destination that has a direct flight to and that can be reached faster).
2. **School excursions (shugaku ryoko)**
   This segment (both students and their parents) still prefers travelling inside Japan, and when choosing a destination, they look into cultural and natural attractions and particularities. There has been evident growth in interest for travelling abroad, resulting in their choice of non – branded destinations (in attracting tourists it is necessary to promote accompanying tourist attractions in the cultural segment, but also pointing out all the landscape particularities of a specific destination).
3. **Undergraduate excursions (sotsugyo ryoko)**
   This segment represents Japanese students in the final year of studies. Even though they still prefer the USA, and the countries of Asia, the interest in Europe is growing. They travel mostly in March, which would significantly prolong the tourist season in Croatia.
4. **Weddings overseas**
   This category of Japanese tourists can be viewed separately, as a unique segment per se, since the data from the *Watanabe* tourist agency shows that in the last few years more than 40.000 Japanese couples organized their weddings abroad. These travels are mostly organized in smaller groups of twenty people, or in larger ones. The most interesting destinations for them still remain Hawaii, Guam and Australia, but there is a great, growing interest in Dubrovnik. The luxurious, wedding specialised magazine *25 ans,* published in 70.000 copies, dedicated 16 pages to Dubrovnik. Their journalists stayed in Dubrovnik in the organization of Croatia Tourist Board, Dubrovnik Tourist Board and the Tourist Board of Dubrovacko-Neretvanska County. There has been growth of 40% in this segment compared to the last year.

   This trend is a consequence of lower costs of a ceremony compared to a traditional wedding in Japan; the organization is simpler, more intimate for the family and their guests. This is currently the fastest growing segment of Japanese tourists.

5. Newlyweds on a honeymoon

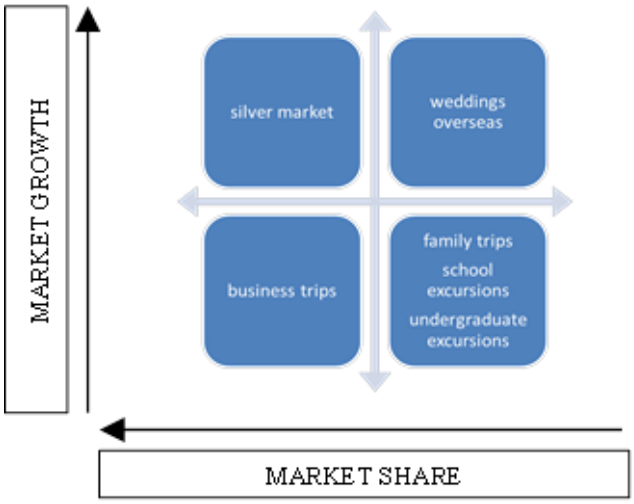
Japan is a traditional country with 750.000 new marriages a year. The data shows that 60%-80% of newlyweds choose to have their honeymoon somewhere abroad. This segment is rather appealing, since they spend a lot, go for the best accommodation, restaurants, and special excursions, go on a shopping spree, etc. The Republic of Croatia is of special interest for this segment as well (as for the one above mentioned).

6. Business trips (shokuba ryoko)

It is a common practice in Japan for colleagues to travel abroad in smaller or larger groups (depending on the size of a company). These trips last from a few days to an entire week, during the months in autumn or in June. Statistics show that 74% of companies in Japan salute and support these trips, and around 7-10% of Japanese actually travel with colleagues from work (Japan Explained FASAQ, 2013). Currently we are dealing with shorter trips, of 3-4 days, and the destinations chosen are mostly the distant ones.

7. Silver market

This segment includes elderly tourists, above the age of 60. Japan is an old nation, with more than 25% of population being elders. They travel mostly with spouses, or a close family member. There is an evident interest for Europe, even though their preferred destinations remain the USA, South Korea, China, Taiwan and Hong Kong. These segments, in comparison to others, stay abroad longer, and are in the focus of Japanese travel agencies. Retired Japanese have considerate savings, and can travel throughout the year. This trend is high due to the tax of 25% on the legacy in Japan. More of these tourists are coming to the Republic of Croatia. From the segmentation performed, in sequence the BCG matrix, Figure 1 is given for tourist segments from the aspect of the receptive tourist market of Croatia:



Source: authors` based on the research conducted in August 2013

Figure no. 1 – BCG matrix of tourist segments of Japanese market for the Republic of Croatia

Having seen the segmentation of Japanese emissive market, it is important to take into consideration the trends and habits of clusters on the Japanese emissive market.

Cluster 1 - *novelty in the tourist offer and nature seekers*

This cluster comprises the tourists interested in culture, new destinations, purchase, different lifestyles and environmental awareness. The average tourist in this cluster is being maintained (housewife or a child), or employed in the industrial sector. They travel mostly during the summer or autumn.

Cluster 2 - *vacation seekers*

This cluster comprises those holding on higher positions, mostly singles, in their late twenties or early thirties. They travel to escape from the stressful reality, go for larger cities with more attractions to offer.

Cluster 3 - *active vacation (and family vacation)*

Those falling in this category choose programs with lots of activities, filled with hiking, cycling, climbing - going on expeditions, etc. We are dealing with relatively younger population, going for destinations that provide diverse recreation and sports activities.

In the structure of Japanese guests visiting Croatia, women over 50 are predominant, rarely travelling with husbands and children. The size of the group depends on the total cost of the travel arrangement, but in general groups of 30 have cheaper and of 20 more expensive travel arrangements. They show special appreciation for the UNESCO heritage sites, when in the Republic of Croatia, they visit the following destinations: Dubrovnik, Split, Trogir, Plitvice Lakes and Zagreb. In the vicinity they chose to visit Kotor, Mostar, Ljubljana, Bled and Wienna (Japan Tourism Marketing Co., 2013). Consequently, Japanese tourists who visit a certain country once do not usually come back (The Tokyo Times, 2013). It is a real enterprise to try to attract them to come back. The duration of the trip depends on the cost of the travel arrangement. The pricey ones can take even 15 days. Japanese tourists appreciate politeness and courtesy in communication, and punctuality of great important for them as well in terms of following the set timetable and program components.

Japanese tourists often ask for a bathroom with a tub, separate beds (that doesn`t mean that the spouses don`t share the same bed, but for certain reasons they keep the folded clothes on the bed instead of keeping them in the wardrobe). Some other particularities have been noticed as well, they don`t want covers, blankets and comforters to be in blue. Speaking of meals they prefer their courses to be in smaller portions and in few sequences. They are aware of the inappropriateness of smoking, and they don`t like to see tourist guides smoking when in their company. Even more, they find it rude and disrespectful. They can recognize some Croatian souvenirs, like the Croata Program, Croatian chocolates, truffle products, dry figs, and they appreciate fig marmalade very much. It is important that those in close contact with Japanese are familiar with and educated in their culture and habits. They will always prefer a local tourist guide fluent in Japanese, regardless of the additional cost. Japanese come from a safe country and it is important to make sure this aspect is implemented in the promotion arrangements.

4. CONCLUSIONS

Segmentation in the managing of the national tourist offer for specific emissive markets is an imperative in order for the available tourist resources to be adjusted to the targeted tourists. Segmentation results in the realization of the following goals:

- Growth in the tourism trading with the prolonged season
- Increase in spending from tourists from those markets
- Adjustment in image of tourist arrangements to target segments
- Encouraging the development of the quality of the tourist offer (attractions and experience)
- Creating a recognizable national tourist label.

Promotion in tourism should send clear messages about what is and how it is being offered. It is important to adjust the offer to the target segments, in order to have an efficient potpourri. Undifferentiated marketing in tourist promotion concentrated exclusively on a specific emissive market weakens the competitiveness of national tourist offer. Strategic tourist segments are selected based on their interests (and trends in tourist behaviour), combined with the available tourist resources of the receptive country. Tourist promotion thus works in the interest of better promotion of what is being offered and presented in accordance with the strategic standards of the segments of the emissive market being addressed. Due to the discrepancy and generalization of tourist offer, in Croatia we are experiencing the absence of synergy in the promotion of national tourist offer. It results in great dissatisfaction with the structure of guests, and inactivity when trying to attract more affluent tourist segments. Internet marketing enables tactical operating in managing the promotion for the selected tourist segments on the target emissive market. Promotion for strategic segments on Japanese emissive market should put emphasis on the following:

- Landscape preservation with groomed pathways, promenades, beaches and accompanying tourist infrastructure
- Accessibility of cultural, archaeological and other attractions of a destination can prove interesting to target tourist segments
- Professional competence of tourist qualified workers
- Coordination of all subjects taking part in the tourist offer of a given destination
- Continuity in tourism planning, monitoring and controlling
- Other facts and attractions that are generally important for the tourist on Japanese emissive market in their decision making.

Together with everything stated so far, it is advisable to further integrate in promotional assortment the following:

- Cooperation with the leading emissive Japanese tourist agencies
- Implementation and adjustment of promotional material with the Japanese culture, habits and standards.

Preliminary research conducted in the paper was performed on two levels in Japanese tourist structure - based on the data collected from a few Mediterranean countries, and on the data related to the number of Japanese tourists coming to the Republic of Croatia from 2005 – 2012. The primary research obtained from the sample of Japanese group tourist guides and their tourist agencies representatives showed discrepancy in the expected and given service to the Japanese guests. The reason can be traced in the undifferentiated marketing approach in promoting tourism on different markets, neglecting specific cultural and historic genesis of Japan. The practice of tourist promotion of Mediterranean countries at the Japanese emissive market is based on generalization of approach to the three basic, large segments of Japanese tourists. This approach does not result in the creation of loyalty to Mediterranean countries. This is confirmed by the experiences of Croatia. Trends also

show slowed growth in the share of Japanese tourists in comparison with growth of the share of tourists from other Far East countries. Research findings indicate that Mediterranean countries should implement a more detailed segmentation of Japanese emissive market in order to attract more Japanese tourists. Promotion of resources and facilities should be adjusted to selected market segments. This paper presents seven essential segments of Japanese tourists. Personalization of the tourist promotion of Mediterranean countries or Mediterranean destinations is suggested for these market segments. Research findings confirm the potential of the developed and complex Japanese emissive market. The specificity and the number of proposed target segments suggest the need for a differentiated approach in the management of tourist promotion. Generalized approach, so far the practice of Croatian tourism, rarely results in the formation of loyalty to the Mediterranean destinations. Japan is an insufficiently known and complex tourist market, which is why new knowledge presents a usable foundation for new research. It would be too complex to generalize the management of the tourist promotion of each Mediterranean country, but the presentation of seven target segments of Japanese tourists can be a usable starting point for such mission.

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SAFETY MANAGEMENT IMPROVEMENT POSSIBILITIES IN SMEs

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Abstract

The safety management system in 16 Estonian manufacturing companies (eight certified and eight non-certified in OHSAS (occupational health and safety management systems standard) 18001; four of the last corporated to the foreign firms) were investigated using the MISHA method. The results showed that if the advanced safety methods (like proposed by OHSAS 18001) are implemented by the initiative of the employers of the locally-owned Estonian SMEs, the level in safety performance, comparable with OHSAS certified companies could be achieved. The regression analysis showed strong correlation between the personnel management, safety activities in practice, communication, physical work environment, psychological working conditions, hazards analysis procedures and the safety level, R2= 0.7312-0.9596; medium correlation between the participation, personnel safety training, occupational accidents and illnesses, social work environment and the safety level (R2=0.3133- 0.6044). Low correlation (R2= 0.2139) was recorded between the safety policy and the safety level and there was no correlation between the work ability of the employees and the safety level. The methods to improve the locally-owned enterprises' safety level up to the corporated and OHSAS 18001 certified level are proposed. The cost of suitable safety measures is calculated. The MISHA method improvement possibilities for the use in the SMEs (small and medium size companies) are presented.

Keywords: Safety management, Safety measures, Safety performance, Risk assessment, Safety training, SMEs (small and medium size companies)

JEL classification: A13, B41, F64, I15

1. INTRODUCTION

The number of work accidents (with ≥3 days of disability) is ~4000 per year in Estonia (workforce 600,000); the number of the fatal accidents per 100,000 workers was 3.2-3.4 during 2008-2010 (National Labour Inspectorate of Estonia, 2015a). With these accident levels Estonia takes the middle position in the list of the European Union countries. The numbers slightly increase or decrease with the economic upturn or downturn. The number of

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occupational diseases in Estonia is 10/100,000 workers and the number of work-related diseases (which do not give irreversible health damage) is 25-30/100,000 workers (National Labour Inspectorate of Estonia, 2015b).

The main tool for improvement the situation in the safety area in the Estonian small and medium-size enterprises (SMEs) is to promote the safety management. The activities in this direction begin with risk analysis as settled in the Parliament of Estonia (1999). The quality of the risk assessment in the work area gives the overview of the health hazards existing in the enterprise and of the workers at risk.

Safety management seizes a large area in the enterprises' activities and includes as technical as psychological risk assessment and management. Risk management in the industrial enterprises has been investigated by a large number of researchers abroad and domestically (Ballou, 1992; Peterson, 2000; Geller, 2005; Leiter *et al.*, 2009; Traumann *et al.*, 2013; Reinhold *et al.*, 2009).

Safety climate is considered to be a sub-component of the "safety culture" (Cooper, 2000). The leading indicators for safety performance are the size of the safety budget, safety audit scores, the number of safety inspections and the number of safety meetings involving management (Tomlinson *et al.*, 2011). Young workers are more likely to be injured at work than older ones (Breslin and Smith, 2005; Laberge and Ledoux, 2011) and this appears to be related to inexperience. Sorock *et al.* (2001) showed that work accidents happen more frequently while the worker is performing an unusual task.

The objectives of the study are:

1. To clarify the advantages in the safety level at enterprises where OHSAS (occupational health and safety management systems standard) 18001 has been implemented or the enterprises that belong to the big international corporations compared with the locally-owned companies;
2. The implementation of OHSAS 18001 is expensive. Therefore the goal of the study is to show the ways for locally-owned companies (often SMEs), in which areas the changes are more needed to gain the better safety level.

2. THE SCIENTIFIC BASIS FOR COMPILE THE QUESTIONNAIRE IN THE INVESTIGATION OF SAFETY PERFORMANCE

2.1. Safety culture, climate and performance

Safety culture is a subset of organizational culture. It is thought to affect the attitudes and safety-related behaviour of the members of an organization (Cooper, 2000; Fernandez-Muniz *et al.*, 2007; Luria and Rafaeli, 2008). However, there is another closely linked concept: safety climate. Safety climate is often understood as the surface expression of safety culture, and is said to be measured directly through the perceptions and attitudes of the employees (Flin *et al.*, 2000). One has never clearly distinguished these two terms, and indeed, many authors use them interchangeably (Wu *et al.*, 2010). "A Guide to measuring health & safety performance" (HSE, 2001) is a guide document for employers who understand the principles of health and safety (H&S) management and wish to improve the measurement of H&S in their organizations. Information from H&S performance measurement is needed by the people in the organization who have particular responsibilities within the H&S management system: the leadership, senior managers, line managers, supervisors, H&S professionals and employees/safety representatives. Each organisation must create and communicate performance measures that reflect its unique strategy.

What to measure?: 1) the health and safety management system; 2) the safety policy; 3) the organizing of the work in H&S; 4) planning and implementation of safety measures; 5) the measurement of the safety performance; 6) the measurement of the failure- reactive monitoring.

One field is to measure the activities designed to prevent the occurrence of injuries and work-related ill-health (active monitoring). Failures in the risk control as the reactive monitoring, provide the opportunities for organizations to check performance, learn from failures and improve the health and safety management system. The measurement of the H&S culture includes control, communication, co-operation and competence (Cooper, 2000).

The term health and safety climate has been used to describe the tangible outputs of an organization's H&S culture. H&S climate survey tool has been worked out by Health and Safety Executive (Great Britain). Measuring progress with plans and objectives is facilitated by defining who does what, when and with what result. This means that regular checks on progress can be made at appropriate intervals against a defined performance standard. Measuring is ongoing activity, the process is continuous. H&S performance needs to be measured at each management level in an organization, starting with the most senior management. The measurement process can gather information through the direct observation of conditions and of peoples' behaviour; talking to people to elicit facts and their experiences as well as gauging their views and opinions; and examining written reports, documents and records. These information sources can be used independently or in combination. Direct observation includes inspection activities and the monitoring work environment (e.g. temperature, dust levels, solvent levels, noise levels) and people's health and safety-related behaviour. This may be achieved by developing checklists or inspection forms which covers the key issues to be monitored in a particular area of the organisation within a particular time period.

The checklists contain: premises, including access/escape, housekeeping, work environment; plant and substances, including machinery guarding, local exhaust ventilation, use/storage/separation of materials/chemicals; procedures, including permits to work, use of personal protective equipment, producers followed; people, including health surveillance, people behaviour, appropriate authorised person.

Many authors have addressed the dimension structure of safety culture/climate and its effect on safety performance. Some of the authors suggest that safety leadership is a causal factor for safety climate (Zohar and Luria, 2005; Luria and Rafaeli, 2008).

Different grades of managers play different roles. Higher-level managers generally deal with policy and strategy; mid-level managers mainly take care of safety procedure and tactics; low level managers work on safety practice and operations. An organization that wants to improve the safety in their enterprises, have to found the appropriate safety managers: safety caring, safety coaching and safety controlling predict a good safety culture.

Today (Wu *et al.*, 2010), the middle management plays a more important role in safety than lower level supervisors. The management's three roles in creating a good safety climate at the enterprise are: collection of information, dissemination of information and creating an open environment in which safety issues can be discussed (Peterson, 2000).

Measurement of safety performance is notoriously problematic as measures such as accident rates and compensation costs tend to be reactive (after the event). The links between the safety climate and safety behaviour are not strong (Cooper and Phillips, 2004).

2.2. Safety training

Safety training and informing can significantly improve employee's safety-related behaviour. Safety informing includes three aspects: safety monitoring, safety dissemination and safety representing. Safety monitoring means acquiring safety information through the different type of learning methods. The workers have to get the newest information.

Training has received much attention in the safety literature, and several comprehensive reviews exist (Jonston *et al.*, 1994; Cohen and Colligan, 1998; Wirth and Sigurdsson, 2008). The one-time and traditional trainings might not be official if there is no program how to motivate behaviour of the worker (). The newer training tools are also available (Sinclair *et al.*, 2003; Wallen and Mulloy, 2006; Wirth and Sigurdsson, 2008; Paas *et al.*, 2015b). The new direction for training is blended learning (Stanca and Lacurezeanu, 2012), but it is suitable only for the leadership, not in the safety education of the industrial workers. Safety training and injury prevention are closely connected (Jonston *et al.*, 1994; Bell and Grushecky, 2006). The human factor and worker's behaviour have to be considered (Dermol, 2013). The videos and interviews are useful in safety learning process (Laberge *et al.*, 2014).

2.3. Risk assessment tools

Another area in safety research concerns the evaluation and development of new risk assessment tools that safety professionals can use. Various tools, such as root cause analysis of injuries (AbsConsulting, 2005) and PIC/NIC analysis of consequences (Angew and Snyder, 2002; Daniels and Daniels, 2006) have been developed to identify the risky behaviours. The authors of the present paper have worked out a flexible risk assessment method (Reinhold *et al.*, 2006) in 2006. It differs from the general risk assessment method proposed by the British Standard Association (BS8800) and is suitable for the use in SMEs (small and medium size enterprises).

Safety is a very complicated matter and needs thorough research in the certain areas of the industrial activities. Safety management is a multi-level control problem (Wahlstrom and Rollenhagen, 2014). Safety culture is identified to safety climate in the analysis of the causal relationships between its key dimensions.

3. THE MATERIAL AND METHOD

To select industrial companies for the research, the database of Estonian Association for Quality (2014) was scanned. By January 2014, 178 Estonian companies owned OHSAS 18001 certification. The scan showed that 32 % of certified firms come from manufacturing sector. The authors contacted each of these firms and explained briefly the purpose and the scope of the research. Finally eight companies (representing main manufacturing areas in Estonia such as printing, textile, metal, food industry etc.) agreed to participate which was enough to perform a qualitative study. In order to compare the results with non-certified organizations, eight companies with similar background were selected. The research objective was assess the safety level at the enterprise. 16 enterprises were chosen. The top managers, middle-stage managers, work environment specialists and work environment representatives were interviewed (Table 1).

During 2014, eight (OHSAS 18001-certified organizations, group I) + eight (non-certified organisations, group II) Estonian enterprises from different branches of manufacturing participated in 25 interviews with employers, middle-level safety personnel and with safety responsible persons (Table 1). Altogether 55 questions (presented in Kuusisto, 2000) were asked from each of the person interviewed. The MISHA (method for industrial safety and health activity assessment) method (scale 0-3) was used for assessment as the safety auditing method (Kuusisto, 2000). The interviews were carried out by the expert-interviewer (the first author of the paper). The MISHA method consists the following safety areas:

A. Organization and administration
   A1. Safety policy
   A2. Safety activities in practice
   A3: Personnel management
A. Participation, communication , and training
   B1. Participation
   B2. Communication
   B3. Personnel safety training
B. Work Environment
   C1. Physical work environment
   C2. Psychological working conditions
   C3: Hazard analysis procedures
C. Follow-up
   D1. Occupational accidents and illnesses
   D2. Work ability of the employees
   D3. Social work environment.

Each area give 25% of the total, so maximum total score (safety level) is 100. Each safety sub-area (like A1, A2 etc.) includes different numbers of questions (from three to 20) according to the MISHA method.

Table no. 1 – The characterisation of enterprises investigated (N=16)* (Paas *et al.*, 2015)

Id. of the company	**The activity area**	**Life-time, years**	**Size, employees**	**The overall assessment on safety** Likert scale*** **	**OHSAS 18001 imple-mented**	**The persons interviewed: position, age**
K (Int 1)	Textile industry	11-25	50 - 249	3	-	Production manager, 38
L (Int 2-4)	Plastic industry	11-25	50 - 249	4	+	Quality manager, 41 Safety manager, 62 WER, 25
M (Int 5)	Furniture industry	> 50	50 - 249	4	+	Personnel manager, 64
N (Int 6)	Heat industry	> 50	50 - 249	5	+	Quality and environ-ment manager, 58
O (Int 7)	Printing industry	1-10	< 50	2	-	Production manager, 36
P (Int 8-9)	Metal industry	> 50	≥ 250	5	-	Safety manager, 35 Trade union representative, 60

Id. of the company	**The activity area**	**Life-time, years**	**Size, employees**	**The overall assessment on safety** Likert scale*** **	**OHSAS 18001 imple-mented**	**The persons interviewed: position, age**
Q (Int 10-12)	Electronics industry	11-25	≥ 250	5	-	Quality manager, 36 Safety specialist, 42 WER, 53
R (Int 13-15)	Food industry	> 50	≥ 250	4	-	Safety specialist, 62 WER I, 34 WER II, 39
S (Int 16-18)	Electronics industry	11-25	≥ 250	5	+	Quality manager, 59 Safety manager, 39 WER, 66
T (Int 19)	Metal industry	> 50	≥ 250	5	+	Safety manager, 64
U (Int 20)	Food industry	> 50	≥ 250	5	+	Safety manager, 37
V (Int 21)	Metal industry	1-10	< 50	4	-	Production manager, 36
W (Int 22)	Wood processing industry	1-10	≥ 250	4	+	Quality manager, 47
X (Int 23)	Food industry	> 50	≥ 250	5	+	Safety chief specialist, 68
Y (Int 24)	Glass industry	11-25	< 50	3	-	Production manager, 41
Z (Int 25)	Textile industry	11-25	≥ 250	2	-	Health and safety manager, 67

**Companies are listed and coded in chronological order;*
***assessed by expert-interviewer;*
****Likert scale: 1 – poor, 2 – average, 3 – good, 4 – very good, 5 - excellent;*
Abbreviations: Id. – identification; Int – interview, WER – working environment representative.

In the present study the non-certified companies have been taken into special observation with the aim to present the key areas in the safety and health management which improvement can gain on the safety level without the implementation of the expensive OHSAS 18001 certification system. The non-certified companies were from the following areas of manufacturing: **K**- textile industry, **O** – printing industry, **Y**- glass processing industry, **Z**-textile industry, **P**- metal industry, **R**- food processing industry, **Q**- electronics industry, **V**-metal processing industry. The number of workers in the enterprises was from 50 to 250.

The research question is: what we have to do in the locally-owned Estonian SMSs to raise the safety level and improve the occupational health system until the corporated enterprises level. As a rule, the standard OHSAS 18001 is not implemented in the Estonian enterprises because of the high implementation and surveillance costs.

In Table 2, the non-certified companies (eight) are divided into two groups: IIa (locally-owned) and IIb (corporated to some of the international companies).

4. THE RESULTS OF THE ANSWERS TO THE QUESTIONNAIRE (MISHA)

The results (Table 2) show that for the non-certified companies, the subdivision into two groups is reasonable. Four (4) companies (**K, O, Y** and **Z,** group IIa) which are locally established and owned have the total safety level scores 29.10…52.73 (Anova, p=0.034) and the other four companies (**P, Q, R** and **V,** group IIb) belonging to the Nordic or global corporations have scores 79.80…88.08 of 100 (T-test, p-value 0.03 in the question group D).

It shows that the safety management systems owned and run by the local businessmen may lack in several OHS activity areas. The reasons may lay behind lack of the resources, knowledge, skills and time, while the companies belonging to the corporations are able to prioritize safety more. The total safety level scores among group I (OHSAS 18001-certified organisations, eight) are between 74.1 and 93.3 (Anova, p=0.026), so very similar to the corporated group IIb (enterprises **P, Q, R, V**).

This demonstrates that the companies who have implemented OHSAS 18001 or whose management approaches great attention to the safety matters (group IIb) benefit from it in safety performance as the activity scores are considerably higher than for the locally-owned non-certified companies. The results show that the safety level depends on the ownership, size of the company, dedication and attitudes of the top management, knowledge and resources availability and the consistency of safety activities in the company. However, the scores also show that some companies with no OHSAS 18001 certification can function as safely as the ones having the certification; mainly due to the affiliation to a larger international consolidated company with developed safety systems (Paas *et al.*, 2015).

The regression analysis between the safety performance components and the safety level are given in Table 3.

Table no. 2 – The initial data for regression analysis: the scores of MISHA method audit in Estonian enterprises (K, O, Y, Z, P, Q, R, and V)

Scores/ enterprises	K	O	Y	Z	P	Q	R	V
A1	12.12	24,24	12.12	3.03	89.39	91.92	91.92	84.85
A2	54.17	25.00	75.00	70.83	87.50	88.89	81.94	100.00
A3	50.00	25.00	41.67	33.33	79.17	80.56	75.00	83.33
∑A	33.33	24.64	39.13	31.88	86.96	88.89	85.51	89.86
B1	55.56	33.33	33.33	66.67	94.44	92.59	85.19	55.56
B2	50.00	33.33	58.33	50.00	95.83	100.00	83.33	58.33
B3	66.67	33.33	83.33	50.00	100.00	100.00	91.67	91.67
∑B	57.58	33.33	60.61	54.55	96.97	97.98	86.87	69.70
C1	74.07	48.15	77.78	70.37	98.15	90.12	95.19	88.89
C2	44.44	22.22	66.67	44.44	83.33	70.37	59.26	77.78
C3	33.33	11.11	66.67	33.33	72.22	66.67	55.56	77.78
∑C	60.00	35.56	73.33	57.78	90.00	81.48	74.07	84.44
D1	44.44	22.22	55.56	11.11	77.78	100.00	92.59	100.00
D2	50.00	33.33	50.00	33.33	41.67	50.00	5.59	33.33
D3	33.33	00.00	0.00	0.00	100.00	100.00	100.00	100.00
∑D	44.44	22.22	16.67	44.44	69.44	83.33	64.81	77.78
Total*	46.67	29.09	41.82	52.73	87.88	88.08	80.40	83.03

**The total score= safety level is get from Ax0.25 + Bx0.25 + Cx0.25 + Dx0.25*
A, B, C, D are get from A1, A2, A3 etc., for example: A1x0.33 + A2x0.33 + A3x0.33

Table no. 3 - Results of the regression analysis
(linear dependences between the safety level (y) and the safety sub-areas (x))

Component A	R^2	Component B	R^2	Component C	R^2	Component D	R^2
A1	0.2139	B1	0.5838	C1	0.8738	D1	0.3133
A2	0.7312	B2	0.7835	C2	0.7865	D2	0.0600
A3	0.9596	B3	0.6044	C3	0.7555	D3	0.5797

5. THE WORK TASK

The work task is to present the possibilities to raise the safety level in the locally-owned non-certified companies (**K, O, Y, Z,** group IIa) up to the safety level in corporated enterprises (**P, Q, R, V,** group IIb) (Figure 1). The qualitative analysis of the safety sub-areas (as a result of MISHA method use) are given below.

The safety sub-areas scores in the locally-owned enterprises and the scores to achieve (corporated enterprises, group IIb and OHSAS 18001 certified, group I) are presented in Table 4. The numerical data have been derived from the analysis of the questionnaires. The analysis of the safety performance begins from the lowest score in the locally-owned Estonian enterprises.

The lowest value in locally-owned companies is expressed in **D3 (8.33)**: social work environment; there is no politics for measuring the social climate in these enterprises and no corrective actions implemented if the problems in social relations between the workers have been observed. The best mark in locally-owned companies has been measured in **C1 (67.59)**: physical work environment. This result is in accordance with the Estonian reality: if something at all has been done for improvement the situation in the safety area (particularly in SMEs), then the hazards in the work environment have been identified and the risk analysis have been carried out (Tint *et al.*, 2009). The risk analysis are demanded by the Parliament of Estonia (1999).

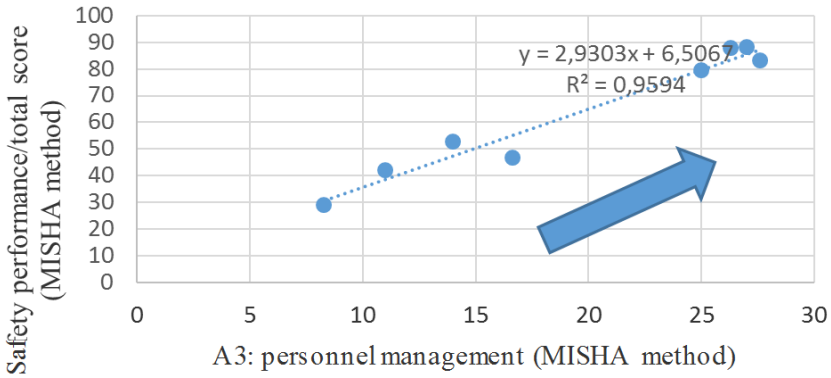

Figure no. 1 – The dependence of the safety level from the personnel management (A3)

Table no. 4 – The numerical data of the safety sub-areas in the locally-owned, corporated and OHSAS 18001 certified companies (mean values)

Component/company group	**Group IIa** K, O, Y, Z; Locally-owned enterprises mean value	**Group IIb** P,Q, R, V; Corporated enterprises mean value	**Group I** L, M, N, S, T, U, W, X OHSAS 18001 certified enterprises, mean value
D3: social work environment	8.33	100	87.50
A1: safety policy	12.83	89.51	92.80
D1:occupational accidents and illnesses	33.33	41.67	88.43
C3:hazard analysis procedures	36.11	68.06	65.25
A3: personnel management	37.50	79.52	74.65
D2: work ability of the employees	37.50	32.65	30.56
C2: psychological working conditions	44.44	72.69	58.80
B1: participation	47.22	81.94	75.00
B2:communication	47.92	84.37	80.90
A2. safety activities in practice	56.96	89.58	86.40
B3: personnel safety training	58.33	95.84	94.79
C1: physical work environment	67.59	93.09	88.73

6. THE POSSIBILITIES FOR IMPROVEMENT THE SAFETY LEVEL IN LOCALLY-OWNED ESTONIAN MANUFACTURING ENTERPRISES

The scores (taken from Table 4) are given in the 100 point scale as maximum. The analysis begin with the lowest score in the locally-owned enterprises (group IIa); the scores to gain on for these companies are the scores of the corporated (group IIb) and OHSAS 18001 implemented companies (group I) (initial data in Paas *et al.*, 2015).

D3: Assessment of the social work environment: 8.3 (group IIa**) → 100 (**group IIb**); 87.5 (**group I)

It is recommended for the group IIa companies to have a system for measuring the social climate. The management is obliged to react on shortages in the social climate if the conflict situations have come obvious; it is obligatory to carry out periodically the questionnaires that explain to the management the satisfaction of the workers with the social climate in the workplace and out of it (care after children, flexible work time etc.). It is recommended to use the work-breaks for the communication between the workers to help to improve the social satisfaction at the workplace.

A1: **Safety policy: 12.8 (**IIa) → **89.5** (IIb); **92.8 (**I)

The written safety policy is the perquisite for the improvement of H&S in the workplace. It is more directed to the top management, high, medium and low level safety responsible personnel. It is hard to believe that workers will read the SP, but it is likely that more active and highly educated work environment representatives (elected by the workers) are able to do it and are interested; the top management has to be committed to the SP; the compilers (including the top managers) of the policy document have to settle the roles for

each of the safety responsible, so that the responsibilities are very clear. The main safety activities and procedures have to be settled in the policy. Very important is to make clear to the compilers of the policy the initial status values in the workplace: current health and safety level in the company, typical and potential hazards in the company; the state of the safety documents, instructions.

D1: Follow-up of occupational accidents and illnesses: 33.3 (IIa**) → 61.7 (**IIb**); 88.4 (**I**)**

The group IIa companies usually hold the statistics in written form on accidents and occupational diseases, but it is not a highly desirable information and not distributed to the workers in the form of meetings. Sometimes there is an attempt from the side of the employers to conceal the accident from the workers. The precaution measure and recommendations are not on the wallboards. These are the areas that is recommended to improve to get a better safety level. It is settled in the Estonian legislation that accidents are investigated by the enterprises themselves, only in the case of fatal or group accidents, the investigation is leaded by the Labour Inspectorate representative. There has to be settled in the policy, who are the members of the investigation committee if the accident or occupational illnesses has happened. The safety level could be improved and the accidents number decreased if the near-accidents are reported and investigated. This policy component has to be announced to the workers. Otherwise, they do not announce the near-accidents. The plan for corrective actions after the near accident has to be available to the workers and lean managers. The data for fulfilment the correcting actions have to be written into the safety policy. The reasons for absenteeism are not available for the employers in Estonia, but the data, how long the worker is absent from the work, are known to the employer in the occurrence of the easier accidents.

C3: Hazard analysis procedures: 36.1 (IIa**) → 68.1 (**IIb**); 65.3 (**I**)**

This part includes the measurement in the work environment and risk assessment, but also the occupational health professional's activities and services. As it is seen from the scores, the activities in the group IIa enterprises constitute a half of these in the corporated and OHSAS 18001 implemented enterprises. The goals to achieve: carry out questionnaires among the workers for clarification, what troubles the workers. The company itself (the managers) can settle the intervals between the risk analyses, not to wait, until the labour inspector comes. The risk assessment is obligatory by the law, but the measurements of occupational health hazards have also to be carried out. To get better and faster results in the work environment improvements, the safety specialist should be to supplied with a combined work environment hazards analyser, possible to measure noise, lighting, microclimate factors. It has to be written in the policy, that the results of the measurements and risk analysis have to be announced to the top management and to the workers and the discussion between these parties have to be organized in reality (during the work-breaks or business days in summer-time). Action plan has to be prepared and the surveillance after the fulfilment of the plan has to be settled in the policy.

There are great problem in the co-operation of the managers and occupational health service providers. The medical service providers are not interested in walk-throughs in the enterprises to get acquainted with the hazards in the work environment and the employer is not interested to pay more for getting better occupational health service. The goal for implementation in all the investigated enterprises is: to include the occupational health personnel into the workers safety training. In some enterprises rehabilitation from the

musculoskeletal disorders (massage, mud and hot treatment) are available (it does not depend on the certification in OHSAS 18001).

A3: Personnel management: 37.5 (IIa**) → 79.5 (**IIb**); 79.7 (I)**

The job market is very changeable. Everything depends on the (often foreign) customer. Therefore, it is difficult to plan the personnel resources. Usually in the successful enterprises, there are short-term and long-term plans for the number of needed personnel resources. Such enterprises also can allow the workers who make investigations of economic development. It is not a question of safety only. Ageing workforce use: some of the enterprises use older workforce, but it is not connected with the certification in OHSAS 18001. The actions for the enterprises when the economy goes down-size are not directly (but they influence on the workers) connected with the safety and health management. These tendencies make people more nervous and stressful that could be a cause of an accident or occupational illness.

D2: Physical ability of the employees: 37.5 (IIa**) → 32.7 (**IIb**); 30.6 (**I**)**

The Estonian Ministry of Social Affairs (2001)(based on the directives of the EU) settles that the employer has to carry out the risk assessment on manual lifting of loads. The scores (30.6 to 37.5) show that in all enterprises it has been done very formally. In some enterprises the system for rehabilitation has been introduced. Usually it is not possible to find a new job for the persons whose illnesses are not recoverable. The workers mental ability is investigated only if there are some neurotoxic chemicals in the air of the work environment and these investigations are carried out by the occupational health doctor. The enterprise do not carry out the investigations particularly on the mental health, therefore the scores (30.6 to 37.5) are low for all of the enterprises. The questions in MISHA method in this section are not appropriate.

C2: Psychological working conditions: 44.4 (IIa**) → 72.8 (**IIb**); 58.8 (I)**

The scores (group IIa) are higher than in the previous safety component (D2). It is difficult to justify the reasons, why the scores here differ from D2 (particularly for the groups I and IIb), although the questions asked are very similar. The question about the designers abilities to foresee the psychological risk factors at workplace. The designers usually are not able to foresee the psychological risk factors as they are not educated for this matter. Nevertheless, these factors are certainly recommended to take into consideration if possible in the design of the machines and instruments. In some enterprises (groups I and IIb) for the special group of engineers- designers, the knowledge of physiological risk factors is included into their work obligations, but it is impossible for them to foresee the psychological risk factors before the machine is in the workplace and ready to work.

B1: Participation: 47.2 (IIa**) → 81.9 (**IIb**); 75.0 (**I**)**

The scope of the supervisor and the employees' communication depends on the company size: if the company is large, then the supervisor itself is not communicating with the employees, the communication is more expressed between the line manager and the employee. Sometimes the line managers forget about the safe work methods because of the productivity needs. The employees participate in the workplace design in the groups I and IIb enterprises when the machines and other equipment is already reserved. The employees' opinions and suggestions are asked when the work processes and work environment are

redesigned. In these enterprises sometimes the small work-teams for development are developed. These teams could often work actively if they have the necessary management support. The score in the group IIa (47.2) and the content of the answers to the questions shows that the safe work methods are shown to the workers by the line manager; the workers are instructed in the safe work methods, but over 50% of the maximum score (100%) is possible to progress.

B2: Communication: 47.9 (IIa**) → 84.4 (**IIb**); 80.9 (**I)

The management arranges the information meetings for all personnel only during the implementation of OHSAS18001 (group I). The information in the group IIb is spread from the top managers to the safety personnel and line managers. In the group IIa the information is spread only through the line managers to the employers. The communication from the employee level to the upper organizational levels is arranged through the WE representatives (group I and II). In the group IIa, the WE representative's activities are at a very low level, depending on the character of the responsible itself and also the character of the industrial activities. The wall-boards and e-mails are effectively used on the employers level, but not on the employees level. The personnel (in the groups I and IIb) is aware of the hazard reporting systems. The personnel is informed in advance on the new work practices and procedures. In the safety policy (exists in the groups I and IIb) there is a systematic procedure for informing the employees about the changes in the technological process and the change of the hazardousness of the chemicals in the process. Campaigns: the certified companies arrange the health and safety campaigns twice a year, where they focus on the potential hazards. The campaigns are organized after the safety personnel's or top management's participation in different conferences, high level meetings and it is possible with the support of the top management also to use external experts in the campaigns.

A2: Safety activities in practice: 57.0 (IIa**) → 89.6 (**IIb**); 86.4 (**I**)**

The top management's safety knowledge is satisfactory in the certified enterprises, but the score 57.0 from 100 (group IIa) is some more than a half of the achievable for the locally-owned enterprises. Health and safety is usually considered in the design of the new workplaces (rarely machines); buying of suitable chairs according to the workers desire (or working in the standing position is also ergonomically recommended) to prevent MSDs (musculo-skeletal disorders). The ergonomic design of machines is also developing and if the employer has been educated and has the desire to buy better work instrument, it is usually possible, but not always. The workers are mentally not satisfied with the repaired workrooms or new buildings in the educational institution or public buildings, but that kind of situation is rear in the industrial buildings. They are used to work, where they get more money.

The costs of occupational accidents and illnesses were first calculated by Heinrich (1941). Afterwards some authors have worked on this topic and the conclusion is that there are direct and non-direct costs of accidents, the last is difficult to see for the managers. The education and also investigations in this field are very few. The cost-effectiveness of the safety activities (Abrahamsen *et al.*, 2009; Tint *et al.*, 2010) is presented in Fig. 2. We have to consider beside the cost also the risk reducing effect, the number of people who will take advantage of this measure and the uncertainty of the accident appearance.

The methodology is presented in Abrahamsen *et al.* (2009). The cost-effectiveness of safety measures can be calculated considering three factors: the expected cost of the

measure C; the effect of the safety measure Z (using Likert scale: zero to five) and the uncertainty of the measure N (zero to one).

The scale for expected cost (EUR) of the measures is divided as follows:

- very low cost- < 350;
- low cost- ≥350-650;
- medium cost- ≥650-3500;
- high cost- >3500.

The problem of using these expected values is that the expected values are conditional and could produce poor predictions of the real outcomes. As a result, uncertainties need to be taken into account in addition to the expected values. High uncertainty may indicate that the expected risk reducing effect can give a poor prediction of the real risk reducing effect. For uncertainty dimension, three categories are used:

1) low uncertainty;
2) high uncertainty;
3) medium uncertainty.

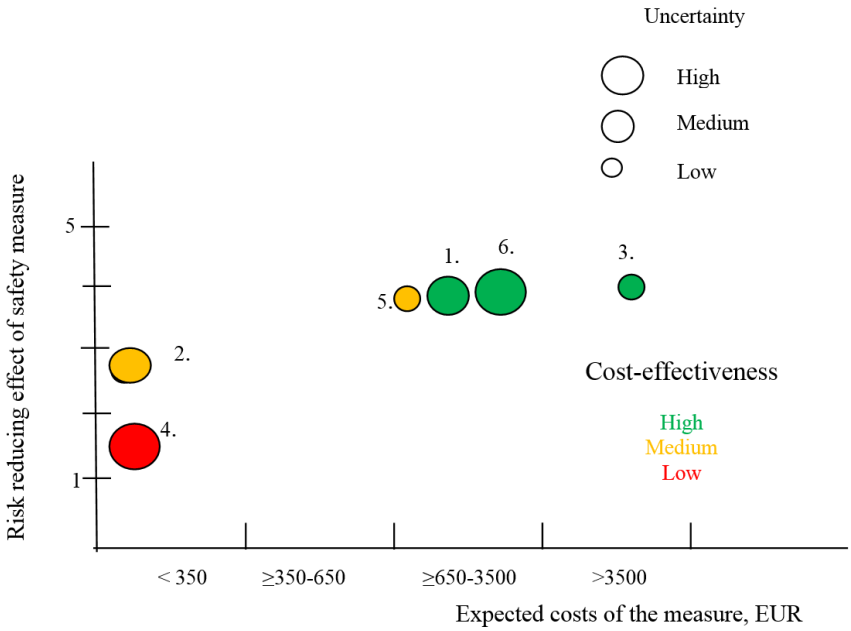

Figure no. 2 – Cost-effectiveness of safety measures in metal processing industry

The data for the metal processing industry (Figure 2):

1) Installation of a wall around the guillotine saw (C/Z-N): 300 /4-0.5
2) Installation of raw materials and half-products properly, not on the walking area: 300/3-0.5
3) To modernize the washing rooms: 10.000/5-0.1
4) Re-arrangement of the local-ventilation equipment for welding activities: 4.000/2-0.8
5) Analysis of chemicals' hazardousness by welding activities: 600/4-0.1
6) Provide the workers with protective footwear: 3.000/4-0.8

The most cost-effective of previously listed safety measures is No. 6 as the uncertainty is very high (we do not exactly know how many hazardous situations may occur in the metal industry).

B3: Personnel safety training: 58.3 (IIa**) → 95.8** (IIb**); 94.8 (**I)

The safety training of employees, work environment specialists, representatives, the members of the work environment committee are settled in the Estonian legislation (Estonian Ministry of Social Affairs, 2000). Usually the employees cannot participate in the evaluation of the safety training needs. The top management usually do not undergo the safety training (24 hours) except the situation when the manager is in the same time responsible for the safety management and matters (small enterprises). Usually the supervisors are not able to estimate the need for safety training themselves, but they are able to estimate it through the line managers and safety specialists. The safety training usually covers the industrial workers safety training. The office-workers are trained separately (Estonian Government, 2000). The need for first-aid training is also settled in the Estonian law (Estonian Ministry of Social Affairs, 2000). All employees, including temporary workers, have to be trained before their work at the workplace. The work instructions in the company are compiled by the safety engineer (work environment specialist) or the service is bought from the external service providers. In all the enterprises, the work instructions are in the written form and they are available at the workplace. The employees have seen the instructions, and can operate according to them. In the group IIa, the employees and supervisors have not participated in the preparation of the instructions. They have been trained by the work environment specialist or the line manager. The instructions are regularly renewed. Development in teams is a method used for improvements in the group IIb and I. These groups manage effectively and they are working actively. These groups have the necessary management support. The last is the goal for the enterprises of the group IIa to raise the safety level.

C1: Work environment: 67.6 (IIa**) → 93.1 (**IIb**); 88.7 (I)**

The workplace designers (in the group I, in some enterprises, the engineers) have passed the advanced training for considering the health and safety aspects from the initiative of the employer. This area seizes also the risk assessment of occupational health hazards (analogous to C3). The maintenance question: the floors are clean or dirty, it depends on the character of the manufacturing. The maintenance of the machines and equipment is at the adequate level in all enterprises' groups, but nevertheless the accidents happen. Major accident hazards are usually assessed (needed for the fire risk assessment). The handling of hazardous chemicals is settled by the law in different documents. The companies have plans for the evacuation of the personnel.

A very high dissatisfaction from the side of the employers was directed to the occupational health service providers. In 2014, the targeted inspections of occupational health service providers by the National Labour Inspectorate of Estonia were carried out and this inspection revealed that 21% of the companies had not conducted with the medical staff for medical examinations of the workers working in hazardous conditions, in 37% of the cases the occupational physician was not familiar with the hazards in the work environment and in 44% of the cases (National Labour Inspectorate of Estonia, 2015b). The initial medical examinations were not carried out during the first month of employment as it is needed by the law (Estonian Ministry of Social Affairs, 2003).

7. DISCUSSION AND CONCLUSIONS

The results of the work show that the implementation of OHSAS 18001 or affiliation to the international corporation give 4 to 10 times higher safety level scores (part 4) than in locally-owned companies (SMEs), but there are several safety measures that can be implemented without high financial expenses. They are listed in the part 6. The list of safety measures is connected with finance, but also with the probability of the safety risks in enterprise depending on the character of the process carried out in the industrial building (part 6, **A2**).

The improvement of safety level at SMSs in Estonia is possible if there is the intention from the side of the employer and subsequently the high, medium-level safety personnel and the direct manager in the workplace are interested in. More thorough assessment of workers' safety knowledge (after the safety training) is needed. The safety budget has to be settled.

The key questions in the improvement are: the existence of a written safety policy; management and employees' communication in the safety policy compile process, the participation of employees and the employer in the solution of the safety problems, near-accidents notation, the improvement of the risk assessment documents, the work-out of the risk reduction measures and fulfilment of these measures. The cost-effectiveness analysis have to be taken into consideration.

The MISHA method is a good method for assessment of safety level, expect in some areas that are connected with scientific investigations, like assessment of the social work environment (D3), work ability of the employees (D2), psychological stress factors' investigation (C2.2), psychological working conditions (C2). These assessments are not realistic to carry out on the enterprise level in the current economic development stage in the Estonian SMEs.

The occupational health and safety system in Estonia is not very strong from the officials (The Ministry of Social Affairs of Estonia) side. The work of occupational health doctors is not appreciated. The policy for the use of the ageing workforce continuously is worked out only in some of the enterprises. Usually the employers recruit only young workers. In some enterprises the engineers have also obligations for designing of workplaces and these designers consult with the supervisors, and the health and safety personnel.

The critical overview of the MISHA method: the safety areas are chosen on the scientific basis: A: organization and administration; B: participation, communication and training; C: work environment; D: follow-up. All these areas have three sub-areas, but the number of questions in these sub-areas is different. This fact influences on the total score of the sub-area. Furthermore, there are questions, that repeat each other. The questionnaire has also questions on the activities not-achievable at the enterprise level that are more oriented to the scientific research and so resolvable, like: Is the personnel encouraged to make suggestions for the improvement of communication? Are the best suggestions awarded (in the area of communication)? Some of the questions have to be removed to make the MISHA questionnaire suitable and popular among the companies for the safety level assessments.

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CONSUMERS' ATTITUDES TOWARDS CAUSE-RELATED MARKETING

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Abstract

The paper presents the development of 5-point Likert scale for measuring attitudes towards cause-related marketing, as well as its application on a sample of Croatian consumers. The results of the research show that respondents are familiar with cause-related marketing and regard it as a good investment in the community. They see cause-related marketing campaigns as a good communication tool; they find a cause to be relevant for their personal involvement in campaigns, although the match between the cause and the product's characteristics seems to be less important. Finally, respondents do not find the size of the donation to be crucial for their participation in cause-related marketing campaigns, but they find it important to know about the size of the donation. The results of the research can serve to marketing managers, who need to thoroughly consider how to communicate specific elements of campaigns in order to achieve maximum understanding by the target group.

Keywords: cause-related marketing, Likert scale for measuring attitudes, elements of cause-related marketing campaigns

JEL classification: M14, M31, M37

1. INTRODUCTION

Cause-related marketing was firstly introduced by American Express in 1983 (Adkins, 1999, p. 15; Andreasen, 1996, p. 4; Varadarajan and Menon, 1988, p. 59), although there were some solitary examples of commercial cooperation between enterprises and non-profit organizations at the end of the nineteenth century (Adkins, 1999, p. 9), as well as in the seventies of the twentieth century (Husted and Whitehouse, 2002, p. 5).

Sinčić Ćorić *et al.* (2011, p. 4) reveal that there were different understandings of cause-related marketing during the eighties of the last century. In the absence of a formal definition at that time, Varadarajan and Menon first offered one, proposing that „Cause-related marketing is the process of formulating and implementing marketing activities that are characterized by an offer from the firm to contribute a specified amount to a designated cause when customers engage in revenue-providing exchanges that satisfy organizational and individual objectives" (Varadarajan and Menon, 1988, p. 60). They concluded that

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cause-related marketing is distinct from sales promotion, corporate philanthropy, corporate sponsorship, corporate good Samaritan acts, and public relations, though it is often an amalgam of such activities.

In alignment with that thinking, Varadarajan and Menon (1988, p. 60), Andreasen (1996, p. 4), and Polonsky and Speed (2001, p. 1362) describe cause-related marketing as a specific marketing strategy, different from sales promotion, sponsorship and philanthropy. Webb and Mohr (1998, p. 227) view cause-related marketing as a strong marketing communication tool that can be used for different goals of a profit organization.

Adkins (1999, p. 11) defines cause-related marketing as a partnership between profit and non-profit organizations, designed with a goal of promoting a product's or service's image and meeting non-profit goals or any other type of non-profit initiatives. Daw (2006, p. 24) similarly points out that cause-related marketing initiatives provide benefits for both profit and non-profit organizations. Dow emphasizes that there are four key characteristics that differ cause-related marketing from other forms of cooperation between profit and non-profit organizations: creation of value for stakeholders and the community, mutually valuable cooperation and partnership between profit and non-profit organizations, participation of employees and consumers, and communication of the value of the cause-related marketing program to the general public. Sinčić Ćorić and Kurnoga Živadinović (2009, p. 71) in definition of cause-related marketing stress that campaigns always include a contribution of a specified amount to a designated non-profit cause, while Hajjat (2003, p. 95) describes cause-related marketing as marketing activities and funding programs that enable an association of a profit organization's identity with a non-profit organization, good cause or important social issue.

Contemporary marketing practices reveal that cause-related marketing is a specific type of partnership between profit and non-profit organizations (Sinčić Ćorić and Kurnoga Živadinović, 2009, p. 71) that also serves as a strong marketing communication tactic (Adkins, 1999, p. 43; Subrahmanyan, 2004, p. 116; Simcic Bronn and Belliu Vrioni, 2001; Adler, 2006, p. 5). Pringle and Thompson (1999) stress that cause-related marketing should be seen as a strategic and efficient source for brand differentiation and emotional positioning, as well as means of communicating a social sensitivity.

Cause-related marketing can be realized in different ways and at different levels. Daw (2006, p. 61) depicts three different types of initiatives of cause-related marketing campaigns: initiatives connected to the product, initiatives connected to the promotion's activities and initiatives connected to the program, while Varadarajan and Menon (1988, p. 64) differentiate strategic alliances of profit and non-profit organizations, linkage of a certain product to a non-profit cause, or linkage of a certain brand to a non-profit cause. Andreasen (1996, p. 5) distinguishes three forms of cause-related marketing programs: promotions based on transactions, promotion of common issues and licensing.

This paper starts from the studies confirming that cause-related marketing initiatives influence consumers' attitude and intention to buy. Unlike previous research, this paper analyzes what are the attitudes of consumers who have previous experience with such initiatives. Apart from measuring the general attitudes, in this particular study two elements of a campaign are selected: the donation size and personal connection with a cause. The study is carried out in Croatia, a small post-transition economy, that has recently become a full member of the EU, and companies are adapting to competitive environment also by pursuing modern cause-related marketing practices. Cause-relating marketing is rather

present in Croatia and so far consumers have responded to it well. There are many examples of cause-related marketing initiatives and most of them yielded desired results.

The paper is organized in the following way: in the second section, the literature review of the role of attitudes in consumers' intention to participate in cause-related marketing campaigns is presented. The methodology used in this research is explained in the third section. Results are given in the fourth section, while conclusions and limitations are presented at the end of the paper.

2. THE ROLE OF ATTITUDES IN CONSUMERS' INTENTION TO PARTICIPATE IN CAUSE-RELATED MARKETING CAMPAIGNS

Schiffman and Kanuk (2004, p. 200) define attitudes as a learned predisposition to act in a rationally favorable or unfavorable way toward the object, while Page and Luding (2003, p. 149) describe them as a psychological personal drift to a rationally positive or negative response and behavior due to stimulants and as a result of an attitude toward it. In order to understand the attitudes and the relationships between consumer attitudes and their behavior, different models for attitude interpretation are created. Schiffman and Kanuk (2004, p. 202) emphasize the theoretical model of attitudes that provide affective, conative and cognitive components of attitude. They stress that research in consumer behavior indicate that conative aspect of attitude is often treated as an expression of consumer intention to buy.

Fishben *et al* developed The theory of reasoned action (Summers *et al.*, 2006, p. 407; Matos *et al.*, 2007, p. 37) that relates attitudes, intentions and behavior and predict consumers' buying activities. They point out that the attitude is in a high positive correlation with intention to buy, and that it can correctly predict consumer buying action. They conclude that consumers' intention to buy is a better indicator of a final decision to buy in relation only to the attitude toward the buying object. Page and Luding (2003, p. 149) say that The theory of reasoned action confirms that it is possible to predict consumer behavior if attitudes are known at the time the behavior occurs, although other factors, such as personal attitudes and reference groups impact, influence the intention to buy (Matos *et al.*, 2007, p. 37). Verdurme and Viaene (2003, p. 97) indicate that after The theory of reasoned action, Ajzen developed The theory of planned behavior to which the intended behavior is determined by personal attitudes toward behavior, subjective norms and perceived behavioral control. In doing so, the personal attitudes towards the behavior are defined by certain beliefs about the behavior and their subjective evaluation. Pratkanis *et al* (1994, in Page and Luding, 2003, p. 149) emphasize that the strength of an attitude has a positive effect on attitudes and behavior in so much that a more a positive attitude towards the brand or product leads to a more positive impact on purchase intention.

Thus, consumer behavior is under the direct influence of attitudes towards specific products and marketing activities associated with the same product Engel *et al* (1995, in Darling and Puetz, 2002, p. 171). Cause-related marketing initiatives are, as noted above, a strong marketing communication tool by which it is possible to achieve the desired marketing objectives. Thorne McAlister and Ferrell (2002, p. 693) and Husted and Whitehouse (2002, p. 3) emphasize that the most common target of companies that conduct cause-related marketing initiatives are making a positive impact of favorable consumer attitudes and purchase intentions of the involved product and increase sales. In the context of consumer behavior it is important to note that the success of cause-related marketing

campaigns relies on the existence of socially conscious consumers who are willing to help others. Supporting the cause-related marketing is a pro-social consumer behavior (Youn and Kim, 2008, p. 124) that Basil *et al* (2006, in Youn and Kim, 2008, p. 124) described as a consumer behavior that contributes to the common good as opposed to satisfying only personal interests.

Webb and Mohr (1998, p. 227) state that research of the consumer attitudes and the impact of cause-related marketing initiatives on their behavior began in the mid nineties of the last century, despite the earlier acceptance and support of the cause-related marketing campaigns by all involved stakeholders. Landreth Grau and Garretson Folse (2007, p. 20) suggest that the research interests spread from the initial focus on the elements of campaign, such as donations proximity, product type or donation size to research of other aspects, such as the impact of advertising campaigns and efficient quantification of donations, all aimed at a comprehensive understanding of the impact of cause-related marketing campaigns and the consumers' behavior (Landreth Grau and Garretson Folse, 2007, p. 20).

Desired impact of cause-related marketing campaigns on consumer attitude and intention to buy the product involved in the campaign has been confirmed by several authors (Hajjat, 2003, p. 96). Farache *et al.* (2008, p. 212) explain that the studies show that consumers, when they are asked to evaluate cause-related marketing initiatives, are usually positive. Schiffman and Kanuk, say that it is possible to change attitudes towards products, services or brands by highlighting their links with social groups, events or occasions (2004, p. 214). Ross *et al* (1992, in Hou *et al.*, 2008, p. 365) state that cause-related marketing of the common good has a positive impact on attitudes and perceptions of consumers and that this influence is stronger on women than on men. On the other hand, Moosmayer and Fuljahn (2010, p. 545) found only an insignificant impact of gender in forming consumers' attitudes toward cause-related marketing. Galan-Ladero *et al.* (2013, p. 264) prove that attitudes toward a cause-related marketing campaign have positive influence on post-purchase satisfaction, as well as that post-purchase satisfaction with a product involved in a cause-related marketing campaign has a positive influence on brand loyalty.

Adkins (1999, p. 61), Drumwright (1996, in Farache *et al.*, 2008, p. 212), Hajjat (2003, p. 95), Kotler and Lee (2009, p. 88) and Vanhamme *et al.* (2012, p. 261) point out that cause-related marketing activities positively influence corporate reputation, raise consumer loyalty and create favorable attitudes, motivate and connect employees, increase sales and market share and create positive publicity. According to research by Business in the Community, 86% of surveyed consumers would buy a product associated with a non-profit cause as opposed to one that is not, if the quality and price of a product are equal (Hajjat, 2003, p. 95). Effective implementation of strategic cause-related marketing initiatives has a positive influence on consumers' perception of the company and its products, state Dacin and Brown (1997, p. 70).

Studies further indicate that some factors like the type of non-profit cause, suitability between cause and company, personal relationship with a cause, gender and donation size can influence and change consumer attitudes (Farache *et al.*, 2008, p. 212). Trimble and Rifon (2006, p. 31) point that when compatibility does not play a key role, consumers are influenced by other elements of the campaign, such as the length of the campaign, importance of the non-profit cause or proximity and donation size.

Laferty (2007, in Hou *et al.*, 2008, p. 376) reveals that the perceived balance between the cause and the brand does not have a crucial influence on purchase intention and participation in the campaign, while Strahilevitz (1999, in Hou *et al.*, 2008, p. 376) says that

the harmony between the cause and the brand certainly contributes to a positive impact on the intention to buy. Furthermore, Cheron *et al.* (2012, p. 362) conclude that perceived match between the brand and the cause have positive impact on consumers' perceptions about cause-related marketing, while duration of the campaign is not confirmed to be important. Zdravkovic *et al.* (2010, p. 158) add that consumers' attitudes depend not only on congruence between the cause and the brand, but also on the interaction between fit and familiarity with the cause. Chang (2008) claims that when the donation magnitude is constant, a donation amount framed in absolute (money unit, i.e. dollar or euro) value is more effective than that in percentage terms for low-priced products, and the opposite is true for high-priced items. Hou *et al.* (2008, p. 364) examine the impact of cause on consumers' purchase decision and conclude that consumers prefer local causes over nation-wide ones. Landreth Grau and Garretson Folse (2007, p. 21) conclude that the proximity of donations and correctly formatted messages can have a positive impact on creating a favorable attitude and intention to buy for consumers which have less personal involvement with the cause. They also point out that even at high levels of involvement with the cause there is a greater positive incentive for consumers when there is a local donation opposed to a national or global donation, which is different from the research made by La Ferle *et al.* (2013), who didn't prove that beneficiary of the campaign (local of worldwide) impact the consumers' attitudes towards the campaign. Rosen Robinson *et al.* (2012, p. 135) claim that consumers will be more inclined to purchase the product involved in a cause-related marketing campaign if they have latitude to choose the focal cause of the campaign, and that providing choice is more important when the perceptual fit between company and cause is low.

Landhert Grau *et al* (2006, in Landreth Grau and Garretson Folse, 2007, p. 19) hint that there are causes for which it is difficult to achieve high personal involvement, such as the problem of chronic world hunger or homelessness. Lafferty *et al.* (2004) proved that attitudes toward both the cause and the brand can be enhanced as a consequence of an alliance if perceptions of the alliance are favorable. Furthermore, they claim, the cause appears to benefit from the alliance to a greater extent than the brand. Their study supports the notions that the fit between partners plays a pivotal role in consumer acceptance of the alliance as plausible and that familiarity with the cause moderates the effectiveness of the alliance.

Duncan (2005, in Landreth Grau and Garretson Folse, 2007, p. 21) states that companies recognize the importance of the non-profit cause and the consumers' attitude towards it, and that they develop partnerships through cause-related marketing bearing this in mind. Broderick *et al.* (2003, p. 583) and Landreth Grau and Garretson Folse (2007, p. 20) point out that the level of emotional involvement is a key factor in the consumer's perception and response to a cause-related marketing campaign. They conclude that personal connection to the cause encourages consumers to participate in a cause-related marketing campaign, and that the contribution depends on the awareness of the personal importance of the cause. Bhattacharya *et al* (2003, in Landreth Grau and Garretson Folse, 2007, p. 20) conclude that consumers are encouraged to participate because of a close identification with the company or cause that they want to support. Lafferty (1995, in Webb and Mohr, 1998, p. 227) similarly considers that the consumers' response and support of the cause-related marketing campaign is more positive if the cause is personally more important. Farache *et al.* (2008, p. 210) say that personal connection with the cause has a significant impact on consumers' attitude and buying behavior.

Benefits arising from campaigns depend also on the donation size (Landreth Grau and Garretson Folse, 2007, p. 19; Polonsky and Speed, 2001, p. 1363). Hajjat (2003, p. 97)

declares, for example, that a high personal involvement with the cause together with a high donation size has a higher positive impact on attitudes and intention to buy, in relation to the reverse situation. Dahl *et al* (in Webb and Mohr, 1998, p. 227) suggest that consumers have a tendency to believe that the company exploits a non-profit organization if the donation is small, compared to a larger donation. Landreth Grau *et al*. (2007, p. 75) conclude that a small donation can lead to skepticism among consumers. Sinčić Ćorić and Kurnoga Živadinović (2009, p. 76) in research conducted in Croatia, find that the donation size does not affect the consumers' decision to change brands for those participating in the cause-related marketing campaign.

3. RESEARCH METHOD

In order to measure the consumers' attitudes towards cause-related marketing, the research was made in two phases which are described below.

3.1. Phase 1: Developing instrument

The construction of Likert scale started with a literature review. Based on a literature review the authors constructed a pool of 95 items related to cause-related marketing; 42 of them were associated to the relationship and consumers' attitudes toward cause-related marketing and socially responsible behavior in general, 25 items were associated to the consumer's personal relation to the cause, and 28 items were associated to the importance of donation size. The pool of items was given to a sample of judges. They were all MBA postgraduate students at their final year of study. They were chosen in accordance to the methodological routine; they represented a homogeneous sample, and they were not experts in the field of research, but rather as similar as possible to the population that is interesting for the research. In total, there were 32 judges. The judges have been asked to evaluate the intensity of each item, where "1" stands for the lowest and "5" for the highest intensity of an item.

Only items with a correlation above 0.5 were included in the final scale (Table 1).

Table no. 1 – Items in Likert scale (correlation above 0.5)

No.	Items	Correlation
1.	I support socially responsible behavior and actions for common good.	0.52
2.	I would buy a product from a company that supports non-profit organizations that work for common good.	0.63
3.	Supporting non-profit goals, investing in the community and being socially responsible are necessary for successful and profitable business.	0.69
4.	I consider cause-related marketing as a good way for companies to invest in the community and support non-profit organizations.	0.59
5.	The cause of the cause-related marketing campaigns is important to me.	0.54
6.	It is important to me that the cause of the cause-related marketing campaign is associated with the characteristics and nature of the product itself.	0.53
7.	The donation size in cause-related marketing campaign is important.	0.57
8.	Increased involvement in a way of greater connection with the cause strongly influences the intention to buy a product that is involved in the cause-related marketing campaign.	0.54
9.	It is important to know the donation size allocated by a single purchase of the product that supports a specific charitable cause.	0.59

No.	Items	Correlation
10.	The non-profit goal in a cause-related marketing campaign is important.	0.66
11.	I think that companies that are involved in cause-related marketing campaigns contribute to communities by doing so.	0.59
12.	Corporate socially responsible behavior and supporting non-profit goals positively influence consumers' perceptions of a company.	0.74
13.	There are causes which I personally prefer and which I would support more as a consumer if they were involved in cause-related marketing campaigns.	0.53
14.	I think that the donation size from each single purchase of the product through cause-related marketing campaign is important to me.	0.53
15.	Cause-related marketing campaigns are a great communication tool for communicating with consumers.	0.54
16.	The allocated donation size affects my intention to buy.	0.53
17.	Companies that are involved in cause-related marketing campaigns and therefore support non-profit goals have my trust and consumer's support.	0.59
18.	It is very important to me which cause supports the cause-related marketing campaign.	0.58
19.	I think that consumers will respond in the form of higher purchase intentions when the donation size is significant.	0.55
20.	Cause-related marketing campaigns positively influence consumers' perceptions.	0.57
21.	The important thing to me is what amount will be donated to a specific cause if I buy a product that is involved in the cause-related marketing campaign.	0.67
22.	Corporate socially responsible behavior and supporting non-profit goals positively influence consumers' intention to buy the products of that company.	0.56
23.	Donation size is extremely important in cause-related marketing campaigns.	0.53
24.	The donation size is playing an important role in the intention to buy the product that is involved in cause-related marketing campaign.	0.72
25.	The higher the personal connection with the cause the higher the consumer's willingness to choose a product that supports the cause.	0.63
26.	The donation size for a non-profit goal is in a highly positive correlation with the intention to buy a product involved in a cause-related marketing campaign.	0.59

3.2. Phase 2: Measuring the attitudes towards cause-related marketing

Sample. The sampling was purposive, because the idea of the research was not to find out the general attitudes of an average consumer, but rather to see the attitudes of those consumers who have learned about cause-related marketing programs, and have some previous experience with such programs.

From 186 respondents in total, 162 claimed that they have previously bought a product that was involved in a cause-related marketing campaign, and could remember and name some of the cause-related marketing campaigns. Sample therefore consisted of 162 respondents who have had a previous experience with cause-related marketing campaigns. 72% of them were females, ranging from 26 to 45 years. 47% of the respondents were highly educated.

Data collection. The data were collected through a highly structured questionnaire. Apart from demographic data, the questionnaire consisted of a 5-point Likert scale with 10 items associated with cause-related marketing and socially responsible behavior in general, 7 items associated with the consumer's personal relation to the cause and 9 items associated with the donation size. The respondents were asked to score their level of agreement with

each item, on a scale from 1 to 5, where "1" stands for "I strongly disagree", "2" stands for "I disagree", "3" stands for "I neither agree, nor disagree/I cannot evaluate", "4" stands for "I agree", and "5" stands for "I strongly agree". The respondents were guaranteed anonymity, therefore they were giving authentic answers.

Data analysis. A descriptive statistical analyses and two simple regression analyses, using E-Views were conducted.

4. RESULTS

4.1. General consumers' attitudes

The overall attitude of consumers that have previous experience with cause-related marketing campaigns towards such campaigns is neutral to positive (mean is 3,1).

Deeper analysis reveals that even 97% of the respondents support socially responsible behavior in general. 65% of them find that supporting non-profit goals, investing in the community and being socially responsible are necessary for successful and profitable business. 85% of the respondents consider that socially responsible corporate behavior and supporting non-profit goals positively influence consumers' perceptions of a company. 94% of the respondents report their willingness to buy a product that supports non-profit organizations working for a common good.

As Table 2 reveals, 95% of the respondents consider cause-related marketing as a good way of investment in the community, while 93% of them think that companies involved in cause-related marketing programs contribute to the community by being involved in such programs. 82% of the respondents consider cause-related marketing as a great marketing communication tool. When asked about trust towards companies that are involved in such campaigns, or that support them in different ways, 70% of the respondents report agreement, while 20% of them cannot evaluate and 10% of them even disagree with that. Finally, 86% of the respondents feel that cause-related marketing campaigns positively influence consumers' perceptions of actors involved.

Based on frequency of answers "I agree" and "I strongly agree", as well as on means related to items, it can be concluded that consumers have positive attitude toward cause-related marketing in general, although there are cases in which their opinions are to a certain extent disperse (for instance, item no 17).

Table 2 also gives descriptive statistics for the items associated with the cause in cause-related marketing programs. As can be observed, the majority of the respondents agree with different items related to the cause. 86% of the respondents think that the cause is important for them, as well as 88% of them find the non-profit goal to be important. 85% of the respondents think that the greater their personal involvement with the cause, the greater their willingness is to buy the brand that supports a cause-related marketing campaign. 87% of the respondents find some causes more preferred than the other. Only 43% of the respondents state that the cause involved in a cause-related marketing campaign needs to be related to the characteristics of the product (whereas 40% of them feel that this is not important or not important at all). Finally, 60% of the respondents find that their personal involvement with the cause influences their intention to buy a brand that supports a cause-related marketing campaign, while 30% of them cannot evaluate that influence, and 10% of them feel that there is no influence of a cause to their intention to buy a brand that supports a cause-related marketing campaign.

Table no. 2 – Descriptive statistics for items

Item no	Frequency of "I agree" and "I strongly agree" (4 and 5 in 5-point Likert scale) % of respondents	Mean	Variance	Standard deviation	Variation coefficient
items associated to general attitudes toward cause-related marketing					
4.	95%	4,41	0,33	0,64	14,44
11.	93%	4,29	0,59	0,77	17,84
15.	82%	4,13	0,64	0,80	19,42
17.	70%	3,74	0,81	0,90	24,11
20.	86%	4,03	0,52	0,72	17,97
items associated to "cause" in cause-related marketing programs					
5.	86%	4,18	0,71	1,27	30,47
6.	43%	3,05	1,62	1,27	41,81
8.	60%	3,68	0,89	0,94	25,65
10.	88%	4,16	0,67	0,82	19,74
13.	87%	4,17	0,59	0,77	18,36
18.	70%	3,80	1,18	1,08	28,53
25.	85%	4,23	0,68	0,82	19,43
items associated to "donation size" in cause-related marketing programs					
7.	53%	3.39	1.32	1.15	33.92
9.	82%	4.11	0.88	0.94	22.80
14.	61%	3.58	1.11	1.05	29.48
16.	46%	3.09	1.21	1.10	35.55
19.	47%	3.42	0.95	0.97	28.44
21.	62%	3.55	1.05	1.02	28.86
23.	57%	3.56	0.98	0.99	27.86
24.	53%	3.48	0.88	0.94	26.94

Based on the presented facts, it can be concluded that the majority of consumers find the cause in cause-related campaigns to be important. They perceive some causes to be of a greater importance for them. In such cases they feel themselves more motivated to participate in such campaigns. On the other hand, there seems to be substantial dispersion in their opinions about the "match" between the cause of the campaign and the characteristics and nature of the product itself (item no 6).

The situation is to some extent different when respondents were asked to take donation size in mind. Table 2 reveals that for most of the items respondents did not have the same opinion. The exception is item no 9, where 82% of the respondents agreed that it is important to know the donation size. It can be observed from Table 2 that only 53% of the respondents think that the donation size is important for their participation in the cause-related marketing campaigns. At the same time, 31% of them do not consider donation size to be important. Mean value for the majority of the items is around 3 (I cannot evaluate or I neither agree nor disagree), with rather large variation coefficients. Both prove that

respondents have different opinions about the importance of the donation size. The only exception is related to the item no 9 ("It is important to know the donation size allocated by a single purchase of the product that supports a specific charitable cause"). 82% of the respondents agree with that argument (mean 4.11).

Taking the above in mind, it can be concluded that consumers consider donation size less important than the cause of the campaign. However, the majority of them would like to know the specific amount of the donation size allocated by a single purchase of the product involved in a cause-related marketing campaign.

4.2. Elements influencing consumers' intention to buy

In order to explore the influence that "cause" and "donation size" may have on consumers' intention to buy, two simple regression analyses were conducted.
In the first model respondents' answers about socially responsible behavior were used as the constant variable, while their answers related to item number 10 were used as the independent variable (Table 3).

Table no. 3 – Results for the first simple regression analysis – "cause"

	Estimated parameter	**Standard error**	***t* value**	***p* - value**
Constant	2.142883	0.252424	8.489210	0.0000
Cause	0.463795	0.067737	6.847004	0.0000

According to the data from Table 3, estimated regression equation is:

Intention to buy = 2.142883 + 0.463795 *cause*
(0.252424) (0.067737)

The results show that a p-value is statistically significant (0.000); therefore it can be concluded that consumers' intention to buy a brand that supports a cause-related marketing campaign is greater for those more involved with the cause.

In the second model, respondents' answers about socially responsible behavior were used as the constant variable again, while their answers related to item number 13 were used as the independent variable (Table 4).

Table no. 4 – Results for the first simple regression analysis – "donation size"

	Estimated parameter	**Standard error**	***t* value**	***p* - value**
Constant	2.830632	0.282670	10.01389	0.0000
Donation size	0.283363	0.079407	3.568508	0.0005

According to the data from Table 4, estimated regression equation is:

Intention to buy = 2.830632 + 0.283363 *donation size*
(0.282670) (0.079407)

The results show that a *p*-value is statistically significant (0.005); therefore it can be confirmed that *consumers' intention to buy a brand that supports a cause-related marketing campaign increases with the donation size.*

5. CONCLUSIONS

Companies constantly attempt to enhance their corporate image, cultivate a favorable attitude in the minds of consumers, and realize some sales gains by prominently advertising their acts of philanthropy and sponsorship of worthy causes. This was firstly emphasized by Varadarajan and Menon in their seminal paper from 1988, and is still pertinent. In that sense, contemporary companies view cause-related marketing as a manifestation of the alignment of their corporate philanthropy and enlightened business interest, simultaneously responding to the changing marketing conditions. In order to plan and implement specific elements of cause-related marketing campaigns it is important to understand how consumers perceive them, as well as what are their general attitudes towards such programs. This was an incentive for many research projects, including the one presented in this paper.

The research presented in this paper analyzes consumers' attitude towards cause-related marketing in general, as well as towards the importance of cause and donation size in cause-related marketing programs.

The results of the research show that respondents are familiar with cause-related marketing and specific marketing activities that are allied to such campaigns. The majority of respondents regard cause-related marketing as a good investment in the community. They also support non-profit organizations in their activities in the community. They see cause-related marketing campaigns as a good communication tool; they find a cause to be relevant for their personal involvement in campaigns, although the connection between the cause and the product's characteristics seems to be less important. However, the research results prove that their intention to buy a brand that supports a cause-related marketing campaign is greater for those more involved with the cause. The respondents do not find the size of the donation to be crucial for their participation in cause-related marketing campaigns, but they find important to know about the size of the donation. More to it, the results confirm that their intention to buy a brand that supports a cause-related marketing campaign increases with the donation size. To conclude, the overall consumers' attitude toward such campaigns is neutral to positive. There are two limitations to these results. Firstly, the structure of a convenient sample consisted of majority of the female respondents (72%). Although this is so, women primarily make purchasing decisions, therefore their answers can be considered indicative. The second limitation is connected to the selected elements that can influence consumers' attitudes. Apart from investigating consumers' general attitude towards cause-related marketing, this research specifically analyzes selected elements that can influence consumers' intention to participate in cause-related marketing campaigns, i.e. cause and donation size. For that reason, when interpreting the results one should not exclude the influence of other elements on consumers' intention to buy the brand that supports a cause relation marketing campaign. As a consequence, the results can be considered indicative, and can serve as a starting point for future research of cause-related marketing.

Regarding strategies and tactics facilitating cause-related marketing, the findings provide useful insights to marketing practitioners. The results point out that it is necessary to thoroughly consider how to communicate specific elements of campaigns (i.e. donation size,

match between product's characteristics and purpose of campaign, personal involvement with a cause etc.) in order to achieve maximum understanding by a target group.

Since this research specifically analyzes cause and donation size, as elements that can influence consumers' intention to participate in cause-related marketing campaigns, some future research should include other elements, such as perception of connection between cause and product, perception of fit between cause and company etc. It would be also interesting to find out whether there are gender differences as well as differences between consumers with previous experience with cause-related marketing programs and those without it.

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IDENTIFYING AND EXPLAINING THE EFFICIENCY OF THE PUBLIC HEALTH SYSTEMS IN EUROPEAN COUNTRIES

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Abstract

The purpose of this study was to identify the efficient European healthcare systems. The study differs from other similar researches in that it uses different variables in assessing the efficiency of the healthcare systems, and also in that it uses a two-stage approach in the analysis.
In order to identify the efficient healthcare systems, we used a non-parametric method, Data Envelopment Analysis, which allows the evaluation of the countries against an efficiency frontier. Furthermore, we explain the efficiency by analysing several factors which influence the efficiency of the healthcare systems, using the censored regression analysis.
The findings indicate that there are significant efficiency disparities both among the developed states and among the developing ones. Finally, we suggest several directions for the public policy, in order to increase the efficiency of the public healthcare systems in the European countries.

Keywords: efficiency, public health system, determinants, data envelopment analysis

JEL classification: C4, C5, I1

1. INTRODUCTION

The efficiency of the health systems is a key issue of the public policy and creates a clear picture of the welfare level. In order to establish a hierarchy of the European countries in terms of efficiency, we conducted an analysis of the national health systems. This can be useful in establishing the priorities when allocating the funds and in the widely debated restructuring plan of the health systems in Europe. In the second part of the study we highlighted the factors that influence the (in)efficiency of the health systems, using regression analysis to suggest directions for the public policy. The methods we used are the Data Envelopment Analysis (DEA) and the censored regression.

Our approach is placed at the macro level, evaluating the systems as wholes (Delnoij *et al.*, 2003; Berkman, 2011; Brand, 2007; McKee and Ryan, 2003; Lahelma *et al.*, 1996), taking into consideration 30 European countries. DEA has been widely used for highlighting

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the efficiency of health systems from developed and developing countries (Hussey *et al.*, 2009). The efficiency of the Norwegian health care system was analysed (Van den Noord *et al.*, 1998), and also DEA was used to analyse the efficiency of health care systems in 191 countries (Evans *et al.*, 2001). There are other studies that evaluate the efficiency of health systems with the DEA method: Fizel and Nunnikhoven, 1992; Valdmanis, 1992; Kooreman, 1994; Thanassoulis *et al.*, 1996; Parkin and Hollingsworth, 1997; Chirikos and Sear, 2000; Rollins *et al.*, 2001.

Using DEA, we identified an efficiency frontier by calculating efficiency scores. Most of the countries analysed are outside this border. Using the regression analysis, we found that four variables are significant in explaining the efficiency (or, in some cases, we will analyse in terms of inefficiency): the percentage of the population over 65, the level of urbanization, the Literacy Rate, and Euro Health Consumer Index (EHCI). Our research differs from a number of other previous studies, which take into account the level of GDP/capita, the obesity or the smoking habits of the population (Afonso and Aubyn, 2006), the number of treated patients, the mortality rate, the life time span (Palmer and Torgerson, 1999). We believe that the variables selected by us provide a more accurate picture of the positioning of the various European health systems. The correlation between the hierarchy we established through the efficiency analysis and that of the World Health Organization, determined by direct questioning the beneficiaries (patients), is high.

The hypotheses are:

- there is a great heterogeneity in terms of efficiency in the health systems among the European countries;
- the Eastern European countries have inefficient health systems, requiring major adjustments in their organization;
- the most developed countries are closest to the efficiency frontier, with a direct correlation between the level of development and the health state of the population;
- the efficiency of health public spending is influenced by a number of exogenous variables.

The paper contains five sections, as follows: literature review is provided in section two; section three outlines the methodological approach used in the paper; in section four we present and interpret the results of our analysis and section five contains the conclusions.

2. LITERATURE REVIEW

If we look back in history, it is impossible not to notice that spectacular bounces in the evolution took place when population's health status was good and that significant throwbacks occurred when population's health status was bad. Diseases such as plague ("The Black Death" haunted Europe between 1347 and 1351 and killed over 25 million people, pushing the old continent into its darkest period of the Middle Ages; the next pandemic was in the 18th century and considerably delayed the start of the Industrial Revolution), measles, flu, syphilis, tuberculosis, etc., stopped great economic evolutions or even destroyed civilizations (according to the experts, the Maya civilization disappeared because of a pandemic). There are many studies which emphasize the correlation between the health status and economic growth. For example, eradication of the plague in Mediaeval Europe created the premises of a demographic boom, which later became the basis of the industrial revolution (Braudel, 1998). In the USA, the increased attention towards the medical system's reform after the Great Depression generated a substantial increase in

productivity. Sanitary hygiene and food hygiene also account for the increase in productivity. According to Fogel (1994), a sufficient amount of calories collected through correct nutrition and the acknowledgement of its importance achieved by promoting medical information, led, over 200 years, from 1780 to 1980, to an increase by over 56% of the work provided by the British workers. The workers' physical condition visibly improved, thanks to appropriate medical assistance and adequate nutrition. Certain studies (Benefo and Schultz, 1996; Fogel, 1994; Martorell and Habicht, 1986) conclude that there is a direct connection between the weight/height ratio, nutrition and work capacity or between nutrition and productivity. An interesting study is that conducted by Thomas, Schoeni and Strauss (1996) on Brazil's population, in which the authors correlate the data on the individuals' height and their salaries. They conclude that 1% increase in height leads to a 3% increase in the salary in the case of men and 2% in the case of women. In poor countries, this correlation is even stronger, according to Schultz (2003). According to Bloom and Canning (2000) improving health can be as important as an increase in the revenues, if we consider the welfare of the individuals. The relation between different demographic factors and economic growth was assessed by Lleras-Muney (2005) who showed that as the mortality rate falls, the demand for educational investments increases.

Each individual is responsible for his own health status. However, due to the fact that, by its essence, the health status generates many externalities, it also becomes a public policy concern.

For this reason, when talking about the state's intervention in this domain, the comments of the non-interventionists have been conducive to the gradual acceptance of a fruitful cohabitation of the public and private competing systems. Once this compromise is put into effect, the issue of efficiently spending the public money on health services is raised.

Public policies can be evaluated by analyzing whether governments use their resources in an economically efficient manner (Geys and Moesen, 2009). For example, Geys and Moesen use parametric and nonparametric methods to estimate the level of local government technical efficiency in Flanders in 2000. In assessing the efficiency, the choice of inputs and outputs is extremely important and depends on what is important for both the subject(s) and those responsible for the efficiency study (Geys and Moesen, 2009, p. 501).

DEA model was not used convincingly in health systems analysis. At the same time, however, in the literature we find many analyses of public resources allocation efficiency.

The researchers' interest have also been channelled towards the connection between sectorial public spending (especially for education and health) and their outcomes (Rajkumar and Swaroop, 2008). The economic efficiency of the healthcare system means the latter gives to the economy more than it takes from it. The economic effectiveness of the health-care system is frequently higher than the activity directly aimed at the solution of economic problems (Miller and Adam, 1996). Jayasuriya and Wodon (2007) used panel data for provinces from Argentina and Mexico to measure the efficiency of medical and educational services.

Previous research on the efficiency of the public sector that apply non-parametric methods find significant differences in efficiency across countries [Fakin and De Crombrugghe (1997), Gupta and Verhoeven (2001), Aubyn (2003), Afonso et al. (2005, 2006), Afonso and Aubyn (2003, 2006), Baciu and Botezat (2014)]. Most studies apply the Data Envelopment Analysis method, while Afonso and Aubyn undertake a two-step DEA/Tobit analysis in a cross country analysis of secondary education efficiency.

3. DATA AND METHODS

The data were collected from Eurostat and the WHO databases for 30 European countries. In order to calculate the efficiency scores, we used the following input variables: the number of radiotherapy units per 1,000,000 inhabitants, public health expenditures as a percentage of the Gross Domestic Product (GDP), the number of hospital beds for 10,000 inhabitants. The output variables are the incidence of tuberculosis, the number of deaths by ischemic diseases per 100,000 inhabitants, and the health adjusted life expectancy (HALE).

Why have we selected those indicators? The percentage of the GDP spent on the public health sector shows a good correlation in the existing resources, between the development level and the governments' interest in the population's health. The number of beds is one of the most widely used indicators in health; theoretically, it shows the treatment capacity of the health-care systems. However, this indicator has some shortcomings, because there are suspicions that the countries of Central and Eastern Europe artificially keep the beds, for reasons of statistical reporting but also due to the managers' interest. On the other hand, the existence of the beds does not always correlate with the presence of the whole existing infrastructure (equipment, support staff, procedures, etc.). However, the number of beds can provide an insight into the hospital capacity of a health system, as a result of the investments that have been developed over the time. The number of Radiotherapy Units, was selected due to the complexity of the investments and to the relatively strict control over the functioning, which mostly removes the false reports.

In terms of output indicators, Health Adjusted Life Expectancy (HALE) is a reflection of the effectiveness of the health systems, as there is a strong correlation between health expenditure and the population's life expectancy. The number of deaths by ischemic diseases per 100,000 inhabitants has been selected because the ischemic diseases are a leading cause of death in Europe and in the world, and proper but expensive treatments can significantly extend the life expectancy even if the disease has occurred. The Incidence of Tuberculosis is the third output variable used. Tuberculosis appears and spreads as a result of poor nutrition, lack of prevention and of the ineffectiveness of treatments applied in hospital units. From our analysis showed that the incidence of tuberculosis may play the role of an adjustment variable, because of its specificity: it occurs where there is poverty and lack of preventive actions.

The efficiency scores calculated with DEA are used as dependent variables. The explanatory variables considered in the model are: the percent of population over 65, the level of urbanization, the literacy rate, and the Euro Health Consumer Index (EHCI).

The aging population is one of the major problems of the developed countries. According to the 2012 Ageing Report, issued by the European Commission, the ratio of the people over 65 will increase in the EU from 17% to 30% by 2060, while the percentage of active persons will decrease by over 11%.As a result, the ratio between the retired people and the workers will increase from 39% in 2010 to 71% in 2060, which will significantly influence the social systems. An aging population leads to increased expenditures for the health sector and to its decreased efficiency or, in other words, to its inefficiency.

The level of urbanization also influences the efficiency of health system. Increased urban facilities help the improvement of the population's level of health. Easy access to the health infrastructure, rapid interventions and better dissemination of the information are advantages which should support a higher state of health.

The literacy rate is also an explanatory variable of the efficiency in the health system. A high degree of literacy means increased access to information and a better perception of

the preventive medicine. It is well-known that the birth and infant mortality rates are higher among uneducated families. Therefore, the spending for the health recovery of this segment of the population may affect the efficiency of a system.

The Euro Health Consumer Index is one of the most used indicators of the effectiveness of the health systems in Europe. It is an index based on the subjects' self-assessment of their health status and the quality of medical services. This is a good explanatory variable for the inefficient health care systems because, according to self-perceived health status, people may or may not use the services of the health systems. Periodical checks, keeping the patients under control, preventive treatments consistently reduce the occurrence of certain serious illnesses that require substantial amounts to perform treatment and to prolong the life. An exaggerated optimism regarding their health state associated with a negative perception of the health services offered leads to an increased number of serious illnesses such as cancer, heart diseases, etc.

The empirical analysis contains descriptive statistics followed by correlation analysis for the variables used in DEA. Then, the (in) efficiency scores are determined for each country using Data Envelopment Analysis.

Measuring system's efficiency concerns the relationship between the inputs it uses and the outputs it produces. An efficient health system would be one that produces the maximum possible outputs with a given inputs, or one that produces a certain level of output with minimum inputs. The method applied in this research, Data Envelopment Analysis (DEA), is generally accepted as one of the best in assessing the efficiency of a set of decision making units (DMU). DEA is a 'data-oriented' method in that it effects its evaluations directly from observed data (Cooper and Tone, 1997, p. 72).

A DMU is to be rated as fully (100%) efficient on the basis of available evidence if and only if the performances of other DMUs does not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs (Cooper *et al.*, 2000, p. 3). In this study, an input oriented DEA model is applied. All deviations from the efficient frontier are classed entirely as inefficiency.

In order to assess the influence of environmental variables on (in)efficiency, the regression analysis was used. The (in)efficiency scores are regressed on factors that may influence inefficiency. These factors are measured by environmental variables. The environmental variables are different from input variables used in DEA.

We have used a limited dependent variable model because of the restriction for the values of the dependent variable. The dependent variable is continuous but it is censored below 1 and above 0 values. The censored regression model arises due to data censoring. We assume that the true inefficiency score depends on the environmental variables. In our analysis, we used both left-censored and right-censored variables with the lower limit 0 and the upper limit 1.

4. RESULTS

4.1. Descriptive Statistics and Correlations

Table 1 summarizes the main descriptive statistics of the six variables. The number of radiotherapy units ranges from 1.2 units for 1,000,000 inhabitants (Romania) to 9.9 units for 1,000,000 inhabitants (Denmark). Moreover, 50% of the countries from the sample have less than 4.45 radiotherapy units per 1,000,000 inhabitants

Table no. 1 – Descriptive Statistics of output and input variables

Statistics	Radiotherapy Units	Public Health Expenditure Percentage	Number of Beds	Incidence of Tuberculosis	Ischaemic Heart Disease	HALE
Min.	1.2	2.457	21	4.4	32.1	52.4
Median	4.45	6.696	56.5	8.75	84.05	62
Max.	9.9	8.98	82	116	305.1	71.7
Mean	4.88	6.527	54.27	18.007	113.59	61.67

Source: Authors' calculations

The percentage of public health expenditures has a minimum of 2.45% (Cyprus) and a maximum of 9% for (Denmark and France). Furthermore, 50% of the states allocate less than 6.7% of the GDP to Health. The number of hospital beds for 10,000 inhabitants ranges from 21 beds per 10,000 inhabitants in Sweden, to 82 beds per 10,000 inhabitants in Germany. 50% of the countries have less than 56.5 beds per 10,000 inhabitants. The incidence of tuberculosis per 100,000 inhabitants ranges from 4.4 new cases per 100,000 inhabitants (Cyprus) to 116 new cases of tuberculosis per 100,000 inhabitants (Romania). The mean is 18 new cases per 100,000 inhabitants and the median is 8.75. These values provide clear evidence that the values of the incidence of tuberculosis are skewed and that mean is biased by Romania's high value. The number of deaths by ischemic deaths per 100,000 inhabitants ranges from a value of 32.1 in France to 305.1 ischemic deaths per 100,000 inhabitants in Lithuania. Also, 50% of the countries have less than 84.05 ischemic deaths per 100,000 inhabitants. HALE ranges from 52.4 years (Slovakia) to 71.7 years (Sweden). 50% of the countries have a population with less than 62 healthy years.

The health expenditures are significantly and strongly correlated with the number of radiotherapy units (0.71). The correlation is explainable by the fact that wealthier economies spend more money on technologies, research and development than growing or poor economies, which spend the health budget on curing and assuring basic services. There is a negative and statistically significant correlation between HALE and the number of death caused by ischemic diseases (-.576). HALE decreases as the number of people suffering from ischemic diseases increases.

4.2. Data Envelopment Analysis

Introducing these variables in the model, we have obtained the results presented in Table 2. The Constant Return to Scales (CRS) input oriented model identifies 8 countries out of the 30 states on the efficiency frontier and 22 countries with inefficient health systems. Thus, Denmark, France, Germany, Italy, Netherland, Portugal, Spain and Sweden were identified as having efficient health systems. Close to the frontier are also Norway and Austria, with a score of 0.95 meaning that, in order to be as efficient as their reference set, the countries should reduce their input utilization level by 5%. The Eastern European block is in the second part of the ranking, with the lowest scores. Thus, starting with the Czech Republic which has a score of 0.68, the scores for the Eastern countries decrease constantly down to 0.38 (Latvia). In other words, Eastern European countries should reduce the level of resources used in health with values ranging from 32% (Czech Republic) to 62% (Latvia), to become as efficient as the Western health systems. The lack of coherence in health system reforms, their insufficiency and poor management of resources can be some of the causes of such poor results.

Table no. 2 – Results for the health system's efficiency, Input oriented, Constant Returns to Scale

Country	Score	Rank	Country	Score	Rank
Denmark	1	1	Iceland	0.867	16
France	1	1	Finland	0.732	17
Germany	1	1	Luxembourg	0.730	18
Italy	1	1	Malta	0.706	19
Netherlands	1	1	Czech Republic	0.681	20
Portugal	1	1	Croatia	0.679	21
Spain	1	1	Slovenia	0.629	22
Sweden	1	1	Slovakia	0.535	23
Norway	0.952	9	Hungary	0.510	24
Austria	0.952	10	Estonia	0.509	25
Greece	0.944	11	Poland	0.508	26
Belgium	0.922	12	Bulgaria	0.489	27
Ireland	0.912	13	Lithuania	0.465	28
United Kingdom	0.906	14	Romania	0.441	29
Cyprus	0.877	15	Latvia	0.377	30

Source: DEA Solver, 2012.

When discussing the weights obtained for the set of variables, it can be seen that for 16 countries the public health expenditures as a percentage of the GDPcontributesto100% when calculating the score of the overall efficiency. This is because the DEA input model takes into account the highest attainable score, given by the combination of inputs. Thus, for the Eastern European countries for example, the gap between the uses of radiotherapy units compared to Western economies was more important and more difficult to absorb than the percentage of health expenditure. The countries from the efficiency frontier obtain their score from a mix of different proportions of the three input variables. Italy, Germany, Netherland and Spain perform best in the public health expenditures as percentage of the GDP; Spain, Portugal and France perform best in the number of beds per 10,000 inhabitants and Denmark performs best in the number of radiotherapy units per 1,000,000 inhabitants. Moreover, Denmark is also the state with the highest value for the number of radiotherapy units per 1,000,000 (9.9).

In terms of slacks, the model identifies Cyprus as the only state which should increase health expenditures percentage of the GDP in order to become efficient. The other states except those on the frontier have to modify the use of radiotherapy units and the number of beds to different extents, in order to achieve efficiency.

In order to reach the efficiency frontier, Romania should increase the number of radiotherapy units to 9.85 per 1,000,000 inhabitants. Moreover, the percentage of the GDP allotted to health should increase to a 226.96% of the current level, reaching 9.74% of the GDP and the number of beds should decrease by 74.09%. Even in these conditions, the model emphasizes that Romania should reduce the incidence of tuberculosis to 8.48 cases per 100,000, this way reducing the considerable gap compared to the other states. In broader terms than those imposed by the model, Romania should focus on the increasing the technological aspects of the health system and on avoiding the tendency to oversize it, at the expense of the quality of the medical service. A smaller number of health units would allow better funding of the existing ones, which would lead to an improvement in the results.

Luxembourg and Finland have a high value of the GDP per capita, high percentages of the GDP allocated to the health system and yet the model reveals a certain degree of efficiency. This can be explained by the output variables chosen. Heart diseases occur more often with older people and their health significantly deteriorates. Therefore, the health system spends considerable amounts to support the elderly. In the case of Finland a further problem occurs, that is a high consumption of alcohol, which is a significant cause of ischemic death.

4.3 Regression Analysis

Because economic and demographic factors play a relevant role in determining heterogeneity across countries regarding health systems and in order to explain efficiency, we have extended our analysis to exogenous factors and have performed the regression analysis.

Therefore, the hypotheses are that the efficiency of the health systems depends on the percentage of the population over 65, the level of urbanization, the Literacy Rate, and EHCI.

The correlations across dependent and independent variables indicate that there is a significant, positive, relatively strong correlation between the DEA score and the EHCI indicator (0.74).The following regression equation is estimated:

$$y_i = \beta_0 + \beta_1 OldPop + \beta_2 UrbLev + \beta_3 Literacy + \beta_4 EHCI + \varepsilon_i$$

Table 3 reports the results of the censored regression analysis.

Table no. 3 – Censored regression' results

Coefficients					
	Estimate	**Std. error**	**t value**	**Pr (> t)**	
(Intercept)	5.7211086	1.8640797	3.069	0.002147	**
OldPop	2.9245393	1.2067272	2.424	0.01537	*
UrbLev	-0.0029739	0.0025834	-1.151	0.249667	
Literacy	-0.0676094	0.0189039	-3.576	0.000348	***
EHCI	0.0022153	0.0003304	6.705	2.02E-11	***
logSigma	-2.0315569	0.1556593	-13.051	< 2e-16	***

*Source: Authors' calculations; Note: Significance codes: '***' 0.001 '**' 0.01 '*' 0.05.*

β_i estimates the effect of explanatory variables on the latent response variable, y*. The estimated coefficients are the marginal effects of a change in x_i on y*, the latent variable. Change in observable y is found by multiplying the coefficient with Pr (0<y*<1) that is the probability of being uncensored. The logarithm of the residuals' standard deviation is used during the estimation procedure (Table 3).

Our findings from the regression analysis support three out of the four hypotheses on the determinants of efficiency. Therefore, the score is influenced by the percentage of the population over 65, the Literacy Rate, and EHCI. The level of urbanization did not prove to influence significantly the differences among countries regarding the efficiency of the health systems. The variables EHCI and old population have positive effects on the efficiency score, while Literacy has negative effects on the efficiency measure.

An increase in education achievement measured by literacy reduces the inefficiency score by 6.5%, implying that the relevant countries move closer to the production frontier. Therefore, the better the level of education of the population is, the higher is the efficiency.

Aged population affects the inefficiency score, especially in countries with a high GDP and a large proportion of population over 85, such as Luxembourg and Finland. In theory, these two countries should be much closer to the efficiency frontier, having high percentages of the GDP allocated to health care and good infrastructure. However, the costs are also high just because of the large number of medically assisted aged persons.

5. CONCLUSIONS

The evaluation of the health care systems is a very difficult process. The difficulty arises from the specificity of the approach, which cannot be achieved in a purely economic manner, given that an output with deep social implication is taken into account. We refer to an individuals' health status, which is an important determinant of welfare and social stability and not just an economic effect of resources allotment. For this reason, increasing the efficiency of the health system should be a priority for each state which wants to acquire the status of a developed economy. Moreover, speaking from the perspective of human capital theories, an economy cannot positively evolve in the long term unless it invests in a continuous process of improvement in the health status, which is an important determinant of labour.

Starting from these premises, we have tried to identify a possibility to measure the efficiency/inefficiency of the public money allocations for the health services in the European Union, in order to identify the best cases and to classify the states according to their efficiency scores. What is the reason? The new member states, as well as some of those ranked as developed countries, are currently going through certain stages of restructuring the public health system, where they need models and examples. Although imitating is not the best approach to increase efficiency, it remains the cheapest option. The alternative could be experimentation. However, given the specificity of the domain and the immediate implications (e.g. the health of the citizens and the immediate impact on economic growth), situations of uncertainty should be avoided. The social experiment, as Popper emphasized, is inappropriate. A possible failure would be measured in loss of human lives and there is neither morale nor political justification for those policy-makers who would assume the process.

Our results show that there are situations, like Denmark's, where a certain efficiency state can be attained by correctly allocating available resources, even if these are low. There are many examples of countries in which, although they spend large amounts of money on health (UK, Belgium, Austria with over 3400 $ per capita), the efficiency of their allocation is substantially lower than in countries like Portugal, Spain (which allocates under 3000$ per capita).

Therefore, the hypothesis according to which the most developed states are closest to the efficiency frontier is only partially verified. The reality shows that there are developed countries with very inefficient health systems (Finland, Luxembourg). Instead, the paper proves the hypothesis that the developing states, especially the former communist countries sample, are located furthest from the border, still need in reforms and major investments focused on resources allocation and their correlation with the economies' potential. Increasing the efficiency of the health system should be a priority for each state which wants to acquire the status of a developed economy.

Overall, it can be seen that there are huge differences within the analysed sample. There are significant efficiency disparities both between the developed states and between the developing ones. The last hypothesis, that of exogenous influences, is mostly confirmed, as three of the four variables proposed by us get positive scores. Therefore, making health

systems efficient is not related just to the volume of investments, but also to global reforms, aimed to raise the living standard, the level of education, the social security and the positive social perception.

Our analysis has some limitations, induced by the adopted analysis model, which limited the number of possible variables that could be taken into account. Although we have tried to choose the most representative ones, changing them could reorder a countries' position in the efficiency table. However, the changes are not significant, the assumptions being validated in the same way and in other possible combinations. In the future, we intend to check the efficiency using another model that allows the introduction of a greater number of variables.

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FINANCIAL RESOURCE ALLOCATION IN A PROJECT PORTFOLIO: ANALYSING THE NECESSITY TO INTEGRATE SUSTAINABILITY INTO RESOURCE ALLOCATION

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Abstract

Resource allocation in a project portfolio is a complex decision-making process that is influenced by multiple and very often conflicting objectives. Furthermore, companies are coming under strong social pressure to integrate elements of sustainability into their decision-making process, which makes this process even more complex. Nowadays, the concept of sustainability is widely applied by many companies through their mission statement and strategy. It is also one of the most popular research fields for scholars. Despite the fact that sustainability is considered one of the most important challenges of our time, the integration of sustainability into project or project portfolio management (especially in resource allocation) is not fully recognised. This paper presents a literature-based analysis of the use of the sustainability concept in project management and therefore makes suggestions on how to integrate sustainability into resource allocation in a project portfolio.

Keywords: resource allocation, project portfolio, project management, project portfolio management, sustainability, composite sustainability index

JEL classification: G11, M21, L21, O22

1. INTRODUCTION

At present, both sustainability and project management are important and expected to become even more important in the future. The relationship between project management and sustainability is rapidly gaining interest from both practitioners and scholars. Silvius (2014) reported 250 publications and studies on this topic (compared to 85 publications in 2012 (Silvius *et al.*, 2012, p. 1). However, this research field is relatively new and unexplored (Martens and Carvalho, 2013, p. 111, Brook and Pagnanelli, 2014, p. 59, Daneshpour, 2015, p. 321).

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Sustainability is one of the most important issues that need to be taken into account in decision-making process at different levels of project-oriented organization (Daneshpour, 2015, p. 321). It has to be an integrated part of a project and project portfolio to support and achieve the objectives of organization (Sanchez, 2015, Hope and Moehler, 2014, p. 358, Tufinio *et al.*, 2013, p. 91).

The Association for Project Management suggested that the discipline of project management is ideally placed to deal with these issues (APM, 2006). However, current standards for project management fail to seriously address the sustainability issues, or equip project managers with the tools necessary for them to integrate sustainability into project management and operation (Eid, 2011, Silvius and Schipper, 2010, Ebbesen and Hope, 2013; Hope and Moehler, 2014, p. 359).

Today there is an increasing understanding of the need to develop methods, tools and techniques to integrate sustainability criteria into the management of projects, as well as a growing need of knowledge and concepts how to adopt sustainability in project management (Ebbesen and Hope, 2013, p. 1, Brook and Pagnanelli, 2014, p. 61, Fernández-Sánchez and Rodríguez-López, 2010, p. 1194, Martens and Carvalho, 2013, p. 112, Tufinio *et al.*, 2013, p. 91, Silvius and Schipper, 2014, p. 40).

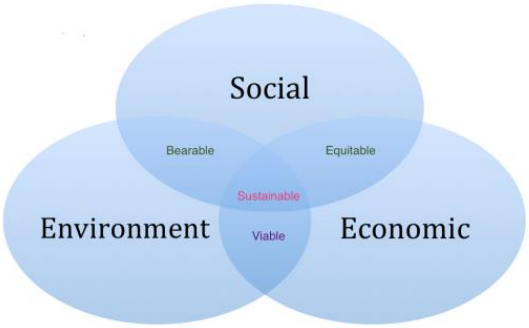
The aim of this paper is to present a literature-based analysis about the use of the sustainability concept in project management and to introduce a potential area for the integration of sustainability in project portfolio management.

The paper is structured into sections. Section 2 (The concept of sustainability) provides a brief overview of the concept of sustainability. Section 3 (Relationship between sustainability and project management) discusses the literature on project management and sustainability in order to understand how sustainability is integrated into project management. Section 4 (Sustainability-oriented resource allocation) describes a framework for sustainability-oriented financial resource allocation in a project portfolio. Finally, Section 5 (Application of the framework) demonstrates the applicability of the proposed framework.

2. THE CONCEPT OF SUSTAINABILITY

A literature review reveals that there is no agreed definition of sustainability. Sustainability in the context of sustainable development is defined by the World Commission on Environment and Development (WCED) as "the kind of development that meets the needs of the present without compromising the ability of future generations to meet their needs". This definition contains two concepts – the concept of needs, in particular the essential needs of the world's poor, to which priority should be given, and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (Brundtland, 1987). It emphasizes the aspect of future orientation as a basic element of sustainability. This care for the future implies a wise use of natural resources and other aspects regarding the environmental footprint. However, sustainability requires not just an environmental "green" perspective, but also the social one (Silvius *et al.*, 2012, p. 1054). According to Ebbesen and Hope (2013), this definition is primarily theoretical or conceptual and does not seek to offer solutions to the problem of how to reconcile the principle of sustainable development with the fundamental aim of business (and, some degree, projects) to generate profit.

A broader concept of sustainability is based on the integration of three dimensions, namely social, environmental and economic, constituting the sustainability tripod, known as Triple-Bottom Line (Elkington, 1997).



Source: Elkington, 1997

Figure no. 1 – The Triple-P concept of sustainability

Drawing on this, Dyllick and Hockerts (2002) identified three key elements of corporate sustainability:

- Integrating economic, ecological and social aspects in a "triple-bottom line";
- Integrating short-term and long-term aspects;
- Consuming the income rather than the capital.

In their analysis of the aspects of sustainable development in the business environment, Rutkauskas and Lapinskaitė (2012) distinguished several contradictory views, for instance, Davidson (2011) maintained that the essence of the definition is so obscure that it becomes meaningless. According to Lindsey (2001), this definition is so loose that it is not practically applicable, the concept is of such general nature that anybody can accept it. However, it should be borne in mind that it is one of the most frequently quoted definitions and has become the axis of deeper, more conceptual definitions.

Despite contradictory views, sustainability principles reflecting the Brundtland definition are steadily incorporated into strategic and activity plans of companies (Davidson, 2011). Moreover, a growing tendency to adopt this well-known truth in business has not only shaped the concept of sustainable development – it was defined by Galbreath (2009) as business strategy aimed at creating long-term value for stakeholders, including opportunities and managing economic, environmental and social development-related risk – but also led to the concept of corporate sustainable development which over the last decades became the subject of numerous research studies, while scholars provided different and varying perspectives (Chow and Chen, 2012).

3. RELATIONSHIP BETWEEN SUSTAINABILITY AND PROJECT MANAGEMENT

While there are plenty of sources on project management (project portfolio management) or sustainability itself, there are relatively few authors that linked sustainability with project management (Tufinio *et al.*, 2013, p. 92, Martens and Carvalho, 2013, p. 111). This relation involves many concepts depending of the approach adopted by

the research team (Tufinio *et al.*, 2013, p. 92). This section discusses the literature on project management and sustainability in order to understand how sustainability is integrated into project management.

Tom Taylor, (former) chairman of the Association for Project Management, was one of the first to suggest that the project management community familiarize themselves with the issue of sustainability, recognising that more should be done to contribute to a more sustainable society (APM, 2006). In some of the first publications on sustainability and project management, Labuschagne and Brent (2005) related the principles of sustainable development to project life cycle management in the manufacturing industry. They described three goals for sustainable development (i.e. social equity, economic efficiency, and environmental performance) in various project life cycle management problems.

Project management approaches and instruments were put together in toolboxes and handbooks to manage sustainability projects. Project sustainability checks have been developed for specific project types such as facility and infrastructure projects (American Council of Engineering Companies, 2009). Studies of appraising sustainability in projects have been reported for construction projects (Edum-Fotwe and Price, 2009). Gareis *et al.* (2009) developed a model to address relationships between sustainable development and project management. The model comprises sustainable development principles and project management objects. A Maturity Model for integrating sustainability in project management was developed by Silvius and Schipper (2010). The model assesses the level (i.e. business process, business model, and product and services delivered by the project) on which different aspects of sustainability are considered in the project. A Sustainability Checklist (this tool was developed at the 2010 IMPA Expert Seminar "Survival and Sustainability as Challenges for Project) was one of the basis for developing this Maturity Model.

A more academic approach to sustainability in projects was taken by Oehlmann (2011). She developed the "Sustainable Footprint Methodology" to analyse and determine the relevant social, environmental and economic impacts of a project. The framework confronts the life cycle of a project, consisting of three phases: project pre-phase, project execution and operation of the asset (Silvius and Schipper, 2014, p. 45).

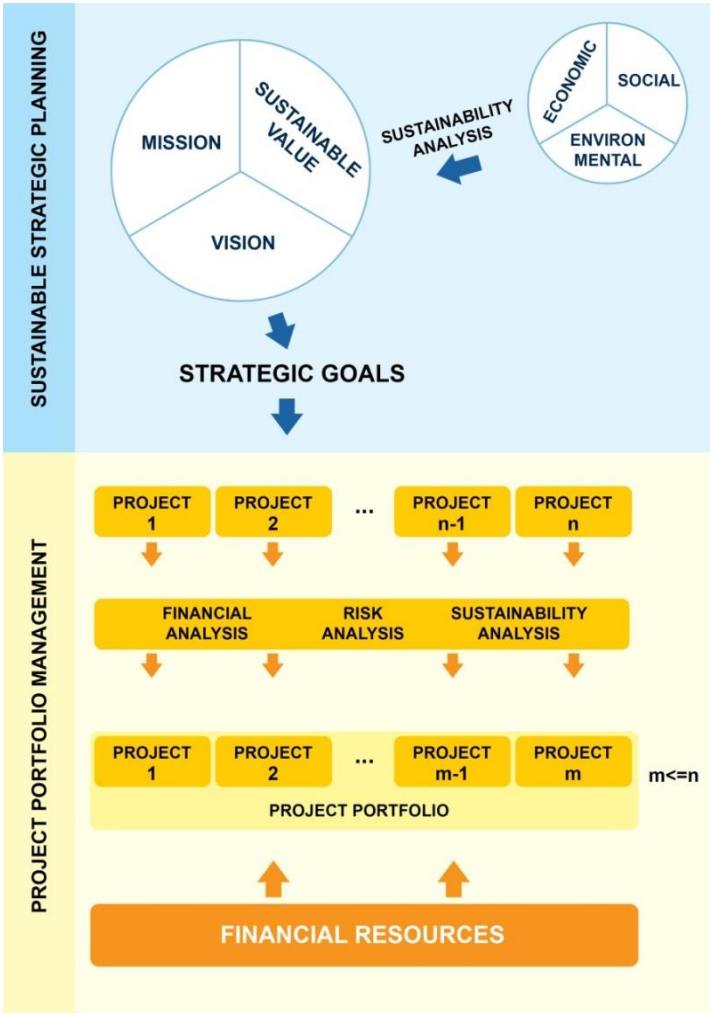
The problem of selecting the best portfolio with respect to the organizational strategy that includes sustainable goals was considered by Vandaele and Decouttere (2013). The authors developed a data envelopment analysis (DEA) model with the aim of supporting strategic Research and Development portfolio management. The authors proposed to use development costs, investment costs, and technical risk as inputs for DEA, and performance indicators, such as market size, competition, sales potential, profit ability or technical probability of success, as outputs for DEA. Sanchez (2015) developed a framework to help ensure that organization is working on the right projects to implement its business strategy and satisfy stakeholders' demands. The author believes that this conceptual framework has a good potential for integrating sustainability and project management in operational terms. Khalili-Damghani and Tavana (2014) proposed a comprehensive framework for sustainable strategic project selection problem.

The consideration of sustainability is gaining prominence in the field of project management. There is an increasing understanding of the need to develop methods, tools and techniques to integrate sustainability criteria into the management of projects (Ebbesen and Hope, 2013, p. 1). Silvius and Tharp (2013) concluded that "the relationship between sustainability and project management is […] picking up momentum".

4. SUSTAINABILITY-ORIENTED RESOURCE ALLOCATION

Since sustainability is one of the most important current issues, it is obvious that this new element must be incorporated in one way or another into decision-making process when resources are allocated in a project portfolio.

This section describes a framework for sustainability-oriented resource allocation in a project portfolio (Figure 2).



Source: created by authors

Figure no. 2 – Framework for sustainability-oriented financial resource allocation

The proposed framework consists of two modules. The first module of the framework is concerned with the integration of the sustainability into the strategic planning process. The sustainability criteria (economic, social and environmental) are considered an essential

component of strategic planning. The output of the first module is a set of projects that support the strategic goals. The second module of the framework is designed to deliver a project portfolio where resources are allocated taking into account not only financial criteria but also sustainability. Sustainability-oriented financial resource allocation in a project portfolio takes into consideration the economic, social and environmental dimensions of a project.

Financial analysis is performed to assess project efficiency on the basis of expected cash flows. The analysis of scientific literature showed that in order to assess project efficiency most of the authors apply the following indicators: return on investments (ROI), payback period (PB), accounting rate of return (ARR), net present value (NPV), internal rate of return (IRR), profitability index (PI), and modified internal rate of return (MIRR).

Risk analysis is divided into two complementary parts: qualitative and quantitative. Qualitative analysis is performed using various experimental methods. It identifies any and all risk and uncertainty factors as well as their importance for the project. The task of quantitative analysis is to assess the effect of deviations of risk factors on project efficiency in a quantitative manner.

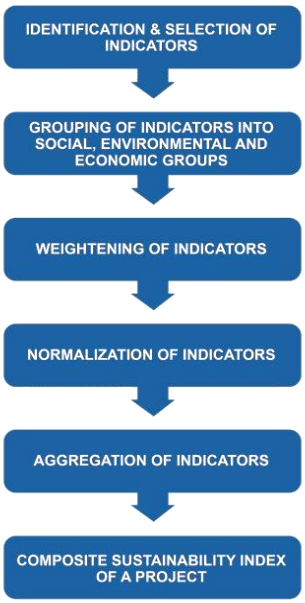
Sustainability analysis is aimed at assessing the sustainability of a project. The literature analysis of the use of the sustainability concept in project portfolio management revealed that there are no efforts to assess the sustainability of a project when making decisions regarding project selection and resource allocation.

Over the past decades a plethora of methodologies and tools were developed to perform sustainability assessment studies, focusing on different scopes (i.e. different pillars) and scales (i.e. micro, meso and macro) (Cinelli *et al.*, 2014, p. 139). Taking into account the fact that sustainability indicators and composite index are used to assess different aspects of sustainability (Ness *et al.*, 2007, Kemmler and Spreng, 2007, Bohringer and Jochem, 2007, Singh *et al.*, 2007, Ugwu and Haupt, 2007, Fernández-Sánchez and Rodríguez-López, 2010, Kocmanova and Simberova, 2013, Kocmanova and Docekalova, 2012, Zhou *et al.*, 2012, Manzini *et al.*, 2011, Singh *et al.*, 2012, O'Ryan and Pereira, 2015), we decided to use a composite sustainability index for assessing the sustainability of a project (CSIP). Therefore, we present a scheme for the calculation of a composite sustainability index of a project.

Various methodologies exist to construct composite indicators (CIs). Nardo *et al.*, 2008 described a framework for the construction of a composite, which includes the selection of relevant indicators and data, imputation of missing data, normalization of the selected indicators, weighting and aggregation. Cherchye *et al.* (2007) used DEA in their construction with the aim of neutralizing the recurring sources of criticism about CIs. The application of this method makes it possible to skip the normalization stage. Hatefi and Torabi (2010) proposed a common weight MCDA-DEA approach for constructing CIs. Zhou *et al.* (2010) developed a multiplicative optimization approach for constructing CIs, using the weighted product (WP) method.

The scheme for the calculation of a composite sustainability index of a project is divided into several steps which are presented in Figure 3.

The first step covers identification and selection of sustainability indicators which are suitable for a project in a particular industry. Then the indicators are grouped into economic, social and environmental. After sustainability indicators are selected and grouped, the weight of each indicator has to be determined. Since indicators may be expressed in different units, normalization is necessary. The final step is aggregation of indicators.



Source: created by authors

Figure no. 3 – Scheme for the calculation of a composite sustainability index of a project

It should be noted that we encounter a problem when assessing the sustainability of a new project that the project concerned does not have tendency. Therefore, a baseline (the simplest reference point) should be used. Baselines are starting points for measuring change from a certain state or date (Ten Brink, 2007). They are a common practice and broadly accepted in such fields as medicine, economics, environmental quality, climate change or education (Moldan *et al.*, 2012, p. 7).

Once financial, risk and sustainability analyses are performed, it should be decided which criteria (financial or non-financial) are given priority by a decision-maker prior to any allocation of financial resources in a project portfolio. For instance, a simple weighting function (using a weight λ) is needed that expresses preference (e.g. the sustainability) of a decision-maker (Peylo, 2012, p. 36).

5. APPLICATION OF THE FRAMEWORK

Since the aim of our paper is to show how sustainability can be integrated into project portfolio management (more specifically, financial resource allocation), this section demonstrates the applicability of the second module of the proposed framework. We do not look into the first module but just make an assumption that all projects meet sustainability-oriented strategic objectives, whereas the second module of the framework is tested on ten actual construction projects.

An efficient two-dimensional portfolio (return-risk) is traditionally described as a portfolio that provides the least risk for a given return, or the greatest return for a given level of risk (Kancerevicius, 2009). A range of literature has covered extensively the concept of

optimal portfolio (Markowitz, 1952, Tobin, 1958, Merton, 1972, Sharpe, 1994), so this subject will not be covered in this paper. It is sufficient to understand that the return and standard deviations obtained from screening can be extended to the development of an optimal portfolio (Siew, 2015). Therefore, we also propose to use project returns and standard deviation as measures of profitability and risk when building a project portfolio.

Based on Markowitz's theory, the expected return of a portfolio is calculated as the product of the return on a security and its probability (Filipavicius and Kazlauskas, 2015):

$$E(R_p) = \sum_{i=1}^{n} R_i P_i, \quad (1)$$

where:
R_i = return on a security;
P_i= probability for return on a security.

However, in practice, a simple formula is used to calculate the total return on a security because the assessment of the expected return on a security is rather complicated (Mangram, 2013). On the assumption that an investor gains from the buy-sell spread, the return on a security can be calculated as the average of daily, weekly, monthly or annual returns (Haugen, 2001):

$$\bar{R} = \frac{1}{n}\sum_{i=1}^{n} \frac{V_1 - V_0}{V_o}, \quad (2)$$

where:
V_1 = selling price of a security;
V_0 = buying price of a security.

Based on the second formula, and on the assumption that the project return is the difference between profits and investments, the return of a project portfolio will be calculated as the average of project returns in different scenarios (in the absence of historical data):

$$\bar{R} = \frac{1}{n}\sum_{i=1}^{n} \frac{P - I}{I}, \quad (3)$$

where:
P = project profits;
I = project investments.

The degree of risk of a project is expressed by standard deviation. Standard deviation shows the average deviation of the return of a project from the mean of the sample in terms of the same measures. A standard deviation is calculated by using the following formula:

$$\sigma = \sqrt{\sum_{i=1}^{n} (R_i - \bar{R})^2}, \quad (4)$$

where:
R_i = project's return in scenario *i*;
$\bar{R}$ = project's average return.

When allocating resources, it is important to understand how the uncertainties of different projects interact. In financial markets, the key determinant of the risk of a portfolio is the extent to which the returns vary either together or in the opposite direction. Risk depends on the correlation between returns on different securities in the portfolio. We do not take into consideration the correlation between projects in this paper as projects implemented by a particular company are, for the most part, closely interrelated.

In this study, beyond return and risk, we consider an additional objective, i.e. sustainability. For the integration of sustainability into portfolio theory several approaches are possible (Peylo, 2012). The first option would be to combine the concept of sustainability and portfolio theory by first selecting a suitable set of projects using sustainability criteria and afterwards applying a portfolio optimisation to find an efficient portfolio. As a second alternative, the portfolio optimisation could be applied first and then a certain degree of sustainability of the portfolio could be used. A third alternative is the integration of sustainability as an additional criterion into a new three-objective portfolio optimisation.

As already mentioned in Section 4, we use a composite sustainability index to assess the sustainability of a project. It is calculated using the following formula:

$$CSIP = \sum_{i=1}^{m} \omega_i \, I_i, \tag{5}$$

where:
$\boldsymbol{CSIP}$ = composite sustainability index of a project;
$\boldsymbol{\omega_i}$ = weight of sustainability indicator *i*;
$\boldsymbol{I_i}$ = normalised value of sustainability indicator *i*.

We formulated the portfolio selection as a three-objective optimisation problem so as to find tradeoffs between return, risk and sustainability:

1) The maximisation of the return of the portfolio;
2) The minimisation of the standard deviation of the portfolio;
3) The maximisation of a sustainability index of the portfolio.

Goals:

$$\begin{cases} max\, R_p \\ min\, \sigma_p \\ max\, I_p \end{cases} \tag{6}$$

where:

$$R_p = \sum_{i=1}^{n} w_i \, \bar{R}_i, \tag{7}$$

$$\sigma_p = \sum_{i=1}^{n} w_i \, \sigma_i, \tag{8}$$

$$I_p = \sum_{i=1}^{n} w_i \, CSIP_i, \tag{9}$$

where:

R_p = return of the portfolio;
$\overline{R}_i$ = average return of project *i;*
σ_p = standard deviation of the portfolio;
σ_i = standard deviation of a project *i;*
I_p = sustainability index of the portfolio;
$CSIP_i$ = composite sustainability index of a project *i*
w_i = fraction of the portfolio invested in a project *i*

Constrains:

$$\sum w_i = 1.$$

The weight of individual projects may not exceed 20%.

The proposed model for ten construction projects, using Excel Solver tool, was computed under different scenarios. A weight λ was used to express preference (e.g. sustainability) of a decision maker. First of all, a project portfolio is constructed taking into account only return and risk (financial portfolio, λ=1). Then a portfolio is constructed taking into account not only return and risk but also project sustainability, by giving equal weight to financial and sustainability criteria (balanced portfolio, λ=0.5). Finally, the best possible sustainable portfolio is constructed (λ=0). The results of the study are presented in Tables 1 and 2.

Table no. 1 – Comparison of portfolios

	Financial portfolio	Balanced portfolio	Sustainable portfolio
	λ=1	λ=0.5	λ=0
Return, %	50.21%	46.80%	46.20%
Risk, %	4.86%	4.54%	4.48%
Sustainability, %	52.80%	67.20%	67.80%

Source: prepared by authors

Table no. 2 – Portfolio structure

	Financial portfolio	Balanced portfolio	Sustainable portfolio
Projects	λ=1	λ=0.5	λ=0
P1	20%	20%	20%
P2			20%
P3	20%	20%	20%
P4	20%		
P5		20%	20%
P6			
P7	20%		
P8			
P9	20%	20%	20%
P10		20%	

Source: prepared by authors

As should have been expected, the incorporation of sustainability changes the structure of a portfolio and values of different criteria. Nevertheless, the incorporation of sustainability in the case at hand has moderately affected financial indicators of the portfolio

(i.e. return and standard deviation). These results do not conflict with recent research (Utz *et al.*, 2014, Trenado *et al.*, 2014). It is clear that this result heavily depends on the empirical characteristics of the case under study.

6. CONCLUSIONS

The literature analysis revealed that sustainability is defined in many different ways. In spite of this fact, most authors agree on the three pillars of sustainability, namely social, environmental and economic.

The concept of sustainability has also been linked to project management. And today there is an increasing understanding of the need to develop methods, tools and techniques to integrate sustainability criteria into project management.

This study presents an original contribution by proposing a means of integrating sustainability into project portfolio management. We proposed a framework for sustainability-oriented financial resource allocation in a project portfolio, which consists of two modules. The first module is concerned with the integration of the sustainability into the strategic planning process, whereas the second one is designed to deliver a project portfolio where resources are allocated taking into account not only financial criteria but also sustainability. We also proposed to assess the sustainability of a business project using a composite sustainability index. Based on the review of existing literature, this has not been attempted.

The empirical testing of the model showed that the incorporation of sustainability into the process of constructing a project portfolio causes moderate changes in the structure of the portfolio and the values of different criteria. In principle, these findings are not contrary to previous research.

However, this study has some limitations. Firstly, in order to select the best portfolio option the interaction between projects should be taken into account. Secondly, in order to ensure the optimised use of resources, scheduling would need to be done. Thirdly, the risk assessment should take into account only negative deviations as higher returns are always desirable. Lastly, the portfolio was constructed with the limitation that the weight of individual projects may not exceed 20%. Any change of this limitation may affect both the structure of the portfolio and the values of criteria; therefore, a greater number of scenarios should be evaluated.

Despite all shortcomings, we believe that the understanding of this study should enable companies to execute right (sustainable) projects, which could make a contribution to the sustainable development of organizations and thereby increase their competitive advantage.

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THE IMPACT OF ECONOMIC GROWTH ON GENDER SPECIFIC UNEMPLOYMENT IN THE EU

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Abstract

The relationship between unemployment and economic growth is known as Okun´s Law. Okun´s Law is used to estimate the reaction of unemployment rate on change in GDP growth. The purpose of this paper is therefore to examine the possibly asymmetric relationship between changes in output and gender specific unemployment rates by estimating Okun´s coefficients for all countries of the EU, as well as for selected groups of the EU countries. These groups include countries with similar characteristics that differ from other groups and represent the diversity among the EU. The results confirm that male unemployment is more sensitive to changes in GDP than the unemployment of females. Furthermore, findings differ on the country´s specifics with higher sensitivity in countries with lower economic performance.

Keywords: Okun´s Law, unemployment, economic growth

JEL classification: E24, E32

1. INTRODUCTION

The relationship between output and unemployment has become known as Okun´s Law (Okun, 1962, p. 99). This basic law of economics considers the economic growth as the main and only factor of changes in unemployment. In Okun´s original statement, 3% increase in output corresponds to a 1% decline in the rate of cyclical unemployment. Over the years Okun´s Law has been revised so that a one point increase in the cyclical unemployment rate is associated with two percentage points of negative growth in real gross domestic product (GDP). The relationship varies depending on the country and time period under consideration. In literature we can find some representative studies focused on demographic characteristics of the relationship between output and unemployment. The shocks to output may not impact unemployment rates equally across age, race and gender.

Several studies present statistical evidence of gender differences in unemployment due to the business cycle (Queneau and Sen, 2008; Peiro *et al.*, 2012). Lynch and Hyclak (1984) find that unemployment rates of men, teens and non-whites are more sensitive to output deviations from its full employment level. They also find that the unemployment rate of

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non-white teenagers fall in the current period, while the unemployment rates of the other groups react with a lag. Belaire-Franch and Peiró (2015) using nonlinear Markov switching regime model observed, that the male unemployment is much more sensitive to business cycle than female unemployment and this statement is observed more in UK than in the US. The response of male unemployment is almost double than of female unemployment in expansions, and more than double in contractions. Bisping and Patron (2005) examined the degree to which the cyclical nature of unemployment might vary across race and gender groups using VAR models. They also find that demographic groups do not experience a similar response and males are generally more responsive to shocks than females.

Hutengs and Stadtmann (2014) show that young people in Scandinavian countries are predominantly and significantly more exposed to business cycle fluctuations than older ones. This especially holds for the male population. According to their study, the recent economic crisis led to a strong gap between male and female youth unemployment, caused by a much sharper increase in the male unemployment rate. Furthermore, the male Okun´s coefficients are significantly higher than female ones and the unemployment changes of women are not so well explained by GDP growth only. Ewing *et al.* (2002, 2005) and Hotchkiss and Robertson (2012) argue that the female participation decisions are more dependent on changes in labour market conditions, and this could explain why female unemployment is less affected by cyclical shocks. The different behaviour could also lie in the fact that women are less likely to be laid off than men.

The purpose of this study is therefore to examine the possibly asymmetric relationship between changes in output and gender specific unemployment rates by estimating Okun´s coefficients for all countries of the European Union (EU) and selected groups of countries with similar characteristics. To achieve this we have specified two hypotheses. First, the unemployment of males is more sensitive to changes in GDP than the unemployment of females. Second, the impact of the GDP changes on the unemployment of males and females is more visible in EU countries with lower economic performance due to higher gap between real and potential product. Section 2 provides a general description of the data and methodology. Section 3 discusses the regression approach and results. Section 4 concludes.

2. DATA AND METHODOLOGY

To estimate the relationship between an economic performance and unemployment, the Okun´s Law is an adequate theoretical background. As known, we may express this relationship by three different approaches as given by Knotek (2007).

Firstly, the difference version, where:

*the change in the unemployment rate = a + b * growth of real output*

This is expressed as:

$$\Delta UR_t = a + b * gGDP_t \quad (1)$$

Second is the gap version giving the level of unemployment by gap of output that is:

*unemployment = a + b * gap between actual and potential output*

or:

$$UR_t = a + b * GDPgap_t \quad (2)$$

Third version is the dynamic approach that assumes the relationship between the change of unemployment and economic growth in present and previous period, as well as the change of unemployment in previous period. Then, dynamic version is given by following equation:

$$\Delta UR_t = a + b * gGDP_t + c * gGDP_{t-1} + d * UR_{t-1} \quad (3)$$

We have used the sample of EU28 countries for period 2000 – 2013, e.g. 14 periods in annual base. Furthermore, we have analysed selected groups of countries, which are the core countries, north countries, countries PIIGS and the Visegrad group (V4) countries. The reasons for selection of these groups are particular economic features, geographical location and similar historical and cultural development. Selected groups of countries represent the diversity of the EU. The core and north countries we consider to be more developed and the PIIGS and V4 counties we supposed to have lower economic performance. The core countries represent the major EU economies – Germany, France and Great Britain. Analysis continues with north countries. These represent welfare states with outstanding social system and stable economic and political environment. That includes Scandinavian countries – Finland and Sweden; and one of most developed EU and world country – Denmark. PIIGS countries are Portugal, Italy, Ireland, Greece and Spain. These countries are characterized by substantial instability of their economies mainly in period after the 2008 financial crisis. According to our hypotheses we suppose that unemployment in these countries is more volatile, particularly in male unemployment that is sensitive to cyclical development. The last group are V4 countries, sc. Czech Republic, Hungary, Poland and Slovakia. These new member countries of the EU are catching up the EU15 countries by nominal and real convergence. We expect a large change of male and female unemployment rate as a result of cyclical development of these economies.

3. RESULTS

Although we have introduced three versions of Okun´s Law, their results are very similar. Due to this, analysis covers only the first introduced - difference version. We start the analysis with the run of panel regression with fixed effects for EU 28 countries, followed by regressions with using data of unemployment for males and females separately. Further, we have made the same regressions for specified groups of countries. The results of estimation with dependent variable unemployment rate for entire population and by genders are listed in the following tables.

Table no. 1 – Estimation result of Okun´s Law for EU 28 and selected group of countries – total unemployment

unemployment rate – total [ΔUR_{it}]

	EU28		core countries		north countries		PIIGS		V4	
const	0.821452 (0.0706137)	***	0.274528 (0.123129)	**	0.329169 (0.128961)	**	1.11693 (0.153045)	***	0.607638 (0.237403)	**
$gGDP_{it}$	-0.334277 (0.0176435)	***	-0.232369 (0.0514155)	***	-0.206189 (0.0424242)	***	-0.447090 (0.0460503)	***	-0.278777 (0.0551184)	***
R^2	0.558840		0.390676		0.432193		0.631254		0.413566	

- dependent variable in square brackets
- standard errors in parentheses
*- ***, **, * - statistical significance on 1%, 5%, and 10% level*

Results of the analysis are as the same as we have expected. We have found out the existence of disparity in unemployment development, respectively unemployment changes due to changes in economic growth between genders. Analysing the Okun´s Law, it is valid and significant in EU countries as well as in core, north, PIIGS and V4 countries. Obviously, the Okun´s coefficients should gains higher values coming out from higher level of unemployment in developing economies as well as from higher rates of economic growth. 1% GDP growth thus might cause the larger change in unemployment rates for whole population, as well as for males and females.

Firstly, we have analysed the validity of Okun´s Law for entire EU and groups of countries considering total unemployment. The coefficients and constants of difference version are significant and might be interpret as follows. Constant reflects the change in unemployment in case of zero GDP growth. In all run panel regression is the constant positive, i.e. stagnation causes the rise in unemployment rate. It can be described as a result of technological changes, factor substitution, productivity or labour growth. However, as assumed, the constant differ among the analysed countries. Its higher value is in PIIGS countries, followed by V4 countries. Thus, the rise in unemployment rate is the largest in less developed countries. Under the zero GDP growth, unemployment rate rise in PIIGS countries by 1.12 percentage points. Unemployment rate in the V4 countries would rise in such situation by 0.61 percentage points, while only 0.27 or 0.33 percentage points in core, respectively north countries. The growth in unemployment rate, if analysing the all EU28 countries under the zero growth (stagnation) is 0.82 percentage points.

The GDP growth results in declining unemployment rate. As seen, the negative coefficients of gGDP have proved such assumption. The 1% of economic growth thus decreases unemployment by the percentage points given by analysis. The higher decline in unemployment is in PIIGS countries, i.e. the 1% GDP growth causes the decline in unemployment rate by 0.45 percentage points. Okun´s coefficients for core, north and V4 countries are almost similar; differ only from 0.21 percentage points in north countries to 0.28 percentage points in V4 countries. Analysis of EU28 data gives the result of 0.33 percentage points of fall in unemployment rate caused by 1% of economic growth. As results show, the higher volatility in unemployment rate is in PIIGS countries. The development of unemployment rate in PIIGS countries largely depends on economic performance. On the other hand, unemployment rate is more stable in core and north countries with smaller reaction on economic performance.

Table no. 2 – Estimation result of Okun´s Law for EU 28 and selected group of countries – unemployment of males

unemployment rate – males [ΔURm_{it}]

	EU28		core countries		north countries		PIIGS		V4	
const	0.991041 (0.0809342)	***	0.402369 (0.132828)	***	0.459150 (0.150515)	***	1.28009 (0.163401)	***	0.664052 (0.243949)	***
$gGDP_{it}$	-0.392276 (0.0202221)	***	-0.288142 (0.0554653)	***	-0.279374 (0.0495149)	***	-0.470842 (0.0491665)	***	-0.303557 (0.0566382)	***
R^2	0.567361		0.447934		0.485350		0.622876		0.433337	

- dependent variable in square brackets
- standard errors in parentheses
*- ***, **, * - statistical significance on 1%, 5%, and 10% level*

Further analysis focuses on gender differences in unemployment rates of males and females as reaction on changes in GDP growth. The assumption we try to prove is that unemployment of males is more volatile than unemployment of females (or unemployment of females is more stable). This is caused due to higher proportion of males working in more cyclical industries (manufacturing, electronics, etc.). On the other hand, females usually work in industries with lower or any reaction on business cycles such as education or health services and their employment depends on other features of labour market and economy.

Table no. 3 – Estimation result of Okun´s Law for EU 28 and selected group of countries – unemployment of females

unemployment rate – females [ΔURf_{it}]

	EU28		core countries		north countries		PIIGS		V4	
const	0.623492 (0.0722170)	***	0.120985 (0.123620)		0.173717 (0.128983)		0.877979 (0.166709)	***	0.510009 (0.252345)	**
$gGDP_{it}$	-0.271847 (0.0180441)	***	-0.162535 (0.0516202)	***	-0.117179 (0.0424317)	***	-0.420612 (0.0501618)	***	-0.239982 (0.0585876)	***
R^2	0.450552		0.273612		0.262047		0.566677		0.335657	

- dependent variable in square brackets
- standard errors in parentheses
*- ***, **, * - statistical significance on 1%, 5%, and 10% level*

Firstly, consider the unemployment of males. Results of panel regressions show the significance of constants and Okun´s coefficients in entire EU sample, as well as in selected group of countries. However, to compare with total unemployment, constants attain higher value. The same with negative numbers occurs in values for Okun´s coefficients. Stagnation in economic growth causes the growth of male´s unemployment by 1.28 percentage points in PIIGS countries and only 0.40 percentage points in core countries. These changes are higher in comparison with analysis of total unemployment that includes both genders. To explain the Okun´s coefficients for analysis of male´s unemployment, 1 percentage points of GDP growth decreases the unemployment of males by 0.47 percentage points in PIIGS countries and by 0.29, 0.28 and 0.30 percentage points in core, north and V4 countries, respectively. Results show the higher volatility of male´s unemployment due to economic growth. The difference between Okun´s coefficient for total unemployment and unemployment of males is not higher than 0.07 percentage points (in case of north countries) and constant is higher no more than 0.16 percentage points (in case of PIIGS countries). Although these results show only small difference between total and males unemployment reaction on GDP growth, it is multiplied by the size of growth. Thus, the higher economic growth, the more obvious is this difference. Further, even small percentage difference in unemployment rates represents a high number of confined workers measured in absolute terms. To continue on analysis of Okun´s Law for female unemployment, results shows the insignificance of constant in core and north countries, that means the most developed countries. PIIGS and V4 countries' constants are significant with lower values when compare to analysis of total unemployment. Further on, the GDP growth contribution to decrease the unemployment of females is lower than in total unemployment. Okun´s coefficient is the lowest in case of north countries, followed by core and V4 countries. Its higher value with a relatively high margin is in PIIGS countries, where the 1% increase in economic performance causes the decline in unemployment rate by 0.42 percentage points,

while it is only 0.12 percentage points in north countries. To compare with total unemployment, Okun´s coefficients differ no more than 0.09 percentage points that is the case of north countries. The lowest difference is in PIIGS countries (0.02 percentage points) and V4 countries (0.04 percentage points).

To analyse the gender differences, we use the Okun´s coefficients for unemployment of males and females. According to coefficients, the 1% GDP growth causes the highest decline in unemployment in PIIGS countries, followed by V4, core and north countries in total, male, as well as in female unemployment. The important result is given by the comparison of Okun´s coefficients for same group of countries in male and female unemployment analysis. The lowest difference between coefficients for males and females are in PIIGS countries with difference only 0.05 percentage points, followed by V4 countries (0.06 percentage points). The highest difference is in north countries (0.16 percentage points) and core countries (0.13 percentage points). These results indicate that the highest gender diversity in change of unemployment as a reaction to GDP growth is in most developed members of EU countries. The reason may be a high average income, a high social security for women or an income effect of wages.

The results, as we have described it, have proved the differences between genders. However, the small difference in Okun´s coefficient does it just slightly. We assume, the difference might be seen more obvious by interpretation of results in charge of the growth that is necessary for the fall in the unemployment rate by 1 percentage point. Such growths are in following table.

Table no. 4 – The economic growth necessary for 1 percentage point decline in unemployment rate (according to estimation of Okun´s coefficient; in %)

gender/countries	EU28	core countries	north countries	PIIGS	V4
total	2.99	4.30	4.85	2.24	3.59
male	2.55	3.47	3.58	2.12	3.29
female	3.68	6.15	8.53	2.38	4.17

Note: Estimated growths consider Okun´s coefficients and assume the hysteresis in labour market (that is, constant does not enter the calculation formula)

The growth necessary for fall in unemployment by 1 percentage point has divided the countries into two groups. The most developed - core and north countries require a higher growth in order to decrease unemployment rate. Also, gender differences are evident. To decrease the male unemployment, the growth has to be approximately 3.5%, but it has to be more than 6% in core countries and even more – 8.53% in north countries for females. On the other hand, PIIGS and V4 countries require lower economic growth and have not such different results for genders. Almost the same result for genders is clear in PIIGS countries. Here, the difference between the growths is only 0.26 percentage points. A little higher difference is in V4 countries (0.88 percentage points). To compare, in core and north countries, the difference is 2.68 percentage points, respectively 4.95 percentage points. To conclude, the difference between the growths necessary to decrease male and female unemployment by 1 percentage point for EU28 countries is 1.13 percentage points.

4. CONCLUSIONS

The relation between economic growth and unemployment is well known macroeconomic phenomenon. For that reason it is in interest of many economists in various forms and specifications. The paper deals with the estimation of the GDP change impact on the gender specific unemployment for the whole EU and separately for selected groups of countries with similar characteristics – core countries, north countries, countries PIIGS and V4 countries. Economic growth influences unemployment of males and females differently. Reaction of male unemployment is steeper, while it is more modest in case of females. Thus, response of male unemployment to business cycle is more evident. Okun´s coefficients in analysis confirm this assumption. In all EU countries and selected groups, Okun´s coefficients for male unemployment are higher in absolute term. With respect to results, we have accepted the first hypothesis that unemployment of males is more sensitive to changes in GDP than unemployment of females. Such result is not surprising. Males more often occupy vacancies in sectors very sensitive to business cycle as manufacturing, construction or electronics. On the other hand, females are usually employed in stable sectors of economy such as administration, health care or education.

To be more precise, we have analysed the difference between reaction of male and female unemployment in selected groups of countries. The highest spread of Okun´s coefficients for male and female unemployment is in the group of north countries, followed by the group of core EU countries. To the contrary, the spread in PIIGS and V4 countries is less than the half of the spread in countries with better economic performance. The reaction of males and females unemployment is very similar in countries with lower economic performance, while it differs in more developed countries.

Furthermore, the paper deals with comparison of results between selected groups of the EU countries with better and lower economic performance. The question that has arisen is if the GDP changes influences more group of core and north countries or the PIIGS and V4 countries. Due to results presented in section 3, we have accepted the second hypothesis. The impact of the GDP changes on unemployment of males and females is more visible in the EU countries with lower economic performance. Thus, these countries have to be more attentive to changes in economic performance. The same decrease of their GDP as in core or north countries causes the higher increase in unemployment rate. Such situation was obvious mainly in PIIGS countries after the 2008 financial crisis has arisen. To compare, the increase of unemployment rate in core and north countries was lower.

The results point out on the gender differences in unemployment reaction on GDP growth in the European Union with the higher divergence between most developed EU countries (core and north countries) than in case of less developed EU members (PIIGS countries and V4 countries).

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A SYNTHESIS OF THE HECKSCHER-OHLIN AND ONIKI-UZAWA TRADE MODELS WITH HETEROGENEOUS TASTES, DIFFERENT TECHNOLOGIES, AND ENDOGENOUS WEALTH

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Abstract

This paper examines the role of preferences and technological differences between two countries in determining dynamics of global wealth and pattern of trade in a reformed H-O model of international trade. The paper builds a trade model with endogenous wealth accumulation and labor and capital distribution between sectors and between countries under perfectly competitive markets and free trade. The model is based the H-O model, the Solow-Uzawa neoclassical growth model and the Oniki-Uzawa trade model. Each country has three sectors, producing one globally homogenous tradable capital good, specifying in producing one-tradable commodity, and supplying non-tradable goods and services. The study simulates the model for the economy to demonstrate existence of equilibrium points and motion of the dynamic system. It examines effects of changes in output elasticity of an industrial sector, population expansion, and propensities to consume the domestic commodity, to consume the other country's commodity, to consume services, and to hold wealth.

Keywords: trade pattern; O-H model; Oniki-Uzawa model; economic growth; wealth accumulation

JEL classification: F11, F21

1. INTRODUCTION

The Heckscher-Ohlin (H-O) model is one of the core models in model trade theories. A standard H-O model is for a two-countries global economy, each country having access to the same technology for producing two goods using two fixed factors (labor and capital) under conditions of perfect competition and constant returns to scale. Factors of production are mobile between sectors within a country, but immobile internationally. No international borrowing and lending are allowed. As pointed out by Ethier (1974), this theory has four "core proportions". In the simple case of two-commodity and two-country world economy, these four propositions are as follows: (1) factor-price equalization theorem by Lerner (1952) and Samuelson (1948, 1949), implying that free trade in final goods alone brings about complete international equalization of factor prices; (2) Stolper-Samuelson theory by Stolper and Samuelson (1941), predicting that an increase in the relative price of one

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commodity raises the real return of the factor used intensively in producing that commodity and lowers the real return of the other factor; (3) Rybczynski theorem by Rybczynski (1955), stating that if commodity prices are held fixed, an increase in the endowment of one factor causes a more than proportionate increase in the output of the commodity which uses that factor relatively intensively and an absolute decline in the output of the other commodity; and (4) Heckscher-Ohlin theorem by Heckscher (1919) and Ohlin (1933; see also Heckscher and Ohlin, 1991), proving that a country tends to have a bias towards producing and exporting the commodity which uses intensively the factor with which it is relatively well-endowed. The model explains patterns of trade based on the factor endowments of countries. According to Chen (1992, pp. 923-924), "It appears to be the general consensus in this body of literature that the main determinant of long-run comparative advantage is the countries' savings rates. The question of what has caused the difference in savings rates among countries, however, is rarely explicitly discussed in the literature. The models that do endogenize savings rates (e.g., Stiglitz, 1970) attribute the difference in savings rates and hence long-run comparative advantage to a difference in preferences; in particular, a difference in agents' time discount factors among countries. Yet explaining trade in terms of differences in preferences is no longer in the spirit of the Heckscher-Ohlin model in which trade arises because of differences in relative factor proportions." There is a large literature related to introducing dynamic elements to H-O models. An early example is given by Chen (1992) whose purpose is study long-run equilibria in open economies in an H-O modelling framework with endogenous savings and endogenous labor supply. The model provides an H-O type explanation for long-run trade between countries with identical preference. Baxter (1992) builds a model structurally similar to Chen's with tax rates being different across countries. The pattern of trade and specification is determined by the taxes in steady states. Ventura (1997) builds a model by combining a weak form of the factor-price-equalization theorem of international trade with the Ramsey model of economic growth. Bajona and Kehoe (2010) develop a dynamic H-O by combining a static two-good, two-factor H-O trade model and a two-sector growth model in infinitely lived consumers where borrowing and lending are not permitted. There are other models which attempt to generalize or extend the H-O model in different directions (Zhang, 2008). These H-O models don't allow international factor mobility and don't allow borrowing and lending. Observing goods and capital flows between countries in contemporary world, we see evidently that capital immobility is not a realistic assumption. This study relaxes this assumption. In particular, we apply the utility function proposed by Zhang (1993) to develop a dynamic H-O model.

The model in this study is as Ricardian as it postulates cross-country differences in technology and labor productivity, without providing endogenous determinants of the differences. We consider endogenous wealth as a main engine of global economic growth. We describe international trade on the basis of the dynamic model with accumulating capital developed by Oniki and Uzawa and others (for instance, Oniki and Uzawa, 1965; Frenkel and Razin, 1987; Sorger, 2003; and Nishimura and Shimomura, 2002). The Oniki-Uzawa model is constructed for the two-country with two goods with fixing saving rates. Deardorff and Hanson (1978) construct a model of different fixed rates in which the country with the higher savings rate exports the capital intensive good in steady state. The Oniki-Uzawa model is often used as a start point for analyzing interdependence between trade patterns and economic growth. In most of this type models goods and services are classified into capital goods and consumer goods. Nevertheless, it has been recorded that a high share of GDP in modern economies is non-tradable. Distinction between tradable good and non-tradable good is

significant for explaining the terms of trade (Mendoza, 1995), for explaining the exchange rate (Stulz, 1987; Stockman and Dellas, 1989; Backus and Smith, 1993; Rogoff, 2002); for dealing with current account dynamics (Edwards, 1989), or for solving the home premium puzzle (Baxter *et al.*, 1998; Pesenti and Van Wincoop, 2002). Backus and Smith (1993) emphasized the significance of this distinction as follows: "The mechanism is fairly simple. "Although the law of one price holds, in the sense that each good sells for a single price in all countries, PPP may not: price indexes combine prices of both traded and nontraded goods, and because the latter are sold in only one country their prices, and hence price indexes, may differ across countries". There are also other studies emphasizing distinction between tradable and non-tradable sectors (Stockman and Tesar, 1995; Zhao *et al.*, 2014). This study introduces distinct sectors to examine trade patterns and economic dynamics.

As the model in this study is a dynamic general equilibrium model, it can properly address issues related to income convergence between countries. Discussions about these issues are mostly based on the insights from analyzing models of closed economies in the literature of economic growth and development (Barro and Sala-i-Martin, 1995). One might reasonably expect that one can get little proper insights into the convergence issues with a framework without international interactions. This paper develops a two-country growth trade model with economic structure, treating the global economy as an integrated whole. We analyze trade issues within the framework of a simple international macroeconomic growth model with perfect capital mobility. The model in this study is a further development of the two models by Zhang. Zhang (2012, 2014) proposes a multi-country model with capital accumulation and knowledge with traditional one-tradable capital good and one non-tradable good framework. This paper develops an international growth model with three sectors in each national economy by adding one country-specified tradable good into the analytical framework. The introduction of this good makes the modelling framework more robust in exploring complexity of global economic growth. The rest of the paper is organized as follows. Section 2 defines the basic model. Section 3 shows how we solve the dynamics and simulates the motion of the global economy. Section 4 carries out comparative dynamic analysis to examine the impact of changes in some parameters on the motion of the global economy. Section 5 concludes the study. The appendix proves the main results in Section 3.

2. THE MODEL

Our model is influenced by some typical dynamic H-O models and the neoclassical trade growth theory. For simplicity, we consider a world economy with two national economies, indexed by $j=1, 2$. Rather than two goods in the standard H-O model, this study assumes that each national economy produces three goods. Both countries produce a homogeneous capital consumer goods which can be used as capital and consumer goods. The sectors in the two countries are called industrial sector. This sector is similar to the homogenous sector in the traditional neoclassical trade model (e.g., Ikeda and Ono, 1992). Capital goods are freely mobile between countries. There is no tariff on any good in the global economy. Each country provides services and country-specified goods which are not internationally tradable and can be consumed only by domestic households. Each country specifies in producing a good called global commodity which is internationally tradable and consumed by both countries. Global commodities are pure consumption goods. The industrial sector, global commodity sectors, and service sectors are indexed by i, j, s. Production sectors use capital and labor. Exchanges take place in perfectly competitive markets. Factor markets

work well; factors are inelastically supplied and the available factors are fully utilized at every moment. Like in the traditional H-O model, labor is internationally immobile. Capital and labor are freely mobile within each country and are immobile between countries. Saving is undertaken only by households. All earnings of firms are distributed in the form of payments to factors of production. We omit the possibility of hoarding of output in the form of non-productive inventories held by households. We describe capital sector and wealth accumulation as in the neoclassical growth theory. Most neoclassical growth models are based on the pioneering works of Solow (1956).

Let all the prices be measured in terms of capital good. We use $p_j(t)$ to represent the price of country $j's$ services. The price of global commodity supplied by country j is denoted by $p_{jj}(t)$. As labor is immobile between countries, wages vary between countries. Markets are competitive; thus labor and capital earn their marginal products, and firms earn zero profits. We denote the wage rate in the j th country and interest rate by $w_j(t)$ and $r(t)$, respectively. Capital depreciates at a constant exponential rate δ_{jk}, being independent of the manner of use within each country. Depreciation rates may vary between countries. We use $N_{jq}(t)$ and $K_{jq}(t)$ to stand for the labor force and capital stocks employed by sector q in country j. Let $F_{jq}(t)$ stand for the output level of sector q in country j.

Production functions

The production functions are neoclassical and homogeneous of degree one with the inputs. The production function of section q in country j is specified as

$$F_{jq}(t) = A_{jq} K_{jq}^{\alpha_{jq}}(t) N_{jq}^{\beta_{jq}}(t), \quad A_{jq}, \alpha_{jq}, \beta_{jq} > 0, \quad \alpha_{jq} + \beta_{jq} = 1 \tag{1}$$

where A_{jq}, α_{jq}, and β_{jq} are positive parameters. Different from the Richardian trade theory which assumes technological differences between countries, the H-O model assumes variations in capital and labor endowments with the identical technology between countries. In this study we assume not only differences in capital and labor endowments like in the H-O model but also differences in technologies between countries like in the Ricardian trade theory.

Marginal conditions for industrial sectors

The rate of interest, wage rate, and prices are determined by markets. Hence, for any individual firm rate of interest, wage rate, and prices are given at each point of time. The industrial sector chooses the two variables $K_{ji}(t)$ and $N_{ji}(t)$ to maximize its profit. The marginal conditions are

$$r(t) + \delta_{jk} = \frac{\alpha_{ji} F_{ji}(t)}{K_{ji}(t)}, \quad w_j(t) = \frac{\beta_{ji} F_{ji}(t)}{N_{ji}(t)}, \quad j = 1, 2. \tag{2}$$

Marginal conditions for the global commodity sectors

The marginal conditions for global commodity sector j in country j are

$$r(t)+\delta_{jk}=\frac{\alpha_{jj}\ p_{jj}(t)F_{jj}(t)}{K_{jj}(t)},\quad w_j(t)=\frac{\beta_{jj}\ p_j(t)F_{jj}(t)}{N_{jj}(t)},\quad j=1,2 \tag{3}$$

Marginal conditions for service sectors

The marginal conditions for service sectors are

$$r(t)+\delta_{jk}=\frac{\alpha_{js}\ p_{js}(t)F_{js}(t)}{K_{js}(t)},\quad w_j(t)=\frac{\beta_{js}\ p_{js}(t)F_{js}(t)}{N_{js}(t)},\quad j=1,2 \tag{4}$$

The current income and disposable income

This study uses Zhang's utility function to describe behavior of households (Zhang, 1993). Consumers make decisions on consumption levels of goods and saving. Let $\bar{k}_j(t)$ stand for the wealth of household in country j. Per household's current income from the interest payment $r(t)\bar{k}_j(t)$ and the wage payment $w_j(t)$ is

$$y_j(t)=r(t)\bar{k}_j(t)+w_j(t).$$

Here, we assume that selling and buying wealth can be conducted instantaneously without any transaction cost. The per capita disposable income is given by

$$\hat{y}_j(t)=y_j(t)+\bar{k}_j(t)=(1+r(t))\bar{k}_j(t)+w_j(t). \tag{5}$$

The disposable income is used for saving and consumption.

The budgets and utility functions

Let $c_{jq}(t)$ stand for consumption level of consumer good q in country j. We use $s_j(t)$ to stand for the saving made at the current time by the representative household in country j. The consumer j is faced with the following budget constraint

$$c_{ji}(t)+p_1(t)c_{j1}(t)+p_2(t)c_{j2}(t)+p_{js}(t)c_{js}(t)+s_j(t)=\hat{y}_j(t). \tag{6}$$

We assume that consumers' utility function is a function of the consumption levels of goods、services and the saving as follows

$$U_j(t)=c_{ji}^{\xi_{ji0}}(t)c_{j1}^{\xi_{j10}}(t)c_{j2}^{\xi_{j20}}(t)c_{js}^{\gamma_{js0}}(t)s_j^{\lambda_{j0}}(t),\ \ \xi_{ji0},\xi_{j10},\xi_{j20},\xi_{js0},\lambda_{j0}>0, \tag{7}$$

where ξ_{ji0} is called the propensity to consume industrial goods, good 1, ξ_{jj0} the propensity to consume global commodity j, and λ_{j0} the propensity to own wealth. Maximizing (7) subject to (6) yields

$$\begin{aligned} &c_{ji}(t)=\xi_{ji}\,\hat{y}_j(t),\quad p_1(t)c_{j1}(t)=\xi_{j1}\,\hat{y}_j(t),\quad p_2(t)c_{j2}(t)=\xi_{j2}\,\hat{y}_j(t),\quad p_{js}(t)c_{js}(t)=\xi_{js}\,\hat{y}_j(t),\\ &s_j(t)=\lambda_j\,\hat{y}_j(t), \end{aligned} \tag{8}$$

where

$$\xi_{ji}\equiv\rho_j\,\xi_{ji0},\ \xi_{j1}\equiv\rho_j\,\xi_{j10},\ \xi_{j2}\equiv\rho_j\,\xi_{j20},\ \xi_{js}\equiv\rho_j\,\xi_{js0},\ \lambda_j\equiv\rho_j\,\lambda_{j0},$$

$$\rho_j\equiv\frac{1}{\xi_{ji0}+\xi_{j10}+\xi_{j20}+\xi_{js0}+\lambda_{j0}}.$$

Wealth accumulation

According to the definitions of $s_j(t)$, the wealth change of the representative household in country j is

$$\dot{\bar{k}}_j(t)=s_j(t)-\bar{k}_j(t). \tag{9}$$

This equation simply states that the change in wealth is equal to saving minus dissaving.

Factor marketing clearing conditions

We use $K_j(t)$ to stand for the capital stocks employed by country j. The capital stock is fully employed by the three sectors. That is

$$K_{ji}(t)+K_{jj}(t)+K_{js}(t)=K_j(t),\quad j=1,2. \tag{10}$$

The labor force is fully employed by the three sectors

$$N_{ji}(t)+N_{jj}(t)+N_{js}(t)=N_j,\quad j=1,2. \tag{11}$$

Market clearing for two tradable goods

The demand and supply of services balance in each national market

$$c_{js}(t)N_j=F_{js}(t),\quad j=1,2. \tag{12}$$

Market clearing in global commodity markets

The demand and supply of tradable goods balance in global markets

$$c_{1q}(t)N_1+c_{2q}(t)N_2=F_{qq}(t),\quad q=1,2. \tag{13}$$

Market clearing in capital markets
The global capital production is equal to the global net savings. That is

$$\sum_{j=1}^{2}\left(s_j(t)N_j - \bar{k}_j(t)N_j + \delta_{kj}K_j(t)\right) = \sum_{j=1}^{2}F_{ji}(t). \tag{14}$$

Wealth balance
The wealth owned by the global population is equal to the total global wealth

$$\bar{k}_1(t)N_1 + \bar{k}_2(t)N_2 = K_1(t) + K_2(t) = K(t), \quad j = 1, 2. \tag{15}$$

We thus built the dynamic model with endogenous wealth accumulation.

3. THE DYNAMICS AND EQUILIBRIUM

We have the dynamic equations for the two-country global economy. As the system is nonlinear and is of high dimension, it is difficult to generally analyze behavior of the system. Before examining the dynamic properties of the system, we show that dynamics of the two-country economies can be expressed by 2 differential equations. Before further stating analytical results, we introduce a variable

$$z_1 \equiv \frac{r + \delta_{1k}}{w_1}.$$

The following lemma shows how to follow the dynamics of global economic growth with initial conditions.

Lemma 1

The motion of the 2 variables $z_1(t)$ and $\bar{k}_2(t)$ is given by the following 2 differential equations

$$\begin{aligned} \dot{z}_1(t) &= \tilde{\Lambda}_1\left(z_1(t), \bar{k}_2(t)\right), \\ \dot{\bar{k}}_2(t) &= \tilde{\Lambda}_2\left(z_1(t), \bar{k}_2(t)\right), \end{aligned} \tag{16}$$

where $\tilde{\Lambda}_1(t)$ and $\tilde{\Lambda}_2(t)$ are functions of $z_1(t)$ and $\bar{k}_2(t)$, defined in the appendix. The values of the other variables are given as functions of $z_1(t)$ and $\bar{k}_2(t)$ at any point in time by the following procedure: $r(t)$ by (A2) → $w_j(t)$ by (A2) → $p_j(t)$ by (A4) → $p_{js}(t)$ by (A5) → $\bar{k}_1(t)$ by (A7) → $K(t)$ by (A14) → $N_{jj}(t)$ by (A12) → $N_{ji}(t)$ by (A8) → N_{js} by (A7) → $K_{ji}(t)$, $K_{jj}(t)$, $K_{js}(t)$ by (A1)→ $F_{jq}(t)$ by (1) → $\hat{y}_j(t)$ by (A5) → $K_j(t)$ by (10) → $c_{j1}(t)$, $c_{j2}(t)$ and $s_j(t)$ by (8).

For simulation, we specify values of the parameters as follows

$$
\begin{aligned}
&N_1 = 10,\ N_2 = 20,\ \delta_{jk} = 0.05,\ A_{1i} = 1.2,\ A_{2i} = 1.3,\ A_{11} = 1.3,\ A_{22} = 1.2,\ A_{1s} = 1,\\
&A_{2s} = 1,\ \alpha_{1i} = 0.32,\ \alpha_{2i} = 0.3,\ \alpha_{11} = 0.31,\ \alpha_{22} = 0.31,\ \alpha_{1s} = 0.29,\ \alpha_{2s} = 0.3,\\
&\xi_{1i0} = 0.04,\ \xi_{110} = 0.05,\ \xi_{120} = 0.03,\ \xi_{1s0} = 0.03,\ \lambda_{1s0} = 0.75,\ \xi_{2i0} = 0.05,\ \xi_{210} = 0.03,\\
&\xi_{220} = 0.05,\ \xi_{2s0} = 0.04,\ \lambda_{2s0} = 0.7.
\end{aligned}
\tag{17}
$$

Country 1 and $2's$ populations are respectively 10 and 20. We consider equal depreciation rates of physical capital between the countries and between sectors. The total factor productivities are different between the two economies. The total factor productivity of country 1's industrial sector is higher than that of Country 2's. The propensity to save of country 1's representative household is higher than that of Country 2's. We specify the initial conditions as follows:

$$z_1(0) = 0.05,\ \bar{k}_2(0) = 8.$$

The motion of the system is given in Figure 1. In the figure the national incomes and the global income are defined as follows:

$$Y_j \equiv F_{ji} + p_{js} F_{js} + p_j F_{jj},\ Y \equiv Y_1 + Y_2.$$

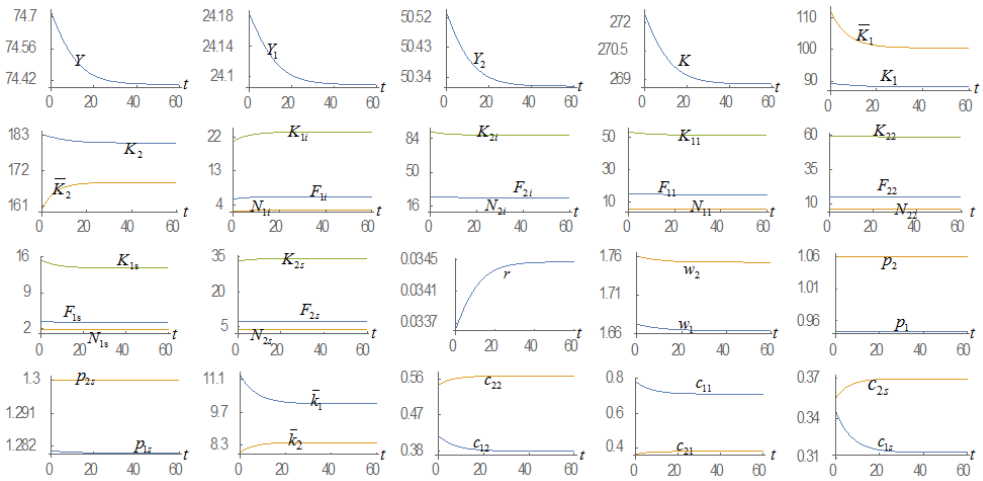

Figure no. 1 – The Motion of the Global Economy

The global income and wealth fall in association with rising rate of interest and falling wage rates. The national and global incomes fall over time. Country $1's$ wealth is more the capital stock employed by the national economy, implying that the country is in trade surplus. Country $2's$ wealth is less the capital stock employed by the national economy, implying that the country is in trade deficit. Country $1's$ wealth and the capital employed fall over time.

Country $2's$ wealth rises and the capital employed falls. Each sector also experiences changes over time as illustrated in Figure 1. The prices of two commodities and services are slightly changed. The consumption levels of commodities and services and wealth of country $1's$ ($2's$) representative household fall (rise) over time.

From Figure 1 we observe that the system becomes stationary in the long term. Following the procedure in the lemma, we calculate the equilibrium values of the variables as follows

$$Y = 74.4,\ Y_1 = 241,\ Y_2 = 50.3,\ K = 268.77,\ K_1 = 88.18,\ \bar{K}_1 = 100.53,\ K_2 = 180.59,$$
$$\bar{K}_2 = 168.24,\ r = 0.035,\ w_1 = 1.66,\ w_2 = 1.75,\ p_1 = 0.94,\ p_2 = 1.06,\ p_{1s} = 1.28,$$
$$p_{2s} = 1.3,\ c_{1i} = 0.54,\ c_{2i} = 0.6,\ c_{11} = 0.71,\ c_{21} = 0.38,\ c_{12} = 0.38,\ c_{22} = 0.57,$$
$$c_{1s} = 0.31,\ c_{2s} = 0.37,\ \bar{k}_1 = 10.05,\ \bar{k}_2 = 8.41,$$

$$\begin{pmatrix} F_{1i} \\ N_{1i} \\ K_{1i} \end{pmatrix} = \begin{pmatrix} 6.16 \\ 2.52 \\ 23.32 \end{pmatrix},\ \begin{pmatrix} F_{2i} \\ N_{2i} \\ K_{2i} \end{pmatrix} = \begin{pmatrix} 24.66 \\ 9.85 \\ 87.58 \end{pmatrix},\ \begin{pmatrix} F_{11} \\ N_{11} \\ K_{11} \end{pmatrix} = \begin{pmatrix} 14.74 \\ 5.77 \\ 51.06 \end{pmatrix},\ \begin{pmatrix} F_{22} \\ N_{22} \\ K_{22} \end{pmatrix} = \begin{pmatrix} 15.14 \\ 6.13 \\ 59.86 \end{pmatrix},\ \begin{pmatrix} F_{1s} \\ N_{1s} \\ K_{1s} \end{pmatrix} = \begin{pmatrix} 3.14 \\ 17.2 \\ 13.81 \end{pmatrix},\ \begin{pmatrix} F_{2s} \\ N_{2s} \\ K_{2s} \end{pmatrix} = \begin{pmatrix} 7.4 \\ 3.84 \\ 34.14 \end{pmatrix}.$$

It is straightforward to calculate the two eigenvalues as follows

$$\{-0.17, -0.14\}.$$

This implies that the world economy is stable. This implies that we can effectively conduct comparative dynamic analysis.

4. COMPARATIVE DYNAMIC ANALYSIS

We simulated the motion of the dynamic system. This section carries out comparative dynamic analysis. As we can follow the motion of the global economy, it is straightforward to provide transitory and long term effects of changes in any parameter on the global economy. It is important to ask questions such as how a change in one country's conditions affects the national economy and global economies. First, we introduce a variable $\overline{\Delta x}(t)$ to stand for the change rate of the variable $x(t)$ in percentage due to changes in the parameter value.

A rise in the total factor productivity of country 1's industrial sector

It has been argued that productivity differences explain much of the variation in incomes across countries, and technology plays a key role in determining productivity. We now study effects of an improvement of productivity in country $1's$ industrial sector. We allow the total factor productivity to be changed as follows $A_{1i} : 1.2 \Rightarrow 1.25.$ The results are plotted in Figure 2. As the system variables interact in nonlinearly, it is tedious to interpret why variables vary over time in a clear manner, even though it is not difficult to see by observing the motions in the plots. The improvement in country $1's$ industrial sector results in expansion of the sector in the country. More output is produced and more labor and capital inputs are employed. The output level and labor and capital inputs of country

$2's$ industrial sector are reduced over time. The global and country $1's$ total incomes are enhanced. Country $2's$ total income initially falls and rises in the long term. The global wealth falls initially and rises in the long term. Country $1's$ wealth and capital employed fall initially and rise in the long term. Country $2's$ capital employed is slightly affected and wealth falls initially and rises slightly in the long term. The wage rate in country 1 rises and the wage rate in country 2 falls and varies slightly in the long term. The prices of country $1's$ services and global commodity are increased and the prices of country $2's$ services and global commodity are slightly affected. Country $1's$ household initially reduces the wealth and consumption levels of all goods and services and augments these variables in the long term. Country $2's$ household reduces consumption of country $1's$ global commodity and keep the wealth and consumption levels of its own country's global commodity and services almost invariant. It is worthwhile to note that the technological change has almost no impact on the other country's service sector, and though it changes the other country's industrial and global commodity sectors.

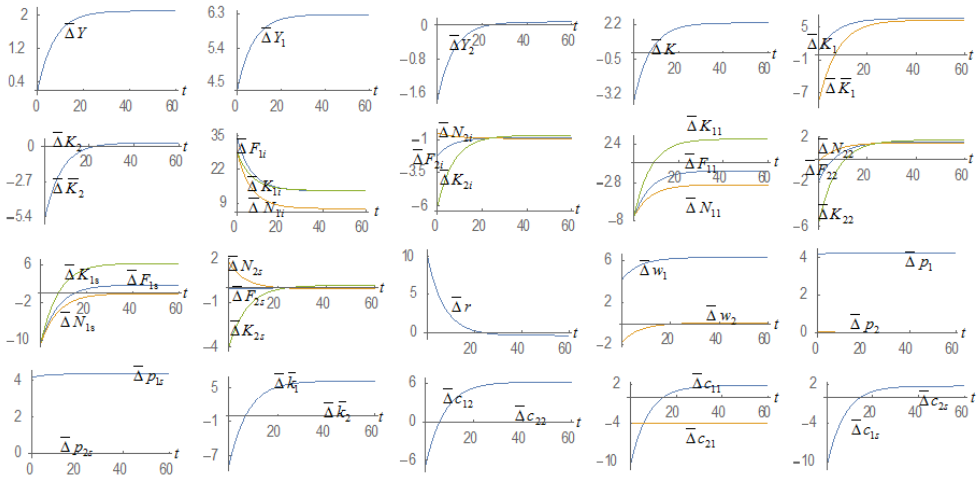

Figure no. 2 – A Rise in the Total Factor Productivity of Country 1's Industrial Sector

A fall in the output elasticity of country 1's industrial sector

This study uses the Cobb-Douglas production functions to describe production of all the sectors. The output elasticities of capital and labor represent the sector's technology and are equal to capital's and labor's shares of output. We now allow the output elasticity of country 1's industrial sector to fall as follows $\alpha_{1i} : 0.32 \Rightarrow 0.31.$ The results are plotted in Figure 3.

The falling in capital share of country $1's$ industrial sector reduces the output level and capital and labor inputs of country $1's$ industrial sector. This occurs partly as a consequence that the labor is constant and immobile in the country. The parameter change increases the output level and capital and labor inputs of country $2's$ industrial sector. The global and country $1's$ total incomes are lowered. Country $2's$ total income initially rises and changes slightly in the long term. The global wealth rises initially and falls in the long term. Country $1's$ wealth and capital

employed fall in the long term. Country $2's$ wealth is slightly affected and capital employed is increased. The wage rate in country 1 is reduced and the wage rate in country 2 is increased slightly. The rate of interest is reduced. The prices of country $1's$ services and global commodity are reduced and the prices of country $2's$ services and global commodity are slightly affected. Country $1's$ household initially increases the wealth and consumption levels of all goods and services and reduces these variables in the long term. Country $2's$ household increases consumption of country $1's$ global commodity and keeps the wealth and consumption levels of its own country's global commodity and services almost invariant. There are also some changes in the industrial structures. Country 1's global commodity sector produces more and employs more labor force and the sector initially employs more capital input. Country 2 's global commodity sector produces less and employs less the two input factors in the long term.

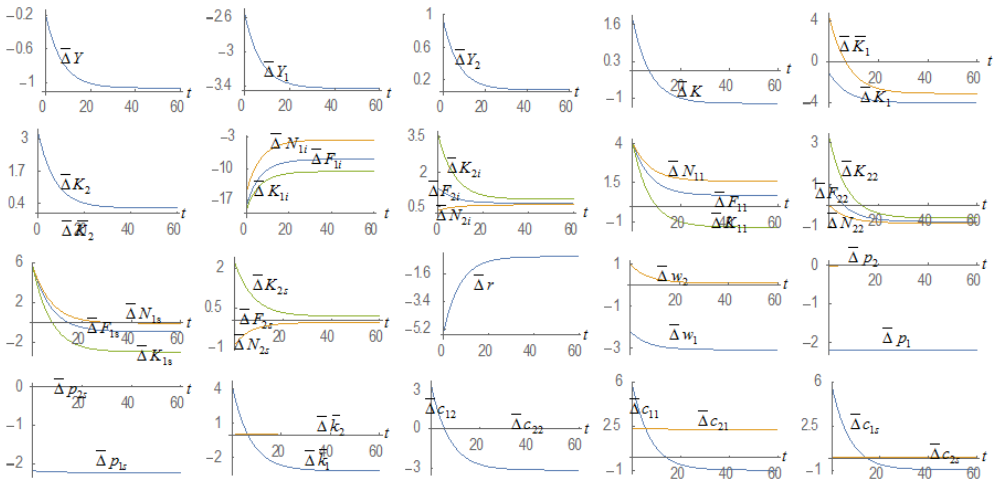

Figure no. 3 – A Fall in the Output Elasticity of Country 1's Industrial Sector

Consequences of country 1's population expansion

Chen (1992) observed: "There have been few attempts in the literature to explain long-run comparative advantage in terms of differences in initial factor endowment ratios among countries." As economists failed to analytically solve or simulate their dynamic models, it is difficult to explain transitory as well as long-run effects of initial factor endowments. As our model follows the dynamics of the global system with any conditions, it is straightforward for us to completely illustrate the effects of differences in any factor endowments. We now allow country 1's population to rise as follows $N_1 : 10 \Rightarrow 20.$ The simulation results are given in Figure 4. The rise in country $1's$ population increases the global total income, wealth, and two countries' total incomes. The wage rates of the two economies are increased and rate of interest is reduced. The prices in the two economies are slightly affected. The wealth and consumption levels of all the goods and services of country $1's$ representative household are reduced in the short term and these variables are slightly affected in the long term. The wealth and

consumption levels of all the goods and services of country $1's$ representative household are slightly affected. Country 1 expands the scales of the three sectors. Country 2 reduces the scale of its industrial sector and keeps the output level of services sector almost affected. Country 2 expands the scale of its global commodity sector due to the expansion of country 1's population.

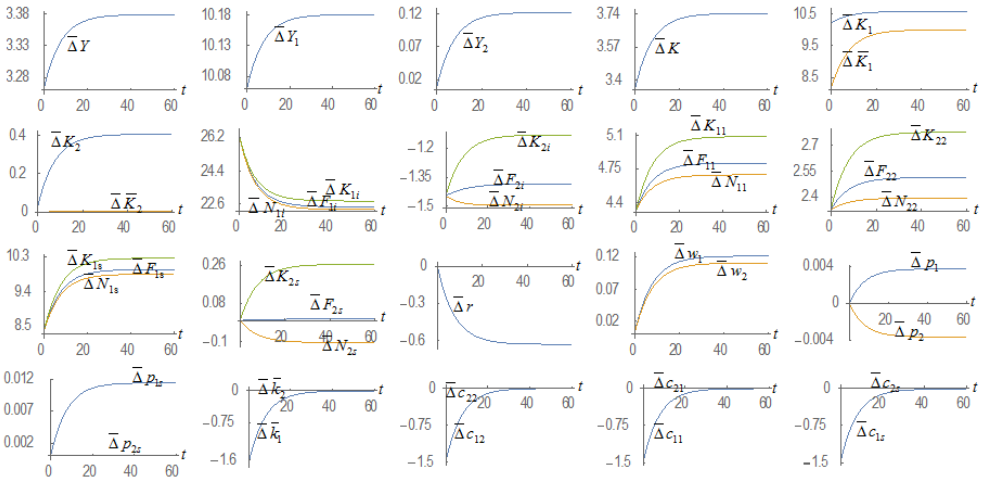

Figure no. 4 – Consequences of Country 1's Population Expansion

Country 1 increasing its propensity to consume the domestic commodity

We now study effects of the following change in country 1's propensity to consume the country's global commodity: $\xi_{110}: 0.05 \Rightarrow 0.06.$ We illustrate the results in Figure 5. Country 1's household consumes more country 1's global commodity. The household has less wealth and consumes less the other global commodity and domestic services. Country 2's household has the wealth level and consumption levels of two commodities and services unchanged. Country 1's global commodity sector expands its output by employing more capital and labor force. Country 2's global commodity sector expands its output by employing more capital and labor force. A higher propensity to consume consumer goods reduces the global total income and wealth, and two countries' total incomes. Country 1 has less wealth and employs less capital stocks. Country 2 has almost same level wealth and employs less capital stocks. The increased propensity to consume goods reduces the wage rates and augments the rate of interest. The prices are slightly affected.

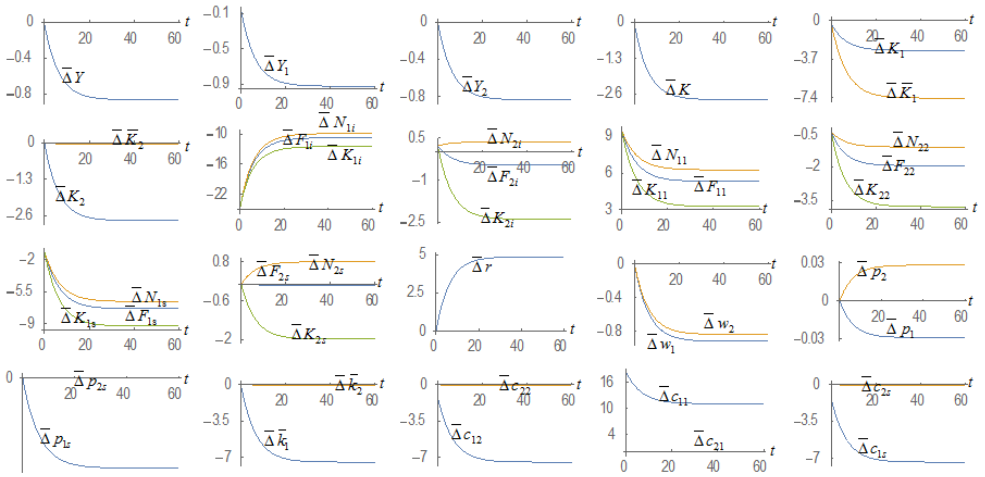

Figure no. 5 – Country 1 Increases Its Propensity to Consume the Domestic Commodity

Country 1 increasing its propensity to consume country 2's global commodity

We now study effects of the following change in country 1's propensity to consume country 2 's global commodity: $\xi_{110} : 0.03 \Rightarrow 0.04.$ The results are plotted in Figure 6. Country 1's household consumes more country 2 's global commodity. The household has less wealth and consumes less the domestic global commodity and services. Country 2 's household has the wealth level and consumption levels of two commodities and services unchanged. The rest effects are similar to the previous case when country 1's propensity to consume country 2 's global commodity is increased.

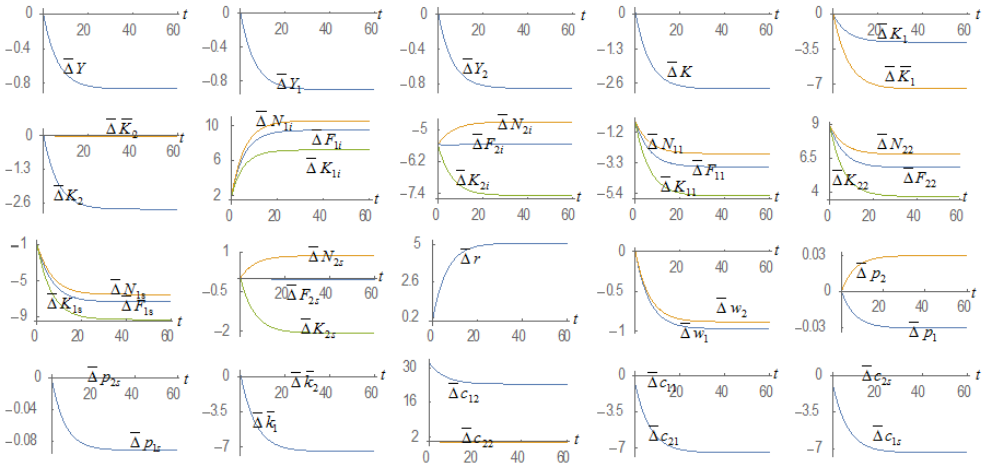

Figure no. 6 – Country 1 Increasing Its Propensity to Consume Country 2's Global Commodity

Country 1 increasing its propensity to consume services

We now study effects of the following change in country 1's propensity to consume services: $\xi_{1s0}: 0.03 \Rightarrow 0.04$. The results are plotted in Figure 7.

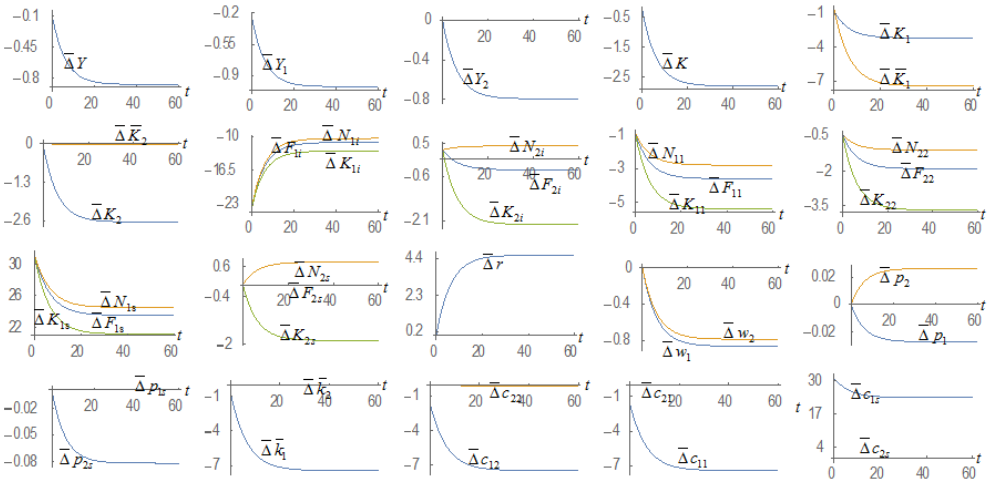

Figure no. 7 – Country 1 Increasing Its Propensity to Consume Services

Country 1 augmenting its propensity to save

We now study effects of the following change in country 1's propensity to save: $\lambda_{10}: 0.75 \Rightarrow 0.77$. We illustrate the results in Figure 8.

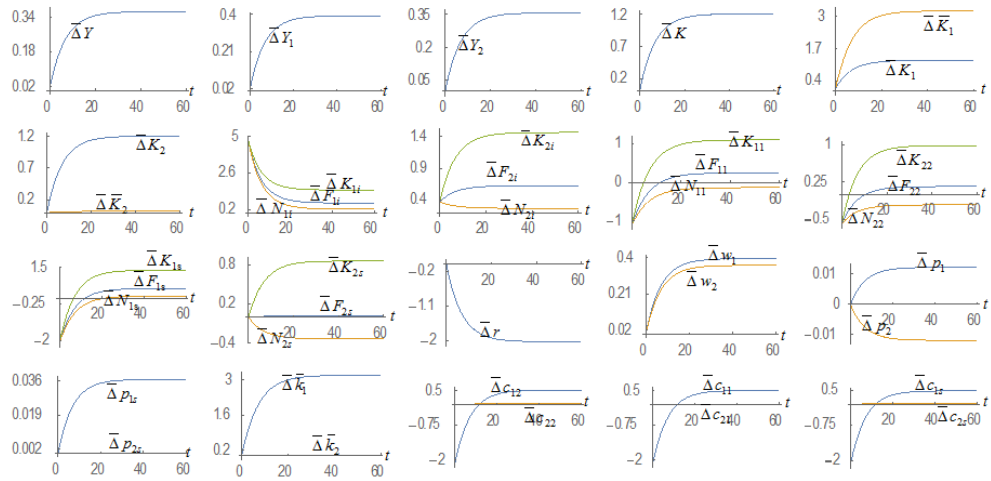

Figure no. 8 – Country 1 Augmenting Its Propensity to Save

The rise in the propensity to save augments the global total income and total wealth and the two countries' total incomes. Country 1's household increase the wealth over time.

The household initially reduces the consumption levels of two goods and services and raises these variables in the long term. The behavior of country 1's household is slightly affected. The wage rates are enhanced and the rate of interest is reduced. The prices of services are slightly increased. The price of global commodity 1 is slightly increased and the price of global commodity 2 is slightly decreased. The output levels and two inputs of the industrial sectors are increased.

5. CONCLUDING REMARKS

This paper studied the role of preferences and technological differences between two countries in determining the dynamics of capital stocks, and pattern of trade in a reformed H-O model of international trade. The paper built the trade model with endogenous wealth accumulation and labor and capital distribution between sectors and between countries under perfectly competitive markets and free trade. The model is built on the basis of the H-O model, the Solow-Uzawa neoclassical growth model and the Oniki-Uzawa trade model. The model synthesized these well-known economic models with Zhang's utility function to determine household behavior. We simulated the model for the economy to demonstrate existence of equilibrium points and motion of the dynamic system. We also examined effects of changes in output elasticity of an industrial sector, population expansion, and propensities to consume the domestic commodity, propensity to the other country's commodity, to consume services, and to hold wealth. The economic structures and interactions between different determinants of global economic growth are delicately interrelated. We might get more insights from further simulation. Our comparative dynamic analysis is limited to a few cases. The Solow model, the Uzawa two-sector growth, and the Oniki-Uzawa trade model are most well-known models in the literature of growth theory. Many limitations of our model become apparent in the light of the sophistication of the literature based on these models. We may generalize and extend our model on the basis of the traditional literature in the neoclassical growth model and trade. We may extend the model in other directions. We may introduce tariffs into the model. This study does not consider public goods and services. This study shows the role of capital accumulation as a source of economic growth and trade pattern change. There are many trade models which explicitly emphasize technological change and human capital accumulation as sources of global growth (e.g., Grossman and Helpman, 1991; Zhang, 2008).

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APPENDIX: PROVING THE LEMMA

We now derive dynamic equations for global economic growth. From equations (2)-(4), we have

$$z_j \equiv \frac{r+\delta_{jk}}{w_j} = \frac{\overline{\alpha}_{ji} N_{ji}}{K_{ji}} = \frac{\overline{\alpha}_{jj} N_{jj}}{K_{jj}} = \frac{\overline{\alpha}_{js} N_{js}}{K_{js}}, \tag{A1}$$

where $\overline{\alpha}_{jq} \equiv \alpha_{jq} / \beta_{jq}$. From (1), (2), and (A1), we have

$$r(z_j) = \frac{\alpha_{ji} A_{ji} z_j^{\beta_{ji}}}{\overline{\alpha}_{ji}^{\beta_{ji}}} - \delta_{jk}, \quad w_j(z_j) = \frac{r+\delta_{jk}}{z_j}. \tag{A2}$$

From (A2) we have

$$z_2 = \left(\frac{r(z_1)+\delta_{2k}}{\alpha_{2i} A_{2i}} \right)^{1/\beta_{2i}} \overline{\alpha}_{2i}. \tag{A3}$$

From (1), (3) and (A1)

$$p_j = \frac{w_j z_j^{\alpha_{jj}}}{\beta_{jj} A_{jj} \overline{\alpha}_{jj}^{\alpha_{jj}}}. \tag{A4}$$

From (1), (4) and (A1)

$$p_{js} = \frac{w_j z_j^{\alpha_{js}}}{\beta_{js} A_{js} \overline{\alpha}_{js}^{\alpha_{js}}}. \tag{A5}$$

From (10) and (A1) we have

$$\overline{\alpha}_{ji} N_{ji} + \overline{\alpha}_{jj} N_{jj} + \overline{\alpha}_{js} N_{js} = z_j K_j. \tag{A6}$$

From (12) and (8) we have

$$N_{js} = \tilde{n}_j \bar{k}_j + \beta_{js} \xi_{js} N_j, \tag{A7}$$

where

$$\tilde{n}_j \equiv \left(\frac{1+r}{w_j} \right) \beta_{js} \xi_{js} N_j.$$

Insert (A7) in (11)

$$N_{ji} = \bar{n}_j - \tilde{n}_j \bar{k}_j - N_{jj}, \quad j = 1, 2, \tag{A8}$$

where $\bar{n}_j \equiv \left(1 - \beta_{js} \xi_{js}\right) N_j$. Insert (A7) and (A8) in (A6)

$$N_{jj} = \left[z_j K_j - \overline{\alpha}_{js} \beta_{js} \xi_{js} N_j - \overline{\alpha}_{ji} \bar{n}_j - \left(\overline{\alpha}_{js} - \overline{\alpha}_{ji} \right) \tilde{n}_j \bar{k}_j \right] \frac{1}{\left(\overline{\alpha}_{jj} - \overline{\alpha}_{ji} \right)}. \tag{A9}$$

Insert (8) in (13)

$$\xi_{1j} \hat{y}_1 N_1 + \xi_{2j} \hat{y}_2 N_2 = p_j F_{jj}, \quad j = 1, 2. \tag{A10}$$

Insert (3) in (A10)

$$N_{jj} = \frac{\beta_{jj} \xi_{1j} \hat{y}_1 N_1}{w_j} + \frac{\beta_{jj} \xi_{2j} \hat{y}_2 N_2}{w_j}, \quad j = 1, 2. \tag{A11}$$

Insert (5) in (A11)

$$\tilde{w}_{1j} \bar{k}_1 + \tilde{w}_{2j} \bar{k}_2 + \tilde{w}_j = N_{jj}, \quad j = 1, 2. \tag{A12}$$

where

$$\tilde{w}_{1j} \equiv \frac{(1+r)\beta_{jj}\,\xi_{1j}\,N_1}{w_j},\quad \tilde{w}_{2j} \equiv \frac{(1+r)\beta_{jj}\xi_{2j}\,N_2}{w_j},\quad \tilde{w}_j \equiv \frac{w_1\,\beta_{jj}\,\xi_{1j}\,N_1}{w_j} + \frac{w_2\,\beta_{jj}\xi_{2j}\,N_2}{w_j}.$$

Equal (A12) and (A9)

$$\begin{aligned}
&[(\bar{\alpha}_{11} - \bar{\alpha}_{1i})\tilde{w}_{11} + (\bar{\alpha}_{1s} - \bar{\alpha}_{1i})\tilde{n}_1]\frac{\bar{k}_1}{z_1} + (\bar{\alpha}_{11} - \bar{\alpha}_{1i})\frac{\tilde{w}_{21}}{z_1}\bar{k}_2 + \\
&\frac{(\bar{\alpha}_{11} - \bar{\alpha}_{1i})\tilde{w}_1 + \bar{\alpha}_{1s}\,\beta_{1s}\,\xi_{1s}\,N_1 + \bar{\alpha}_{1i}\,\bar{n}_1}{z_1} = K_1, \\
&(\bar{\alpha}_{22} - \bar{\alpha}_{2i})\frac{\tilde{w}_{12}}{z_2}\bar{k}_1 + [(\bar{\alpha}_{22} - \bar{\alpha}_{2i})\tilde{w}_{22} + (\bar{\alpha}_{2s} - \bar{\alpha}_{2i})\tilde{n}_2]\frac{\bar{k}_2}{z_2} + \\
&\frac{(\bar{\alpha}_{22} - \bar{\alpha}_{2i})\tilde{w}_2 + \bar{\alpha}_{2s}\,\beta_{2s}\,\xi_{2s}\,N_2 + \bar{\alpha}_{2i}\,\bar{n}_2}{z_2} = K_2.
\end{aligned} \tag{A13}$$

Add the two equations in (A13)

$$a_1\bar{k}_1 + a_2\bar{k}_2 + a_0 = K, \tag{A14}$$

where

$$\begin{aligned}
a_1 &\equiv [(\bar{\alpha}_{11} - \bar{\alpha}_{1i})\tilde{w}_{11} + (\bar{\alpha}_{1s} - \bar{\alpha}_{1i})\tilde{n}_1]\frac{1}{z_1} + (\bar{\alpha}_{22} - \bar{\alpha}_{2i})\frac{\tilde{w}_{12}}{z_2}, \\
a_2 &\equiv (\bar{\alpha}_{11} - \bar{\alpha}_{1i})\frac{\tilde{w}_{21}}{z_1} + [(\bar{\alpha}_{22} - \bar{\alpha}_{2i})\tilde{w}_{22} + (\bar{\alpha}_{2s} - \bar{\alpha}_{2i})\tilde{n}_2]\frac{1}{z_2}, \\
a_0 &\equiv \frac{(\bar{\alpha}_{11} - \bar{\alpha}_{1i})\tilde{w}_1 + \bar{\alpha}_{1s}\,\beta_{1s}\,\xi_{1s}\,N_1 + \bar{\alpha}_{1i}\,\bar{n}_1}{z_1} + \frac{(\bar{\alpha}_{22} - \bar{\alpha}_{2i})\tilde{w}_2 + \bar{\alpha}_{2s}\,\beta_{2s}\,\xi_{2s}\,N_2 + \bar{\alpha}_{2i}\,\bar{n}_2}{z_2}.
\end{aligned}$$

From (15) and (A14) we solve

$$\bar{k}_1 = \phi(z_1, \bar{k}_2) \equiv \left(\frac{N_2 - a_2}{a_1 - N_1}\right)\bar{k}_2 - \frac{a_0}{a_1 - N_1}. \tag{A15}$$

It is straightforward to confirm that all the variables can be expressed as functions of z_1 and $\bar{k}_2$ by the following procedure: r by (A2) $\rightarrow$ w_j by (A2) $\rightarrow$ z_2 by (A3) $\rightarrow$ p_j by (A4) $\rightarrow$ p_{js} by (A5) $\rightarrow$ $\bar{k}_1$ by (A7) $\rightarrow$ K by (A14) $\rightarrow$ N_{jj} by (A12) $\rightarrow$ N_{ji} by (A8) $\rightarrow$ K_{js} by (A7) $\rightarrow$ F_{jq} by (1) $\rightarrow$ $\hat{y}_j$ by (A5) $\rightarrow$ K_j by (10) $\rightarrow$ c_{j1}, c_{j2} and s_j by (8) $\rightarrow$ K_{ji}, K_{jj}, K_{js} by (A1). From this procedure and (9), we have

$$\dot{\bar{k}}_1 = \tilde{\Lambda}_0(z_1, \bar{k}_2) \equiv s_1 - \phi, \tag{A16}$$

$$\dot{\bar{k}}_2 = \tilde{\Lambda}_2(z_1, \bar{k}_2) \equiv s_2 - \bar{k}_2. \tag{A17}$$

Here, we don't provide explicit expressions of the functions as they are tedious. Taking derivatives of equation (A15) with respect to t yields

$$\dot{\bar{k}}_1 = \frac{\partial \phi}{\partial z_1}\dot{z}_1 + \frac{\partial \phi}{\partial \bar{k}_2}\tilde{\Lambda}_2, \tag{A18}$$

where we use (A17). Equal (A16) and (A18)

$$\dot{z}_1 = \tilde{\Lambda}_1(z_1, \bar{k}_2) \equiv \left(\tilde{\Lambda}_0 - \frac{\partial \phi}{\partial \bar{k}_2}\tilde{\Lambda}_2\right)\left(\frac{\partial \phi}{\partial z_1}\right)^{-1}. \tag{A19}$$

In summary, we proved the lemma.

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REQUIREMENTS FOR CIOS' COMPETENCIES IN THE CZECH ECONOMY

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Abstract

Economy of the Czech Republic, just like the country's ICT sector, underwent significant changes after 1990. The fall of socialism and transition to market economy had significant impact on development of ICT sector and its competitiveness. In the article, we analyze practical requirements in the field of strategic knowledge demanded from Chief Information Officers (CIOs). The analysis is based on a representative survey carried out among approximately 1,000 companies on the Czech market in 2006, 2010. The last survey in 2015 was performed in the form of interview in 147 corporations. The companies are divided by branch in economic sector, by dependence on ICT and by size. The requirements put on CIOs are divided into sixteen knowledge domains. The results of the survey indicate that ICT sector in Czech Republic has gone from centrally planned economy to almost advanced economy since 1990. This is evidenced by identified development of strategic knowledge and practical skills required from CIOs in Czech Republic between 2006, 2010 and 2015. Knowledge requirements on CIO's degreased visible between year 2006 and 2015 but change between 2010 and 2015 is not noticeable. In general, we can say that requirements on CIO's are in 2015 lower than in 2010 except domains like "Team leadership skills", "IS/ICT knowledge", "Knowledge in Business Sector" and "Law".

Keywords: Chief Information Officer, CIO competences, knowledge profile, ICT skills, ICT management

JEL classification: A23, J01, J21, J24, O15

1. INTRODUCTION

The implosion of the socialist camp and the socialist system were reflected very strongly in the economic field in the conditions of former Czechoslovakia (Czech Republic). The transition of the country's economy from central planning to market economy was accompanies by political and ownership changes, which were accompanied by changes on both macro- and micro-economic levels (Klaus, 2006). One of the important accelerators of the economic reform and subsequent development became ICT. However, in line with the development of ICT, new ICT roles arose and the knowledge

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required from them developed dynamically. With the development of ICT and economy as a whole, there were naturally also significant debates about the impact of new ICTs on economic performance and competitiveness in general, and on productivity, efficiency, and innovation in particular. Notably, in seeking an explanation for the acceleration in productivity and economic growth experienced in many industrialized countries in the latter half of the 1990s and early 2000s, many economists have looked at the development, application, and utilization of ICT as a critical factor. It has been argued that ICT represents a new general purpose technology, with the potential of transforming economic processes into a "New Economy," generating a sustained increase in economic growth through processes of technological development and innovation. Hence, at firm level, the expectations are of greater efficiency, lower costs, and access to larger and new markets, while governments see the application and use of ICT as generating higher national productivity, job creation, and competitiveness. (World Bank, 2007).

In the Czech economy, this development manifested twice, for the first time, in 1990s, when ICT services were privatized (Klaus, 2006), and Czech companies were outfitted with software and hardware. For the second time, this development manifested also in the first years of the new millennium, when new trends appeared in the form of participation in international integration in the field of providing ICT services and increased share of foreign and international companies in the ICT services market. Along with that, the trend of improving the qualification of experts and CIOs in the companies appears.

The subject of the current article is the analysis of strategic thinking and practical ICT skills requirements for the role of CIO. The research on ICT specialists conducted in the Czech Republic had a broader context in which we examined not only common business practice needs but also a possibility of satisfying such needs by human resources represented by university graduates from ICT area of specialization. During the research we identified interesting trends in the development of requirements from practice for ICT roles identified by us. In this paper, our attention is focused on the development of requirements for CIO role. The article shows the development of business practice requirements on strategic thinking and practice skills for CIO role identified by us during two surveys. The first survey was conducted in 2006 and the second one in 2010. The development of requirements for a CIO role was studied from various perspectives. Detailed views of the points at issue are:

- With respect to all sectors of economy based on the dependency on ICT and
- With respect to the size of companies (10-49, 50-249 and more than 250 employees) included in the survey.

We don't take into account in this paper questions connected with gender that are solved for example in (Rodgers and Boyer, 2006).

2. BACKGROUND

Transition economies are defined as countries that are in transition from a communist style central planning system to a free market system (Roztocki and Weistroffer, 2008a; Lee *et al.*, 2012) present that the two regional groups of transition economies are distinguished in their contribution (Lee *et al.*, 2012) - Central and Eastern Europe and Latin America. The International Monetary Fund's classification does not include Latin countries. The definition of transition economies applies to a country or region with low absolute, but fast growing, and authorities committed to economic and political liberalizations (Amold and Quelch,

1998). As we discussed, most studies on transition economies have aimed at examining ICT-driven economic and political changes in the initial stages of transition process, so they do not present rich insights on the transformative role of ICT in this type of economy. Countries in Central and Eastern Europe included the part of Soviet sphere of influence. They have the same transitional year of 1990, the year for the collapse of the U.S.S.R. and the subsequent dismantling of communism in Eastern Europe. The five-exemplar countries included in this study joined the European Union in 2004. While their overall economic and societal indicators had stabilized, their economic markers remained below the European and OECD average. Important economic indicators such as GDP per capita and employment ratio were much lower than other OECD countries. In this regard, these countries hoped to catch up with living standards in developed countries and use ICT to stimulate overall societal improvements. Higher ICT spending would reflect such efforts around 13.2% of GDP, which is approximately twice as high as the average spending of other OECD countries (Doucek, 2010; Hančlová and Doucek, 2011; Agayev and Mamedova, 2012). The manner of transition from central planning to market economy left also its marks on the development of the ICT sector and on the requirements and knowledge for the CIO role.

The process of ICT adoption in developing countries is connected with different considerations as compared to practice observed in developed economies (Bingi *et al.*, 2000; Roztocki and Weistroffer, 2008a). In particular, ICT adoption projects conducted in developing and transition economies **struggle with lack of ICT experience**, inadequate ICT infrastructure and maturity, and **lack of long term strategic thinking** (Huang and Palvia, 2001; Roztocki and Weistroffer, 2008b; Solar *et al.*, 2013). Lack of strategic thinking and lack of experience in ICT yields lack of human resources in the ICT field on the market in the Czech Republic are presented f. e. in (Doucek, 2010) and subsequently low competitiveness of the whole economy due to underdeveloped ICT (Sołoducho-Pelc and Radomska, 2012), (Doucek *et al.*, 2014, Doucek *et al.*, 2013; Crespo and Cota, 2012).

Another aspect with impact on the CIO competencies are ICT trends. Some of these are specified in Roztocki and R. (2012). According to Cohen *et al.* (2002) the main features of ICT are as follows:

- very dynamic technological changes, with rapid penetration and adoption rates,
- decreasing costs for new equipment,
- a rapidly increasing range of applications and penetration in an increasing number of realms of professional and personal life.

In the world literature, various concepts of **CIOs' competences** may be found (for example (Porter, 2008). Their extent is given by the range of professions and their activities performed by managers in the ICT field. ICT managers are not only chief information officers (CIO) but they are also at the level of informatics department management, project management or they hold a position of specialized directors (e.g. safety director, computer network department director, etc.).

3. METHODOLOGY AND DATA COLLECTION

The research methodology was based on the problem formulation, i.e. identification of the development of requirements from practice for ICT specialist roles highlighting the role of ICT managers with respect to time, field of company‘s activity, and the company size.

To define individual ICT roles for the purpose of business practice it is essential to understand who may be considered an ICT specialist. During our survey we adopted the

following concept of an ICT specialist. An ICT specialist is considered to be an employee whose job position requires specific knowledge and skills about the creation, implementation and operation of ICTs in companies and use of ICTs in support of main company processes. Working with ICTs is their main job task (OECD, 2010). End users whose activity does not influence the work of other ICT users are not, therefore, considered to be ICT specialists. The reason behind such concept is the fact that a growing number of professionals (traders, physicians, financiers, architects, accountants and others) use ICTs in their work but they do not influence other ICT users. For the purpose of the first survey conducted in 2006 six basic roles of ICT specialists were defined in cooperation with professional associations of ICT specialists and companies – The Czech Association of Chief Information Officers (CACIO): business analyst/architect, CIO (Chief Information Officer), salesperson for ICT products and services, developer/IS (of information systems) architect, application and ICT infrastructure administrator, advanced ICT user/ methodologist.

Based on the requirements for skills, abilities and competences of ICT managers (Zanda, 2011) and after consultations with experts from academic environment and top and ICT managers from business environment the following main activities for CIO role were defined:

- Preparation of company strategies – strategy targets
  - Information strategies (how ICTs will be implemented in a company in order to support the achievement of its strategic goals).
  - Sourcing strategies (which services, processes and sources should be owned / internally administered and which ones should be purchased from partners),
- ICT performance management – tactical targets
  - Measurements of corporate ICT (based on PDCA approach) (Jaquith, 2007, Maryska and Novotny, 2013).

A CIO is required to possess the knowledge of best global practices as well as of local conditions and business culture (Xu and Xu, 2011). In particular, off-shore outsourcing of these activities is unlikely to happen in current conditions (Contractor and Mudambi, 2008).

Each of the above mentioned roles was described in a structured format. Business practice usually uses various names to designate professional roles. For this reason the description of each professional role was extended to include common names of positions which are used in business practice and which may be included in the given professional role. Furthermore, we extended the description of roles to include key knowledge and activities which we assume are associated with the given role (Doucek *et al.*, 2007).

These methodology modifications do not affect the issues discussed in this article because the CIO role was incorporated in both the surveys almost without change in the description of key knowledge and key activities.

3.1. Skills Categories

Another research task was to identify the skills which a good ICT specialist should possess in order to be admissible for business practice. The definition of obligatory knowledge and skills was followed by the definition of skills domains. Skills domains include knowledge and skills which can be acquired through a verbal message (pedagogical process) or by practical exercises. Their definition was based on (Strawman *et al.*, 2004) and they were broken down into the following skills domains: MS01 Process Modeling, MS02 Functionality and Customization, MS03 IS/ICT Management and Definitions of ICT

Services and Operation Variations, MS04 Analysis and Design (of business information system as a whole and of its parts), MS05 Software Engineering (techniques and procedures for the creation of programme products), MS06 Data and Information Engineering, MS07 IS/ICT Knowledge, MS08 Operational Excellence, MS09 Team Leadership Skills, MS10 ICT Market Knowledge, MS11 Organizational Management Methods, MS12 Enterprise Finance and Economics, MS13 Sales and Marketing, MS14 Mathematics, MS15 Law, MS16 Knowledge in Business Sectors. Furthermore, domains were internally broken down into ICT and non-ICT knowledge and skills. Pure ICT knowledge is to be found mainly in MS01 – MS08 domains.

Knowledge and skills on the transition between ICT and non-ICT is represented by MS09 and MS10 domains. Other knowledge domains (MS11 – MS16) represent a set of knowledge and skills which can be classified as non-ICT knowledge.

The domains significant for the purposes of our article are MS09-MS12 and MS16. These domains comprise CIO expertise related to a transition from central planning to market economy (transition economy). They contain expertise that enhance CIOs' managerial skills, the skills of working team leadership and the knowledge of the different economic sectors (MS16) – i.e., with respect to (Bingi *et al.*, 2000; Roztocki and Weistroffer, 2008a) and (Huang and Palvia, 2001; Roztocki and Weistroffer, 2008b), these are domains covering strategic skills of CIOs and their overall knowledge of ICT issues rather than narrowly focused skills relation to deployment of information systems in organizations. The domain MS09 was conceived for ensuring CIO's skills of working team leadership and with an aim of achieving strategic objectives not only of ICT, but also of the whole organization. The domain MS10 comprises knowledge of the overall awareness of the ICT market, not only local, but also international. This involves not only the knowledge of ICT product packages offered, but also hardware and subsequently also knowledge of the systems of management, application of deployment. MS11 comprises information on management methods and on solving the most pressing issue of present, namely linking ICT to the company's organizational structures. MS12 deals with strategic and tactical connection of financial management and corporate ICT management. Also the domain MS16 is very important, where we queried knowledge and skills in a particular economic sector. The questions in this domain were focused on linking ICT management to achieving the organization's own business objectives – i.e., the connection between ICT and the core business management both on strategic and tactical levels.

Each of above mentioned skills domains was described in such a manner that the survey respondents would be able to specify how many days of intensive training (8 hours of class training) they require the ICT manager should attend in each domain. Individual domains, their description and mapping between individual surveys are specified more detail in, for example, (Maryska *et al.*, 2010). These domains represent optional knowledge and skills the ICT manager should possess. Volumes of knowledge, quantified in individual skill domains, were converted into a six-level scale. The conversion method was specified as follows: **1 – No knowledge**, **2 – A general overview** of the subject area (corresponding to ca 1-2 days of intensive training), **3 – A basic orientation** in the subject area and terminology (corresponding to ca 3-5 days of intensive training), **4 – A solid overview** of the subject area and basic practical skills (corresponding to ca 6-20 days of intensive training), **5 – A solid overview** of the subject area **and solid practical skills** (corresponding to ca 21-40 days of intensive training), **6 – The highest knowledge quality** – profound up-to-date knowledge and advanced practical skills (corresponding to 41+ days of intensive training).

3.2. Survey among Economic Operators

Requirements of economic operators for the role of ICT manager were identified by the sample survey method (Pecáková, 2010). In order to define the observed sample information on economic operators was used. The first survey in 2006 used data about economic operators from the end of 2005 (CSU, 2007; Doucek *et al.*, 2012). The second survey conducted in 2010 used the data from the beginning of 2010. In 2005 there were 1,266,336 active economic operators in total. At the beginning of 2010 it was 1,399,983 operators.

The first classification criterion of economic operators was the type of activity performed by the economic operator. The Czech Statistical Office distinguishes 17 main sectors according to the ISCO classification (CSU, 2010). These sectors were, for the purpose of the survey, broken down into three groups according to the intensity of ICT utilization as follows:

Low IT –sector includes companies with **low ICT utilization rate** whose main processes do not show high dependence on ICTs. This is mainly the "primary economic sector" – agriculture, hunting, forestry, fishing, mining, quarrying, textile industries, leather and footwear, wood, of wood and cork industries, construction, building industry, etc. This sector did not change its characteristics during transition period.

Medium IT – medium ICT utilization rate. Economic operators in this group include regular partners with whom we come into contact in everyday life. They are mainly economic operators falling within the sector of trade activities, real estate agencies, food, beverages, tobacco industries,, mechanical engineering – light and heavy engineering, services to citizens, state and public administration, oil companies, fuel producing sectors, transport and storage, hotels , restaurants etc. – i.e. in secondary, tertiary or quaternary public sectors. Changers in transition period thanks ICT were significant.

High IT –Sectors with **high requirements for ICT utilization** are represented in economy mainly by financial institutions – banks, insurance companies, brokerage firms, telecommunication corporations, economic operators providing ICT services, post services, electricity, gas and water supply etc. Apart from the financial sector this group also includes the sector of communications and the provision of communication services. Important representatives of this sector are also mobile operators. Other representatives of the sector are ICT companies involved in ICT services and productive manufacturing. Therefore, this is mainly a market quaternary sector. Changers in transition period thanks ICT were crucial. This business cannot be realized without ICT support.

The second classification criterion for economic operators was the number of employees. Economic operators were, according to their number, divided into the following five groups: 0-9, 10-49, 50-249, 250-999, 1,000 and more.

3.3. Data Collection Method

The basic method for the collection of data was survey sampling. The basic set of active economic operators was, for the purpose of the sample survey, split into 18 strata in 2006 based on six size categories and three categories according to the requirements of their field of operation for the use of information technologies. Probability sampling without replacement was done in each stratum. The sample of observed economic operators does not contain clearly identifiable homogeneous subgroups of economic operators. This is, in particular, due to the size of economic operators which include a wide range of values. It

also relates to the fact that the same variables may be seen in the number of ICT specialists in observed economic operators. All such facts were taken into consideration during the survey preparation in such a manner that in subgroups in which it was possible to expect a lower number of operators (for example, large operators with high dependence on ICTs) a higher proportion of observed economic operators of all operators of the given subgroup was required. In 2006, the observed sample was set to be 1,002 operators (Table 1). The survey among economic operators was carried out by a private company specializing in conducting surveys on a professional basis. The survey was performed by using CAWI (Computer Aided Web Interviewing) and CATI (Computer-Assisted Telephone Interviewing) methods.

The second survey was conducted at the end of 2010. It was also carried out with the help of experience and facilities of a private company specializing in conducting surveys. In both cases they were companies which were part of multinational companies providing their services also on the territory of the Czech Republic. The structure of the sample of economic operators in the survey conducted in 2010 slightly differed from the first one. This was caused by some changes in the stratification methodology for economic operators. The essential change is the classification of economic operators according to the number of employees. Economic operators were divided into only three groups in the second survey according to the number of employees. Based on experience from the first survey conducted in 2006 and also based on recommendations of experts from the Czech Statistical Office the groups with 0 and 1-9 employees were excluded from the survey (these were in most cases sole traders or micro companies with a minimum impact on the overall situation of economy). Groups with 250-999 and 1,000+ employees respectively were consolidated into one group of 250+ employees. The resulting sample of economic operators contained 1,011 economic operators in the classification shown in Table 1.

The factor of the operator's dependence on ICTs remained unchanged from the previous survey carried out in 2006.

Table no. 1 – Structure of the Observed Sample in 2006 and 2010

Category		**0-9**	**10 – 49**		**50 – 249**		**250 +**		**Total**	
Sector	**2006**	**2006**	**2010**	**2006**	**2010**	**2006**	**2010**	**2006**	**2010**	**2006**
Low IT	84	28	45	28	46	53	44	193	135	84
Medium IT	112	56	57	56	474	107	98	331	629	112
High IT	166	160	66	122	142	30	39	478	247	166
Total	362	244	168	206	662	190	181	1,002	1,011	362

Source: authors

Table no. 2 – Structure of the Czech Economy

	0–9	**10–49**	**50–249**	**250+**	**Total**
Low IT	313,203	14,270	4,317	456	332,246
Medium IT	835,935	28,014	6,217	1,346	871,512
High IT	59,441	2,216	710	211	62,578
Total	1,208,579	44,500	11,244	2,013	1,266,336

Source: CZSO

The third round of the research was realized among stakeholders, CIO's, managers and ICT managers in 147 companies (39 in Low IT, 96 in Medium IT and 12 in High IT) in

summer 2015. Only preliminary over all results of this survey are presented in this article. We choose different approach to research in 2015 because it should give initial information for the further directions of our research work.

3.4. Principles of Data Processing and its Evaluation

Data collected from respondents was processed with the use of technology enabling work with a large volume of data. For the processing of data we used the platform Microsoft SQ Server 2008 R/2 (MS SQL). Extracts of data from primary systems were made in two forms: in the form of text files and in the form of extracts in Microsoft Excel format.

In the MS SQL Server database system the data model DWH (data warehouse) was prepared in the traditional architecture of DWH Stage and DWH Core. The filling of the proposed DWH was realized by means of import and transformation processes, known as ETL (Extract Transform Load). These ETL instruments, called Microsoft Integration Services, are a standard part of the MS SQL platform.

For analytical work an analytical layer was built up over the data model and the data were prepared in it in Microsoft Analysis Services, which are also part of MS SQL. Data blocks and dimensions were prepared within the framework of SSAS.

With respect to the subsequent statistical analysis of respondents' answers in both surveys variables were evaluated **mainly by the median**. To compare differences in knowledge domains of ICT role manager the box plots method (for sampling distributions) and scatter plots (for medians) were used (Pecáková, 2010; Vojacek and Pecakova, 2010).

The EM algorithm (expectation-maximization) (Bilmes, 1998; MacLennan *et al.*, 2009) was selected from cluster analysis methods which best described our data set.

4. RESULTS

The surveys carried out among economic operators identified a total of seven roles of ICT experts in 2006 and 2010. In this article attention is focused only on the presentation of results acquired for ICT manager role, which is currently considered to be one of the most demanded roles on labor market (OECD, 2010; OECD, 2011).

Surveys carried out among economic operators aimed to identify which knowledge economic operators require from those who want to become CIO. By processing the survey results according to the methodology described in section 2 the following conclusions have been drawn – classified per company type. Another criterion for the analysis was the evaluation of economic operators' requirements for CIO role according to the size of such operators.

Note: Although the survey was carried out in each year in question over a sample of more than 1,000 economic entities in the Czech Republic, the lower number of respondents for each group is yielded by the fact that not all respondents needed make a statement on the CIO position. If a respondent did not include this position, the results of his/her response have not been included in this article.

4.1. Requirements per Company Dependence on ICT

For the purpose of our survey economic operators were divided into three groups according to demands on the use of ICTs and their technological dependence on ICTs.

Table no. 3 – Requirements of Companies for the CIO Role Based on the ICT Utilization

ICT utilization	Low IT		Medium IT		High IT	
Year/Domain	2006 n=26	2010 n=35	20006 n=74	2010 n=22	2006 n=93	2010 n=71
MS01 Process modeling	3.42	2.89	3.58	3.02	3.58	2.76
MS02 Functionality and customization	3.42	3.31	3.45	3.25	3.67	3.14
MS03 Management IS/ICT	3.23	3.06	3.38	3.15	3.56	3.21
MS04 Analysis and design	3.04	3.29	3.36	3.28	3.59	3.18
MS05 Software engineering	3.00	2.66	3.14	2.76	3.43	2.79
MS06 Data and information engineering	2.62	3.03	3.27	3.13	3.35	3.00
MS07 IS/ICT knowledge	3.19	3.57	3.45	3.64	3.72	3.55
MS08 Operational excellence	3.00	3.31	3.59	3.46	3.81	3.56
MS09 Team leadership skills	3.54	3.09	3.47	3.24	3.95	3.46
MS10 ICT market knowledge	3.23	3.00	3.24	3.21	3.53	3.07
MS11 Organizational management methods	3.15	2.94	3.39	2.77	3.42	2.84
MS12 Enterprise finance and economics	2.92	2.51	3.26	2.72	3.27	2.48
MS13 Sales and marketing	2.88	2.40	3.05	2.33	3.26	2.13
MS14 Mathematics	2.77	2.37	3.00	2.48	2.97	2.04
MS15 Law	2.77	2.46	2.89	2.38	3.00	2.39
MS16 Knowledge in business sectors	2.85	3.29	2.93	3.13	2.86	3.14

Source: authors

Remark: The Low IT means Low ICT utilization rate, Medium IT – Medium ICT utilization rate and High IT = High requirements for ICT utilization (see above) The ”n” means number of respondents in the group.

The evaluation of the obtained results for organizations by dependence of the organization on ICT show very interesting shift between 2006 and 2010, in particular in the domains that are important for transition economies, which are discussed in detail later.

The domain MS09 – Team leadership skills – indicates a slight change in understanding the CIO's role in the organizations, as CIOs are no more in charge of concrete projects, but from the strategic viewpoint, they move to the correct role, in which they primarily direct a small number of direct reports in carrying out their tasks in managing the company's ICT. Therefore, the demands on concrete skills in this area decline, which are characteristic and essential for lower management levels (the team leaders), who directly communicate, assign and in particular motivate their subordinates.

MS10 – ICT market knowledge, MS11 – Organizational management methods, MS12 – Enterprise finance and economics – the changes in the demands on CIOs indicate growing specialization within the economic sectors, where CIOs are no more required to understand the surveyed areas of internal management of the company, as is, for instance, for the domain MS10 assignment and organization of tenders, and for the domain MS11 design of organizational structures, and for the domain MS12, for instance, financial management. The domain MS16 – Knowledge in business sectors – shows increased demands on the domain's skills. This confirms the trend that the transformation of the Czech ICT sector is not yet complete, as the role of CIOs is understood more as managing the ICT operations than a strategic function of connecting between the business objectives and ICT management.

Research 2015 among stakeholders, managers, owners etc. provides similar results like research from year 2010. The leap was much bigger between year 2006 and 2010 than between 2010 and 2015 in ICT.

4.2. Requirements per Company Size

In order to identify the knowledge and skills requirements another dimension was selected – a company size. We took into account the needs and general situation of a rather small open economy and therefore the distribution of companies into size groups was adapted to common practice in the Czech Republic. Small companies (10-49 employees) which have approximately a 16 % representation in the observed sample and the Czech economy as well, medium-sized companies (50-249 employees) and is most heavily represented by 66 % and large companies (250+ employees) - their proportion in economy was identified as approximately 18 %. The "n" means number of respondents in the group.

Table no. 4 – Requirements of Companies for the CIO Role Based on the Number of Employees

Number of Employees	**10 – 49**		**50-249**		**250+**	
Year/Domain	**2006 n=48**	**2010 n=35**	**2006 n=55**	**2010 n=128**	**2006 n=56**	**2010 n=78**
MS01 Process modeling	3.73	3.19	3.67	2.89	3.41	2.88
MS02 Functionality and customization	3.71	3.27	3.76	3.26	3.48	3.15
MS03 Management IS/ICT	3.63	2.88	3.64	3.13	3.38	3.29
MS04 Analysis and design	3.75	3.12	3.53	3.34	3.32	3.15
MS05 Software engineering	3.60	3.04	3.35	2.71	2.98	2.73
MS06 Data and information engineering	3.60	3.00	3.24	3.05	2.98	3.14
MS07 IS/ICT knowledge	3.92	3.46	3.65	3.60	3.39	3.65
MS08 Operational excellence	3.73	3.50	3.80	3.46	3.52	3.47
MS09 Team leadership skills	4.10	3.35	3.67	3.20	3.66	3.80
MS10 ICT market knowledge	3.65	3.27	3.44	3.13	3.25	3.09
MS11 Organizational management methods	3.79	3.16	3.38	2.76	3.21	2.81
MS12 Enterprise finance and economics	3.46	2.85	3.38	2.59	2.95	2.58
MS13 Sales and marketing	3.54	2.35	3.22	2.23	2.75	2.34
MS14 Mathematics	3.19	2.19	2.91	2.36	2.95	2.32
MS15 Law	2.98	2.58	3.00	2.28	2.84	2.53
MS16 Knowledge in business sectors	2.88	3.46	2.87	3.09	2.89	3.17

Source: authors

MS09 – Team leadership skills – structured by company size shows a clear trend of growing the requirements of leadership in **large companies**. This means that the requirement on CIOs in companies of this type move to leading of collectives, in which the skill of negotiating compromises, motivating, etc., are needed.

MS10 – ICT market knowledge – the conclusions for this domain are equal for all sizes of surveyed organizations. The demands on knowing the ICT market are less important, in view of its typification and internationalization.

MS11 – Organizational management methods – the issues of relationship between the organizational structures and ICT are particularly pressing for small organizations. For the other types of organizations, these issues are included in the standard solutions of corporate ICT operations.

MS12 – Enterprise finance and economics – in general, these issues are solved by specialization – i.e., reducing the demands on CIO managers in knowledge and skills in the field of finance and increasing the demands on financial management in the departments specializing in the financial area, i.e., accounting, budgeting, planning, etc.

MS16 – Knowledge in business sectors – like in the preceding Table 4, also here the increased demands on skills in this domain confirm the trend that transformation of the Czech ICT sector is not yet finished. In particular small companies, which cannot rely so much on work specialization (they have significantly less staff for ICT management and operation), have increasing requirements on the knowledge of the organization's core business by their ICT managers, including the executive on the CIO level.

In smaller and medium-sized companies, the requirements on CIOs are already relatively stabilized and in larger companies, the transition to understanding CIO as a strategic top manager of the organization is not yet complete. Significantly more is expected from him/her on the position of linking ICT with the enterprise's business objectives.

Research realized in year 2015 provides again similar results in almost all domains. The biggest difference was realized in domains MS15 (Law) and MS16 (Knowledge in business sectors). Requirements increase approximately in average for 30% in MS15 = 3.1 and 15% in MS16 = 3.6 for all company groups. Our assumption for this change is, that the current situation and current fights among companies and last wide change in Czech legal system (changes in corporate law, in civil law and the Cyber Security Act –valid since January 2015) requires much higher general knowledge of law than in previous period. The explanation for the MS16 is (from our point of view) that increasing number of companies in economy causes increasing competition and these companies are pushed to be able to spread to another sectors and try to find out new potential clients by this way.

5. CONCLUSIONS AND DISCUSSION

As available literature indicates, developing economies struggle in the ICT field mainly with the following problems:

- struggle with lack of ICT experience,
- inadequate ICT infrastructure and maturity and
- lack of long term strategic thinking

In our article, we present a transition in solving these problems between 2006, 2010 and 2015 in the Czech Republic. In the survey, we focused the positions of ICT managers in the Czech Republic and in this article, we present the conclusions for the position of the organization's Chief Information Officer – CIO. For this role, we study both the requirements from the aspect of **experience in the ICT field** and from the aspect of **strategic orientation of this group of corporate ICT managers.**

"Lack of ICT experience" as it was identified in the papers, e.g. (Al-Jabri and Fraihat, 2005; Varga *et al.*, 2004) is not so much of a problem in the Czech conditions (Doucek *et al.*, 2014). This trend can be documented by reduction in the requirements of ICT knowledge and skills over the surveyed period for CIOs basically for all ICT knowledge domains. It is interesting that the practice does not also require in-depth skills in the domain MS01 – Process modeling. These skills are, in the opinion of the authors, essential for obtaining competitive edge using ICT in the company and for its preservation. The domain MS 01 "Process modeling" means solving concrete business situations using ICT – i.e. the level of operating ICT management in the company. We did not identify the size of the company or economic sector in our survey for this fact. This implies that the level of knowledge and skills of CIOs in ICT domains is sufficient for the current Czech practice.

Slightly different situation was identified for the area "lack of long term strategic thinking". Here, thanks to our survey, we came to conclusions for the domains MS09 – MS 12 and to interesting conclusions for the domain MS 16 – Knowledge in business sectors.

In view of the facts identified in our survey, we must state that in the opinion of the representatives of companies participating in the survey, the problem of insufficient practical knowledge and skills of CIOs for the conditions in the Czech Republic is sufficiently solved.

The problem of lack or low level of long term strategic thinking of CIOs is in the current Czech conditions solved primarily as follows. The activities of CIOs that are closer to "non-ICT" areas are solved by delegation of competencies in these fields to other specialized departments of companies, such as accounting, planning department, financial department, etc., or to the lower level of ICT management – for instance, leadership is delegated to project managers. Another unpleasant fact is that certain key competencies of CIOs are delegated to other departments in the companies. Frequently delegated competencies include design of organizational structures. Delegated competencies and skills are then not demanded from CIOs.

Knowledge and skills for the domain MS16 – Knowledge in business sectors are the biggest identified problem on the CIO market in Czech conditions. The importance of these knowledge is increasing in time as we see in Chapter 3. Unlike the previous problem of "expertise in strategic ICT concept", it cannot be solved by transfer to other positions in the company or to other roles. Therefore, the demands on the knowledge increased in the surveyed period particularly in the core business of the company. This involves fundamental knowledge allowing CIOs to connect the achieving of the organization's strategic objectives set with the deployment of information technologies. If this group of problems can be solved, the efficiency and purposefulness of ICT deployment in organizations will be increased and thus overall productivity and competitiveness of the Czech economy will grow. The highest importance of this domain was identified in the third round of research. Similar results were identified for the domain MS15 – Law.

A big opportunity and challenge for CIOs is to acquire knowledge and skill in the organization's core business. Here we identified the most pressing shortcomings on the current Czech market, where on the one hand, as our survey confirmed, the requirements of this type of skills by the business grow, but universities are slow in offering corresponding majors in Czech conditions (Doucek, 2010). The majors involving computer science and technology mainly educate in the field of ICT skills and managerial majors train experts with "non-ICT" type skills. However, in order to satisfy the current needs of the Czech economy, CIOs with balanced knowledge of both levels with improved knowledge of the different economic sectors must be trained.

In general we can say that we did not identified essential changes in requirements on CIO's between years 2010 and 2015, as we identified between year 2006 and 2010. This can be explained by the fact that before year 2010 was large boom of ICT. The change of Enterprise Information systems was realized in the majority of large and medium corporations in the Czech Republic. The next period could be characterized as period of relative stagnation (impact of economics crisis has been appeared) and innovation process was competed for next ten years and requirements on CIOs knowledge and competences are relative stabilized. The only two exception are changes in Czech legal system and escalation of concurrence conflicts in decreasing local market. It implies increasing requirements on CIO's knowledge and skills in following domains: MS15 (Law) and MS16 (Knowledge in business sectors).

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THE EUROPEAN CENTRAL BANK QUANTITATIVE POLICY AND ITS CONSISTENCY WITH THE DEMAND FOR LIQUIDITY

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Abstract

In 2008 the European Central Bank added a new quantitative policy strategy to its traditional control of the interest rates. This new policy, sometimes called "enhanced credit support", consists of fully satisfying the demand for liquidity of banks, with the European Central Bank deciding only the timing and characteristics of its interventions. This study analyses the market conditions in which these measures have been taken and their consistency with the demand for liquidity by the banking system. Measures in favour of the sovereign debt of PIIGS countries are also considered.

Keywords: European Central Bank, financial crisis, liquidity supply, liquidity demand

JEL classification: E52, E4, G21

"We must not forget that trust, or its synonym "confidence", derives from the Latin fides, meaning faith, which cannot be produced simply by contract. In fact the legitimacy of central banks does not lie in their policy activism, or the ability to generate income, or even, save in a highly indirect sense, their efficiency. Rather, […] it derives from competence, moderation, the long-term approach, and the refusal to take on any tasks beyond their primary role".
(Curzio Giannini)

1. INTRODUCTION

The financial crisis and its aftermath have led to widespread debate on the role of financial stability in the conduct of monetary policy. This topic has attracted renewed interest in recent years, and for some years there has also been increasing concern about the sustainability of government debt in a number of European countries, which has led to an increased focus on sovereign risk and generated difficulties to the banking system of some EMU countries.

The European Central Bank has therefore set in motion a series of non-standard operations and programs with the objective of restoring the correct functioning of interbank and financial markets, as well as alleviating euro-area sovereign debt problems.

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These non-standard measures, implemented from October 2008 onwards, have been tailored to the specific bank-based financial structure of the euro-area, and aimed at supporting bank liquidity and funding. "They comprised five key elements, drawing in part on the experience with non-standard measures during the financial turmoil, namely regarding full allotment, supplementary liquidity provision at longer maturities, and currency swap agreements"(Cour-Thimann and Winkler, 2013). Only relatively recently (2004 and 2005), did ECB start employing non-standard measures also to tackle inflation and growth problems.

This paper presents an analysis of the ECB's unconventional monetary policy from 2008 to 2013 included. It examines ECB response to the various crises by considering both the types of the different non-standard monetary policy measures and their timing, along with the reasons the Bank gave to justify its quantitative measures. In order to complete the analysis we also build a model estimating the banking system demand for liquidity, the money market interest rates, and the interbank market risks. This model, explicitly considering all main institutional constraints, is used to simulate alternative ECB monetary policies in order to examine the following questions. First, if ECB had not intervened as it did with its non-standard measures, how would liquidity and interest rate paths have been, and second, did these measures meet the demand for liquidity from the banking system?

The paper is organized as follows. In Section 2, we give an overview of the literature of the field. Section 3 gives some background on the non-standard measures undertaken by the ECB over the period 2008-2013 together with some supply estimations, and in Section 4 some information on the measured in favour of PIIGS sovereign debts are given. In Section 5 we introduce a model of the demand for liquidity by the Eurozone banking sector. We focus first on equations and theoretical assumptions related to the interbank market liquidity risks, the interbank interest rates, and bank demand for Eurosystem liquidity, and then present our considerations and empirical results (Sections 6 and 7 respectively). Finally, in Section 8 we present the results of the simulation on the size of ECB liquidity interventions, showing the difference between the dynamic forecasts of the most important variables under alternative hypotheses and under actual ECB monetary policy. Conclusions and some considerations related to the monetary policy perspective follow in Section 9. A list of abbreviations used in this paper is provided in the appendix[1].

Some aspects of our analysis differ from the literature on this topic. First, we stress here the relevance of characteristic ECB operations both on the supply and the demand side. Second, particular attention is paid to the choice of regressors, as well as the shape and the constraints to include in all equations, with the objective of representing the most important institutional aspects of the bank liquidity market. Third, the use of simulation techniques based on dynamic forecasts allows us to verify how our model is consistent with actual EMU banking behaviour, and what might have happened to liquidity and interest rates under different hypotheses on ECB non-standard tools.

2. LITERATURE REVIEW

A review of empirical literature on unconventional ECB measures reveals that there is a wide variety of schools of thought.

Significant analytical contributions have been made by Borio and Disyatat (2009), who distinguish various forms of unconventional monetary policy and characterize the wide range of central bank responses to the crisis. They assess some of the key policy challenges with particular reference to the transmission mechanism.

Interesting empirical evidence on the effect of monetary policy in the downturn is provided by Bech *et al.* (2012). The analysis presented by Giannone *et al.* (2012) and the earlier results shown in Lenza *et al.* (2010) and Giannone *et al.* (2011) promote the idea that ECB intervention has had several significant effects not only on credit markets, but also "indirectly" on economic activity in the euro-area.

Cour-Thimann and Winkler (2013), interpreting response to the financial and sovereign debt crisis consider, in the first instance, a flow-of-funds perspective. They find that the crisis calls for deleveraging by financial and non-financial sectors, but that it is not worth using monetary policy as a unique and universal tool to address directly the underlying causes of the crisis.

The macroeconomic impact of 3-year long-term refinancing operations (LTROs), implemented by the ECB in December 2011 and February 2012, is analysed by Darracq-Paries and De Santis (2013). These authors suggest that when acute tensions occur, non-standard central bank liquidity measures may be helpful to support the provision of bank lending. Furthermore, the unconventional monetary policy measures are complementary to interest rate decisions and, as the authors note, "are essentially predicated on the basis of emerging financial frictions in the credit intermediation sector". Reichlin (2014) detects a progressive dismantling of financial integration involving the interbank market since the first crisis, and the same process in the government bonds market since the second. Abbassi and Linzert (2012) suggest that non-standard monetary policy measures help to lower Euribor rates. Tamakoshi and Hamori (2014) in studying EONIA and the 3-month Euribor rate relations found the best model to be a two-regime threshold cointegration with regime-dependent short-run dynamics

Baumeister and Benati (2010) explore the macroeconomic impact of a compression in the long-term bond yield spread within the context of the Great Recession of 2007-2009 via a Bayesian time-varying parameter structural VAR. They identify a 'pure' spread shock that leaves the policy rate unchanged on impact. This allows characterization of the "macroeconomic consequences of a compression in the yield spread induced by central banks' asset purchases within an environment in which the short rate cannot move because it is constrained by the zero lower bound."

Pattipeilohy *et al.* (2013) suggest that although the ECB's balance sheet has increased dramatically during the crisis, the non-standard monetary policy measures have had only moderate impact on the composition of the ECB's balance sheet compared to other central banks, such as the US Federal Reserve Bank and the Bank of England. They also find that "the LTRO interventions in general had a favourable (short-term) effect on government bond yields. Changes in the SMP only had a visible downward effect on bond yields in summer 2011, when the program was reactivated for Italy and Spain, but this effect dissipated within a few weeks".

Some authors focus on the existing empirical evidence on the effectiveness of non-standard monetary policy measures adopted by the European Central Bank and by the Federal Reserve. Cecioni *et al.* (2011) compare two ways in which monetary policy measures operate: through the signalling channel and through the portfolio balance channel. In the first, "the central bank can use communication to steer interest rates and to restore confidence in the financial markets; the latter hinges on the hypothesis of imperfect substitutability of assets and liabilities in the balance sheet of the private sector and postulates that the central bank's asset purchases and liquidity provision lower financial yields and improve funding conditions". The authors conclude that "the interventions of the

Fed and the ECB were crucial in avoiding a larger collapse in output, persistent deflation and in sustaining credit growth. Still, the magnitude of the stimulus is very uncertain" Freixas *et al.* (2011) suggest that "the central bank should lower the interbank rate when confronted with a crisis that causes a disparity in the liquidity held among banks." More recently, Iyer *et al.* (2014) "find that banks that rely more on interbank borrowing before the crisis decrease their credit supply more during the crisis". In considering ECB's QE, Putnam (2014) claims that its focus on liquidity loans was mainly intended to calm distressed financial markets.

An important critical contribution to the discussion of possible "unintended" consequences of non-standard monetary policy measures in the current context of weak economic activity is made by Belke (2013). Belke underscores the specific risks for price stability and asset-price developments and discusses how differences in money and credit growth in the euro-area cross-country could be a source of policy implications. It also investigates how the new course of "forward guidance" may improve ECB policies. The author argues that the ECB "should respond with its single monetary policy only to euro-area wide risks, leaving to national macroprudential instruments the task of dealing with idiosyncratic risks".

Belke's earlier work (2012) discusses the value of Europe's gold reserves, and explains that gold has been used as collateral in the past and how it could lower yields in the context of the euro crisis. It outlines the specific benefits of using gold: "there is no transfer of credit risk between high risk/low risk countries, losses are borne by specific countries and not by the largest shareholder of ECB. It would prove to be more transparent, it would not be inflationary and it would foster reforms". The author explains that "this move is then compared to the ECB's now terminated Securities Markets Programme (SMP) and its recently declared Outright Monetary Transactions (OMTs). Namely, a central bank using its balance sheet to lower yields of highly distressed countries where the monetary policy transmission mechanism is no longer working".

Gros *et al.* (2012) argues that although the ECB is responding massively to the crisis through 'credit easing', it cannot provide fully effective policy because it is trying to minimize its own risk. "With the LTRO the ECB not only provided longer-term funding against an extended pool of assets eligible as collateral, it also increased considerably the haircuts applied to these newly eligible assets, in some cases up to 50% and even 75%. This means that huge overcollateralization is required to access the LTRO. Banks have to pledge assets between two and four times the amount of the funding they are receiving. Because of this, in case of insolvency, (unsecured) creditors of banks will have little left for them and private investors will thus become even more reluctant to provide the banks with funding. There is thus a danger that even the LTRO might not work if it were tried again".

Central banks, whether on the basis of a formal mandate for financial stability or as an informal obligation as a consequence of the recent crisis, are faced with a tremendous challenge, concludes Otmar Issing (2011). "The independence of the central bank would be hard to defend if it also had the competence to deal with individual financial institutions up to the question of whether such a firm should be closed. The crisis management and some forms of unorthodox measures or quantitative easing have also raised concerns about the relation of the central bank to the fiscal authority".

Continuing the discussion on the role of monetary policy and the responsibilities of central banks, Orphanides (2013) identifies three additional problems that contribute to the overburdening of monetary policy: "beyond what ought to be understood as its primary goal

– to maintain price stability. The first of these public policy goals is the achievement of full employment and related nebulous concepts of real economic activity". The second problem is "the achievement of fiscal sustainability" and the third is "the continued preservation of financial stability, taking into account the weakened private sector balance sheets in many economies". Several years following the crisis were marked by low interest rates and unprecedented liquidity provision by major central banks. Orphanides (2013)warns that the current state of affairs means that certain desirable measures do not necessarily fit into the realm of traditional monetary policy, and also have potential costs. "Failing to appreciate the limits of what central banks can reliably do poses risks. Long-term adverse consequences could outweigh more immediate and more visible benefits."

Gambacorta and Signoretti (2013) analyse interaction between asset-price developments and monetary policy, and highlight the importance of co-operation between the central bank and the macroprudential authorities (Borio, 2006; Angelini *et al.*, 2011).

Finally, literature also covers the impact of the Basel III liquidity risk regulations on banks making recourse to Eurosystem monetary policy operations. It is suggested that central banks should take steps to counter the possible impact. Bech and Keister (2013) argue: "The liquidity coverage ratio (LCR) introduced as part of the Basel III regulatory framework will change banks' demand for liquid assets and their behaviour in money markets". According to Scalia *et al.* (2013), in view of the new Basel III liquidity rules, the evidence suggests that, "when evaluating non-standard monetary policy measures, central banks should also take into account their impact on the fulfilment of the NSFR and the possible cliff effects related to their expiration."

3. USE AND TIMING OF NON-STANDARD MEASURES

In ECB terminology, "non-standard" measures are defined as those "policies that directly target the cost and availability of external finance to banks (Bini Smaghi, 2009)", they "facilitate the functioning of the euro-area money market" and "they are expected to support the provision of credit to households and non-financial corporations (Draghi and Constâncio, 2011)".

Such operations were carried out for first time in October 2008 following the bankruptcy of Lehman Brothers, and aimed "to support the effectiveness and transmission of interest rate decisions (Trichet, 2010)": the "monetary policy decisions in the domain of non-standard measures … help restore a better transmission of monetary policy in circumstances in which we have markets that are not functioning correctly or segments of market that have been disrupted. (Trichet and Constâncio, 2011)" Typical of non-standard measures is the close link between their characteristics and the problem addressed.

Table 1 reports all major decisions on quantitative non-standard measures in euro. The dates refer to the day the decisions were taken by ECB and announced. The main communication channels are the monthly President's "Press conferences" and the ECB "Press releases". Other policy measures, such as the "covered bond purchase programme" 1 and 2 (CBPP1 and CBPP2), non-euro swaps, and eligible collateral expansion are beyond the scope of this paper.

The variables reported in Table 1 are the following. MROs refer to the "*main refinancing operations"*, which are always "liquidity-providing reverse transactions" with a weekly frequency (each Tuesday) and a maturity of one week. LTROs are the "*longer-term refinancing operations*", and are always "liquidity-providing reverse transactions". They can

be divided into three groups: (i) "regular LTROs" (RLTROs), with usually a monthly frequency (the last Wednesday) and a maturity of normally three months; (ii) "supplementary LTROs" (SLTROs), used from time to time by ECB, with a maturity usually longer than 3 months (up to 3 years); (iii) "special LTROs" (STROs) which are offered on the last day of the "required reserves maintenance period" and with maturity corresponding to the "reserve requirements maintenance period" (about 1 month). The other operations (OTs) are mainly *fine-tuning operations* introduced by the ECB on days of temporary shortage or excess of liquidity; they can be both liquidity-providing and liquidity absorbing operations; maturity varies but is usually as short as one day.

The data reported in the other columns of Table 1 refers to ECB decisions on non-standard measures. In "full allotment" columns, the number 1 indicates that ECB announced the introduction (or reintroduction) of a "fixed interest rates with full allotment" procedure, while a 0 indicates when the procedure was abolished (There is just one 0). The numbers in the columns denominated "end" indicate how many months a decision is intended to have effect. For "supplementary LTROs", the "number" is the number of operations announced, and the "maturity" column gives the number of months of maturity of the various SLTROs.

Table no. 1 – The "non-standard" euro quantitative measures

	Fine-tuning **OT**		**MRO**		**LTRO**								**Sovereign debt**	
					regular (RLTRO)		**supplementary (SLTRO)**				**special (STRO)**			
date	**FT**	**FTROB**	Full allotment	End	Full allotment	End	Full allotment	Number	Maturity	End	Full allotment	End	**SMP**	**OMT**
8/10/2008		(1)	**1**	3										
15/10/2008					**1**	5	**1**	3	3/6	3 (10 Sep 2009)	**1**	5		
18/12/2008			1	3										
5/03/2009			1	8	1	8					1	10		
7/05/2009							**1**	3	12	7 (>end 2009)				
3/12/2009	**1**		1	4			**1**	1	12	4 (7 Apr 2010)	1	5		
4/03/2010	**1**		1	6	**0**	6	**1**	1	6	1 (31 Mar 2010)	1	7		
10/05/2010					**1**	2	**1**	1	6	0.1			**1**	
10/06/2010					1	4								
2/09/2010	**1**		1	4	1	3					1	4		
2/12/2010	**1**		1	4	1	4					1	4		
3/03/2011			1	4	1	4					1	4		
9/06/2011			1	4	1	3					1	5		
4/08/2011			1	3	1	5	**1**	1	6	0.1	1	4		
6/10/2011			1	9	1	9	**1**	2	12	2	1	9		
8/12/2011		**0**					**1**	2	36(*)	2				
16/12/2011	**1**													
6/06/2012			1	7	1	6					1	*12*		
6/09/2012													**0**	**1**
6/12/2012			1	7	1	6					1	6		
2/05/2013			1	14	1	14					1	14		
7/11/2013			1	8	1	8					1	8		

The fine-tuning OTs are divided into two columns. In the first, the number 1 means that ECB activated a particular fine-tuning operation; in the second, the number 1 indicates when the 1-day maturity absorbing operations on the last day of the maintenance period were introduced, and 0 indicates when they were abolished. In the column denominated SMP and OMT, the number 1 identifies when the *Security Market Program* and the *Outright Monetary Transactions* of purchase of sovereign securities were announced; a 0 indicates that the corresponding measure was abolished.

Table no. 2 – Main ECB monetary interventions and its official explanation

8-October-2008 (liquidity problem)	-… provision of liquidity to **reduce strains in financial markets**. -… Some **easing of global monetary conditions** is … warranted. -The ECB will continue to **steer liquidity** towards balanced conditions in a way which is consistent with the **objective to keep short-term rates close to the interest rate on the main refinancing operation**.	**Liquidity problems.** Indicators: risk6, EONIA-Repo, Eurepo-Repo
13 October 2008 (liquidity problem)	- Measures designed to address **elevated pressures in the short-term US dollar funding markets …** Central banks will continue to work together and are prepared to take whatever measures are necessary **to provide sufficient liquidity in short-term funding markets.**	**Liquidity problems.** Indicators: risk6, EONIA-Repo, Eurepo-Repo
15 October 2008 (liquidity problem)	-The ECB will continue to **steer liquidity** towards balanced conditions in a way which is consistent with the **objective to keep short-term rates close to the interest rate on the main refinancing operation.**	**Liquidity problems** Indicators: risk6, EONIA-Repo, Eurepo-Repo
4 March 2010 (liquidity abundancy)	-In view of economic and financial market developments, the Governing Council of the European Central Bank **has today decided to continue the gradual phasing-out of its non-standard operational measures. …**	**Reduced liquidity problems** Indicators: risk6, EONIA-Repo, Eurepo-Repo
10 May 2010 (sovereign debt problem)	-ECB decides on measures to address **severe tensions in financial markets**. The Governing Council of the European Central Bank (ECB) decided on several measures to address **the severe tensions in certain market segments which are hampering the monetary policy transmission mechanism** and thereby the effective conduct of monetary policy oriented towards price stability in the medium term. The measures will not affect the stance of monetary policy.	**Sovereign debt problems** Indicators: Spread_PIIGS, CDS_PIIGS
8 December 2011 (liquidity problem)	-ECB announces **measures to support bank lending and money market activity.** The Governing Council of the European Central Bank (ECB) has today decided on additional enhanced credit support measures **to support bank lending and liquidity in the euro-area money market.**	**Liquidity and bank lending problems** Indicators: risk6, EONIA-Repo, Eurepo-Repo, GPFI22
6 September 2012	**-Outright Monetary Transactions.** As announced on 2 August 2012, the Governing Council of the European Central Bank (ECB) has today taken decisions on a number of technical features regarding the Eurosystem's outright transactions in secondary sovereign bond markets **.**	**Sovereign debt problem**: Indicators: Spread_PIIGS, CDS_PIIGS, Target2_saldi

Source: ECB Press conferences and Press releases

The official justifications given by the ECB for its main interventions are reported in Table 2. The most serious problems tackled by non-standard measures were (i) interbank market risk and liquidity problems, (ii) low growth in bank loans, and (iii) the sovereign debt crisis.

From the beginning of the financial crisis in 2007 and until 2011, an increase in both interbank market risk and liquidity shortage was indicated by a higher spread between unsecured and secured interest rates (Euribor minus Eurepo or OIS), also termed "interbank risk premium". Every time this spread widened, (Figure1) the number of interbank market transactions fell and banks with liquidity shortage faced more difficulty in finding a lender.

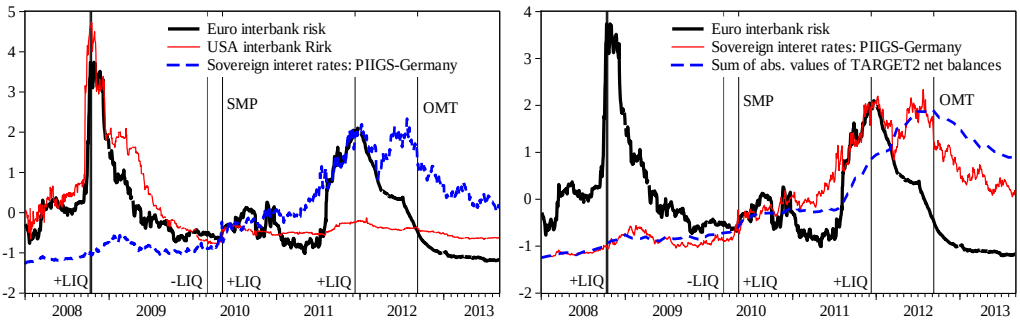
The two periods of greatest interbank market difficulties relating to a high interbank risk premium were the period starting from the Lehman Brothers default to the first quarter of 2009, and the period starting from the third quarter of 2011 to the second quarter of 2012.

The first period was related to the American financial crisis (Figure1, left), and the second occurred in conjunction with the sovereign debt crisis of the PIIGS countries (Figure1, right).

When the sovereign debt crisis worsened again in the third quarter of 2012, a new type of interbank market risk developed: like monetary and financial markets, the Eurozone banking system also started to become, in the words of ECB Chairman Mario Draghi, "fragmented". Not only did sovereign bonds interest rates differ between PIIGS and non-PIIGS countries, particularly Germany, but TARGET 2 flows also became increasingly diversified. See Figure1 left, where the sum of the absolute values of the TARGET 2 flows are reported. This fragmentation was actually endangering the "single monetary policy" rule of the whole Eurozone.

This public debt crisis, in fact, prevented most PIIGS banks from raising funds in the interbank market only because they had a large amount of bad national sovereign securities in their portfolio: risky portfolios caused the banks to become risky, and, at the same time, the collateral such banks could offer in the interbank market lost value. On the other hand, the efforts made by government to reduce public deficit caused economic difficulties to households and firms. This further worsened bank asset quality and made it more difficult for PIIGS banks to receive money from other banks.

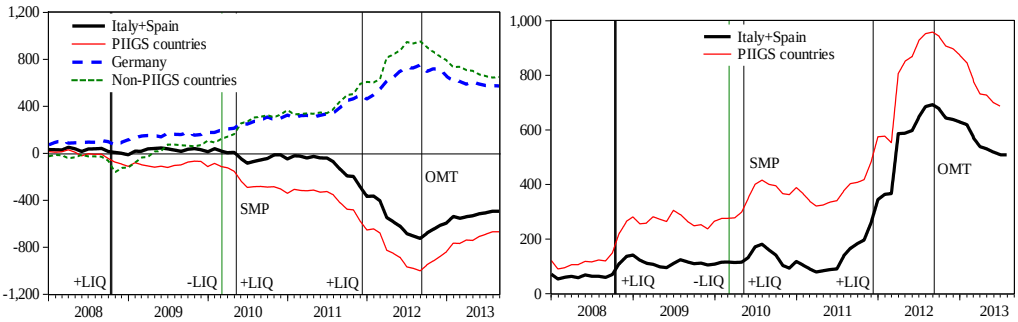
Events after 2011 are shown in Figure1-left and Figure 2. As soon as PIIGS countries were hit by the sovereign debt crisis, large cross-border outflows (TARGET 2) were directed from PIIGS countries to Germany and other non-PIIGS countries (see Figure 2, left). PIIGS bank liquidity dropped, but these banks could not turn to the interbank market to raise new funds.



Euro and USA interbank risk and PIIGS spread *Euro interbank risk, PIIGS spread and Target 2*

Source: ECB, Euribor, Eurepo, Bloomberg, Euro Crisis Monitor; normalised scale

Figure no. 1 – Crisis indicators and ECB main interventions (vertical lines)

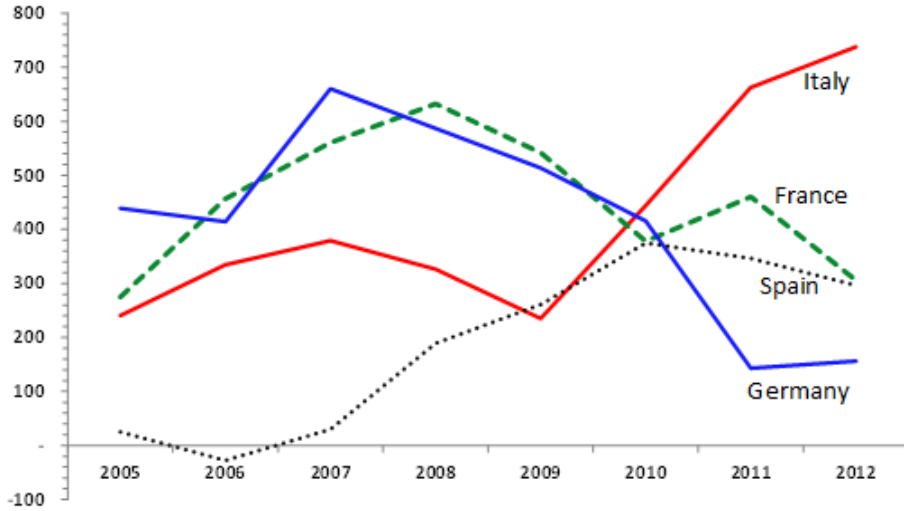


Net Balance with the Eurosystem / Target2 *Eurosystem lending to euro-area credit institutions*

Source: ECB, Euribor, Eurepo, Bloomberg, Euro Crisis Monitor; normalised scale

Figure no. 2 – Eurozone "fragmentation" and main ECB interventions (vertical lines)

Figure 3 completes the picture: in 2011-2012 France and Germany, taken together, reduced their net interbank market borrowing. Owing to the liquidity loss, Italian and Spanish banks, on the other hand, were obliged to increase their borrowing but the sum they could actually raise was not enough. PIIGS banks were thus forced to turn to the Eurosystem for loans.



Source: Bankscope; Borrowing minus lending on interbank market (stock) (mln. of euro)

Figure no. 3 –Net interbank market borrowing for countries

Focussing on the timing and the reasons for ECB non-standard intervention, econometric estimations were run (Table 3 and 4) to better identify circumstances (Tables 1 and 2).The software used in this paper is Eviews 8.1, and in the tables reporting the main results the number of stars of a coefficient indicate its (two-tail) level of significance. Thus *, ** ,*** denote 10%, 5% and 1% probability level.

In Table 3, the dependent variable is a dummy (Dummy_TOT) given by the sum of all the other dummies indicating the presence (or absence) of a "fixed rate with full allotment

procedure" in: "main refinancing operations" (MROs), and "regular", "supplementary" and "special" LTROs" (RLTROs, SLTROs and STROs). In the case of "supplementary LTROs" (SLTROs), used only during the most severe crisis period, the corresponding dummy assumes a value 1 only in the periods of the announced interventions. The "other operations" (OTs) were not considered in this regression since they are carried out for different reasons; either to face very short periods of liquidity shortage (usually one day), or to reduce the cost of excess reserves on the last day of the reserve requirements maintenance period. Time deposits are used to sterilize the monetary base created by ECB's bond purchases on the market.

The regressors in the equations are based on the reasons ECB gave for its major interventions (Table 2) and are listed below. The values are those known at the time of ECB decisions.

- Risk in the interbank market (Risk1m): the higher the risk, the stronger the expansion in liquidity aiming to reduce unsecured interest rates needs to be.

- The spread between the 1-month maturity secured interbank interest rate (Eurepo) and Repo (Eurepo1m-Repo): the greater the spread, the greater the lack of liquidity.

- the official Repo interest rate: the lower the official rate, the more difficult is for ECB to reduce it again, and a greater use of quantitative measures is needed.

- Annual growth of bank loans to non-financial corporations and households (gLoan): the ECB tends to expand liquidity if there is a credit crunch risk.

- The economic confidence index (Sentiment): the lower the degree of economic confidence, the more appropriate are quantitative expansionary measures.

Since the dependent variable (DummyTOT) assumes only integer values, an ordered regression estimation was used. The equation is reported in Table 3. All coefficient signs are exactly as expected and consistent with the explanations given by ECB shown in Table 2.

Since ECB considers the "supplementary LTROs" (SLTRO) one of its most important instruments (Draghi, 2013), and one of their main characteristics is their maturity, we also estimated an equation for this variable (Table 3).The result is consistent with our previous analysis and confirms that the maturity of the supplementary LTRO operations are positively related to the tensions in interbank and banking markets.

Table no. 3 – Estimations of ECB intervention decisions

	DummyTOT	**SLTRO matutity**
const	-	48.669***
Risk1m(t-1)	3.863***	58.721***
Eurepo1m(t-1)-Repo	2.035***	46.120***
Repo(t+1)	-0.819***	-25.329***
gLoan(t-1month)	-0.011***	-0.232***
Sentiment(t-1month)	-0.085***	-
Pseudo R-squared	0.434	-
adjR2	-	0.980
n. obs.	1479	8
Estimation tool	Ordered regression	OLS (White)

Period: 1 Jan 2008 –31 Aug 2013, daily data

4. THE MEASURES IN FAVOUR OF PIIGS SOVEREIGN DEBT AND AGAINST FRAGMENTATION OF THE BANKING SYSTEM

The other group of non-standard measures, i.e. the open market operations in PIIGS sovereign securities to tackle the main sovereign debt crises, are those actions taken by ECB on May 10, 2010 (SMP program) and September 6, 2012 (Outright Monetary Transactions OMT). These are shown by vertical bars denoted SMP and OMT in Figures 1 and 2. These measures however are not considered in the empirical analysis of the present paper and are treated as exogenous. They were introduced by ECB when the spread between the 10 year sovereign bonds PIIGS and Germany bund yield was considered too high, and when the banking system fragmentation reached a maximum.

In particular, the OMTs were introduced in 2012 and aimed to restore the transmission mechanism of monetary policy, and to maintain its principle of uniqueness, which were both endangered by the distorted conditions in some sovereign debt markets. ECB's opinion was that some excessive sovereign debt spread could be partially caused by an unfounded concern about the solvency of the PIIGS countries public debt. In order to restore confidence in these markets, the ECB declared itself a purchaser ready to intervene in those secondary markets for unlimited amounts. Its purchases of government bonds would always be of an outright open market operation type, even if concerning only the short end of the yield curve, in particular from one to three-year maturity. OMTs would however to be suspended if the country concerned did not comply with its existing agreements on debt consolidation. Until 2014 the liquidity so created would always be sterilized by liquidity absorbing operations (OTs) in order not to compromise the objectives of ECB monetary policy.

Investors reacted to the OMTs favourably: unlike the previous SMP program where the announcement had only a temporary effect on PIIGS spreads, the trend towards the reduction of the spread continued throughout the following months (Figure 2). The SMP program was suspended when OMTs were started.

5. THE MODEL OF THE DEMAND SIDE OF ECB OPERATIONS: EQUATIONS AND THEORETICAL ASSUMPTIONS

The complete model used to estimate the interbank market risk, the money market interest rates, and the demand for bank liquidity is described in the flow-chart in Figure 4. The same model was also used to simulate the effects of alternative ECB monetary policy decisions.

This model is made up of three main blocks, and all equations follow an error correction scheme. The first block of equations explains the interbank market risk (measured by the spread between Euribor and Eurepo). Its exogenous variables are the dollar interbank risk and the spread between the 10-year PIIGS treasury securities yield and its corresponding German bund. Among other things, it was found that changes in risk were negatively correlated to the total bank liquidity on the previous day.

The second block contains all the interbank market interest rate equations (EONIA, Euribor and Eurepo). The exogenous variables are the official interest rate (Repo) and its expectations. The other regressors are: (i) the total liquidity available before interest rate quotations, (ii) the net repayments due to ECB, (iii) the interbank market risk. Its impact on interest rates is expected to be null or negative on Eurepo, but positive in the unsecured Euribor market. Up to 2011, a dummy for the last day of the reserve requirements maintaining period was also found to be significant for EONIA.

The last block refers to the demand for liquidity. The dependent variables are the allotments of MROs, LTROs and OTs. The exogenous variables are: (i) the characteristics of these operations (duration, etc.), (ii) the official interest rate Repo, (iii) the amount of absorbing OTs due to SMP and OMT sterilizations. Regressors include: (i) total bank liquidity already available (ii) net repayments due to ECB and already known, (iii) interbank interest rates, (iv) interbank market risk, (v) PIIGS banks outflows (measured by the sum of PIIGS Target2 flows), (vi) spread between short-term market interest rate and Repo, and (vii) the maturity on further future operations already announced by ECB.

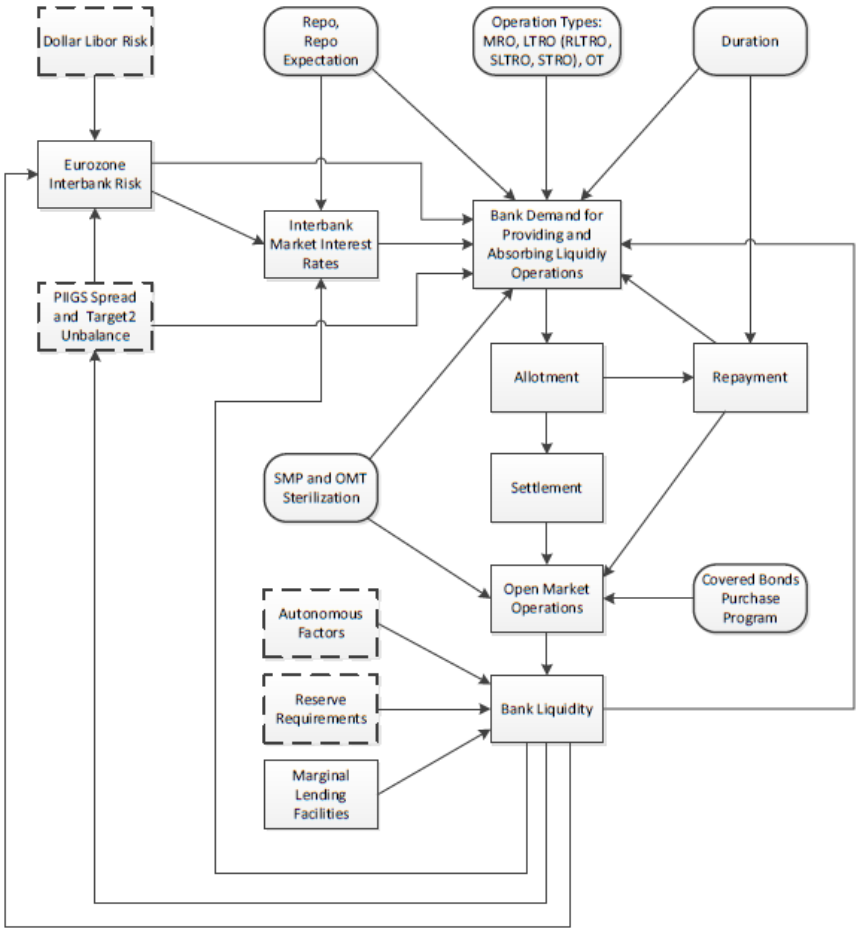


Figure no. 4 – Flow-chart of ECB quantitative policy and interbank interest rates

The stock of the open market operations ECB activated with banks on every day t is identical to its previous value on t-1 plus the amount of MRO, LTRO and OT allotments with settlement on t minus the previous operations matured on t and the OT sterilizations, plus the increase in the "amount of covered bonds purchasing program". These last two variables are considered exogenous.

The total bank liquidity on t is given by the open market operation stock on t, minus the so-called autonomous factors and the reserve requirement, plus the marginal lending facilities. These last three variables are also considered exogenous.

The complete list of variables used in our equations is reported in Table 4.

Table no. 4 – List of variables

MRO (main refinancing operations): amount demanded by banks (bln euro)	MRO
LTRO (longer-term refinancing operations): amount demanded by banks (bln euro)	LTRO
OT (other operations-fine-tuning): amount demanded by banks (bln euro)	OT
LTRO maturity (days)	LTRO_dur
Maximum duration of LTRO during next 4 days and known on day t (relevant for MRO decision)	Max_dur_1w
Maximum duration of LTRO during next 4 days and known on day t (relevant for MRO decision)	Max_dur_45d
Last day of reserve requirement maintenance period	Last_day
Last day of reserve requirement maintenance period until December 2011	Last_day0_till2011
Overall liquidity (deposit facilities + excess reserves) (bln euro)	Tot_liq
Net repayments to ECB on day t (total repayment minus allotted amount to be settled on day t+1 and known on day t) (bln of euro)	Net_repay(t)
Net repayments to ECB on day t+1 (total repayment on t+1 minus the allotted amount of liquidity to be settled on day t+1 and known on day t) (bln euro)	Net_repay(t+1)
Amount of OT for SMP (Securities Markets Programme) sterilization (bln euro)	OT_SMP
Previous week MRO allotment (bln of euro)	MRO(t-1week)
Repo (official interest rate)	Repo
Expected next 3 month changes in Repo at t-1 [bfinance]	E[ΔRepo](t-1)
EONIA (overnight interbank interest rate)	EONIA
1 week Eurepo (secured interbank interest rate) [*Eurepo*]	Eurepo1w
1 month Eurepo (secured interbank interest rate) [*Eurepo*]	Eurepo1m
3 month Eurepo (secured interbank interest rate) [*Eurepo*]	Eurepo3m
6 month Eurepo (secured interbank interest rate) [*Eurepo*]	Eurepo6m
1 week Euribor (unsecured interbank interest rate) [*Euribor*]	Euribor1w
1 month Euribor (unsecured interbank interest rate) [*Euribor*]	Euribor1m
3 month Euribor (unsecured interbank interest rate) [*Euribor*]	Euribor3m
6 month Euribor (unsecured interbank interest rate) [*Euribor*]	Euribor6m
1 month interbank market risk [*Euribor* and *Eurepo*]	Risk1m
3 month interbank market risk [*Euribor* and *Eurepo*]	Risk3m
6 month interbank market risk [*Euribor* and *Eurepo*]	Risk6m
1 month dollar interbank market risk [$*Libor* and *$OIS*]	URisk1m
3 month dollar interbank market risk [[$*Libor* and *$OIS*]	URisk3m
6 month dollar interbank market risk [[$*Libor* and *$OIS*]	URisk6m
10 yr PIIGS soveraing treasury yield (weighted mean) minus 10 yr Germany bunt	PIIGSspread
Total net cross-border liquidity outflows (TARGET 2) coming from PIIGS banks (interpolated for intramonth days)	ΣPIIGS_T2
Difference between Repo and deposit facility interest rate	corridor
Annual growth of bank loans	gLOAN
Sentiment Eurostat index	Sentiment

Data is from ECB unless the source is indicated in square brackets.

6. THE INTERBANK MARKET RISK AND INTERBANK INTEREST RATES

The equations of the interbank market risk (measured by the spread between Euribor and Eurepo returns) are reported in Table 5. The period considered is Oct 2008 - August 2013; the dependent variable corresponds to the daily change in different maturity risks. Consistently with Figure 1, interbank market risk was found to be positively related to both the corresponding US risk (URisk), and the PIIGS sovereign security risk (the spread between the yield of the 10-yr PIIGS treasury securities and the German bund yield (PIIGSspread)). Changes in risk are also negatively correlated to their own lagged values and the total previous day bank liquidity (Tot_liq_{t-1})

Table no. 5 – The interbank market risk

	ΔRisk1m	ΔRisk3m	ΔRisk6m
const	-0.003**	-0.003**	-0.001
$Risk1m_{t-1}$	-0.024***	-	-
$Risk3m_{t-1}$	-	-0.018***	-
$Risk6m_{t-1}$	-		-0.001***
$URisk1m_{t-1}$	0.0103**	-	-
$URisk3m_{t-1}$	-	0.010***	-
$URisk6m_{t-1}$	-	-	0.005*
$\Delta Risk1m_{t-1}$	0.148**	-	-
$\Delta Risk3m_{t-1}$	-	0.220***	-
$\Delta Risk6m_{t-1}$	-	-	0.181***
$\Delta URisk6m_{t-1}$	-	-	0.075***
$PIIGSspread_{t-1}$	0.0031***	0.0031***	0.0022***
$Tot\_liq_{t-1}/1000$	-0.017**	-0.016***	-0.015***
$adjR^2$	0.066091	0.109609	0.073365
S.E. of regression	0.019920	0.017913	0.021795
DW	1.816670	2.053037	2.084076
n. obs	1252	1205	1182

Period: Oct 2008 - Aug 2013; method: OLS (White)

The interest rates considered in this paper are collected from Eurepo, Euribor and EONIA interbank markets. Since the spread between Eurepo and Euribor corresponds to the measure of the interbank market risk, the empirical analysis was limited to just one market. We selected Eurepo because the so-called "zero bound" downward interest rate has more sense in a secured market where there is no positive risk premium generating a positive bias in the bound itself.

In our regressions we assumed that in equilibrium the Eurepo interest rate is given by the value of Repo plus a component negatively related to the banking system liquidity of the previous day. (Eurepo is quoted at 11 am when the amount of liquidity on day t is still unknown). However, in equilibrium (and with no expectations of Repo movements) this negative liquidity effect should not exceed the lower bound of the so-called "corridor" of interest rates (corresponding to the spread between Repo and the ECB deposit facility rate). Even if this constraint is not particularly relevant for the goodness of fit of single equations, it was found to significantly improve their dynamic forecasts. This constraint can be easily imposed by the following representation of the equilibrium liquidity effect:

(1) Eurepo = Repo + (negative) Liquidity effect, i.e. Liquidity effect = Eurepo-Repo = βTot_liq if βTot_liq > -corridor, otherwise = -corridor
(where corridor ≡ Repo–Deposit facility rate)

in formulas:

(2) [β Tot_liq • (β Tot_liq > -corridor) – corridor • (β Tot_liq ≤ - corridor)]

where β is the liquidity equilibrium coefficient, and the logical symbol (x R y) means 1 if xRy is true, 0 otherwise.

Our equations follows an "error correction model" scheme. We explained the change in the Eurepo return on day t as a function of its t-1 disequilibrium level Eurepot-1 – Repot (where the Repo value is taken at day t since its value is known by the previous day), plus the negative liquidity effect:

(3) ΔEurepot = λ (Eurepot-1 – Repot – liquidity effect t-1), therefore:

(4) ΔEurepot = λ (Eurepot-1 –Repot – [β Tot_liq t-1•(β Tot_liq t-1> -corridort) – corridort•(β Tot_liq t-1≤ – corridort)])

Other important explanatory variables we included in the regressions are: (i) net repayments due to ECB on day t and t+1, and already known on t (Net_repay(t) and Net_repay(t+1)); (ii) lagged Eurepo changes; (iii) expectations on future Repo changes from t and t+j months (Et-1[ΔRepot-jm]); (iv) interbank market risk on t-1 (Riskt-1), (v) expected value of Risk for the day t (Et-1[ΔRisk]). All these variables exert an important, although transitory, influence on Eurepo changes and were indicated by our previous analysis. The expected value of Risk is estimated by means of the equations shown in Table 5.

In general:

(5) ΔEurepot = f(t) = α0+ λ(Eurepot-1 – Repot – [β Tot_liq t-1•(β Tot_liq t-1>-corridor) – corridor •(β Tot_liq t-1≤–corridor)]) + α1Net_repay(t) + α2 Net_repay(t+1) + α3ΔEurepot-1 + α4 Et-1[ΔRepot+jm] + α5 Riskt-1 + α6Et-1[ΔRisk]

When significant, the previous coefficient expected signs are: λ< 0, β<0, α1>0, α2>0, α3> or < 0, α4>0, α5≤0, α6≤0.

The risk coefficients (α5 and α6), if significant, should be negative because the higher the interbank risk, the higher the supply of funds on the secured market should be. The effect should also be more relevant for longer maturities.

Since the market expectations on Repo used in this paper come from bfinance, which considers the two and five months forecasts, we used the two month expectations for 1-week, 1-month and 3-month Eurepo maturities and five month expectations for 6-month maturity. We also considered that, in case of 1-week and 1- month maturities, the relevance of expectations depends on the number of days to go before the next ECB meeting. For the 1-week maturity we used weights ranging between 1/7 to 6/7 in the last 6 days before the meeting (w(7)); for the 1-month maturity the weights (w(30))range from 1/30 to 29/30 on the last 30 days.

In order to avoid negative estimations of Eurepo interest rate value, we imposed that fitted Eurepo changes cannot be less than the opposite value of Eurepo on t-1. Eurepot ≥0 implies ΔEurepot +Eurepot-1 ≥0, i.e. ΔEurepot ≥ -Eurepot-1. (In 2004, ECB deposit facility rate became negative, and when including more recent data the constraint should be Eurepot≥ min[0, deposit facility rate]. However the period considered in this paper ends in 2013).

In formulas:

(6) $\Delta Eurepot = f(t)$ if $f(t) > -Eurepot\text{-}1$, $\Delta Eurepot = -Eurepot\text{-}1$ otherwise

There are two econometric solutions for this problem.

The first consists of a non-linear estimation (NLC-OLS) containing the following (constraint) condition in order to exclude negative estimated value:

(7) $\Delta Eurepot = f(t) \bullet (f(t) > -Eurepot\text{-}1) - Eurepot\text{-}1 \bullet (f(t) \leq -Eurepot\text{-}1)$

The second solution uses "censored estimation" with a left censoring (value) series given by -Eurepot-1.

The main difference between the two estimation methods is that the first implies that the expected value of a general dependent variable E[y]=f(x) must satisfy the constraint, while in the second, the constraint must be satisfied by the actual value y of the dependent variable.

In this particular case of interest rate estimations, however, one of the regressors is subject to a constraint (the liquidity effect), but Eview 8.1 software does not allow a direct use of uncensored non-linear estimators. We therefore estimated the coefficient β of Equation (5) by iterations. Results are similar to those obtained by the non-linear methods applied to Equation (7) reported in Table 6.

These results correctly show that the equilibrium effect of liquidity is always negative, and its equilibrium coefficient is similar for all maturities (from approximately -6 to -7). As expected, the effect of net repayments to ECB (Net_repay(t) and Net_repay(t+1)) is positive, with repayments on t more important than repayments on t+1. The adjustment coefficient λof the spread Eurepot-1-Repo is negative, and its absolute value varies inversely with maturity. Repo expectations always exert a positive effect on interest rates, while interbank market risk is significant only for 3- and 6-month maturities.

The last column of Table 6 reports the estimated equation of the interbank overnight interest rate (EONIA).

As for Eurepo, it was also imposed for EONIA that the liquidity effect cannot exceed the lower bound of the "corridor" in equilibrium. Some dynamic factors between EONIA and Eurepo are however different.

First of all, the amount of liquidity relevant for EONIA is the one available on day t, and not on t-1, since EONIA is quoted at 7 pm when the amount of liquidity on t is already known. Second, liquidity changes (ΔTot_liqt) are also significant. The liquidity effect was also found to be weaker on the last days of the reserve requirements maintaining period, at least until 2011. The positive coefficients of these days counteract the normal negative liquidity effect. Until 2011, in fact, an important component of the sharp decline in liquidity during the last days was low bank demand and not exogenous tight liquidity conditions. Third, only net repayments on t+1 (Net_repay(t+1)) are significant.

Table no. 6 – Secured interbank rates (Eurepo) and Overnight interbank interest rate (EONIA)

	ΔEurepo				ΔEONIA
	1 week	1 month	3 months	6 months	
const	-0.001	0.001	0.004***	0.005***	0.023***
($EONIA_{t-1}$-Repo)	-	-	-	-	-0.218***
$Eurepo1w_{t-1}$-$Repo_{t-1}$	-0.053***	-	-	-	-
$Eurepo1m_{t-1}$-$Repo_{t-1}$	-	-0.035***	-	-	-
$Eurepo3m_{t-1}$-$Repo_{t-1}$	-	-	-0.026***	-	-
$Eurepo6m_{t-1}$-$Repo_{t-1}$	-	-	-	-0.020***	-
Tot_liq_t/1000 (equilibrium value)	-	-	-	-	-12.293***
ΔTot_liq_t/1000	-	-	-	-	-0.742***
Tot_liq_{t-1}/1000 (equilibrium value)	-6.968***	-6.194***	-6.389***	-7.220***	-
Net_repay(t)/1000	0.257***	0.184***	0.130***	0.125***	-
Net_repay(t+1) /1000	-	-	0.023**	-	0.149***
Tot_liq_t/1000•Last_day0_till2011					1.510***
ΔTot_liq_t/1000•Last_day0_till2011					0.466***
Δ$Eurepo1w_{t-1}$	0.275***	-	-	-	-
Δ$Eurepo1m_{t-1}$	-	0.162***	-	-	-
Δ$Repo_{t-1}$	-	-	-	-	-0.222***
E_{t-1}[Δ$Repo_{t+2m}$]•w(7)	0.101***	-	-	-	-
E_{t-1}[Δ$Repo_{t+2m}$]•w(30)	-	0.048***	-	-	-
E_{t-1}[Δ$Repo_{t+2m}$]	-	-	0.036***	-	-
E_{t-1}[Δ$Repo_{t+5m}$]	-	-	-	0.026***	-
$Risk3m_{t-1}$	-	-	-0.007**	-	-
E_{t-1}[ΔRisk3m]	-	-	-0.610***	-	-
$Risk6m_{t-1}$	-	-	-	-0.006**	-
E_{t-1}[ΔRisk6m]	-	-	-	-0.845***	-
$adjR^2$	0.230	0.230	0.236	0.185	0.512
S.E. of regression	0.033	0.020	0.019	0.023	0.075
DW	2.008	1.958	1.950	2.027	2.030
n. obs	1227	1227	1241	1242	1245

NLC-OLS with White heteroskedasticity-consistent standard errors & covariance;
period: 15 Oct 2008 – 31 Aug 2013, daily data.

Another difference between EONIA and Eurepo equations comes from the day-to-day constraint imposed. For EONIA, the lower "corridor" limit is always binding: the simple interest rate non-negative constraint is therefore not enough.

If g(t) is the unconstrained ΔEONIAt estimation, its constrained estimation must be: g(t) + EONIAt-1 ≥ Repot – corridort. This can be represented as follows:

(8) $$\Delta EONIAt = g(t)\bullet(g(t) \geq Repot - corridort - EONIAt\text{-}1) + (Repot - corridort)\bullet (g(t) < Repot - corridort - EONIAt\text{-}1)$$

The censor estimation method also obtained similar results for EONIA.

7. THE BANKING SYSTEM DEMAND FOR LIQUIDITY

The dependent variables considered in our regressions are the net quantity of liquidity the banking system requires from the Eurosystem on days t, corresponding to the so-called "submission of bids" day. In the case of "standard tender procedures", such days precede the corresponding "allotment" days by one, and the corresponding "settlement" days by two days. Only in case of "quick tender procedures" do submission, allotment and settlement occur on the same day.

We divided ECB operations into their three official main groups: MROs (main refinancing operations), LTROs (longer-term operations), and OTs (other operations).

Data are daily, and refer to the period October 2008 -August 2013. Estimations have been limited to the days on which ECB liquidity bids took place. Only values of explanatory variables actually known on day t (i.e. predetermined), are used in our equations. Possible endogenous variables have been replaced by their estimations derived from other equations in order to avoid endogeneity problems.

Apart from simple OLS, we also used both "non-linear constrained OLS" (NLC-OLS), and the "censored regression" method (Censored), but all results are mutually consistent. The equation used in "non-linear constrained OLS" is of the type $y = F(x) \bullet (F(x) > 0)$; the equation used in "censored regression" is $y = F(x)$ with a left censoring (value) series = 0.

The equation for the main refinancing operations (MROs) is reported in Table 7 (second column). Only OLS regression is included since the estimated quantities were always positive.

Demand is inversely correlated to the overall liquidity already held by banks (Tot_liqt-1). It is positively correlated to net repayments already scheduled for t e t+1 (Net_repay(t)+Net_repay(t+1)); the demand for MROs is also even higher than the higher borrowing the previous week (MROt-1week) (which banks have to repay to the Eurosystem on t).

Demand is positively influenced by all variables which indicates difficulties in the interbank market, i.e.: (a) risk of the interbank market (Risk6mt-1), (b) spread between 1-week Eurepo and Repo (Eurepo1mt-1-Repot-1)/corridort-1, (c) total net cross-border liquidity outflows (TARGET 2) coming from PIIGS country banks to the others (ΣPIIGS_T2t-1). The coefficients of these three variables are consistent with the hypothesis that the demand for liquidity is higher when interbank markets do not work well. The demand for MROs is lower in cases where ECB has announced it is offering LTROs within one week, and the impact is stronger the longer LTRO duration (Max_ dur_1wt-1).

The estimation of the demand for longer-term refinancing operations (LTROs) is reported in Table 7 (last two columns). Consistently with the explanations supplied by the ECB and reported in Table 1, the period used in the regressions begins on 15 October 2008. Regular LTROs were however excluded from March 4 to May 10 2010 when the Eurosystem exogenously fixed the supply of liquidity. Since there are three types of LTROs, ("regular" (RLTROs), "supplementary" (SLTROs) and "special" LTROs (STROs)), the possibility that coefficients could depend on the operation type has been taken into account by using dummy variables corresponding to the dates the different types of operations took place (RLTROday, SLTROday and STROday respectively). These dummies have been introduced among regressors both in additive and multiplicative position. When they do not explicitly appear in Table 7,no significant difference appeared between the three types.

The demand for LTROs depends negatively on the overall liquidity already held by banks (Tot_liqt-1), and positively on the net repayments already scheduled for t e t+1

(Net_repay(t) + Net_repay(t+1)). However, Tot_liqt-1 is relevant only for the regular LTRO demand, and more overclose repayments are irrelevant in case of the very long SLTROs. The amount of LTROs is also strongly influenced by the behaviour of the three indicators of interbank market difficulties (Risk6mt-1, (Eurepo1mt-1-Repot-1)/corridort-1 and ΣPIIGS_T2t-1).As for MROs, their coefficients are consistent with the hypothesis of higher demand for liquidity when interbank markets do not perform well. LTRO duration (LTRO_dur) was found to exert a significant positive influence on the demand for SLTROs, whose maturity varies over time. (In the case of RLTROs and STROs, however, duration is fixed: three months for the former, one required reserve maintaining period for the latter). In our regressions the supplementary LTRO duration offered by ECB on day t (LTRO_dur) was in fact found significant at the 1% probability level. In the few cases where two SLTRO operations with different durations took place on the same day, we defined LTRO duration as the greater of the two maturities. The dummy SLTROday added to the regression was found significant and negative, suggesting that, in normal conditions, supplementary operations are somewhat less popular than the others.

Table no. 7 – Bank demand for MRO and LTRO

	MRO	LTRO	
	OLS	Censored	NLC-OLS
constant	32.350***	34.026***	31.289***
$SLTRO_{day}$	-	-30.292***	-27.611***
Tot_liq_{t-1}	-0.056***	-	-
Tot_liq_{t-1}•$RLTRO_{day}$	-	-0.041***	-0.045***
Net_repay(t)+Net_repay(t+1)	0.111**		-
(Net_repay(t)+Net_repay(t+1)) $RLTRO_{day}$	-	0.389***	0.399***
(Net_repay(t)+Net_repay(t+1)) $SLTRO_{day}$	-	0.176***	0.184***
$MRO_{t-1week}$	0.655***		-
(LTRO_dur-90)•$SLTRO_{day}$	-	0.417***	0.413***
$Max\_dur\_1w_{t-1}$	-0.102***		-
$Max\_dur\_45days_{t-1}$		-0.028***	-0.029***
$Risk6m_{t-1}$	24.815***	35.383***	36.643***
$(Eurepo1w_{t-1}-Repo_{t-1})/corridor_{t-1}$	21.554**	55.710***	57.357***
$\Sigma PIIGS\_T2_{t-1}$	-0.059***	-0.046***	-0.052***
$E_{t-1}[\Delta Repo]$	-28.353***	-	-
$adjR^2$	0.912	-	0.944
S.E. of regression	20.192	16.994	16.874
n. obs	249	130	130

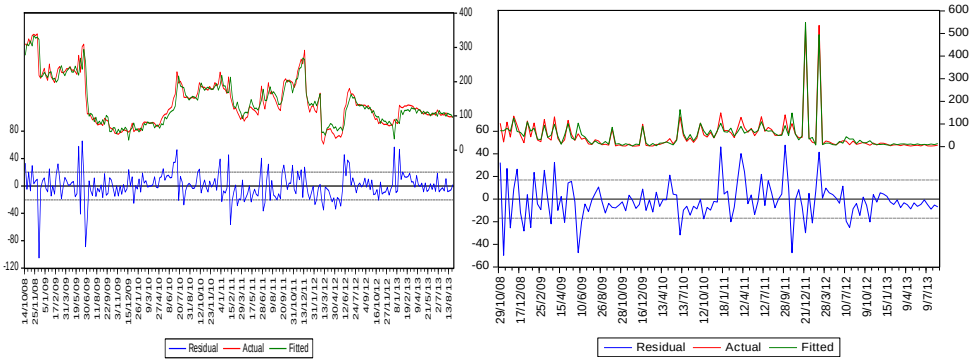
OLS with White heteroskedasticity-consistent standard errors & covariance;Censored: ML - Censored Normal (TOBIT) (Quadratic hill climbing); MRO period: 15 Oct 2008 – 31 Aug 2013, daily data; LTRO period: 15 Oct 2008 – 31 Aug 2013 (only full allotment procedures).

We also examined whether other explanatory variables such as risk were influenced by the type of LTRO, but no significant result emerged.

Another important explanatory variable is the maximum duration of SLTROs announced by the ECB for the next 45 days (Max_dur_45days). Its impact on the demand

for LTROs is negative: since in the period under consideration there was a preference for longer durations, banks preferred to await the announced operations with longer duration.

An outlier was detected in regression residual, corresponding to the first 1-year duration SLTRO of 24 June 2009, when the demand was much higher than in other similar cases. Such high demand might be a consequence of the following ECB official communication of just some days before: "the rate in the first of these operations will be the rate in the main refinancing operations at that time. In subsequent longer-term refinancing operations with full allotment, the fixed rate may include a spread [italics ours] in addition to the rate in the main refinancing operations, depending on the circumstances at the time". This observation was omitted from the sample used in estimations. Using a dummy revealed that demand was in fact about 263 billion euro higher than usual on that date.



MRO LTRO

Figure no. 5 – Demand for MRO and LTRO: actual, fitted and residual values

Estimates of the demand for liquidity resulting from ECB "other operations" (OTs) are shown in Table 8. The operations are both absorbing and providing liquidity (i.e. with a positive or negative sign), and were classified into three subgroups. The first group (OT_SMP) can be considered exogenous since it corresponds to the time deposits employed by ECB to sterilize the previous liquidity inflows caused by the Securities Markets Programme (SMP), whose amount is predetermined and known by banks in advance.

Table no. 8 – Bank demand for "other operations" (OT1) and OT2

	OLS (1)	OLS (1)
constant	-48.957**	19.826*
Tot_liq_{t-1}	-0.786**	-
Net_repay(t)	-	0.349***
Net_repay(t)+Net_repay(t+1)	0.138**	-
OT_SMP_t	-	-0.656***
$(EONIA_{t-1} - Repo_{t-1}) / corridor_{t-1}$	71.222***	32.932*
$adjR^2$	0.882	0.926
S.E. of regression	27.981	15.806
n. obs	38	7

OLS, White heteroskedasticity-consistent standard errors & covariance.

The second group (OT1) includes the liquidity absorbing operations of the last day of the reserve maintenance period, offered by ECB until the end of 2011. Their duration was one day only, and their purpose was to reduce bank idle liquidity costs. They were abolished in January 2012. Their amount is negatively related to the total liquidity already available to banks (Tot_liqt-1), and positively related to the net repayments on day t and t+1 (Net_repay(t)+Net_repay(t)), as well to existing pressures in EONIA market (EONIAt-1-REPOt-1)/corridort-1).

The last group of "other operations" (OT2) are the fine-tuning instruments ECB employs in the case of temporary shortage or excess of liquidity. Their duration is very short and demand is positively influenced by the amount of day repayments (Net_repay(t)) and pressures in EONIA market. Demand however is negatively related to the amount of liquidity absorbed on t by time deposits (OT_SMPt).

8. THE RELEVANCE OF ECB LIQUIDITY INTERVENTIONS: SOME SIMULATIONS

Up to the first months of 2014, Trichet's distinction between "standard" and "non-standard" measures was a guideline for ECB policy. "Non-standard measures … aim to remove the major roadblocks"; "the measures must address a problem of significant magnitude to warrant exceptional action". The "non-standard measures, by their nature, are temporary to the extent that they have to be strictly commensurate to the degree of dysfunctionality of markets that is hampering the transmission mechanism. Trichet (2010)". The distinction was also noted by Cohen-Setton and Dorfmeister (2013), "While standard measures [i.e. interest rates and communication policy] are aimed at addressing the overall monetary stance, non-standard measures (initially called enhanced credit support) are designed to restore adequate liquidity and the proper functioning of financial markets".

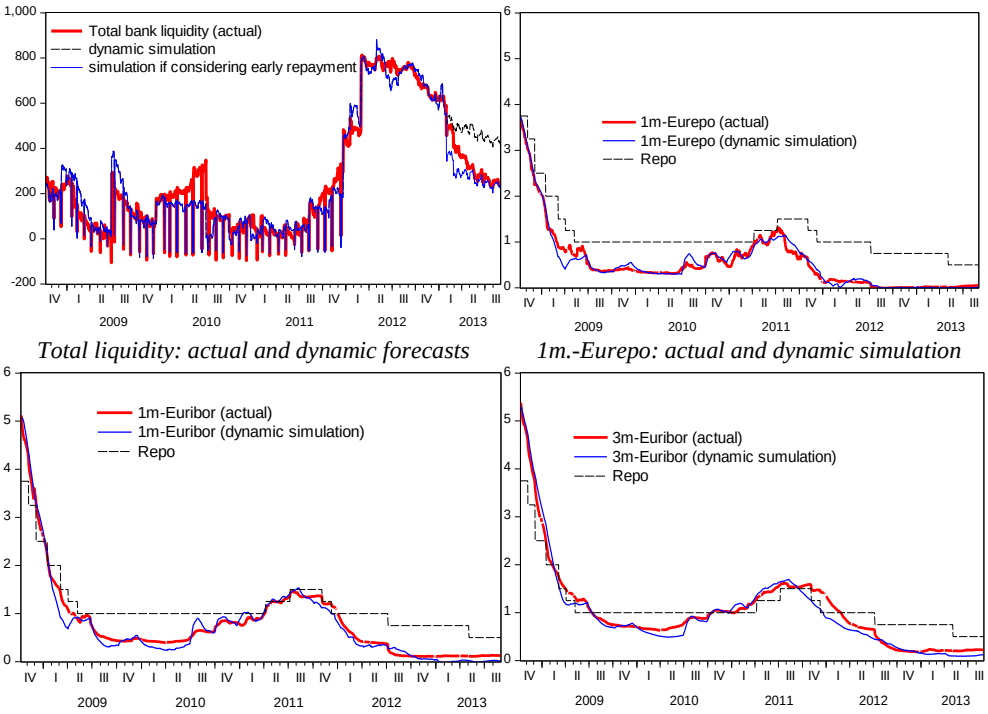
This section examines three main questions. First, it aims to identify what the paths of liquidity and interest rates would have been if the ECB had not taken non-standard measures. Secondly, it assesses whether the non-standard measures were consistent with demand for liquidity by the banking system. Thirdly, it assesses whether the non-standard measures were sufficient to meet demand for liquidity by the banking system.

The last regressions seem to confirm that ECB policy was consistent with its target since interventions increased banking sector liquidity: the levels of interest rates and risk are negatively influenced by liquidity, while a high level of risk increased the demand for liquidity and, in a full allotment regime, the amount of liquidity too. Moreover, from time to time ECB activated "supplementary" longer-term financing operations (SLTROs), with long durations that were particularly appreciated by banks during the worst crises 2008-2013.

In order to bring into focus the impact of ECB non-standard policy on liquidity operations, we ran some simulations by using the model presented in Figure 4 where parameters come from the equations reported in previous tables.

Before starting the simulation, however, we checked whether our model is a good approximation of reality by comparing the actual trend of the main endogenous variables with their so-called dynamic forecasts in the period Oct-2008-Aug-2013. The exogenous variables entering the model are: the Repo (the official interest rate), its expectations, the exogenous components of liquidity, the timing and types of ECB intervention, the interbank market risk and PIIGS countries sovereign spread.

Results obtained for the 1 month Eurepo, for 1 and 3month Euribor (an important benchmark for the cost of credit to firms as well to households) and for bank liquidity are reported in Figure 6.



Total liquidity: actual and dynamic forecasts *1m.-Eurepo: actual and dynamic simulation*

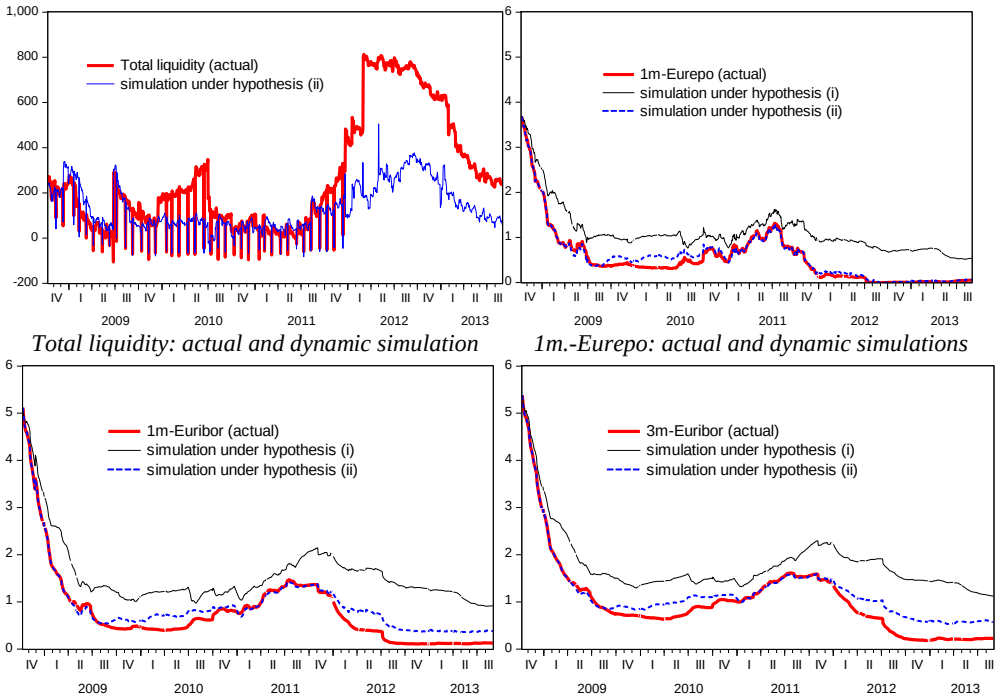
1m.- Euribor: actual and dynamic simulation *3m.- Euribor: actual and dynamic simulation*

Figure no. 6 – Dynamic forecasts and actual values: bank liquidity and interbank interest rates

All equation parameters derive from the non-linear OLS with constraints estimators, but results are also very similar when censored estimators are used. The dynamic forecasts of all variables are closely connected to their actual values, which suggests that our model is a reliable approximation of what really happened in 2008-2013. For the year 2013, forecasts include not including the (negative) "early repayments"[2]. (considered exogenous) of the 2-years supplementary LTRO of Dec.2011 and Feb. 2012. Of course, when the negative effect of early repayments is considered, actual and dynamic forecasted liquidity trends are much more similar.

After this satisfactory result, we compared the actual movements of liquidity and interest rates with their actual values under alternative hypotheses of ECB behaviour. In particular we investigated their plausible dynamics in two cases: (i) bank liquidity exogenously maintained at zero (as it was until 2008), and (ii) the actual allotment procedure but without SLTROs.

The results are reported in Figure 7. They show that if liquidity had been maintained at zero, Eurepo, and particularly Euribor, would have been much higher than they actually were. They also show a significant positive impact of the SLTRO: without them, liquidity would have been lower and interest rates higher in periods of stress.



Total liquidity: actual and dynamic simulation *1m.-Eurepo: actual and dynamic simulations*

1m.- Euribor: actual and dynamic simulations *3m.- Euribor: actual and dynamic simulations*

(a) = Total liquidity maintained at 0; (b) = no use of supplementary LTRO operations

Figure no. 7 – The effect of alternative monetary policies on liquidity and interbank rate

In other words, ECB employed in the years 2008-2013 its non-standard measures in cases of interbank risk and liquidity stress, and chose the type of intervention most attractive to a banking system aiming to increase its liquidity every time. This suggests a high degree of consistency between ECB's targets and non-standard measures. Such measures, however, increased liquidity only when banks demanded this. Until 2013, standard measures were used to prevent a severe credit crunch and to restore the monetary policy transmission mechanism, the ECB's objectives main for their use, but not to encourage banks to increase their lending to firms and households.

9. CONCLUSIONS

The consequences of the financial crisis would have been more serious if the ECB had not taken a number of unprecedented non-standard monetary policy measures. ECB response actually improved the condition of financial markets in the Eurozone. The results of our empirical analysis in fact confirm the consistency of ECB non-standard measures with the demand for liquidity by the banking system. Levels of interest rates and risk are negatively influenced by liquidity, while a high level of risk increases the demand for liquidity. So in a full allotment regime, a high level of risk decreases interest rates. It is significant that ECB also activated from time to time "supplementary" longer-term financing operations (SLTRO), which banks found a very attractive way of funding, particularly in the worst periods of crisis. From an econometric point of view, our estimation

and simulations have shown that including institutional constraints is important for obtaining reliable results. Moreover a previous knowledge of the variables the banking system really considers relevant for its liquidity management is a fundamental tool in deciding the regressors to include in the various equations.

The importance of European Central Bank liquidity interventions that aimed at facilitating the transmission of the interest rate policy and enhancing the flows of credit to the real economy has been highlighted in recent policy debates. Reduction of refinancing concern of the euro-area banking system and a long-term liquidity planning horizon was expected to encourage banks to provide credit. However, disruption of the financial sector in fact prevented the complementary transmission channel, aimed at stimulating lending, from functioning correctly. The dynamics of the demand for credit have become more complex, as the non-financial sector attempted to pay debts resulting from previous over high income expectations.

In implementing adjustments, it is important to acknowledge that there is a limit to what monetary policy can do. The partial ineffectiveness of monetary policy on the real sector shows that "it cannot substitute for measures that tackle the underlying problems, promoting the necessary balance sheet repair and structural reforms" (BIS, 2014, p. 92).

We conclude with some considerations on the monetary policy perspective.

The Basel III international regulatory framework introduced new liquidity regulations for managing liquidity risk and may impact on the effectiveness of ECB operating procedures. Monetary policy operations could affect banks' regulatory liquidity ratios, since the reserves are part of banks' portfolio of highly-liquid assets. Basel III could thus potentially influence interbank market behaviour. The timely identification of the effects of these developments on the money supply will be an important contribution of monetary analysis[3].

Application of expansionary monetary policy in the post-crisis period is a vexed question. Borio (2009) warns of negative side effects of this policy in the crisis resolution phase, and calls for the incorporation of the financial cycle theory into policy. The purchase of government debt by a central bank implies the coordination with the public sector of all matters concerned with debt management operations. "As their balance sheets expand and they take on more financial risks, central banks risk seeing their operational independence and anti- inflation credentials come under threat in the longer-term"[4].

Interesting empirical evidence shows that in normal recessions, a more accommodating monetary policy in the downturn does lead to a stronger recovery. However, in downturns associated with a financial crisis this result is no longer statistically significant. The benefits of accommodative monetary policy appear to be "short-lived".

Unconventional monetary policy only existed as a theoretical concept and had never been tried before the financial crisis and recession. It therefore needs to be examined very carefully and to be applied only in specific circumstances, taking into account its limitations. Otherwise, prolonged accommodation may have unwelcome side effects such as distorting market signals, masking balance sheet weaknesses, misallocating credit and encouraging excessive and unwelcome risk-taking. Accommodation may in fact increase risks to the central bank itself.

It is clear that monetary policy is no substitute for reforms in the labour market and fiscal regulations, but critical aspects of political economy do need to be taken into account. The widespread perception in society that certain liquidity measures may be to the advantage of the financial sector should not be overlooked at the current European economic conjuncture. And lastly, as long as underlying structural problems remain unsolved, repeated rounds of unconventional monetary policy measures by the ECB could affect the crucial aspect of central bank credibility.

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Appendix
List of Abbreviations

BASEL III	Third Basel Accord (international regulatory framework for banks)
BI	Bank of Italy
BIS	Bank For International Settlements
CDS	Credit Default Swap
EBA	European Banking Authority
ECB	European Central Bank
EFSF	European Financial Stability Facility
EMU	Economic and Monetary Union
EONIA	Euro Overnight Index Average
ESM	European Stability Mechanism
EURIRS	Euro Interest Rate Swap
IMF	International Monetary Fund
LCR	Liquidity Coverage Ratio
LTRO	Long-term refinancing operations
MRO	Main Refinancing Operations
NSFR	Net Stable Funding Ratio

OIS	Overnight Index Swap
OLS	Ordinary Least Squares
OMT	Outright Monetary Transactions
OT	Available Stable Funding
REPO	Repurchase Agreement
RLTRO	Regular Long-term Refinancing Operations
PIIGS	Portugal, Italy, Ireland, Greece and Spain
SLTRO	Supplementary Long-term Refinancing Operation
SMP	Securities Markets Program
STRO	Special Term Refinancing Operation
TARGET2	Trans-European Automated Real-Time Gross Settlement Express Transfer
VAR	Vector autoregression

Notes

[1] The data used in this paper and all implemented Eviews-8.1 codes are available on request.

[2] A measure of early-repayments can be obtained by comparing the actual open market operations OMT with their value obtained by the recursive formula described in Section 5: OMTt = OMTt-1 + MRO, LTRO and OT allotments with settlement on t, minus the previous operations matured on t and the OT sterilizations , plus the increase in the amount of covered bonds purchasing program.

[3] The European Banking Authority report December 2013 Art. 509(1) finds: "Evidence of a shift of euro refinancing into vLTROs which may reflect banks' increased demand for longer-term refinancing beyond the 30-day LCR threshold. At the same time, this shift towards vLTROs is also likely to reflect precautionary demand for Eurosystem credit in the context of the financial crisis".

[4] Central bank financed with short-term claims, "shorten the debt maturity profile of the consolidated public sector balance sheet, which comprises the central bank and the government. This raises the sensitivity of the debt service burden to changes in short-term interest rates." Borio (2009) Bank for International Settlements.

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ECONOMETRIC TESTS OF THE CAPM MODEL FOR A PORTFOLIO COMPOSED OF COMPANIES LISTED ON NASDAQ AND DOW JONES COMPONENTS

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Abstract

We tested empirically through econometric methods the classic CAPM model for 15 shares listed on the NASDAQ market in United States of America. The results showed that, for the majority of shares, there is a linear relation between expected return and market return. The shares of the largest companies from sample (AAPL, MSFT, GOOGL, etc. INTC) had a subunitary beta and the shares of smaller companies (ADBE, YHOO, BIDU etc.) had a beta greater than one. Compared with Security Market Line (SML) the shares were found to be overestimated and overstated and using GARCH-VECH model we identified the presence of high correlation between shares and the volatility spillover phenomenon.

Keywords: CAPM models; financial assets valuation; volatility spillover

JEL classification: G11, G12, G14

1. INTRODUCTION

Economic and financial world has been marked by negative events in recent years due to the financial crisis of 2007. They have tarnished the image of the entire financial system globally and determined the investors to be more reluctant with investments decisions but on the same time, they have strengthened the need for protection against risk. However, for stock markets risks are not necessarily a negative thing. A higher risk requires a higher gain. Kotler and Casoline (2009) believe that after the recent financial crisis, the world economy entered in "the new era of turbulence" in which the cyclicality has been replaced by uncertainty. Uncertainty has always been a feature of finances and especially of stock markets, but in time complex financial instruments have been developed, such as derivatives. We have chosen as research theme the CAPM model starting from Damodaran (2012) which divides investors into three categories, first type Buffet-like investors who are buying shares of companies with cash flows stable and liquid assets, the second category of investors rely solely on strategies derived from technical analysis and those in the third category seeking shares of new innovative

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companies, with growth prospects optimistic. To have a satisfactory return on stock investments there is no successful model consecrated. It cannot use only the fundamental analysis or only technical analysis. The safest is to use as many methods and models to make a decision. We chose the CAPM model because it is widely studied in the academic literature and is a reference point in the stock evaluation. Besides intuition, instinct and technical analysis an investor must base their decisions on mathematical analysis. Optimal portfolio management involves consideration of return and risk of the shares into which it is desired to invest. The CAPM model is the easiest and complex (at the same time) mathematical model for analyzing the stocks. Unlike the Sharpe model, the CAPM contains variables with universal role and a better representation of financial reality. Bartholdy and Peare (2003) considered that the CAPM model is the most popular model used by practitioners to estimate the expected return. By using the CAPM model we wanted to analyze the quality and the status of stocks for companies' components of the NASDAQ, from technology sector. This can be achieved on the basis of return required by investors, estimated by CAPM model. Other issues pursued in this paper are the linear relationship between expected return and risk, whether beta fully capture the risk of the stocks chosen and empirical support for the theory that a higher risk brings higher profitability.

The rest of the paper is organized as follows. Section 2 includes prior research in the field, with reference to the research and conclusions of literature recognized in finance, Section 3 includes description of database, methodology used for empirical research and results. The final section highlights conclusions drawn from the analysis of the conducted study.

2. PRIOR RESEARCH OF CAPM

To better understand the CAPM model it requires a brief history of its occurrence and development. In financial theory innumerable researches are studying this model, some arguing its applicability, others contesting it. The CAPM model was originally designed by William Sharpe (1964) and concomitant, but independent by Lintner (1965). Other significant initial studies were carried out by Jack Treynor (1961), Jan Mossin (1966) and Fischer Black (1972). Thus it appeared the first model that linked the return of a financial asset and the return of a fully diversified portfolio through an indicator of systematic risk (beta). The CAPM model (capital asset pricing model) is preferred by investors with risk aversion because it introduces a new factor, namely the risk-free rate which showing the minimum level which must be accepted in order to achieve the investment in stocks. The beta volatility coefficient resulted from CAPM model is a handy tool for the investors to decide whether to invest in a riskier shares that might bring a higher gains (Radcliffe (1989). Graham and Harvey (2001) believed that the CAPM model is a preferred model for calculating the cost of capital by US companies. The great disadvantage of CAPM were restrictive assumptions that makes it quite inapplicable to real life. Megginson (1997) provided a short list with models developed after the CAPM model. The list include the CAPM model which takes into account taxes, the CAPM model which takes into account the heteroskedasticity of returns, models that take into account the beta variability and others. Megginson (1997) said that investors who use CAPM obtain unbiased estimates of future returns which be equal to the actual historical returns. Roll (1977) brought serious criticism to the CAPM model considering that this model cannot be tested and the previous studies were flawed because the investors often build portfolios so that they are located on the efficient frontier SML. Other critics have been those related to stability over time of the coefficients volatility brought by Blume (1975). He showed that beta indicators become more precise with the increase of the number of shares within portfolios.

Although it is a simple model its results are not fully satisfactory and this has been demonstrated by some researchers including Eugene Fama and Kenneth French (1992). They realized, studying the US market, other models of equilibrium like FF3 (Fama-French with three-factor) that want to be developments of the CAPM model but using more factors such as market-to-book ratio, PER, capitalization and debt. Guermat (2014) considers that the CAPM model can be tested and is effective but only if it is used concomitant the OLS estimation with the GLS method. Starting from FF3, Balvers and Huang (2009) have introduced and have tested in model the consumption factor (C-CAPM) and even comprised a factor that include the monetary growth and inflation to derive a MC-CAPM model to better capture the determinants of stock prices. Similar studies were carried out by Jensen and Mercer (2002), Parker and Julliard (2005). By introducing the monetary factor according to Marshall (1992) model, Balvers and Huang (2009) wanted to correct the model developed by Breeden (1979) who believed that a growth of consumption is enough to evaluate the price of an asset. Balvers and Huang (2009) considers that the money supply in the economy and consequently the liquidity of the economy affect the level of trading, a fact which will be reflected in the price of financial assets. For better results he used the Stein's in econometric models. Chordia et al. (2005) have tested econometric a similar CAPM model and the empirical results showed that capital market liquidity is better if it is correlated with growth of the money supply. Balvers and Huang (2009) tested the econometric model MC-CAPM based on studies of Lettau and Ludvigson (2001), that had at its origins the method originated by Fama and MacBeth (1973). So they used the model of GMM for estimation, a method called the generalized moments. The study results indicated a better robustness of the estimated returns, greater stability of the market risk premiums and low levels for the alpha terms (the intercept from econometric model[1)] through C-CAPM and MC-CAPM models. This explains 64% of the cross-sectional variation in returns of the stocks within the analyzed portfolio, exceeding the results of Campbell and Cochrane (1999). Thus, by introducing the monetary impact, the estimates for expected returns have outperformed those made by Lewellen et al. (2010), Cohen et al. (2005), Ahn et al. (2009). Another fact revealed was that the value of financial assets is influenced by monetary shocks. Fama and French (2004) argued that the standard CAPM model which using the market index as a proxy for the return of market portfolio do not properly estimate the expected return of a share. Dittmar (2002) conducted another CAPM model that takes into account, besides the attention of investors for average, variance and asymmetry coefficient (Harvey and Siddique, 2000) (skewness) and coefficient of flattening (kurtosis). This model is better than the standard CAPM model for the US capital market.

Another studies of CAPM model have focused on the issue of distribution of return. Berk (1998) considers that the hypothesis of elliptical distributions is very useful in CAPM model. From this hypothesis, Hodgson et al. (2002) have identified the fact that size of the market affects the return estimated by using CAPM model. The problem of normal distribution assumption is that there is no limit for loss and thus, implies that the investors can lose more than the wealth they hold Huang and Litzenberger (1988). Vorkink (2003) developed the idea of elliptical distribution and found that returns estimated using the CAPM model are influenced by outliers existing in data. An example of outlier is the January effect which no longer highlights the linear relationship between return and risk, specific to CAPM. and can lead to estimated returns erroneously that can lead to wrong investment decisions. Patton and Timmermann (2010) tried to study, using the CAPM, if there is a monotonic relationship between the expected return of a financial asset and its associated risk. Eakins *et al.* (1996) studied the position of institutional investors towards the classic CAPM assumptions. They

found that institutional investors prefer to invest in shares with a greater beta to avoid stocks which have a higher unsystematic risk. The allocation process of resources is influenced by return measured ex-post and thus it does not support the CAPM assumptions for institutional investors. These are adverse to standard deviation, skewness and kurtosis.

Wen et al. (2008) have investigated whether the CAPM model used constantly by insurance companies is effective for them. Returns achieved in this sector follow a non-normal distribution so they considered that it is more effective to estimate expected returns using the model Rubinstein-Leland (RL) when estimating the cost of capital for a small insurance company. On the other hand, if the insurer is big and obtains symmetrically distributed returns than the CAPM model is more suitable to estimate beta and cost of capital. In addition to renowned authors who have studied the issue of CAPM model one can include studies of Kumar (2009), Stambaugh et al. (2012), Frazzini and Pederson (2013) who have made contributions to academic literature.

3. ECONOMETRIC RESEARCH METHODOLOGY

For this study we used the forte static assumption according to which the expected return - and anticipated - to be registered in the future, will be based on the average historical return on the time horizon considered in the analysis (Gourieroux *et al.*, 1997, p. 24). This assumption implies that the variance of historical returns is an estimator for the risk associated with the estimation.

Another hypothesis under consideration is "time interval" proposed by Theobald (1981). Theobald (1981) believes that the optimal period for CAPM analysis is 120 months, but, if there is a possibility of changes of beta, a shorter period should be considered. So we decided to analyze the period from 4 January 2010 to 26 December 2014, because earlier than 2010 there were recorded strongly influences of 2007's crisis. So, the analysis period covered 48 months, similar with period chosen by Roenfeldt et al. (1978). Groenewold and Fraser (2001), Bartholdy and Peare (2005), considers that the five years with monthly data is the CAPM optimal analysis period.

The actions chosen are components of the NASDAQ index and we chose the top 15 companies belonging to the technology sector, based on the market capitalization. List of selected companies can be found in Appendix, Table 1. As a source of database we used Yahoo Finance and NASDAQ official websites. NASDAQ is an electronic stock exchange in the United States, which lists about 3,200 companies. The name comes from the National Association of Securities Dealers Automated Quotations. It was founded in 1971 and is the second largest stock exchange in the world.

By using the CAPM model we wanted to verify whether the shares chosen in the quality of potential investors are undervalued, overvalued or properly assessed. If econometric expected return is lower than the actual return then the asset is undervalued and is a good decision to purchase those shares. Another method of analysis is comparing the theoretical price (exact) of the financial asset with that recorded on market. If theoretical price is higher than the market price the share is worth (on market) less than its real value, so it is undervalued. Other issues pursued in this paper follow the linear link between expected return and risk; whether beta fully capture the risk of the chosen shares; and theory that a higher risk brings higher return.

We used as risk-free rate the iShares 1-3 Year Treasury Bond (SHY). To facilitate comparisons, we used simple returns, applying the formula proposed by Brooks (2014) :

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100\% \quad (1)$$

R_t - share return at the moment „t"
P_t – share price at the moment „t"

From an econometric point of view, CAPM model is similar with Sharpe model. This helps in the econometric writing of the regression formula.

Based on market model described by Sharpe[2] and adding the risk-free rate we obtain:

$$R_{it} - R_f = \alpha_i - r_f + \beta_{i,m} \times (R_{mt} - r_f) + \varepsilon_{it}.$$

From here we can deduce the *excess return market model* denoted α_i^*. According to SML (*Security Market Line*) for CAPM model is necessary to restrict the intercept $\alpha_i^* = 0$.

For CAPM model econometric regression equation is:

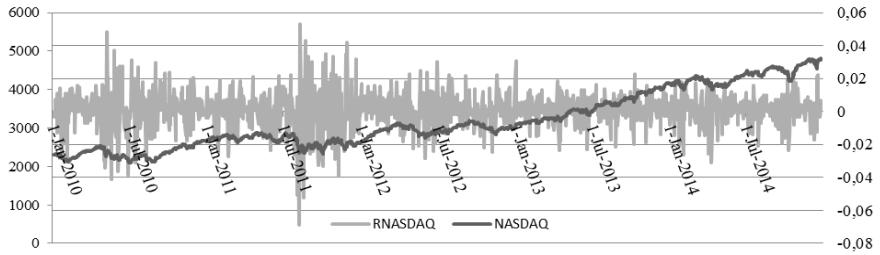
$$R_{it} - R_{ft} = \alpha_i + \beta_i [R_{mt} - R_{ft}] + e_{it}$$

We applied the notation Y= Rit - Rrf (the excess return brought by the asset „i" at t moment compared to risk-free asset return) for the dependent variable and for independent variable X= Rmt - Rrf (market risk premium). The new regression is $Y = \alpha + \beta \times X$. Thus, initial for Apple share, the linear regression will be: $RAAPL - RRF = \alpha + \beta \times (RNASDAQ - RRF)$. After notation, the new CAPM regression is: $CRAAPL = \alpha + \beta \times CRNASDAQ$.

Although the series has constant frequency, due to public holidays, which can not be defined in Eviews 7 software, it cannot choose option Dated. Instead, we chose Unstructured/Undated option with the advantage of rapidity of data entry. For stock markets that only works five days a week from Monday to Friday we can choose Dated – regular frequency (Daily-5 day weeks) and the format is MM/DD/YYYY.

4. EMPIRICAL RESULTS

In Figure 1 we attached a representation of return and of closing market price, for the NASDAQ index. There is a greater variation in NASDAQ index return during July 2011.



Source: author's computation

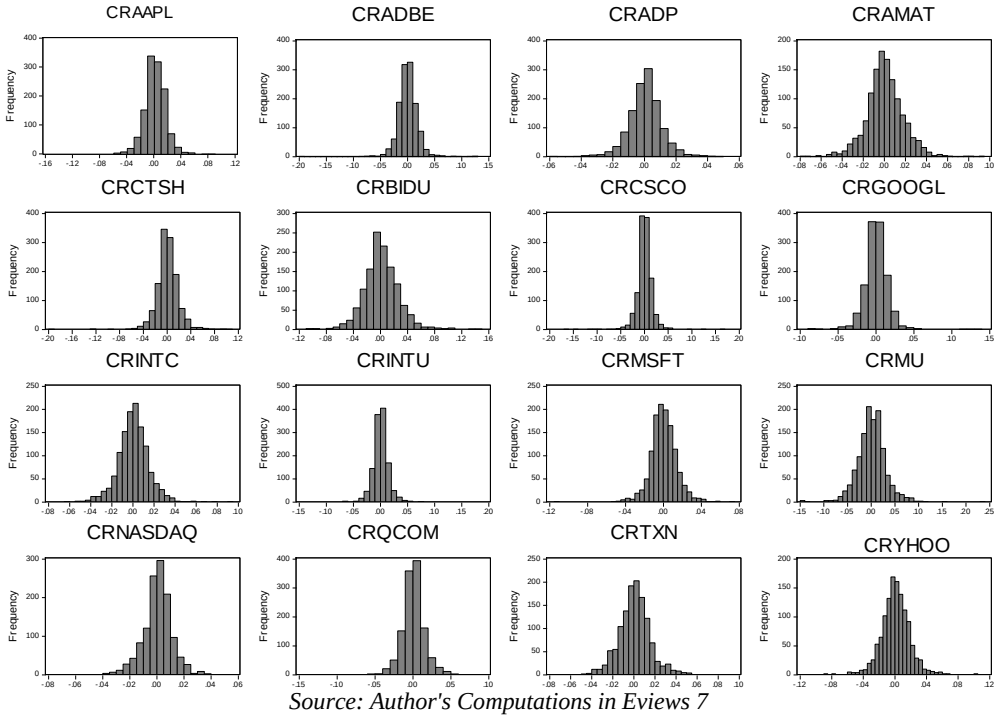
Figure no. 1 – NASDAQ – Return (RNASDAQ) and Market Price

We attached in Appendix, at Figure 2 the graphic representation for Apple (return and price) that will be the benchmark in this paper. In Table 2 we attached descriptive statistics of shares analyzed and it can be seen that INTU has the highest return followed by ADBE. From Jarque-Bera statistics it can be noted that data is not normally distributed a common fact for financial data.

Table no. 2 – Descriptive Statistics

	CRADBE	CRAMAT	CRADP	CRAAPL	CRBIDU	CRCSCO	CRCTSH	CRGOOGL
Mean	0.000699	0.000668	0.00078	0.001199	0.00169	0.0003	0.00083	0.000523
Median	0.000399	1.35E-05	0.00078	0.0011	0.00029	0.00038	0.00041	0.000365
Maximum	0.127564	0.091606	0.04786	0.088416	0.14218	0.1603	0.1091	0.13796
Minimum	-0.19023	-0.0759	-0.0572	-0.12345	-0.1096	-0.1605	-0.192	-0.0845
Std. Dev.	0.018844	0.017692	0.01069	0.016881	0.02612	0.01741	0.01938	0.015821
Skewness	-0.15536	0.123025	-0.0931	-0.147179	0.44247	-0.5798	-0.8076	0.663596
Kurtosis	16.66197	4.900759	5.37948	7.712987	5.73519	23.5998	15.7835	15.33235
Jarque-Bera	9765.252	192.0894	297.884	1166.046	432.157	22260.4	8681.75	8044.99
Probability	0	0	0	0	0	0	0	0
Sum Sq. Dev.	0.4453	0.392507	0.14337	0.357359	0.85529	0.37992	0.47086	0.313897
Observations	1255	1255	1255	1255	1255	1255	1255	1255
	CRINTC	**CRINTU**	**CRMSFT**	**CRNASDAQ**	**CRMU**	**CRQCOM**	**CRTXN**	**CRYHOO**
Mean	0.000677	0.000998	0.00052	0.000614	0.00136	0.00055	0.00077	0.001019
Median	0.000597	0.000595	1.17E-05	0.001022	0.00103	0.00056	0.00067	0.000742
Maximum	0.09277	0.150778	0.07287	0.051869	0.23419	0.0819	0.08517	0.103065
Minimum	-0.06291	-0.1105	-0.1146	-0.069353	-0.145	-0.1429	-0.0718	-0.08784
Std. Dev.	0.014889	0.015211	0.01404	0.011425	0.03047	0.01599	0.01542	0.01933
Skewness	0.222644	0.640895	-0.2105	-0.340401	0.291	-0.6652	0.18571	0.16208
Kurtosis	5.862991	15.32279	8.06215	6.330592	7.82544	11.2878	5.02639	6.391609
Jarque-Bera	438.9885	8026.46	1349.27	604.2999	1235.32	3684.37	221.937	607.0064
Probability	0	0	0	0	0	0	0	0
Sum Sq. Dev.	0.277979	0.290129	0.24718	0.163694	1.1639	0.32079	0.29802	0.468533

Source: Author's Computations in Eviews 7



Source: Author's Computations in Eviews 7

Figure no. 4 – NASDAQ stock return distributions

At Appendix, Figure 3 contains the distribution of quantiles for the analyzed returns. It can be seen that they are not normally distributed. Figure 4 contains NASDAQ stock return distributions. In Table 3 we attached the OLS estimation results.

Table no. 3 – Estimation Results

Dependent Variable	R-squared	F-statistic	Prob F-statistic	Durbin-Watson stat	Ramsey RESET (P-value)	White (P-value)
AAPL	0.3910	804.3291	0.0000	1.9238	0.2463	0.9099
MSFT	0.4536	1040.0090	0.0000	1.9672	0.8922	0.8724
GOOGL	0.4453	1005.7820	0.0000	1.9346	0.8750	0.6459
INTC	0.4581	1059.4410	0.0000	2.0202	0.1269	0.5999
CSCO	0.3771	758.6172	0.0000	1.9823	0.1308	0.1183
QCOM	0.4653	1090.3180	0.0000	1.9742	0.8495	0.8094
BIDU	0.3721	742.3932	0.0000	2.0509	*0.0453*	0.1645
TXN	0.5816	1741.9940	0.0000	2.1894	*0.0060*	0.0000
YHOO	0.3501	675.0251	0.0000	1.9674	0.4263	0.0228
ADP	0.6403	2230.8140	0.0000	2.1778	0.9542	0.0050
MU	0.0073	9.1546	0.0025	2.0270	*0.0136*	0.0000
ADBE	0.4096	869.2039	0.0000	2.2048	0.8078	0.7100
CTSH	*0.0004*	*0.4497*	*0.5026*	*2.1272*	0.0892	0.0271
AMAT	0.5356	1445.1890	0.0000	2.0769	0.2307	0.0342
INTU	0.4368	971.8969	0.0000	2.2133	0.5023	0.8810

Source: Author's computations in Eviews 7

The determination report[3] one of the most common godness of fit statistic, must be as close to 1 for assessing the quality of a model. Being daily data with high dispersion, econometric theory recommends a lower limit for the determination report of 0.15% (Andrei and Bourbonnais, 2008). For the 15 shares examined, the report of determination was in average close to 50%, maximum being touched by the stock ADP with a value of 64.03%. For companies CTSH and MU the determination report had a very low value (0.04%). Thus we can confirm that for the 13 shares examined, the econometric models are valid with exception of CTSH and MU stocks that should be excluded from the portfolio or analyzed by other methods. Since these values are relatively low or even very low, it is possible that much of the variation in return of shares to be determined by factors not included in the model, specific to company. For example, Apple shares indicates that about 39% of the variation in return is explained by the variation of the market portfolio return, so 61% of the variation for AAPL return is due to the company specific risk, a risk which can be adjusted by portfolio diversification. For company ADP, 64% of the variation is explained by the variation of return of the market portfolio, so 36% of the ADP return variation is due to the company specific risk. From these two examples it is difficult to determine which most cost-effective share is and it require a further investigation of return- risk ratio. To validate the estimated CAPM model is not enough just coefficient of determination[4]. If the 1 to 4 properties from the footer are satisfied then the estimated parameters are called Best Linear Unbiased Estimators (BLUE). BLUE means that alpha and beta linear estimators ($\hat{\alpha}$ and $\hat{\beta}$) give the true values for model parameters and are consistent, unbiased and efficient (see Brooks, 2014).

F-Fisher Snedecor Test checks the linear dependence (the validity of the model). The F-Test verify if all the regression coefficients (except the constant) are significantly different from zero. If $F_{calculating}$ by Eviews is bigger than $F_{critical}$ then the model is valid and it can

accept the existence of a linear dependence. If $F_{calculating} < F_{critical}$ then the model is not valid and it cannot accept the existence of a linear dependence. In this case, $F_{critical}$ is: $F_{\alpha;\ k;\ n-1-k} = 3.087$. Another way is to analyze the *P-value* associated with this test. *P-value*, is less than 5% for all stocks analyzed with CAPM model. Thus, this test validates all models except CTSH share.

The first order autocorrelation tests and superior order (Durbin-Watson) verify if errors are linearly independent one of another (residuals are no autocorrelate). Residual values from one time are not correlated with residual values of another time. The simplest case of autocorrelation of residuals is the first order autocorrelation[5]. The consequences of ignoring the autocorrelation are similar to those of ignoring the heteroskedasticity. The coefficients estimated with OLS method are unbiased, but are not BLUE, and therefore are inefficient. It may be combated by estimating with GLS method or Cochrane-Orcutt method. Durbin - Watson procedure is only used for consecutive errors. The DW statistic is between [0,4]. But a value close or equal to 2 highlights the lack of autocorrelation for errors. DW depends on the number of variables included in the model. The Durbin - Watson test it applies only if the regression equation has free term, the regressors are non-stochastic and the dependent variable has no lags. The decision is taken according to Figure 5. For d_L and d_U the intercept is not included for the table values. The critical values of statistics depend on the number of exogenous variables, the number of observations and the significance threshold chosen. Figure 5 and Table 3 show that the DW statistic analyzed is within an interval of values [1.92; 2.21] that corresponding to lack of autocorrelation.

Interval	**Result**
0 - d_L	Reject H_0 / Positive autocorrelation
d_L - d_U	Indecision
d_U - 2	Accept H_0
2 - (4-d_U)	No autocorrelation
(4-d_U) – (4d_L)	Indecision
4d_L - 4	Reject H_0 / Negative autocorrelation

0_____**dL=1.65**_____**dU=1.69**_____2_____4-dU=2.31_____4dL=2.35_____4

Source: Author's computation

Figure no. 5 – The Durbin-Watson Test decision

Ramsey Test verifies the linearity of the model chose, in other words, if the relationship between the asset's expected return and market return can be represented by a straight line. The command function is RESET in Eviews. It is a residual test. This test implies that after the OLS estimation of the regression, building a new auxiliary regression in turn, which will be estimated OLS. The decision is taken by test F test applied to auxiliary estimated regression. If the decision of F test adopts the null hypothesis, then one can accept H_0 from Ramsey test and the model is linear. If the decision of F test adopts the H_1 hypothesis then at least one parameter is not equal to one and we can accept the H_1 from Ramsey test so the model is not linear. The decision may also be made by analyzing the *P-value* of F test associated with auxiliary regression estimates. Thus, following the penultimate column of Table 3 we see that F test *P-value* is greater than 5% for all shares analyzed except the BIDU, TXN, MU stocks, which have a P-*value* less than 5%. By exceeding the 5% threshold we consider that CAPM models analyzed are linear models. By this test we have shown that between the return of the analyzed stocks and the market portfolio return there is a direct linear connection, a fact that can predict, to some extent, the return of the chosen

stocks if we analyze the NASDAQ market index. For shares that are not linear models under the Ramsey test, there may be other factors of influence.

White Test verifies the homoscedasticity of the model. The variance of each random variable is the same[6]. The homoscedasticity supposes that the dispersion should be constant and for heteroskedasticity the dispersion varies. Lack of the homoscedasticity can occur by not including the key explanatory variables in the model. A consequence of the application of OLS which do not check the hypothesis of homoscedasticity is the distortion of the quality of statistical tests performed on the model parameters. The estimator is unbiased and consistent in those conditions. After CAPM model estimation, White Test creates an auxiliary regression on which is applied the F test. If the decision of the F test is to accept the null hypothesis then the White test H_0 hypothesis is accepted and the model is homoscedastic. If the decision is to accept the F-test hypothesis H_1, then at least one parameter is zero, so we accept the H_1 from White test, so the model is heteroskedastic and the dispersion does not has an uniform development throughout the range. Or it may be decided and according to *P-value* associated. For the present study the White test results, applied for CAPM model, can be found in Table 3. It is noted that the stocks AAPL, MSFT, GOOGL, INTC, CSCO, QCOM, BIDU, ADBE, and INTU have a *P-value* associated with F test of auxiliary regression higher 5%, a fact that shows that the models have homoscedasticity. For CAPM models, applied to stocks TXN, YHOO, ADP, MU, CTSH, AMAT the *P-value* associated with F test is less than 5% a fact that signifies the presence of heteroskedasticity for errors. If errors are heteroskedastic, the standard error formula cannot be applied properly to coefficients. For example, the heteroskedasticity presence leads to high standard errors for the intercept. All statistics used for inferences - Student test, F test and others, will be affected. The estimators will be consistent and unbiased but they will not have minimal variance so any inferences based on them will be wrong. The heteroskedasticity can be countered by estimating Generalized Least Squares (GLS). Another solution would be the use of the logarithms but has the disadvantage of ignoring the negative or zero values.

The Normality Test (Jarque-Bera) verifies the normality of the residue $u_t \sim N(0, \sigma^2)$. To see if the results are reliable or not, it must check the errors of the regression equation that have to be normally distributed. Normal distribution of errors is important especially for making predictions based on estimated econometric equation. To define the confidence intervals of the parameters and for making predictions it starts from the hypothesis of normal distribution of the residues. For a normally distributed random variable, the value of the asymmetry coefficient (Skewness) is zero and the flattening coefficient (Kurtosis) is 3 (normal distribution – *mesokurtic* - and shows the form of the extremities). If the distribution has the kurtosis greater than 3, is called *leptokurtic* (and has a height greater than a normal distribution) and if kurtosis has a value of less than 3, the distribution is called *platykurtic*. Overall financial data series have leptokurtic distribution. A feature of this distribution is that the likelihood of extreme events is higher than for the normal distribution. The P-value associated with Jarque-Bera test was very low which leads to the idea that the series are not normally distributed.

After OLS estimation, the next step is to analyze the estimators' properties. An important property is related to dispersion. A lower level means a greater relevance of the estimator and the confidence which we will give in statistical inference is higher. It is therefore important to calculate the variances for the estimators. For the CAPM model is good to know how suitable are the parameters estimators $\hat{\alpha}$ and $\hat{\beta}$ and how accurate. For this, the standard errors[7], resulted

from estimation, are studied. Ideally, is that they to have the lowest possible values. The standard error of regression is called the standard deviation of the residue of each regression. In the market model (Sharpe) is interpreted as company specific risk (or risk diversifiable). Table 4 notes that standard errors are lower than estimation coefficients which give a high degree of confidence to the results obtained. Additional to the example with AAPL and ADP shares, we can say that AAPL has, under standard error assumption, a 3% unsystematic risk and ADP share has a 1.6% unsystematic risk.

Table no. 4 – The OLS estimated results - CAPM model

Dependent variable	**BETA ($\widehat{\beta}$)**	Std. Error	t-Stat	Prob.
AAPL	**0.9238**	0.0326	28.3607	0.0000
MSFT	**0.8276**	0.0257	32.2492	0.0000
GOOGL	**0.9240**	0.0291	31.7141	0.0000
INTC	**0.8820**	0.0271	32.5491	0.0000
CSCO	**0.9356**	0.0340	27.5430	0.0000
QCOM	**0.9549**	0.0289	33.0200	0.0000
BIDU	**1.3943**	0.0512	27.2469	0.0000
TXN	**1.0290**	0.0247	41.7372	0.0000
YHOO	**1.0011**	0.0385	25.9812	0.0000
ADP	**0.7489**	0.0159	47.2315	0.0000
MU	**-0.2271**	0.0751	-3.0257	0.0025
ADBE	**1.0555**	0.0358	29.4823	0.0000
CTSH	**-0.0321**	0.0479	-0.6706	0.5026
AMAT	**1.1333**	0.0298	38.0156	0.0000
INTU	**0.8799**	0.0282	31.1753	0.0000

Source: Author's computation in Eviews 7

T-Student Test tests if the parameters are significantly different from zero. If the module of t-Statistic calculated by Eviews is bigger than $t_{tabular}$ (taken from the Student distribution table) then we accept the alternative hypothesis that the value of the slope coefficient is significantly different from zero, the null hypothesis is rejected and we keep the X_i independent variable in the regression model. If $|t_{calculating}| < t_{tabular}$ then H_0 hypothesis which state that the value of the slope coefficient is not significantly different from zero, is accepted. The decision can be taken on behalf of P-value associated with the test. Table 4 shows that P-value associated with Student test is less than 5% a fact which leads to the idea that all coefficients are significantly different from zero and the model is valid.

The results from the CAPM model estimation can be found in Table 4 and they are essential to testing of this particular model, especially *Coefficients* column that identifies the beta coefficients which represents the risk of the shares. The beta (β) indicator can be can be interpreted in several ways. If is greater than 1 the share is more risky than the market portfolio and analog, if is smaller than 1, the share is less risky than the market portfolio. The stocks BIDU, TXN, YHOO, ADBE, and AMAT have a beta greater than one and stocks AAPL, MSFT, GOOGL, CSCO, QCOM, INTC, INTU, ADP have a beta subunitary but close to 1. Some stocks (MU and CTSH) have a negative beta what means that there exists an inverse relationship between the return on these assets and the market portfolio. Subunitary beta can indicate that the respective shares could be blue chips. One of the proposals of this paper was the link between risk and return of the chosen stocks. According to CAPM model a greater beta should bring with it a higher return.

In Table 5 we attached the results from the OLS estimation regarding the intercept. CAPM assumes the efficiency of the market portfolio. According to SML, the CAPM must comply with the restriction that the intercept α_i^* = 0. This can be checked either using the Wald test or through applying the Student test to the Intercept, to see if the estimated coefficients are significantly different from zero. From Table 5, it is noted that all stocks analyzed have the P-value associated with Student test greater than 5% leading to accepting the null hypothesis, namely that the constant term α_i^* is not significantly different from zero. This condition should be respected for that comes from the market model (Sharpe) and would distort the conditions imposed by CAPM model.

Table no. 5 – The OLS estimation results

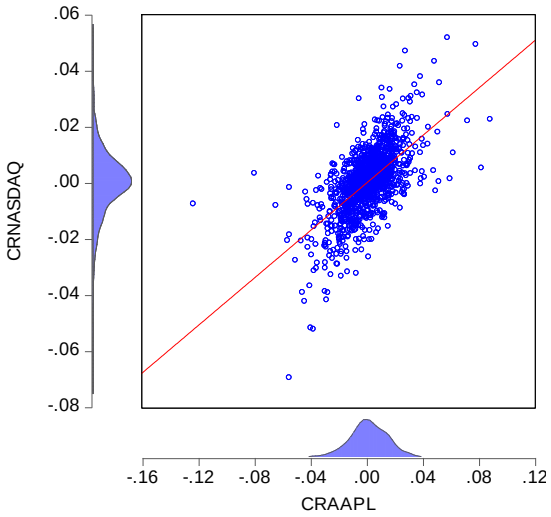
Dependent Variable	**ALFA ($\hat{\alpha}$)**	Std. Error	t-Stat	Prob.
AAPL	**0.0006**	0.0004	1.6967	0.0900
MSFT	**0.0000**	0.0003	0.0249	0.9801
GOOGL	**0.0000**	0.0003	-0.1319	0.8951
INTC	**0.0001**	0.0003	0.4391	0.6607
CSCO	**-0.0003**	0.0004	-0.7054	0.4807
QCOM	**0.0000**	0.0003	-0.1246	0.9009
BIDU	**0.0008**	0.0006	1.4312	0.1526
TXN	**0.0001**	0.0003	0.4814	0.6303
YHOO	**0.0004**	0.0004	0.9176	0.3590
ADP	**0.0003**	0.0002	1.7920	0.0734
MU	**0.0015**	0.0009	1.7434	0.0815
ADBE	**0.0001**	0.0004	0.1266	0.8993
CTSH	**0.0008**	0.0005	1.5414	0.1235
AMAT	**0.0000**	0.0003	-0.0791	0.9370
INTU	**0.0005**	0.0003	1.4184	0.1563

Source: Author's computation in Eviews 7

By respecting the Intercept condition it can be considered that for all 15 stocks analyzed, the CAPM model is sustained and can be used as a model to estimate the expected future return. If the parameters alpha (α) would have been statistically significant different from zero, the analysis of these shares would be: the alpha negative means shares undervalued and overvalued those with positive alpha.

Another way to analyze the CAPM model was bound by the relation $\varepsilon_i = y_t - \hat{y}_t$, where $y_t = E[R_i] - R_f$. This can be done by using Figure 6. If one of the points is above the red line then the actual return of the Apple share is above the characteristic line, so is higher than the estimated return on CAPM model. $E[R_{AAPL}] = 0.0006 + 0.9238 \times E[R_{NASDAQ}]$.

To validate the results with certainty we need to check if beta is stable over time. For this, Chow test it can be used to identify the existence of a structural breaks in the analyzed data. It is estimated regression equations on subsamples, dividing the sample into two or more sub-samples to check the existence of differences between estimated coefficients. Chow's test model verifies the parameters stability[8]. Basically, the initial data series are divided into two subintervals and new estimations are made on them and compared with the first estimations made on the entire period. The test decision is: If *P-value* associated with Chow test has a value of less than 5% then H_0 is rejected (β coefficients are stable) and accept the H1 hypothesis with β coefficients that depend on time and are not stable. We attached the Chow test in Table 6.



Source: Author's computations using Eviews 7

Figure no. 6 – The characteristic line for Apple shares

We divided the sample in two subsamples: a) 2010M01 – 2012M07 and b) 2010M01 – 2013M09. It is noted that the probability associated with the F test indicates a structural rupture for stocks CSCO, YHOO, INTU. Testing the beta stability on other two samples, Apple and Google shares have presented ruptures which suggested that beta is not stable over time. Overall, the Chow test showed that all stocks considered in addition to those mentioned, have a beta stable over time.

Table no. 6 – Chow Test

Stock	1 August 2012		16 October 2013	
	F-stat	Prob. F(2,1251)	F-stat	Prob. F(2,1251)
AAPL	2.157857	0.116	2.634917	0.0721
MSFT	0.516913	0.5965	1.217264	0.2964
GOOG	2.231862	0.1078	5.266869	0.0053
INTC	0.145241	0.8648	2.458897	0.0859
CSCO	3.55774	0.0288	4.318618	0.0135
QCOM	2.358257	0.095	2.236919	0.1072
BIDU	0.690831	0.5014	0.335568	0.715
TXN	0.907903	0.4036	0.528539	0.5896
YHOO	4.215209	0.015	6.428098	0.0017
ADP	0.132548	0.8759	0.360217	0.6976
MU	1.779577	0.1691	0.52585	0.5912
ADBE	1.311362	0.2698	0.617939	0.5392
CTSH	1.220319	0.2955	0.959884	0.3832
AMAT	1.778039	0.1694	0.584298	0.5576
INTU	3.455892	0.0319	0.958645	0.3837

Source: Author's computations in Eviews 7

The next step is to test the **stationarity** of the analyzed series. The regression with nonstationary series is called spurious and cannot be interpreted in a conventional manner, because all tests (t-statistic, F-statistic etc.) change their properties. Also, the relationship between non stationary series tends to be very high (usually in such cases, the coefficients R^2 and R^2 adjusted are high), but the correlation is not conclusive because it may be due to a common trends (deterministic or stochastic) available in this series. A stationary series is not changing its properties over time. The mean, the variance and covariance for each lag are constant. A non-stationary series has a unit root. From an economic point of view, a series is stationary if a shock over it is temporary (is absorbed in time) and do not remain permanently. When the series is not stationary, by differentiation it obtain a stationary series. Thus, the integration order of the series is the number of successive differentiations necessary to obtain a stationary series (or the number of unit roots). In economics, the most common non-stationary series are integrated of order I (requires a single differentiation, have one unit root). For each series we applied unit root's tests using Eviews 7 software: one based on the assumption of WN (white noise) and one based on the assumption of RW (random walk); more precisely, we applied the stationarity test based on correlogram and unit root test (Dickey-Fuller). Econometric analysis was performed using logarithmic series because the logarithm facilitates the interpretation of the regression coefficients obtained (they are elasticities). As example for Microsoft share we use *genr* to apply the logarithmic form: lmsft= log (msft). For first difference: dl_msft=lmsft - msft (-1).

In Figure 6 is observed visually that the series are stationary. But a glance on the graphics is not enough and must be applied the unit root tests on stationarity.

A first step is to start from yt-yt-1= γ yt-1 + et. It formulates hypotheses on the time series:

– H0: the series is nonstationary, has a unit root, (is RW)

– H1: the series is stationary

As the series values y1, y2 ... yt come from a process RW as it was the assumption, does not follow the distribution t (Student) so it cannot check if the coefficients are significant. But they followed a τ distribution, studied by Dickey and Fuller. The decision for Augmented Dickey-Fuller test is similar to that of the Student. Calculate the value of ADF statistics, which are compared with critical values τcrt corresponding to a confidence level of 1%, 5% or 10%.

Table no. 7 – ADF test

Dependent Variable	t-Stat	Prob.
AAPL	-34.7081	0.0000
MSFT	-35.4642	0.0000
GOOGL	-35.6535	0.0000
INTC	-36.4457	0.0000
CSCO	-35.5344	0.0000
QCOM	-35.3206	0.0000
BIDU	-35.5892	0.0000
TXN	-37.6955	0.0000
YHOO	-34.9654	0.0000
ADP	-38.6035	0.0000
MU	-35.9129	0.0000
ADBE	-38.0837	0.0000
CTSH	-37.7084	0.0000
AMAT	-36.3383	0.0000
INTU	-39.5947	0.0000

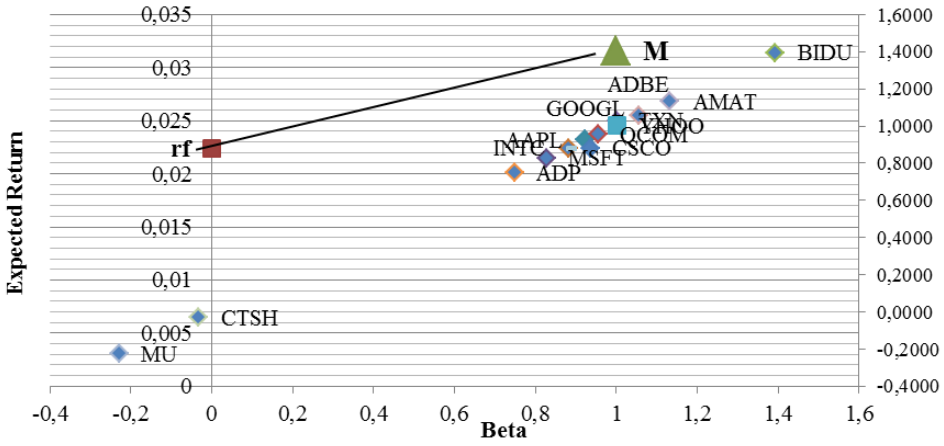
Source: Author's computations in Eviews 7

The ADF test decision can be taken in according to test *P-value* associated with F test. If is greater than all three confidence thresholds then it follows that the series is non-stationary. From Table 7 it is observed that *P-value* is zero in all three thresholds, so all series are stationary.

To take a decision on which of the 15 stocks an investor should invest, according to CAPM model, he must compare the expected return with the return from the market. In this respect, the security market line (SML) should be constructed. The risk-free rate is R_f = 2.24% according to Bloomberg, and the market risk premium is 5.4% according to Fernandez *et al.* (2014). Next, we attached the return computed through CAPM model based on Eviews results.

$$E[R_{AAPL}] = 2.24\% + 0.9238 \times 5.4\% = 7.23\ \%$$
$$E[R_{MSFT}] = 2.24\% + 0.8276 \times 5.4\% = 6.71\ \%$$
$$E[R_{GOOGL}] = 2.24\% + 0.9240 \times 5.4\% = 7.23\ \%$$
$$E[R_{INTC}] = 2.24\% + 0.8820 \times 5.4\% = 7.00\ \%$$
$$E[R_{CSCO}] = 2.24\% + 0.9356 \times 5.4\% = 7.29\ \%$$
$$E[R_{QCOM}] = 2.24\% + 0.9549 \times 5.4\% = 7.40\ \%$$
$$E[R_{BIDU}] = 2.24\% + 1.3943 \times 5.4\% = 9.77\ \%$$
$$E[R_{TXN}] = 2.24\% + 1.0290 \times 5.4\% = 7.80\ \%$$
$$E[R_{YHOO}] = 2.24\% + 1.0011 \times 5.4\% = 7.65\ \%$$
$$E[R_{ADP}] = 2.24\% + 0.7489 \times 5.4\% = 6.28\ \%$$
$$E[R_{MU}] = 2.24\% - 0.2271 \times 5.4\% = 1.01\ \%$$
$$E[R_{ADBE}] = 2.24\% + 1.0555 \times 5.4\% = 7.94\ \%$$
$$E[R_{CTSH}] = 2.24\% - 0.0321 \times 5.4\% = 2.06\ \%$$
$$E[R_{AMAT}] = 2.24\% + 1.1333 \times 5.4\% = 8.36\ \%$$
$$E[R_{INTU}] = 2.24\% + 0.8799 \times 5.4\% = 6.99\ \%$$

From theory we know that beta for risk-free asset is zero and for the market portfolio is 1, so only two points are necessary ((0, R) and (1, E (RM))) to form the SML as it can be seen in Figure 8.



Source: author's computations

Figure no. 8 – Share valuation using SML

If the stocks are properly valued by the market, they should be on the SML. If they are above the line SML are undervalued, and if they are below the SML are overstated. From Figure 8 it is noted that all stocks are considered right beneath the SML, a fact leading to the idea that market shares are overvalued. Not surprising, since that stocks came from technology companies characterized by investors with high expectations from these companies. On the other hand they are companies that rely on innovation so are quite risky because in technology sector new products can occur at any time and can eclipse the products of these companies. For example it can follow Polaroid or Kodak which were some of the strongest companies in this field, and the most appreciated by investors, and now they almost disappeared due to technological advances with which they could not keep up. Normally it would be risky to invest in these overvalued shares because the market will react at a time and prices will fall, which will lead to losses. But on the short term is unlikely to occur revolutionary technologies affecting profits respective companies and should be noted that they are stocks of giant companies known globally as Microsoft, Google and Apple which are highly regarded by investors. But they are somewhat companies mature and it is easy to see that they have a beta lower than companies like BIDU or AMAT which, to a percentage increase of 1% for market return, they will increase by 1.4 and, respectively, 1.15 the expected return which leading to profitability higher for these companies.

As we saw in chapter which summarizes the literature on the CAPM, Fama-French and others use to estimate return Generalized Method of Moments (GMM). Because GMM estimation involves advanced econometric knowledge we did not go into details but we conducted a short estimation to see if such models have estimated a different beta indicator and if return is better estimated in that way. GMM was introduced by Hansen (1982) and has applications in determining prices of financial assets. Table 8 comprise the GMM estimation method results.

From Table 8 it can be seen that there are no significant differences between beta estimated using the OLS and beta estimated with GMM for analyzed stocks which indicates a stability of the returns estimated using the CAPM. The only shares that can attract attention because they have a greater difference in both beta versions are GOOGL and MU.

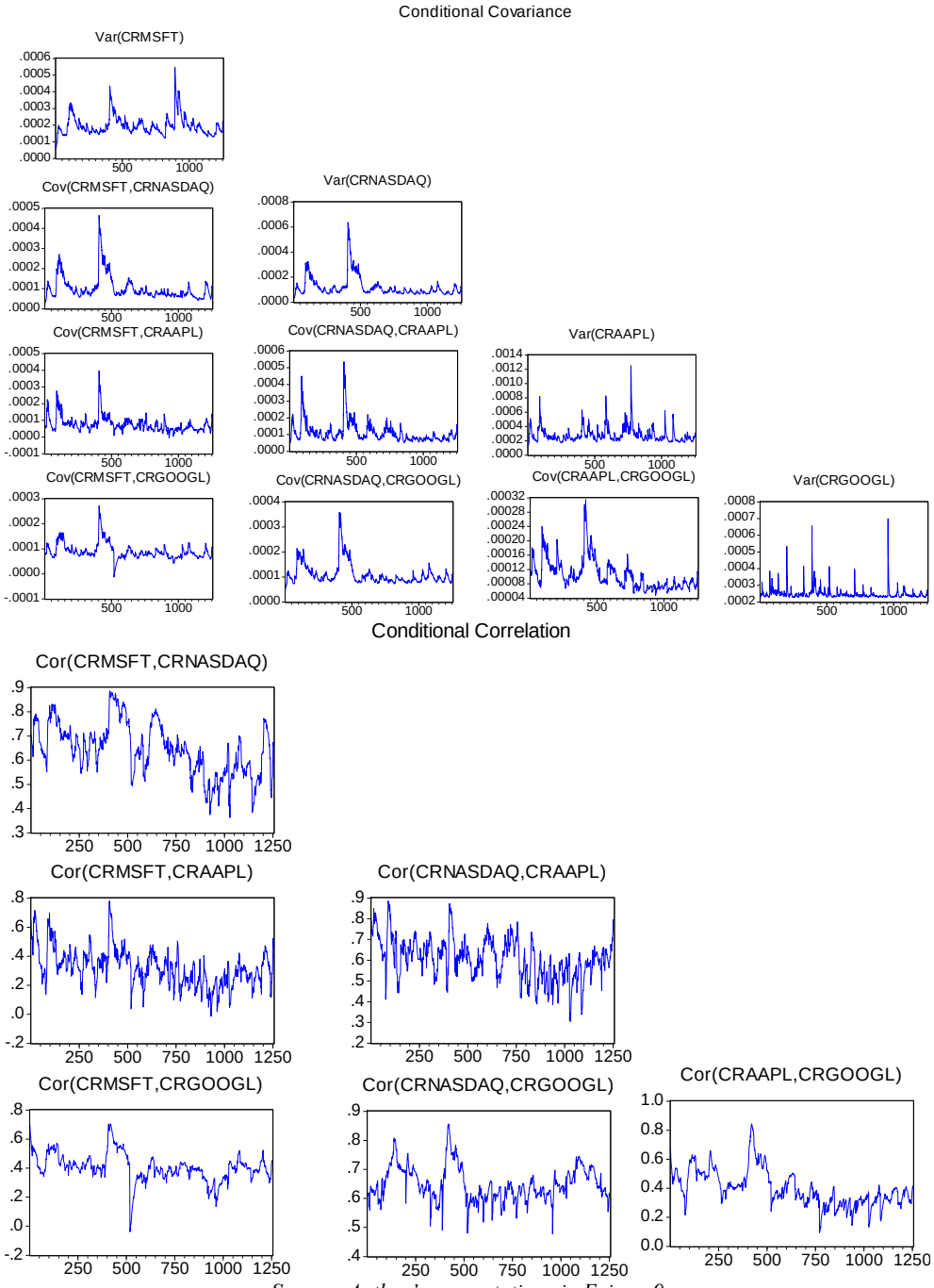
For alpha, the differences are very low and insignificant. Jensen (1968) studied the so-called “Jensen’s alpha” and found that when alpha is positive and significant then it can gain profits in excess or abnormal. The stocks analyzed don't have this effects because they come from US capital markets. It should be noted that the MU and CTSH stocks estimated using the GMM, the same as in the OLS, the model is not valid, a fact claimed by both associated *P-value* of t-Student test and by correlation coefficient R^2. This suggests that for these two stocks, the expected return is not affected by variation of NASDAQ market return but by other factors. For AAPL share it can be considered that an increase of the market return with one percentage point will lead to an increase of 0.87973 for the estimated returns. The beta indices obtained by OLS and GMM estimation methods, are based on historical returns and are "backward-looking". As investors, it is of interest a beta which can capture what will happen to those shares in the future. GARCH multivariate models to estimate beta fulfill these conditions. More specifically, by using GARCH models is estimated the evolution of the covariance over time. The Q-stat of Ljung–Box test is bigger than critical value $\chi^2_\alpha(m)$ for five degrees of freedom and hence, the null hypothesis is rejected and it is accepted that the residues are not from a white noise process.

Table no. 8 – The GMM estimation results

Dependent Variable	$\widehat{\boldsymbol{\beta}}$	Std. Err	t-Stat	Prob.	R^2	DW
AAPL	**0.880**	0.042	20.755	0.000	0.390	1.921
MSFT	**0.806**	0.024	33.033	0.000	0.453	1.967
GOOGL	**0.861**	0.027	31.554	0.000	0.442	1.934
INTC	**0.884**	0.037	23.886	0.000	0.457	2.016
CSCO	**0.886**	0.035	25.442	0.000	0.376	1.980
QCOM	**0.898**	0.036	24.788	0.000	0.461	1.964
BIDU	**1.389**	0.052	26.912	0.000	0.371	2.048
TXN	**1.016**	0.041	24.840	0.000	0.581	2.187
YHOO	**0.971**	0.047	20.606	0.000	0.349	1.965
ADP	**0.730**	0.019	38.482	0.000	0.640	2.181
MU	**0.064**	0.106	0.604	0.546	-0.005	2.029
ADBE	**1.051**	0.032	33.342	0.000	0.409	2.204
CTSH	**0.034**	0.064	0.526	0.599	-0.003	2.123
AMAT	**1.148**	0.048	23.994	0.000	0.535	2.074
INTU	**0.893**	0.026	34.191	0.000	0.436	2.210
Dependent Variable	$\widehat{\boldsymbol{\alpha}}$	Std. Err	t-Stat	Prob.	$\widehat{\boldsymbol{\beta}}$ **OLS -** $\widehat{\boldsymbol{\beta}}$ **GMM**	
AAPL	**0.001**	0.000	2.791	0.005	0.044	
MSFT	**0.000**	0.000	0.571	0.568	0.021	
GOOGL	**0.000**	0.000	-1.481	0.139	0.063	
INTC	**0.000**	0.000	-1.089	0.276	-0.002	
CSCO	**0.000**	0.000	0.443	0.658	0.050	
QCOM	**0.001**	0.000	2.450	0.014	0.057	
BIDU	**0.000**	0.001	0.240	0.810	0.005	
TXN	**0.000**	0.000	-0.885	0.377	0.013	
YHOO	**0.000**	0.000	0.109	0.914	0.031	
ADP	**0.000**	0.000	1.314	0.189	0.019	
MU	**0.002**	0.001	2.524	0.012	-0.291	
ADBE	**0.000**	0.000	0.809	0.418	0.004	
CTSH	**0.002**	0.000	3.427	0.001	-0.066	
AMAT	**-0.001**	0.000	-1.628	0.104	-0.015	
INTU	**0.000**	0.000	0.477	0.633	-0.013	

Source: Author's computation in Eviews 7

The model GARCH-VECH [9] was proposed by Bollerslev *et al.* (1988). The conditions to be met by a GARCH's coefficients are: the coefficients of variance equation should be positive; the sum of the coefficients of the variance equation is less than 1. Otherwise, the model is integrated GARCH (I-GARCH), and the volatility is explosive. We have attached to Table 9 of Appendix the output of GMM estimation for Apple shares. It can be seen that all the estimated parameters are statistically significant and are therefore plausible. In Figure 12 we attached the volatility results from the application of GARCH-VECH model for shares AAPL, MSFT and GOOGL in comparison with the index NASDAQ.



Source: Author's computations in Eviews 9

Figure no. 9 – The results of GARCH-VECH

Conditional variance and *conditional correlations* show variability and dynamics of returns over time for shares analyzed. Thus it can be seen that present a high correlation for all three stocks (AAPL, MSFT, and GOOGL) relative to the NASDAQ market return.

Table no. 10 – GARCH results regarding the correlation and the volatility spillover

	Cor(CRMSFT,CRNASDAQ)	Cor (CRNASDAQ,CRAAPL)	Cor(CRNASDAQ,CRGOOGL)
Min	0.362365163	0.304562055	0.478440645
Max	0.885325084	0.885889011	0.856774586

Source: Author's computations in Eviews 7

In Table 10 we attached the results of GARCH-VECH estimation model regarding the correlation of returns for the three largest IT companies in the US market. From the CAPM model we have obtained that the returns for these three stocks are correlated with market return and that they have a subunitary beta which indicates a less volatility than the market volatility. The GARCH-VECH model can better test the implications of CAPM and see if there is a contagion at the level of volatility of the assets if they are interrelated and correlated and if there is the phenomenon of market *volatility spillover*. The contagion phenomenon is not clear from Table 10 because of the interval values being extended (0.36-0.88) but it can notes that all three stocks present a fairly high correlation with market volatility having an average value of 0.64. A moderate correlation exists between the three stocks. Similar results have been obtained by Song (2009) for the Chinese markets.

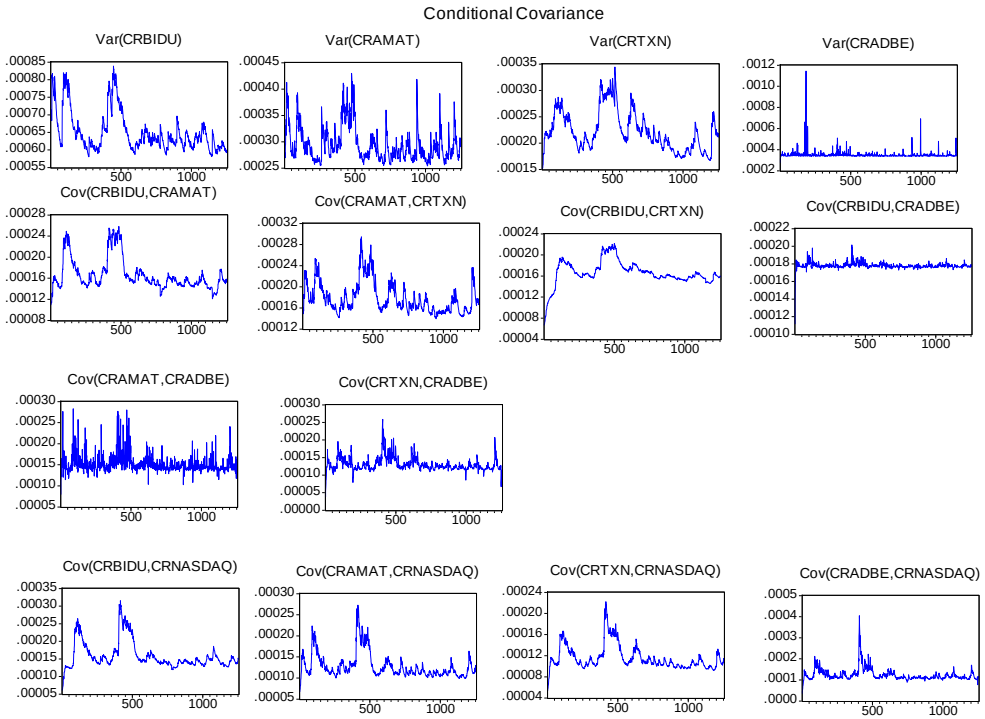
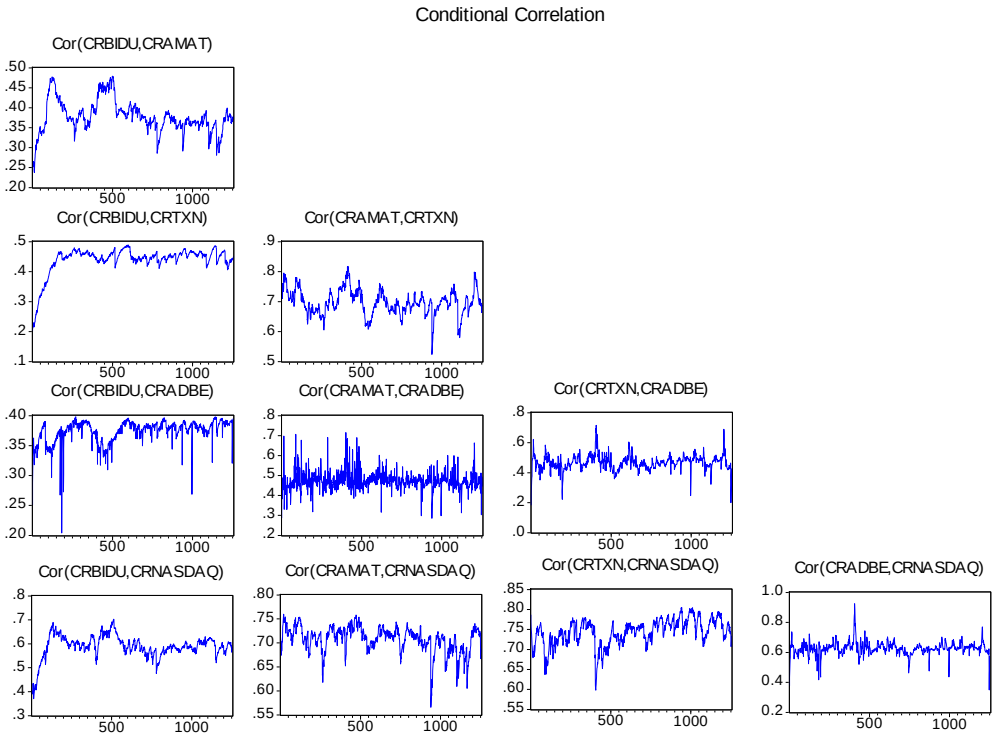


Figure no. 10 – The GARCH-VECH results for shares with supraunitary beta



Source: Author's computation in Eviews 7

Figure no. 10 – The GARCH-VECH results for shares with supraunitary beta (continuation)

In Figure 10 we applied GARCH-VECH model for stocks which had through CAPM model a supraunitary beta to try to identify the differences in the level of volatility compared to the stocks with beta subunitary.

Table no. 11 – The GARCH results regarding the correlation for stocks with beta supraunitary

	Cor(CRBIDU,CRNASDAQ)	Cor(CRAMAT,CRNASDAQ)
Min	0.37029026	0.565483333
Max	0.702809738	0.760040972
	Cor(CRTXN,CRNASDAQ)	Cor(CRADBE,CRNASDAQ)
Min	0.598237482	0.348600624
Max	0.804737161	0.925197176

Source: Author's computations in Eviews 7

From Table 11 it can be observed that at a correlation level with market volatility, the level is higher for shares with beta above 1 and for the ADBE share it can speak about a contagion having a high level of 0.92.

5. CONCLUSIONS

Beginning from the academic literature, we studied the classic CAPM model, theoretically and empirically, through econometric models. CAPM is easy to apply and is a reference point (a benchmark) for the valuation of stocks. We wanted to analyze if the NASDAQ component stocks from technological field, chosen in the quality of potential investors, are undervalued, overvalued or properly assessed. We also studied the linear connection between expected return and risk. From econometric models it resulted that from 15 stocks only two (CTSH and MU) could not be validated and we could not decide whether there is a linear relationship between return and risk. Except actions BIDU, TXN and MU we discovered that all stocks analyzed had a linear relation between expected return and market return. We estimated the beta index by using the OLS and GMM methods and for both variants we achieved similar results. Thus, for stocks BIDU, TXN, YHOO, ADBE and AMAT we obtained a beta greater than one indicating that an increase in market return will lead, by itself, to a greater growth of return for estimated assets. W obtained subunitary beta for stocks AAPL, MSFT, GOOGL, INTC, CSCO, INTC, INTU and ADP all of them being very large sized companies, some mature, which might explain why beta was subunitary. Investors know that a big and mature company is no longer expected to have a growth out of the blue and they don't hope for an abnormal return for such type of stocks. On the other hand, smaller companies have a riskier growth opportunities (beta higher than one) and as a result, it is expected from them a higher return. For MU and CTSH we could not identify a clear conclusion related to the risk associated with them. Compared to SML all shares were overvalued, a fact expected for IT companies because is a continuous development field and investors are expecting high earnings. We used GARCH-VECH model to track the volatility between the analyzed shares and NASDAQ index and we noticed that both classes of shares analyzed (beta over / under unit) had presented a high correlation with market volatility. We obtained even a contagion effect for ADBE share and it can speak about the phenomenon called volatility spillover. The results are not surprising because the analyzed stocks came from technology sector and their products depend on each other and hence they are interdependent, a fact reflected in the volatility level.

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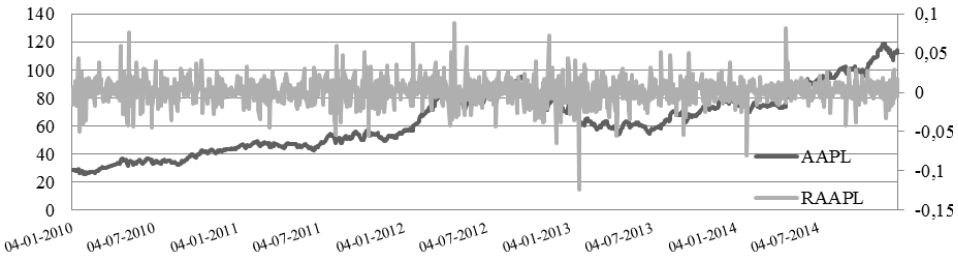
Appendix

Tabel no. 1 – NASDAQ Companies

Symbol	Name	LastSale	MarketCap	IPOyear	Sector
ADBE	Adobe Systems Incorporated	87.86	$ 43,824,510,803.1	1986	Technology
GOOGL	Alphabet Inc.	719.33	$ 493,126,070,663.1	n/a	Technology
AAPL	Apple Inc.	119.08	$ 679,080,135,760.0	1980	Technology
AMAT	Applied Materials, Inc.	16.44	$ 20,247,475,690.3	1972	Technology
ADP	Automatic Data Processing, Inc.	90.53	$ 42,169,790,887.8	n/a	Technology
BIDU	Baidu, Inc.	157.6	$ 43,665,064,184.0	2005	Technology
CSCO	Cisco Systems, Inc.	29.35	$ 148,548,958,090.8	1990	Technology
CTSH	Cognizant Technology Solutions Corp	68.83	$ 41,953,899,516.4	1998	Technology
INTC	Intel Corporation	34.9	$ 165,914,600,000.0	n/a	Technology
INTU	Intuit Inc.	97.94	$ 27,159,408,991.6	1993	Technology
MU	Micron Technology, Inc.	17.24	$ 18,678,430,226.7	n/a	Technology
MSFT	Microsoft Corporation	52.87	$ 422,320,968,346.2	1986	Technology
QCOM	QUALCOMM Incorporated	60.725	$ 95,411,252,866.3	1991	Technology
TXN	Texas Instruments Incorporated	58.98	$ 60,536,234,130.1	n/a	Technology
YHOO	Yahoo! Inc.	33.17	$ 31,225,934,229.1	1996	Technology

Source: http://www.nasdaq.com/screening/companies-by-industry.aspx?industry=ALL&exchange=NASDAQ&pagesize=200&page=3



Source: Authors' computation

Figure no. 2 – APPLE Return and price

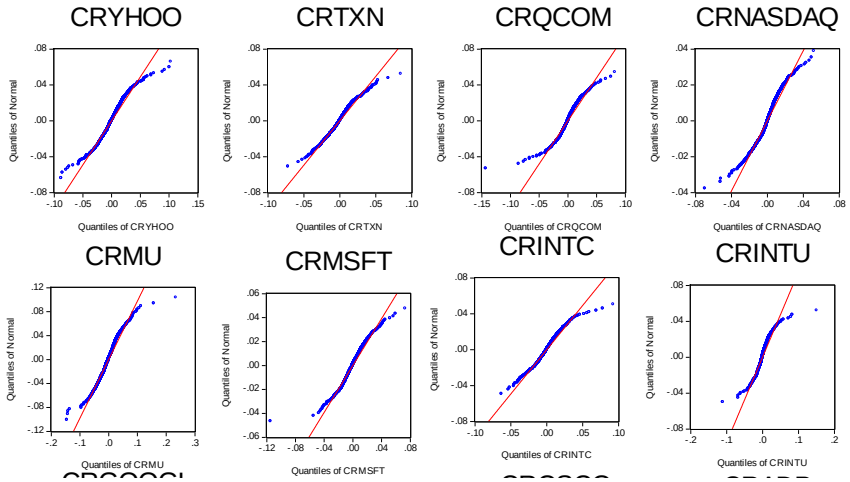
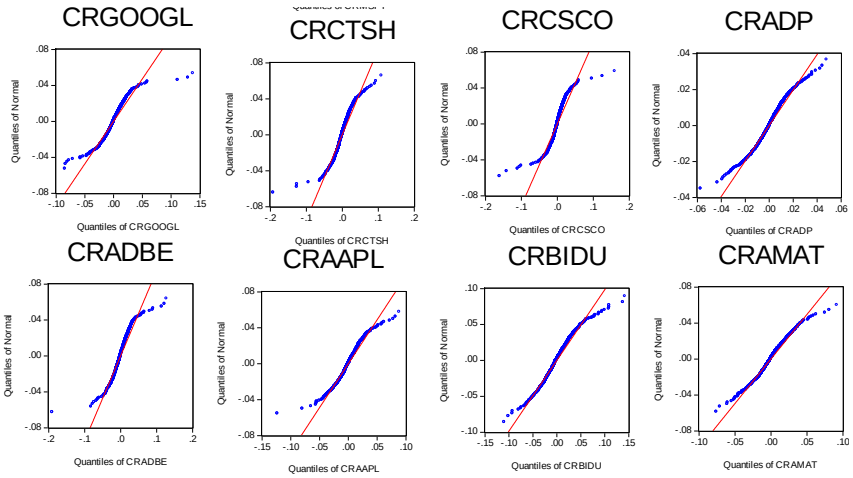
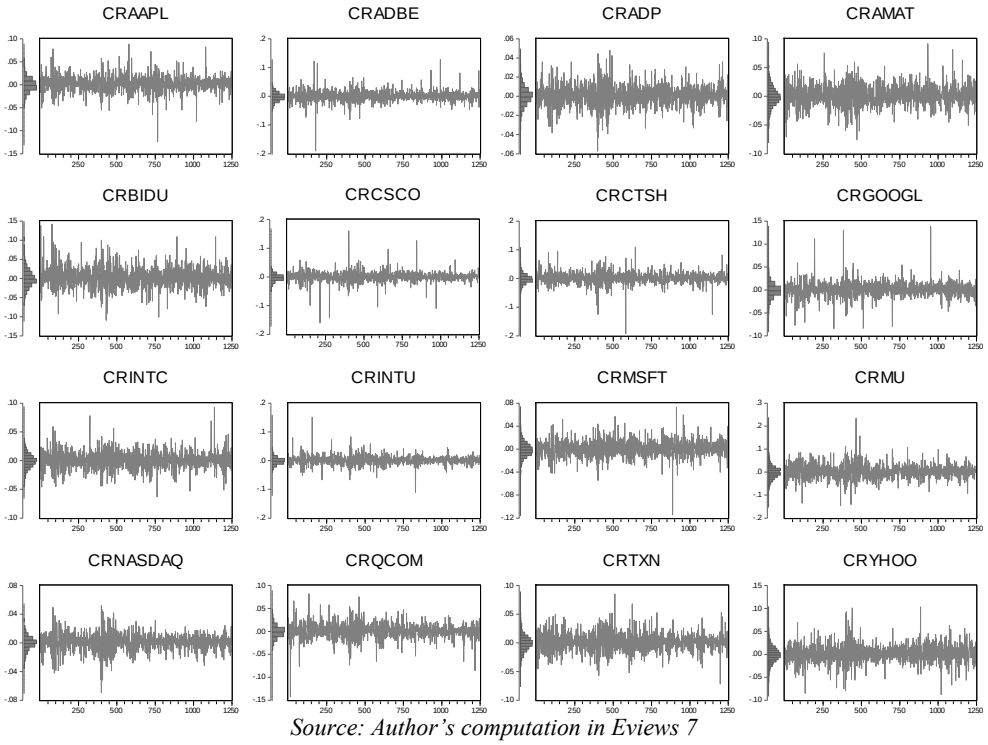


Figure no. 3 –The quantile distribution for the analyzed returns



Source: Author's computation in Eviews 7

Figure no. 3 –The quantile distribution for the analyzed returns (continuation)



Source: Author's computation in Eviews 7

Figure no. 7 – Graphical representation of series for stationarity

Table no. 9 – The GMM– Apple Stocks estimation

Dependent Variable: CRAAPL
Method: Generalized Method of Moments
Sample: 1 1255
Included observations: 1255
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed)
bandwidth = 8.0000)
Standard errors & covariance computed using estimation weighting matrix
Instrument specification: CRAAPL CRNASDAQ C

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRNASDAQ	0.879727	0.042387	20.75480	0.0000
C	0.001038	0.000372	2.791449	0.0053

R-squared	0.389561	Mean dependent var	0.001199
Adjusted R-squared	0.389074	S.D. dependent var	0.016881
S.E. of regression	0.013195	Sum squared resid	0.218146
Durbin-Watson stat	1.920895	J-statistic	59.04336
Instrument rank	3	Prob(J-statistic)	0.000000

Source: Author's computations in Eviews 7

Table no. 10 – The GARCH – VECH estimation

System: UNTITLED
Estimation Method: ARCH Maximum Likelihood (Marquardt)
Covariance specification: Diagonal VECH
Sample: 1 1255
Included observations: 1255
Total system (balanced) observations 5020
Presample covariance: backcast (parameter =0.7)
Convergence achieved after 177 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.000770	0.000384	2.003682	0.0451
C(2)	0.001021	0.000273	3.738892	0.0002
C(3)	0.001884	0.000428	4.405074	0.0000
C(4)	0.001002	0.000439	2.281330	0.0225
Variance Equation Coefficients				
C(5)	5.64E-06	9.27E-07	6.082627	0.0000
C(6)	2.49E-06	4.32E-07	5.780161	0.0000
C(7)	4.58E-06	1.39E-06	3.301556	0.0010
C(8)	3.77E-06	1.19E-06	3.162448	0.0016
C(9)	3.50E-06	5.80E-07	6.026188	0.0000
C(10)	5.93E-06	1.05E-06	5.642879	0.0000
C(11)	4.10E-06	5.56E-07	7.374525	0.0000
C(12)	2.15E-05	3.77E-06	5.702674	0.0000
C(13)	3.38E-06	1.07E-06	3.159204	0.0016
C(14)	5.75E-05	2.08E-05	2.766296	0.0057

C(15)	0.028202	0.004409	6.396092	0.0000
C(16)	0.035867	0.004235	8.468314	0.0000
C(17)	0.045403	0.007704	5.893652	0.0000
C(18)	0.020559	0.004408	4.664517	0.0000
C(19)	0.044767	0.004980	8.989173	0.0000
C(20)	0.051572	0.006661	7.742406	0.0000
C(21)	0.024783	0.003644	6.801170	0.0000
C(22)	0.059034	0.010804	5.464245	0.0000
C(23)	0.022769	0.005463	4.167468	0.0000
C(24)	0.024882	0.011030	2.255833	0.0241
C(25)	0.943781	0.007121	132.5302	0.0000
C(26)	0.937101	0.006949	134.8541	0.0000
C(27)	0.889566	0.022189	40.09045	0.0000
C(28)	0.936120	0.013467	69.51385	0.0000
C(29)	0.922290	0.008688	106.1586	0.0000
C(30)	0.890550	0.014444	61.65588	0.0000
C(31)	0.935944	0.007095	131.9133	0.0000
C(32)	0.863351	0.022823	37.82782	0.0000
C(33)	0.942961	0.013203	71.42153	0.0000
C(34)	0.744145	0.090795	8.195856	0.0000

Log likelihood	15448.16	Schwarz criterion	-24.42529
Avg. log likelihood	3.077323	Hannan-Quinn criter.	-24.51211
Akaike info criterion	-24.56440		

Equation: CRMSFT = C(1)

R-squared	-0.000330	Mean dependent var	0.000515
Adjusted R-squared	-0.000330	S.D. dependent var	0.014040
S.E. of regression	0.014042	Sum squared resid	0.247262
Durbin-Watson stat	2.003884		

Equation: CRNASDAQ = C(2)

R-squared	-0.001273	Mean dependent var	0.000614
Adjusted R-squared	-0.001273	S.D. dependent var	0.011425
S.E. of regression	0.011433	Sum squared resid	0.163903
Durbin-Watson stat	2.068280		

Equation: CRAAPL= C(3)

R-squared	-0.001646	Mean dependent var	0.001199
Adjusted R-squared	-0.001646	S.D. dependent var	0.016881
S.E. of regression	0.016895	Sum squared resid	0.357947
Durbin-Watson stat	1.958253		

Equation: CRGOOGL= C(4)

R-squared	-0.000915	Mean dependent var	0.000523
Adjusted R-squared	-0.000915	S.D. dependent var	0.015821
S.E. of regression	0.015829	Sum squared resid	0.314184
Durbin-Watson stat	2.013349		

Covariance specification: Diagonal VECH
GARCH = M + A1.*RESID(-1)*RESID(-1)' + B1.*GARCH(-1)
M is an indefinite matrix
A1 is an indefinite matrix*
B1 is an indefinite matrix*

Transformed Variance Coefficients

	Coefficient	Std. Error	z-Statistic	Prob.
M(1,1)	5.64E-06	9.27E-07	6.082627	0.0000
M(1,2)	2.49E-06	4.32E-07	5.780161	0.0000
M(1,3)	4.58E-06	1.39E-06	3.301556	0.0010
M(1,4)	3.77E-06	1.19E-06	3.162448	0.0016
M(2,2)	3.50E-06	5.80E-07	6.026188	0.0000
M(2,3)	5.93E-06	1.05E-06	5.642879	0.0000
M(2,4)	4.10E-06	5.56E-07	7.374525	0.0000
M(3,3)	2.15E-05	3.77E-06	5.702674	0.0000
M(3,4)	3.38E-06	1.07E-06	3.159204	0.0016
M(4,4)	5.75E-05	2.08E-05	2.766296	0.0057
A1(1,1)	0.028202	0.004409	6.396092	0.0000
A1(1,2)	0.035867	0.004235	8.468314	0.0000
A1(1,3)	0.045403	0.007704	5.893652	0.0000
A1(1,4)	0.020559	0.004408	4.664517	0.0000
A1(2,2)	0.044767	0.004980	8.989173	0.0000
A1(2,3)	0.051572	0.006661	7.742406	0.0000
A1(2,4)	0.024783	0.003644	6.801170	0.0000
A1(3,3)	0.059034	0.010804	5.464245	0.0000
A1(3,4)	0.022769	0.005463	4.167468	0.0000
A1(4,4)	0.024882	0.011030	2.255833	0.0241
B1(1,1)	0.943781	0.007121	132.5302	0.0000
B1(1,2)	0.937101	0.006949	134.8541	0.0000
B1(1,3)	0.889566	0.022189	40.09045	0.0000
B1(1,4)	0.936120	0.013467	69.51385	0.0000
B1(2,2)	0.922290	0.008688	106.1586	0.0000
B1(2,3)	0.890550	0.014444	61.65588	0.0000
B1(2,4)	0.935944	0.007095	131.9133	0.0000
B1(3,3)	0.863351	0.022823	37.82782	0.0000
B1(3,4)	0.942961	0.013203	71.42153	0.0000
B1(4,4)	0.744145	0.090795	8.195856	0.0000

* Coefficient matrix is not PSD.

Source: Author's computations in Eviews 7

Notes

[1] Theoretical form of econometric model CAPM: $E[R_{it}] - rf = \alpha_i + \beta_{i,M}(E[R_{Mt}] - rf)$.

[2] Econometric Sharpe Model: $R_{it} = \alpha_i + \beta_{i,m} \times R_{mt} + \varepsilon_{it}$.

[3] The determination report: $R^2 = 1 - \frac{SSE}{SST}$ it suppose the variance decomposition for y data series based on the influence of factors included in the model. It measures the intensity of the linear dependence of the endogenous variable (Y) with the regression factors (X). Its value increases with the number of exogenous variables used in the model.

[4] The classical linear regression model $yt = \alpha + \beta xt + ut$ presumes five properties to be fulfilled:

1) $E(ut) = 0$, residual variable (errors) have zero mean
2) $var(ut) = \sigma 2 < \infty$, the variance of the errors is unchanging over time (homoscedasticity) and finite over all xt.

[5] The Order 1 autocorrelation verifies the relationship: $\varepsilon_{t=} \rho\, \varepsilon_{t-1} + u_t$, where u_t is white noise (WN) and ρ is the linear correlation coefficient of first order for prior / current errors. Autocorrelation test is performed on residuals û.

[6] Through White Test must be verified the hypothesis regarding the unchanging variance of residues values (the variances are equal). So $VAR[\varepsilon_i] = \sigma_\varepsilon^2$(constant). Thus, $VAR[\varepsilon_i] = \sigma_i^2$ so the series is characterized by the homoscedasticity („the point cloud" does not have a linear strip form).

[7] $SE(\hat{\alpha})$; $SE(\hat{\beta})$ are the standard errors of the regression model $s = \sqrt{\sum_{i=1}^{n} \frac{r_i^2}{n-2}}$.

[8] The Chow test has the form $y_t = \beta_1 + \beta_2 x_2 t + \beta_3 x_{3t} + ut$. The results are follow from the perspective: SSE (RSS) - $\sum_t (yt - \widehat{yt})^2 = \sum_{i=1}^{n} \hat{u}_t^{\,2}$ sum of squared residues.

[9] It has the form: VECH (Ht) = C + AVECH (Ξt-1 Ξ't-1) + BVECH (Ht-1) where $\Xi t \mid \psi_{t-1} \sim N(0, Ht)$ and A, B, C are parameters. The model have to estimate 21 parameters (C has 3 elements, A and B have each one 9 elements). The operator VECH take "the top triangle" within the matrix and places its elements in a column vector. For matrix

$H_t = \begin{bmatrix} h11t & h12t \\ h21t & h22t \end{bmatrix}$ results $VECH(H_t) = \begin{pmatrix} h11t \\ h22t \\ h12t \end{pmatrix}$.

Instructions for authors

1. Submission of papers

Authors are invited to submit manuscripts reporting recent developments in their field. The paper must be an original unpublished work written in English that is not currently under review by other journals. All papers should be submitted electronically only, via our website (*http://saaic.feaa.uaic.ro/*). There are no submission or publication costs for authors.

Manuscripts should follow the format style of the journal. The papers should not exceed 30 pages, including figures and references. Detailed background information on the submission of papers and reviews can be found in the *Submission section*.

2. Format of papers

Abstract

The abstract will not exceed 150 words, in the Times New Roman font, 9 pts., italic, 0 cm indent. It will mention the aim of the paper, research goals and expected results. Please use a less technical language, able to provide an overview of the paper contents for people who have no special knowledge in the field.

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JEL classification: JEL1, JEL2, Please find it at the following address: http://aeaweb.org/journal/jel_class_system.html. The codes must be written with two digits, e.g. G21, L13 (Times New Roman, 9 pts.)

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