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HIGH-SPEED TECHNOLOGY TRADING INNOVATIONS AND CAPITAL MARKET PERFORMANCE IN BULGARIA[1]

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Abstract

The paper analyses the effects of technology-based innovative techniques on Bulgarian capital market -algorithmic trading, in general, and high frequency trading (HFT), in particular - from macroeconomic costs-benefits perspective. Overwhelmingly, empirical studies emphasize that HFT improves the quality of financial markets in terms of increased liquidity, lowered transaction costs and fast price discovery. On the other side, HFT can have potential destabilizing effects, especially on emerging markets, which require increased regulation. Against this background, the European Union (EU) has introduced new regulatory measures targeting HFT, in 2018, which require fast adaptation of all market participants. Empirically, the author argues that there is a relationship between HFT, increased market volatility, fall in trading activity, liquidity and market capitalization on the Bulgarian capital market following the global financial crisis, concluding that the reasons for the fall in capital market activity are not only purely economic. Last, it elaborates on prospective implications for the Bulgarian capital market after the implementation of the new EU regulation targeting HFT.

Keywords: algorithmic trading, liquidity, volatility, market capitalization, systemic risk, EU integration

JEL Classification: G12, G19, G23

1. Introduction

Technology-based innovative techniques may have an exorbitant impact on capital markets dynamics due to increased

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interdependencies among the various segments of these markets in terms of correlations among traded financial instruments. Various empirical studies (Sornette et al., 2011) point to the potential of HFT to provoke capital market bubbles and flash crashes. According to current analyses, HFT accounts for over 77% of transactions in the UK and to about 50% - 70% of all trading in US equity markets (SEC, 2010; Kirchner, 2015; TABB Group, 2009). For Europe, HFT accounts from 24% to 43% of equities trading volume and from 58% to 76% of overall number of orders (ESMA, 2014). HFT involves processing large volume of market data in a very short time horizon (i.e. measured in milliseconds), in order to identify patterns for future price changes and derive profitable opportunities by submitting, modifying, cancelling market trade orders in less than 7 microseconds. HFT is a subset of algorithmic trading using IT programs to execute high velocity trading activity through trade execution mechanism, identifying the best time, venue and order size (Kirchner, 2015).

HFT can run counter to the existing traditional Fama (1970) approach to efficient financial markets and according to Grossman & Stiglitz (1980) there is inherent contradiction in the strong-form efficiency that no investors could have monopolistic access to stock price information to predict price movements. HFT is a form of arbitrage (i.e. variations of statistical arbitrage, Khandani & Lo, 2007). It aims to generate short-term profits based on high-speed processing of large massifs of publicly available data (about large numbers of liquid shares of stock traded simultaneously at different trading venues) and IT infrastructure innovations (complex algorithms, machine learning etc.), and to generate numerous orders which can be cancelled shortly afterwards and end the trading day on possibly flat positions to avoid commitment of capital and portfolio risks (Jovanovic & Menkveld, 2012). Thus, HFT can potentially lead to generation of a huge volume of orders at high cancellation rates (reaching 90 % or even more).

According to Government Office for Science (2011), HFT is differentiated from arbitrage strategies in that the latter principally aim to contain or hedge risks. HFT generally involves a mixture of speculative strategies (i.e. passive market making, structural, directional, statistical, cross-venue, instrument arbitrage; latency arbitrage, liquidity detection, cross-assets, cross-markets, rebate driven strategies etc.), without taking into consideration fundamental

reasons for changes in stock prices but looking at arbitrage price discrepancies instead.

2. Methodology and data

The integration of the Bulgarian capital market into the EU supports the optimal allocation of capital and is of utmost importance for increasing the economic growth and competitiveness of the country. This process is a result of the joint action of institutional structures and market participants and requires further action by all stakeholders to overcome the limitations to Bulgaria's capital market in the integration process. The Bulgarian capital market remains small in size and insufficiently integrated into EU capital markets – a "periphery market" - after 10 years of fully-fledged membership, against the backdrop of consolidation processes on EU stock exchanges. Driving factors behind these processes are the need to diversify stock exchange revenues to mitigate the risks of the global financial and economic crisis and the subsequent debt crisis in the Eurozone.

The market capitalization on the Bulgarian stock exchange marked an upward trend in the period 2004-2007, before the global financial crisis has started (GFC) (Table 1, Appendix).

As Table 1 shows, the capital market is an alternative financial intermediation channel, with the market capitalization to GDP ratio reaching around 50% (according to BSE) in 2007. After this period there was a decline in market capitalization/GDP in the course of the effects of the financial and economic crisis and the withdrawal of foreign investors from the capital market of the country. Since the global financial crisis has started, market capitalization as a share of GDP continued to decline, reaching 10.89% of GDP by 2016 and then rising up to 24.08 % in 2017, but remains very low as compared to Eurozone countries (an average of 64.41% in 2016), according to ECB (2016). In empirical studies, the capitalization rate is seen as a measure of stock market development (Levine and Zervos, 1998). Low liquidity is a major flaw of the capital market in Bulgaria (Table 2, Appendix). The main factors that have negatively affected the liquidity refer to the small volume of freely traded shares (free float), the outflow of foreign investors from the Bulgarian capital market in the course of the financial and economic crisis and the deteriorating institutional and business environment with high level of corruption.

The total number of issues of financial instruments in the markets of BSE reported a decrease over the years: 557 (2008), 555 (2009), 528 (2010), 507 (2011); 496 (2012); 495 (2013) and 425, (2016) and 419 in 2017. Due to the combination of institutional weaknesses and poorly developed business environment, a number of large Bulgarian companies chose to list their securities abroad, mainly on the Warsaw stock exchange. Since 2008, the activity of investment intermediaries has decreased, analysed by number of concluded deals and realized turnover. It is related to the ongoing financial and economic crisis, the lack of liquidity on the capital market and the absence of diversified financial instruments. Moreover, in 2017, the number of stock exchange members decreased to 47, of which 5 are foreign entities. The global financial and economic crisis had a negative impact on the Bulgarian economy. In 2007, foreign investors owned 42% of the securities traded on the Bulgarian stock exchange, while after 2008 their share dropped to less than 15%. Restricted access to finance led to shrinking investment activity in almost all sectors of the economy, with gross capital formation falling by over 23.2%. Thus, the Bulgarian capital market is becoming a risk element of global financial markets. The restrictive monetary and credit policy under the terms of currency board created conditions for dependence of the investment process on external capital flows.

The paper has a twofold objective. The first one is to analyse the effect of HFT activity on the Bulgarian stock exchange for the period 2000-2017. Second, to prove empirically that the reasons for the falling stock market capitalization, deteriorating liquidity, squeezed trading volumes and increased volatility are not all purely economic, but can partially be explained by institutional weaknesses and technological advancements.

Theoretically HFT can be measured by proxies of trading activity as:

1) stock-based approach as statistics on large volumes of order placements and cancellations, order to trade ratio (Brogaard et al., 2014; ESMA 2014) providing upper bound on HFT activity. In USA high order to trade ratios are proxy for HFT activity (or message traffic activity). According to ESMA estimations (2014) in EU the median unweighted order to trade ratio is 18, 1st quartile is around 3 and 3rd quartile is about 64. Thus if 10% of order modifications and cancellations in any stock are faster than 100 ms, the trading activity

is classified as HFT by ESMA report (2014). Under this approach ESMA has established that the median HFT activity in EU ranges between 31 % and 52 %.

2) direct (or institution-based) approach based on identification (flagging) of HFT firms (ESMA, 2014) providing lower bound on HFT activity. ESMA (2014) has established that under this approach HFT accounts for 21 % to 30 % on 9 EU stock exchanges.

3) collocation is a proxy for HFT activity and according to ESMA estimations (2014) it accounts for about 75 % of value traded in EU. Using the advantages of co-location and physical proximity in direct data feed Menkveld (2012) defines HF traders as "modern market makers" who are generally gaining millisecond speed advantages from co-location.

Following the methodology of Laube et al. (2013) the introduction of the electronic trading platform Xetra in 2008 on the Bulgarian stock exchange is used as an exogenous market structure change (instrumental variable) to identify HFT activity because it is particularly designed to respond to the needs of HFT. Main indicator of HFT activity is putatively increased electronic messages flow for 2008 onwards after the introduction of the electronic trading platform Xetra. However, this direct indicator of HFT is unobtainable for the Bulgarian capital market because it cannot be publicly accessible. For that reason, the present research uses the following proxies for HFT:

Firstly, HFT based on the per cent of shares held by institutional investors in total trading volume. The database from OECD (2017) shows the following institutional statistics for assets (in %) held by institutional investors:

Table 3

Financial assets as % held by institutional investors

	2009	2010	2011	2012	2013	2014	2015	2016
Czech Republic	3,8	4,2	3,7	4,1	4,6	5	5,3	6,7
Greece	3,7	3	2,1	2,5	2,8	2,7	2,4	2,3
Hungary	11,4	13,8	11	11,5	14,7	16,5	16,3	15,8
Slovenia	6,2	6,3	4,9	5,1	5,1	5,7	6	6,1
USA	85,8	89,3	86,1	94,4	105,8	108,2	103	106,3

Source: author's compilations based on OECD Institutional Statistics, 2017

The Bulgarian supervisory authority, however, does not collect and store information about the share of institutional investors holdings in total outstanding shares and trading volume, so the estimations have been based on the average values for Central and Eastern Europe EU member states above (Table 3). During the period 2000 – 2017 the per cent of HFT on the Bulgarian stock exchange could be estimated to vary from the lowest 57,5 % (2007) to the highest 96 % (2012). For estimations purposes, the analysis is based on empirical findings of Zhang (2010) who is calculating HFT using the following formula:

HFT = Total Turnover – (Total Turnover x per cent of institutional holdings in shares outstanding+ Total Turnover x per cent of retail holdings in shares outstanding)   (1)

Since the retail investors on the Bulgarian stock exchange are holding negligible share in total shares outstanding, only institutional holdings data, averaged on the data from OECD for CEE EU member countries has been used.

Secondly, HFT based on ESMA approximations (ESMA, 2014): ESMA empirical analyses show that HFT accounts for 24 % of value traded (HFT flag approach) to 43 % of the lifetime of orders (or order to trade ratio) approach as stock based measure. For the number of trades corresponding HFT activity is estimated between 30% and 49% and for number of orders between 58% and 76%.

Thirdly, HFT based on collocation: from the total sample of 43 stock exchange members in 2017, 17 members have head offices located within 1 mile (1,6 km) from the building of the Bulgarian Stock Exchange. Thus, potentially these intermediaries on the stock exchange could have been presumed to engage in HFT. Due to the very wide variation in prospective HFT contained in proxies 1) to 2) above, in the present research has employed HFT approach based on collocation. This approach is based on ESMA theoretical and empirical results (2014), where most HFT activity (within the sample of 100 stocks from 9 EU countries) has been found to be linked to market participants using collocation services. According to Gomber et al. (2015) using direct market access registered stock exchange members may use various discount fees (asymmetric pricing schemes) to generate trading volume and incentivize liquidity provision. For Allen (2016) profit-driven exchanges do not prioritize the regular and traditional long-term investors but traders as HFT

generating higher trading volumes and paying for preferential access via co-location, thus implicitly harming retail investors who do not have this privileged access. This creates the problem of conflict of interest (Arnuk & Saluzz, 2012): stock exchanges have the incentive to sell preferential access to generate additional profits from collocation fees but they also have obligations to provide equitable and fair access to all market participants on the trading venue. The annual turnover of these 17 member intermediaries on BSE has been estimated on average to represent around 77 % of the turnover of all stock exchange intermediaries for the period 2008-2017 in Bulgaria and the equation (1) has been corrected as follows in order to arrive at approximate HFT based on trade value:

HFT = Total Turnover – (Total Turnover x % of institutional holdings) (Total Turnover x per cent of non-proximity stock exchange member holdings) (2)

The methodological estimations of HFT on the Bulgarian capital market require as a first step the application of logit regression method which is a type of probabilistic statistical classification model. The dependent variable is categorical binary variable for HFT (in which 1 is "there is HFT activity" and 0 is "lack of HFT activity" on the Bulgarian capital market). The independent variable X is "the distance in km from the stock exchange" calculated in ln. The aim is to test how distance in km (i.e. collocation) affects HFT.

2. Empirical Results about High Frequency Trading and Stock Market Performance in Bulgaria

The main results from the logit regressions indicate the following:

Table 4

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	,000[a]	,728	1,000
a. Estimation terminated at iteration number 18 because a perfect fit is detected. This solution is not unique.			

Source: author's calculations

From Table 4, which presents the Cox & Snell R Square and the Nagelkerke R Square as methods of calculating the explained variation (also referred to as "pseudo R^2"), it is clear that the values

indicate that the explained variation in the dependent variable Y "HFT incidence" based on the logit regression model range from 0,728 to 1. The likelihood ratio of 0,000 is a proof of the goodness-of-fit statistics of the model, similar to Pearson's chi-square presented below.

Table 5

Classification Table[a,b]

Observed			Predicted		
			HFT		Percentage Correct
			No Collocation	Collocation	
Step 0	HFT	No Collocation	27	0	100,0
		Collocation	15	0	,0
	Overall Percentage				64,3
	a. Constant is included in the model.				
	b. The cut value is .500				

Source: author's own calculations

From Table 5 it is obvious that the "cut value" is 0,500, meaning that if the probability of a case being classified into the "Collocation" category is greater than 0,500, then that particular case is classified in the "HFT incidence" (Yes = 1) category. The overall correct percentage of predicted probability of Collocation is 64,3 % and in that case the estimated probability of HFT occurring (taking place) based on collocation is 64,3 % (> than the cut value 0,500), classifying the event HFT as likely to take place or to occur.

Table 6

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-0.588	0,322	3,332	1	0.068	0.556

Source: author's own calculations

From table 6 above, the Wald statistics which is used to determine the statistical significance of the independent variable "Collocation", which is 0.068 (>0.05) and indicates that the independent variable does not add significantly to the model. The odds of having HFT incidence is 0,556 (Exp(B)) greater with decrease

in physical proximity of stock exchange intermediary head office by 1 km to the stock exchange building.

Converting odds to probabilities:

Y est. = ODDS/ (1+ODDS) = 0.556/ (1.556) = 0.3573, or 36 % probability of having HFT incidence with decrease in physical proximity of stock exchange member to the stock exchange.

Table 7

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	**Step**	54,748	39	0.048
	Block	54,748	39	0.048
	Model	54,748	39	0.048
Hosmer and Lemeshow test		0.000	1	1.000

Source: author's own calculations

The logit regression was performed to ascertain the effect of collocation (or "physical proximity") of stock exchange intermediaries to the stock exchange on HFT incidence on the Bulgarian capital market. The logistic regression model is statistically significant (Table 7 above), since χ^2 is 54,748, with Sig. 0.048 < α = 0.05. The logit regression model explains 100 % (Nagelkerge R^2) of the variance in HFT incidence and correctly classifies 64,3 % of the cases of collocation. Thus 1 km in physical proximity of stock exchange intermediary premises to the stock exchange leads to 0.556 greater probability of HFT incidence associated with it, although it is not statistically significant (Sig. =0.068 > α = 0.05). The Hosmer and Lemeshow goodness of fit test statistics has Sig. 1> 0.05 and we cannot reject the null hypothesis that there is no difference between the observed and model-predicted values of the depended variable. The model does not predict values significantly different from the observed values.

Overall, the logit regression model described above can be concluded to be valid, because it has observed the four assumptions for validity of results:

1) the dependent variable "HFT incidence" is measured on a dichotomous scale (presence "1" or lack "0" of HFT).

2) the independent variable is "collocation" and it is a continuous variable for distance in km from stock exchange members' premises to stock exchange building. In the sample of 43

intermediaries, 17 are located within 1 mile (1,6 km.) from the stock exchange.

3) the analysis is based on independence of observations and the dependent variable "HFT incidence" has mutually exclusive and exhaustive categories.

4) linearity of the relationship between the continuous independent variable and the logit transformation of the dependent variable has been proved as follows:

The applied **Jarque**-**Bera test** as a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution shows the following statistics: for HFT incidence variable Jarque-Bera p =0.0258974 < α = 0.05). For Collocation variable the Jarque-Bera p = 0.232821 which is an indication for divergence from the normality criterion. In order to test whether this departure from the assumption of normality is moderate, log-linear regression model has been applied. The results are as follows:

Table 8

Correlations

	HFT Incidence	**Collocation in km**
Pearson Correlation HFT	1,000	-0.786
Pearson Correlation Collocation in km	-0.786	1,000

Source: own calculations

From Table 8 above, the negative correlation coefficient between HFT and collocation of -0.786, indicates significant negative relationship, shows that the increase in distance expressed in km leads to decrease of the HFT incidence and vice versa, the decrease in physical proximity in km leads to increase in HFT incidence.

Table 9

ANOVA

Model	**Sum of squares**	**df**	**F**	**Sig.(p value)**
Regression	5,955	1	69,19851	2,43e-10
Residual	3,688	40		
Total	9,643	41		

Source: own calculations

Table 9 above shows that the Ordinary Least Square Model estimating the dependence between HFT and collocation in km is adequate, since Sig. = 0.000 < α = 0,05).

Coefficients

Model	Unstandardized coefficients		t	Sig.
	B	Standard error		
Constant	0,777352	0,0670340	11,60	1,60e-014***
Collocation in km	-0,438724	0,0527404	-8,319	2,43e-010***

Source: own calculations

From Table 10 above it is clear that Sig.2,43e-010, the t-test is robust and not sensitive to moderate departures from the assumption of normality. Since the sample size is large enough (the number of tested stock exchange intermediaries is 43 > 30 observations), then we can conclude that the fourth requirement for linearity has been met.

The co-integration regression model of the relationship between "HFT incidence" and "Collocation" in km. shows the following results:

Table 11

Engle-Granger Cointegration regressions with dependent variable HFT incidence (1ˢᵗ lagged order with constant and trend)

	coefficient	standard error	t-statistics	p-value
Constant	1,05500	0,0724416	14,56	1,39e-017***
Collocation in km.	-0,224901	0,0564000	-3,988	0,0003***
time	-0,0215983	0,00396791	-5,443	2,86e-06

Source: own calculations

Unit root test in HFT(1-st differences) incidence variable: asymptotic p-value $0,0005009 < \alpha = 0,05$. Accept stationarity or unit root.

Unit root test in Collocation variable (1-st differences): asymptotic p-value $0,00001 < \alpha = 0,05$. Accept -stationarity

The unit root test in the residuals around the estimated values of the tested variables (augmented Dicky Fuller test) shows the following asymptotic p-value of $0,04711 < \alpha = 0,05$. → Accept stationarity in the residuals. The co-integration coefficient of determination is $R^2 = 0,786264$ and $R^2_{adj.} = 0,775577$.

From Table 11 above, the regression is as follows:

HFT incidence = 1,005500 + (-0,224901) Collocation in km + (-0,0215983) time (3)

It can be concluded that the influence of the parameters in front of the Constant, "Collocation in km" and "Time" are significant at 5 % level of significance and that there is co-integration among the two variable series "HFT incidence" and "Collocation in km".

The application of the Engle-Granger co-integration test only with constant, constant and trend, and without constant and trend leads to the conclusion: acceptance of the null hypothesis of stationarity in the two variables and the residuals of the co-integration regression. The evaluated variables are co-integrated.

As a second estimation technique, a linear regression model (OLS) has been employed to test for linear relationship between the independent variable HFT and the variables: liquidity ratio, market capitalization to GDP ratio and volatility ratio. The application of Engle-Granger co-integration regressions goes through the following algorithm:

- testing for stationarity for each of the variables (dependent and independent ones) using the Augmented Dickey-Fuller criterion and the following equation:

$$Y_t = a_0 + a_1 * x_t + e_t \tag{4}$$

- estimating the parameters of the econometric model by using the Least Squares method.

-estimating the residuals around the estimated values of the variables using the formula:

$$e_t = y_t - \breve{y}_t \tag{5}$$

- testing for zero hypothesis of stationarity among the residuals of the variables using the following formula:

$$e_t = \theta * e_{t-1} + u_t \tag{6}$$

The application of the above outlined algorithm leads to the following results:

A. Unit Root test (Dicky – Fuller test) results:

Table 12

Unit root test estimations for stationarity

Market capitalization ratio	HFT	Liquidity Ratio	Volatility Ratio
Unit root test first differences second lag order: asymptotic p-value 0,002371< α = 0,05. Accept stationarity.	Unit root test first differences second lag order: asymptotic p-value 0,005009< α = 0,05. Accept of stationarity.	Unit root test first differences second lag order: asymptotic p-value 1.396e-19< α = 0,05. Accept stationarity.	Unit root test first differences second lag order: asymptotic p-value 0,0004551< α = 0,05. Accept stationarity.

Source: own calculations

B. Least Square regression test estimations

Table 13

Regressions with dependent variable Market capitalization ratio (2nd lagged order)

	coefficient	standard error	t-statistics	p-value
Constant	3,73921	1,83563	2,037	0,0610 *
HFT (first differences)	−0,793249	0,171362	−4,629	0,0004 ***
$R^2 = 0,604836$ $R^2_{adj.} = 0,576610$ F (1,14) 21,42832 P – value (F) 0,000390				

Source: own calculations

As Table 13 indicates, the coefficient of determination is R^2= 0,604836 and its alternative adjusted value $R^2_{adj.}$ = 0,576610 show that the model explains about 60 % in the variation of the dependent variable market capitalization with changes in the independent variable HFT. The model indicates negative relationship between the variables – thus 1 % increase in HFT leads to 0.7932% decrease in market capitalization ratio, all else held constant. The t-test Sig.= 0.0004 is indicative of statistical significance of the regression model. The Least Square Model estimating the dependence between Market capitalization ratio and HFT is adequate (F – test), since p = 0,000390 < α = 0,05. Theoretically ESMA (2014) has established from a study of 9 EU countries that level of HFT activity increases with the market capitalization of stocks. Here the results are indicative of underdevelopment of the Bulgarian capital market and the negative consequences of HFT on it.

Table 14
Regressions with dependent variable Volatility ratio (3rd lagged order)

	coefficient	standard error	t-statistics	p-value
Constant	−3,96878	2,86823	−1,384	0,1881
HFT (first differences)	0,701955	0,267758	2,622	0,0201**
$R^2 = 0,32927$ $R^2_{adj.} = 0,281361$ F (1,14) 6,872782 P – value (F) 0,020113				

Source: own calculations

According to Table 14, the coefficient of determination is $R^2 = 0,32927$ and its alternative adjusted value $R^2_{adj.} = 0,281361$ show that the model explains about 30 % in the variation of the dependent variable volatility ratio with changes in the independent variable HFT. The model indicates positive relationship between the variables – thus 1 % increase in HFT leads to 0.7019% rise in volatility ratio, all else held constant. This is in line with empirical findings of Zhang (2010) who also established that this positive correlation appears to be specifically pronounced under conditions of market uncertainty. Other studies that point to increased volatility due to HFT after 2005 are: Boehmer et al. (2015); Benos & Segade (2012), Caivano (2015), Jarrow and Protter, 2011. The t-test Sig.= 0.0201 is indicative of statistical significance of the regression model. The Least Square Model estimating the dependence between volatility ratio and HFT is adequate, since p value is 0,020113 < α = 0,05).

Table 15
Regressions with dependent variable Liquidity ratio (2nd lagged order)

	coefficient	standard error	t-statistics	Sig.(p-value)
Constant	53,146	4,067	13,068	0,000
HFT (first differences)	-0.572	0,073	-7,793	0,000
$R^2 = 0,890$ $R^2_{adj.} = 0,778$ F (1,16) 60,727 P – value (F) 0,007				

Source: own calculations

As per Table 15 above, the coefficient of determination is $R^2 = 0.890$ and its alternative adjusted value $R^2_{adj.} = 0,778$ show that the

model explains over 80 % in the variation of the dependent variable liquidity ratio with changes in the independent variable HFT. The model indicates negative relationship between the variables – thus 1 % increase in HFT leads to 0.572 % decrease in liquidity ratio, all else held constant. The t-test Sig.= 0.000 is indicative of statistical significance of the regression model. The Least Square Model estimating the dependence between volatility ratio and HFT (F - test) is adequate, since p - value is 0,007 < α = 0,05. These results are in line with the findings of Chaboud et al. (2011) which point to HFT and its negative impact on liquidity especially in turbulent times and through cross-sectional correlations among markets. Also Brogaard et al. (2015) have found negative relationship between liquidity and HFT due to adverse selection costs of limit orders for slower traders when HF traders act as liquidity takers (especially in times of market uncertainty) This has been also confirmed by Yamamoto (2015).

Table 16

Co-integration regressions with dependent variable HFT (2nd lagged order)

	coefficient	standard error	t-statistics	p-value
constant	0,306667	0,674887	0.4544	0.6565
Dummy variable for 2008 (introduction of Xtera)	41,3933	2,69955	15.33	3,80e-010***
R^2 = 0.943801 $R^2_{adj.}$ = 0.939787 F (1,16) 60,727 P – value (F) 0,007				

Source: author's estimations

Table 16 above shows that the coefficient of determination is R^2= 0.943801 and its alternative adjusted value $R^2_{adj.}$ = 0.939787 show that the model explains about 94% in the variation of the dependent variable HFT with changes in the independent dummy variable. The model indicates positive relationship between the variables – thus the introduction of Xetra in 2008 on the Bulgarian stock exchange led to rise in HFT by about 41,39 %, all else held constant. This is consistent with the findings of Laube et al. (2013) who found that the introduction of Chi-X MTF in European stock markets increased the number of messages by an average of 31,346 messages per day due to this exogenous stock market change and the effect is more pronounced for large volume stocks. Thus

introduction of Xetra on the Bulgarian capital market can serve as a reliable exogenous proxy for the identification of HFT activity. The t-test Sig.= 3,80e-010 is indicative of statistical significance of the regression model. The Least Square Model estimating the dependence between HFT and dummy variable for 2008 (the implementation of the electronic trading platform Xetra) is adequate, since p - value is 3,80e-10 < α = 0,05).

C. Correlation estimations among tested variables is as follows:

Table 17

Correlations Matrix (Pearson Correlation, Sig. 2-tailed)

	Liquidity Ratio	Volatility Ratio	Market Capitalization Ratio	HFT
Liquidity Ratio	1	0.617** (Sig. 0.006) VIF stat = 1	-0.250 (Sig. 0.318) VIF stat = 1.06	-0.890** (Sig. 0.000) VIF stat = 4.784
Volatility Ratio	0.617** (Sig.0.006)	1	-0.433 (Sig. 0.073)	-0.380 (Sig. 0.119)
Market Capitalization Ratio	-0.250 (Sig. 0.318)	-0.433 (Sig. 0.073) VIF stat.= 1.000	1	0.011 (Sig.0.965)
HFT	-0.890** (Sig. 0.000)	-0.380 (sig. 0.119)	0.011 (Sig. 0.965)	1

Source: author's estimations

From Table 17 above it can be concluded strong negative correlation is exhibited between HFT and liquidity ratio, which is statistically significant (Sig. 0.000 < α = 0.05). The VIX statistics does not denote presence of statistically significant collinearity between the tested variables.

3. Macroeconomic Consequences of Technology-Based Innovative Techniques

3.1 Macroeconomic and Social Welfare Gains

The traditional academic literature on HFT has identified the following macroeconomic and social welfare gains from HFT so far:

A. HFT reduces transaction costs and boosts price discovery

Proponents of HFT generally emphasize the potential of HFT to boost liquidity on stock markets with concomitant positive effects on transaction costs reduction and increased price discovery (Hendershott & Riordan, 2009; Hendershot, Jones and Menkveld, 2010; Menkveld, 2011) on liquid and deep markets as NYSE and Nasdaq based on increased variance ratios as a causal effect of algorithmic trading due to increased information getting into prices and reducing the noise (errors or transitory component) in prices, which is consistent with theoretical models of informed trading (Kyle, 1985).

Specifically, for the capital market performance in Bulgaria, it can be concluded that this positive effect has not been realized. HFT is associated with fall in liquidity ratio (see table 15) and deterioration in the price discovery process.

B. HFT improves market quality (measured by volume, spread, volatility, price efficiency)

The mechanism for improved market quality has been theoretically described as follows: the increased liquidity (Soronette & von der Becke, 2011) boosts trading volumes, narrows bid-ask spreads, and thus reduce stock price volatility (Brogaard, 2011; Hasbrouck & Saar, 2012). The positive externalities from this process are: increased social value of information through price discovery and efficiency (Kirchner, 2015; Brogaard et al., 2012; Handershott & Moulton, 2011)). Aitken et al. (2012) established positive effect of HFT on market efficiency based on reduced costs of trading and synchronization of price movements (Conradt, 2011). According to a study by Deutsche Bundesbank (2016) HFT in normal times supply liquidity close to the best bid-ask price consistent with market making strategy. According to research by Gider et al. (2015) price efficiency is generally higher on large stock exchanges with high levels of market capitalization. HFT reduces price efficiency as market prices incorporate less information based on company fundamentals.

Regarding the Bulgarian capital market, the fact that HFT is associated negatively with market liquidity, it has led to falling trading volumes and increased stock price volatility (Tables 13, 14, 15) with resultant fall in market capitalization levels following the introduction of the electronic trading platform Xetra in 2008 (as an instrumental

proxy for HFT). It can be concluded that for the small and inherently underdeveloped Bulgarian capital market, the consequences from HFT have been generally in the direction of deterioration of market quality.

C. HFT leads to higher returns to investors →lowers cost of capital

The decreasing transaction costs raise asset returns to investors and thus to increased asset prices, which in turn positively influences investors' wealth and social welfare (Kirchner, 2015). In broad macroeconomic aspect the higher asset prices lower the cost of capital for companies and incentivize them to undertake larger investments. This in turn boosts productivity levels, with subsequent rise in wages and living standards.

For the Bulgarian capital market, obviously the fall in market liquidity, increase in market volatility and drop in market capitalization ratio have impacted on the reverse the returns of traditional long-term investors (especially institutional and retail investors) with negative consequences for social welfare.

3.2. Macroeconomic and Social Welfare Losses

A. HFT accelerates market dynamics such as bubbles and flash crashes

There is empirical stock market evidence (Haldane, 2011) that the flash crash in 2010 on E-market S&P futures market segment in US has been partially explained by HFT (Commodity Futures Trading Commission report, SEC, 2014). This points to the fact that such market disruptions generally affect most liquid and deep markets as a result of herding behaviour, and the Bulgarian capital market can still be described as underdeveloped and mostly illiquid.

B. Minimal liquidity welfare gains derived from HFT and largely negative on a long-term investment horizon

Empirical evidence suggests that the welfare gains from HFT on liquidity may well be overestimated in long-term periods (Sornette et al., 2011). The potential for increased liquidity to generate volatility bursts (i.e. flash crashes, bubbles etc..) and overall market risks and disruptions is due to possible spillover effects to other market segments instigated by collective herding behaviour. According to Wyman (2012) HFT provide "ephemeral" or "false" (Lewis, 2014;

Patterson, 2012) liquidity which is drained in times of market stress. Some estimations of Allen (2016) point that if the trend with HFT continues, the traditional long-term investors will leave the market. As a reaction, in US in 2015 Investors' exchange was set up in view of the unfair advantages on other trading venues. The expectations are this measure will contribute to enhancing the quality of US equity markets. To preserve liquidity Harris (1994) suggests information on quotes to be only released when markets are closed or at pre-announced times. For Allen (2016) the best way to prevent HFT monopolizing the trading venues is the use of randomizer: regulations to delay each order between 0 to 10 milliseconds and mitigate the problem of front-running. Another possible approach to combat rent seeking behaviour of HFT is to report approximate order sizes or aggregated volumes at different intervals.

For the Bulgarian capital market this theoretical explanation of HFT has been explicitly proven. The implementation of Xetra in 2008 coincided with the start of the GFC and the existing market volatility was further reinforced by HFT leading to subsequent fall in liquidity levels and rising market risks for other traditional market participants, driving some of them out of the market.

C. Positive correlation between HFT and stock price volatility→negative impact on financial stability and lead to non-linear financial system with possible systematic risk effects

A strong positive correlation between HFT and stock price volatility has been documented by Zhang (2010), especially for stocks with highest market capitalization. The question is about the causality of the relationship: for Linton et al. (2018) higher volatility in the aftermath of the GFC caused higher activity of HFT offering profitable trading opportunities. HFT negatively impacts on price discovery due to overreaction of stock prices to two sources of public information: macroeconomic news announcements (Jegadeesh et al. 1993) and imbalances in the limit order book (Cao et al, 2009). Generally, HFT can lead to reduced volatility at the level of individual stocks but may intensify tail risks and lead to aggravated volatility at macroeconomic level (Kirilienko, Kyle, Samadi & Tuzun, 2011). This is due to the fact that generally HF traders go in opposite direction of orders of institutional investors and attract herding behaviour. This in turn deteriorates the operation of the long-term price discovery mechanism with negative consequences for market confidence and

leads to qualitatively different and non-linear financial system (Glosten, Milgrom, 1985). According to Laube et al. (2013) HF traders lead to increased cross and intra-market correlations of returns and this may be associated with extreme systemic events.

For the Bulgarian capital market and its performance, the empirical results proved the positive correlation between HFT and stock market volatility (see Table 14) with negative consequences on the price discovery mechanism and further fall in market capitalization levels.

D. HFT may pose systemic risk

The mechanism through which HFT could endanger financial stability is that HFT potentially leads to higher levels of liquidity. But at certain point (i.e a plateau) increased liquidity generates diminishing welfare gains because of herding potential. It may threaten systemic stability through the interrelations among capital market segments (the "complex systems approach" proposed by Sornette et al., 2011) and Jiang et al. (2010); Sornette & Zhou (2006). HFT agents, being short-termists who do not absorb risks, may pose systemic consequences also due to the fact that they provide liquidity at their own discretion and do not have the obligations of traditional market makers. For Froot et al. (1992) HFT relies mainly on reduced waiting time in trades (to milliseconds or lower), short-term information and adaptive algorithms with built-in stop losses, which may lead to greater systemic risk consequences. Laube et al. (2013) identify two types of systemic risk in HFT: one is related to stock returns (and their relation to market variance) and the other – to stock liquidity and its covariance with market liquidity (and the algorithmic trading behavior of investors, Chaboud et al., 2011).

For the Bulgarian capital market and its performance this risk so far has been contained due to the following reasons: 1) small and generally underdeveloped capital market in Bulgaria. 2) lack of diversified and complex financial instruments on the market. 3) After the failure of the KTB as one of the principal proximity stock exchange intermediary in 2014, generating about 15 % of the total turnover of proximity stock exchange members, the possible systemic consequences have been contained based on the government liquidity assistance scheme of BGN 3,3 billion.

E. HFT may pose operational risk

This risk can arise in the course of stock market infrastructure disruptions (i.e. IT cyberattacks etc.) and according to Kirchner (2015) analyses machine algorithms may lead to emergence of novel and very sophisticated ways of stock market manipulations. Thus Brogaard et al. (2012) found that HFT may lead to increased transaction costs due to the need for technological IT upgrades by all stock market intermediaries (technological costs).

For the Bulgarian capital market, presently the lack of publicly disclosed information about HFT and their market strategies, the analysis of this threat from HFT needs further quantification and consideration.

F. HFT may lead to market manipulations and market abuse → with negative consequences on market trust and confidence

Critics of HFT point to some of the manipulative strategies that HFT can employ (as layering, spoofing, quote stuffing, flashing, smoking etc.) which involve placing orders without intent to trade and exploiting slower participants' reaction. Some trade protection mechanisms are associated with use of dark pools (for large block trades) and internalization of retail orders, but these may lead to higher transaction costs to retail and institutional investors. These negative consequences on financial markets efficiency will persist as long as HF traders are small minority from the investment community. Model simulations done by Vigrilio (2015) established that HFT leads to rejection of the efficient market hypothesis and confirms the consistent risk-free returns generated by HF traders at the expense of other "patient" investors. Behaving as market makers without having the proportional obligations of these market participants, HF traders realize profits without bearing sufficient risks faced by other market players thus shaking market trust and confidence (Zhang & Powell, 2011). A study by Brigida (2016) found that only those HFT trading in the first 50 milliseconds after the release of stock market gas storage report in US realized significant profits proving that HFT avails trades in high speeds but the tests did not find evidence on informed trading (i.e. positive correlation of HFT with public information announcements, Brogaard et al (2013).

For the Bulgarian capital market, lack of public information prevents analysis of abusive or manipulative strategies of HFT. Yet, the fact that HFT is negatively associated with liquidity and market capitalization and positively with market volatility, is a proof for

negative impact on market trust and confidence in the Bulgarian capital market as an alternative efficient source for firm financing after 2008.

G. HFT leads to inequality of opportunity → disincentives to invest in the market

Even in well-regulated stock markets HFT may lead to unequal outcomes for trading participants due to the information advantage of HF traders. Yet the application of too restrictive regulation as financial transaction tax may discourage market participants and induce capital outflow. The financial transaction tax burden is usually shifted from stock intermediaries on end-investors and the final outcome is increased transaction costs (Matheson, 2010), reducing market liquidity (due to inverse relation between transaction costs and trading volume), lowering the rate of return and of asset prices. Another aspect of inequality among traders is the adverse selection costs that HF traders impose due to their information and speed advantage. The TABB Group (2012) has established that HFT sector generated about 800 USD of profits in 2008 and this exorbitant amount of rents potentially impacts on retail and institutional investors. One important indicator in this respect is to monitor the stock prices of intermediaries and whether they exhibit any extreme profitability patterns.

In conclusion, the established privilege of co-location for this group of stock market members deepens the gap between market participants, discriminates traditional long-term investors and discourages their participation on the Bulgarian stock market. Based on the theoretical review of existing academic literature on HFT it can be concluded that the short-term static costs – benefits should be juxtaposed against long-term dynamic costs-gains in order to arrive at the net social gains or losses derived from HFT on stock market performance.

3.3 Regulatory initiatives at EU level targeting HFT and potential consequences for capital markets

Regulations and various tax measures are considered the main instrument to mitigate the broadly negative welfare gains from HFT. One such approach is the coordination of data on HFT across assets and markets to better measure and evaluate the impact of HFT on stock market performance. The main market tools to contain

sharp and short term movements in prices (defined as flash crashes or rallies) have been use of market trading curbs and circuit breakers. According to Bell & Searles (2015) the approach at EU level is generally in the direction of suppressing HFT through fees and increased regulation. Imposition of cancellation fees on orders (according to Yamamoto, 2015) discourages HF traders to place limit orders and motivates them to execute market orders, thus causing wider spreads and higher stock volatility. Due to the significant welfare losses and the impossibility to differentiate the net effect of HFT presently, at EU level the approach is aimed the middle way: not prohibiting explicitly HFT but subjecting it and other forms of AT to specific supervision (Recital 59, MiFID II) according to Busch (2016). This requires enforcing stricter regulation and disclose regime for HFT as subset of algorithmic trading with the implementation of Markets in Financial Instruments Directive II MiFID II) and Markets in Finacial Instruments Regulation (MiFIR in January 2018.The rules addressing the systemic risks for financial stability derived from HFT require from HFT firms, investment firms, operators of trading venues to upgrade their systems, processes and controls to counter the new technology-generated risks with the growth in HFT activities.

The new regulatory regime for AT and HFT imposes on investment firms, engaging in this types of activities implementation of risk controls (compliance with market abuse regulations; application of business continuity arrangements, risk policies; operational safeguards etc.), recording of all placed, executed orders, cancellations and quotes and disclosure to competent authorities. The trading venues of activities of HFT firms have the discretion to impose higher cancellation fees on those market participants exhibiting high ratio of cancelled to executed orders or engaging in HFT. These investment firms need authorization and demonstrate they meet the authorization requirements and provide accurate and timely information to the competent regulatory authorities. The new regulatory measures require from HFT firms change in their business model to contain possible risks arising from their activities. According to MiFID high message intraday rate of orders, quotes, cancellation is defined as at least two messages per second with respect to single financial instrument, or four messages per second for all financial instruments traded on a given trading venue. The messages relate only to proprietary trading on own account by the HFT firms and not on behalf of clients.

The existing EU market abuse regulations explicitly prohibit spoofing and other strategies that potentially may be employed by HFT firms not intended to execute transactions but to disrupt orderly function of the markets though overloading and stuffing trading systems with large volume of orders. The trading venue may indicate by flagging the orders generated by algorithmic and HFT and to disclose the information to competent authorities as a reaction against potentially abusive techniques. It should be capable of handling peak volumes and to protect itself against technical failures of members' algorithms by using various volatility interruptions and circuit breakers.

The expected benefits from the stricter MiFID II regime for HFT are wider participation in regulated markets, increased liquidity, narrower spreads, reduced short-term volatility and better execution of client orders. Specifically, the risks from HFT involve potential for systems overloading and overreaction to events and macroeconomic and market news. On the downside the expectations (Deloitte, 2016) are that the implementations of the reform package will lead to further squeeze of liquidity. ESMA is expected to further judge the need for striking the right balance between increased transparency, disclosure and monitoring and stock market liquidity. The new rules require from trading venues to establish limits to the ratio of unexecuted orders to transactions and this will obviously lead to further drain of liquidity on stock markets. To counter this, MiFID II rules require the firms engaging in HFT to execute market making during a specified period of the trading day thus leading to predictability and continuous liquidity supply. The main risk from HFT remains the loss of market trust and confidence so the regulations in MiFID require further supervision and transparency, open communication to guarantee fair and non-discriminatory access and maintain confidence of all market participants.

4. Future research directions

One possible strand of future research points to analyzing HFT and its effects on systematic risk in financial markets through better understanding of the interaction of different trading methods (high versus low frequency trading; fundamental versus technical trading), financial instruments (stocks, options, ETFs, futures contracts etc.) and markets (equities, forex, commodities.). These

effects may best be analysed by application of complex systems approach (accounting for the non-linearity of financial markets, Hommes & Wagener, 2009; Evstigneev, Hens & Schenk-Hoppe, 2009), agent-based models established on behavioural patterns (i.e. collective herding regimes) and agent heterogeneity in the formation of expectations (Chiarela et al., 2009). Using interdisciplinary approach (financial economics, behavioural finance, statistical physics et.) could potentially be better tool for explaining bubble-like behavior in HFT (noise trading, herding, non-linear trend following, value investing etc., Kindelberger, 2000; Sornette, 2003; Jiang et. Al. 2009).

Another strand of future research is to empirically test and quantify the main macroeconomic costs and benefits for the Bulgarian capital market before and after the introduction of Xetra in light of the new EU regulatory framework introduced with MiFID II. Third strand of future research will be to delineate the effects the GFC and HFT on market capitalization and capital market performance in quantitative terms and to try to empirically measure what proportion of the fall in market capitalization in Bulgarian capital market was caused by GFC and by HFT separately. Yet, one final strand of future research would be to empirically test the significance of the institutional factors in stock market development in Bulgaria, and more broadly in South and Eastern Europe. Besides institutional factors, future research calls for inclusion of technological &digital factors influencing stock market development, besides AT and HFT.

5. Conclusion

The results of the econometric models on HFT and its impact on the underdeveloped Bulgarian stock market and its performance show that HFT may generally be considered as a potential source of risk due to the relatively low liquidity as a result of increased volatility of stock prices. For that reason, market regulators have to heighten prudential monitoring and supervision on all market participants in light of the newly introduced EU regulatory MiFID framework targeting HDT and its consequences on stock market performance and financial stability. The institutional factor will be crucial in this process because of the need of the regulatory body of the Bulgarian capital market not only to monitor strict application of the regulatory framework for HFT, but also to develop the required level of

knowledge and expertise in analysing the various market strategies employed by HFT firms. Boosting the institutional capacity of the Financial Supervision Commission will be vital and may require increased cooperation and exchange of information with ESMA and the other regulatory authorities in the field.

Acknowledgments

References

1. Aitken, M., Cumming, D.J. and Zhan, F. (2012). "Identifying international start dates for algorithmic trading and high frequency trading." Available at SSRN: http://ssrn.com/abstract=2172455.

2. Allen, Y. (2016). High-frequency trading: regulatory impact in American and European markets.

3. Arnuk, S., & Saluzzi, J. (2012). Broken markets: How high frequency trading and predatory practices on Wall Street are destroying investor confidence and your portfolio. Upper Saddle River, NJ: FT Press.

4. Boehmer et al. (2017). International evidence on algorithmic trading. *SSRN Electronic Journal.*

5. Bell, J. & Searles, H. (2015) An analysis of global HFT regulation: motivations, market failures and alternative outcomes.

6. Busch, D. (2016). MiFID II regulating high-frequency trading, other forms of algorithmic trading and direct electronic market access. *Law and financial markets review.* vol. 10 (2). pp.72-82.

7. Brigida, M. (2016). High-frequency trading and market efficiency. Evidence from the weekly natural gas storage report. SSRN.

8. Brogaad, J. et al. (2013). High-frequency trading and price discovery. ECB Working paper 1602.

9. Caivano, V. (2015). The impact of high-frequency trading on volatility. Evidence from the Italian market. CONSOB. Accessible at: file:///C:/Users/juliastefanova/Downloads/qdf80.pdf

10. Cao, C., O., Hansch, and X. Wang. (2009). The Information Content of an Open Limit-Order Book. Journal of Futures Markets 29:16-41.

11. Chaboud et al. (2009). Rise of the machine. Algorithmic trading in the foreign exchange market. Accessible at: https://www.federalreserve.gov/pubs/ifdp/2009/980/ifdp980.pdf

12. Chiarella, C. Dieci R., and He X.-Z. (2009) "Heterogeneity, Market Mechanisms, and Asset Price Dynamics" in Handbook of Financial Markets: Dynamics and Evolution. Chapter 5, 277344.

13. Conradt, L. Nature 471, 40 (2011).

14. Deloitte. MiFID II and the new trading landscape. Transforming trading and transparency in the EU capital markets.

15. Deutsche Bundesbank. (2016). Significance and impact of high-frequency trading in the German capital market. Monthly report.

16. Dolvin S. (2014). High-frequency trading and market efficiency. Butler University.

17. ECB (2016). Convergence Report.

18. ESMA (2014). Economic report. High-frequency trading activity in EU equity markets.

19. Evstigneev, I.V., Hens, T.; Schenk-Hoppe R. K.,(2009) "Evolutionary Finance" in Handbook of Financial Markets: Dynamics and Evolution, Chapter 9, 507-566.

20. Fama, Eugene, 1970, Efficient Capital Markets: A Review of Theory and Empirical Work, Journal of Finance 25, 383-417

21. Gerig, A. (2016). High-frequency trading synchronizes prices in financial markets. SEC.

22. Gider J. et al. (2015). High-frequency trading and fundamental price efficiency.

23. Gomber, P. et al. (2015). High-frequency trading. Drivers for the widespread use of algorithmic trading and high-frequency trading. Goethe Universitat.

24. Glosten,L & Milgrom, P. (1985) Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics.* Vol. 14 (1). pp.71-100.

25. Government Office for Science (2011). The Future of computer trading in financial markets. Foresight driver review 7. An evaluation of risks posed by high-speed algorithmic trading.

26. Government Office for Science (2011). High-frequency trading and price efficiency. The future of computer trading in financial markets. Foresight driver review 12.

27. Grossman, Sanford, and Joseph Stiglitz, 1980, On the Impossibility of Informationally Efficient Markets, American Economic Review 70, 393–408.

28. Haldane, A. (2011). High-frequency market making problem. Accessible at: https://ftalphaville.ft.com/2011/07/08/616451/haldane-on-hfts-market-making-problem/

29. Harris, L. (1994), Minimum price variations, discrete bid-ask spreads, and quotation sizes, Review of Financial Studies, 7, 149-178.

30. Hasbrouck, J. & Saar, G. (2012). Low-latency trading. Accessible at: http://people.stern.nyu.edu/jhasbrou/Research/LowLatencyTradingJFM.pdf

31. Hendershott, T., & Riordan, R. (2009). Algorithmic trading and information. Accessible at: http://faculty.haas.berkeley.edu/hender/atinformation.pdf

32. Hendershott, T., Jones, Ch., and Menkveld, A. (2010). Does algorithmic trading improve liquidity? *The Journal of Finance.* VOL. LXVI, NO. 1, Accessible at: http://faculty.haas.berkeley.edu/hender/algo.pdf

33. Hendershott, Terrence, and Pamela C. Moulton, 2010, Automation, speed, and stock market quality: The NYSE's hybrid, Working paper, University of California, Berkeley.

34. Hommes, C., Wagner F. (2009) "Complex Evolutionary Systems in Behavioral Finance" in Handbook of Financial Markets: Dynamics and Evolution. Chapter 4, 217-276.

35. Froot, Kenneth A., David S. Scharfstein and Jeremy C. Stein, 1992, Herd on the street: Informational inefficiencies in a market with short-term speculation, Journal of Finance 47, no. 4, 1461-1484.

36. Jarrow, R. & Protter, Ph. (2011). A dysfunctional role of high-frequency trading in electronic markets. Johnson School Research Paper Series No. 08-2011

37. Jegadeesh, Narasimhan, and Sheridan Titman. "Returns to buying winners and selling losers: Implications for stock market efficiency." Journal of Finance 48.1 (1993): 65-91.

38. Jiang, Z.-Q., W.-X. Zhou, D. Sornette, R. Woodard, K. Bastiaensen and P. Cauwels (2010) "Bubble Diagnosis and Prediction of the 2005-2007 and 2008-2009 Chinese stock market bubbles", Journal of Economic Behavior and Organization 74, 149-162

39. Jovanovic, B. & Menkveld, A. (2012). Middlemen in limit-order markets. *SSRN Electronic Journal.*

40. Kindleberger, C.P. (2000) "Manias, panics, and crashes: A history of financial crises", 4th Edition. Wiley, New York.

41. Kirilenko, A., S. Kyle, M. Samadi, and T. Tuzun, working paper http://ssrn.com/abstract=1686004. Khandani, Amir, and Andrew Lo, 2007, What Happened To the Quants in August 2007? Journal of Investment Management 5, 29–78.

42. Kyle, Albert S. 1985. "Continuous Auctions and Insider Trading." Econometrica 53 (6):1315–1335

43. Kirchner, S.(2015). High-frequency trading: fact and fiction. Should high-frequency trading be hit with transaction tax. Policy. Vol. 31 (4).

44. Laube, L. (2013). The impact of high-frequency trading: systematic risk in European equity markets.

45. Levine, R. & Zervos, S. (1998) "Stock markets, banks, and economic growth". *American Economic Review,* American Economic Association, vol. 88(3), pages 537-558, June.

46. Lewis, M. (2014). Flash boys: A Wall Street revolt (1st ed.). New York, NY: Norton & Company

47. Linton, O., Mahmoodzadeh, S. (2018). Implications of high-frequency trading for security markets. The Institute of Fiscal Studies. Centre for microdata methods and practice. UCL.

48. Matheson, T. (2010) "Taxing Financial Transactions: Issues and Evidence", IMF Working Paper

49. Menkveld, A. (2012). High-frequency traders and market structure. *The Financial Review, special issue on HFT.*

50. OECD. (2017). Institutional statistics.

51. Patterson, S. (2012). Dark pools: The rise of the machine traders and the rigging of the U.S. stock market (1st ed.). New York, NY: Crown Business.

52. SEC (2010). Concept release on equity market structure.

53. Sornette, D. (2003) "Why Stock Markets Crash (Critical Events in Complex Financial Systems)" Princeton University Press.

54. Sornette, D. and S. von der Becke, 2011, Crashes and High Frequency Trading, UK Government Foresight Driver Review 7.

55. Sornette, D. and W.-X. Zhou (2006) "Predictability of Large Future Changes in Major Financial Indices", International Journal of Forecasting 22, 153-168.

56. TABB Group. (2009). US Equity High Frequency Trading: Strategies, Sizing and Market Structure.

57. Virgilio, G. (2015). High-frequency trading and the efficient market hypothesis. *The Business and Management Review.* Vol. 6 (3).

58. Wyman, O. (2011). Enhancing liquidity in emerging market exchanges. Accessible at: http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2016/oct/Liquidity-in-Emerging-Markets-Exchanges-.pdf

59. Yamamoto, R. (2015). Does high-frequency trading improve market quality. WINPEC working paper series N E1515.

60. Zhang, X. (2010). The effect of high-frequency trading on stock volatility and price discovery.

61. Zhang, X., & Powel (2011). The impact of high-frequency trading on markets. *CFA Magazine.*

Table 1

Market capitalization on BSE

Indicator	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Market capitalization (billion BGN)	4,033	8,433	15,214,	28,986	12,460	11,795	10,754	12 ,435	9, 828	9, 961	9, 756	8, 587	9, 683	23,620
Market capitalization /GDP (%)	10.54	20.11	29.30	51.29	18.73	17.21	15.22	16,13	12,71	12,54	12,39	10,19	10,89	24,08

Source: the authors, according to data from BSE, NSI, www.bse-sofia.bg, www.nsi.bg

Table 2

Liquidity Ratio and Trade Volume on BSE

Indicator	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Liquidity Ratio (%)	40	38	22	33	23	13	9	12	15	8	14	13	14	8
Trade Volume (in billion BGN)	1,596	3,182	3,384	9,640	2,903	1,551	920	1,498	1,447	2,008	1,414	1,154	1,357	1,891

Source: the authors, according to data from BSE, NSI, www.bse-sofia.bg, www.nsi.bg

A RISK ASSESSMENT FRAMEWORK FOR ALTERNATIVE INVESTMENT FUNDS, BOTH AT FUND LEVEL AND MARKET LEVEL

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Abstract

In this paper we propose an integrated approach to assessing risk for alternative investment funds, both at micro and macro (market) level. Building upon the experience and practice in European Supervisory Agencies and different National Competent Authorities on assessing risk for other type of financial intermediaries (ex. banks, insurance companies), we construct a risk dashboard for Alternative Investment Funds. Our proposed framework includes multiple categories of indicators and has both a time series approach and a cross sectional approach. At the same time, the proposed risk scoring can be calibrated using mechanically computed thresholds and expert judgment, in different combinations. The result is a new and flexible framework that can accommodate situations when not enough observations are available in the time series to compute mechanically the risk scores. In addition, it serves asset managers for their mandatory self-assessments and market supervisors in making relevant comparisons between the industry participants.

Keywords: risk dashboard, alternative investment funds, prudential supervision

JEL Classification: G15, G23, G28

1. Introduction

Alternative investment funds (AIFs) are relatively new entities in the Romanian financial markets, resulted from a reclassification of the collective investment schemes (CIS) other than undertakings for

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collective investment in transferable securities (UCITS). Until now, new type of undertakings include the closed end investment funds, the five investment firms (SIFS) and the Ownership Fund (FP).

The legal framework for this type of financial intermediaries is new in Romania: Law no. 74/2015 on alternative investment fund managers transposes Directive no. 2011/61/EU on alternative investment fund managers into the Romanian legislation. Also, the Commission Delegated Regulation (EU) no. 231/2013 supplementing Directive 2011/61/EU of the European Parliament and of the Council with regard to exemptions, general operating conditions, depositaries, leverage, transparency and supervision regulates the risk management activity that an alternative investment fund manager (AIFM) must carry out.

According with the mentioned new legal framework, the collective investment schemes that qualify as AIFs registered to the Romanian Financial Supervisory Authority during 2017-2018 and were supposed to fill their first annual reports.

The current legislation on AIFMs fails to present a standardized methodology for assessing the risks an alternative investment fund (AIF) is exposed to, leaving it up to AIFMs/AIFs to develop internal risk assessment models, provided that certain principles and rules are observed.

This derives from the particularities in terms of legal organization and operation of the alternative investment funds industry and implicitly from the impossibility of imposing a standardized risk management model for all types of funds.

Legally speaking, AIFs can come in two organization forms, namely: trading company and civil society. Whereas trading company AIFs have legal personality, civil society AIFs have no legal personality.

Therefore, AIFs organized as trading companies have the option of managing themselves internally or of resorting to external management offered by an AIFM. AIFs organized as civil societies do not have this option, as they are managed only externally by an AIFM.

In terms of risk management, the Capital Requirement Directives (CRD) and Solvency Directive legislative packages provide a standardized approach to market risk, credit risk, and operational risk management, with the final purpose of determining a "solvability

indicator" of the financial entities (e.g.: capital adequacy rate – CRD, solvency rate – Solvency Directive).

The solvency indicator aims at determining the ratio between a) the level of potential losses that could result if the risks of the managed assets are exposed to get materialized, and b) the level of own funds held by those financial entities. Also, besides this solvency indicator, financial entities also determine certain liquidity indicators.

This solvency indicator can be determined only by financial entities that have legal personality or are self-managed, because only these entities have in their balance sheet structure the necessary items to determine own funds (equity), can be affected by a potential bankruptcy and, also, the solvency indicator can incorporate only the categories of financial and operational risks identified and assessed at the level of that entity.

For the other financial entities that are managed externally, due to the organization and operation method, risk assessment mechanisms can be developed only for certain risk categories (market risks and credit risks) and also, to limit the losses caused by those risks, exposure limits to various categories of issuers/debtors, financial instruments and activities can be developed.

Considering the adopted organization form and management method, the risk management system of AIFs can be represented as follows:

- ✓ AIFs organized as trading companies: the market risks and credit risks can be determined for the asset portfolio held by AIFs. The operational risks are assessed:
  - at the level of the AIFM, if the AIF is externally managed. In such situation, the final purpose of the risk management system for the AIF cannot be to simply determine exposure limits to various categories of issuers/debtors, financial instruments and activities.
  - at the level of the AIF, if it is managed internally. In such situation, a risk management system can also be developed, the final purpose of which would be to determine a solvency indicator for the AIF.
- ✓ AIFs organized as civil societies: the market and credit risks are determined for the portfolio held by the AIF, whereas the operational risks are assessed at the level of the AIFM. In this situation, the final purpose of the risk management system for the AIF is simply to establish exposure limits to various

categories of issuers/debtors, financial instruments and activities, with the intention of limiting the liquidity risk, market risk, and credit risk of the countertrade.

In the case of civil society AIFs and in the case of externally managed trading company AIFs, the operational risks are assessed at the level of the AIFM because, at the level of those AIFs, there is no hired personnel and no current activity is being carried out (the four categories of operational risks cannot be assessed). These types of AIFs are only legal forms of pointing out a portfolio of financial assets that are managed by the AIFM according to a set of rules established in a prospectus or in articles of incorporation (depending on the legal form of the AIF).

Civil society AIFs are the method through which several investors are able to participate in an investment strategy materialized in a certain structure of financial assets and with a certain level of the leverage effect, aspects presented in the prospectus of that fund. The portfolio of this type of AIFs is collectively held by investors, each of them holding a ratio of that portfolio, whereas the minimum share of participation in that particular financial strategy is given by the value of a fund unit. The AIFM is responsible for implementing the financial strategy and of building the structure of financial assets by using the financial resources provided by the investors.

The trading company AIF is an entity with legal personality, in which its assets suggest an investment strategy in financial instruments. In the case of this category of AIFs, the portfolio of financial assets is held by that AIF, whereas the representatives of the shareholders (investors) can be organized as a committee that selects and subsequently assesses the performances and costs of the assets management company activity achieved by an AIFM (external management). In the case of an internal management, the representatives of shareholders (investors) shall be organized as a management board or a supervisory board (depending on the management system) responsible for the management of that AIF. The trading company AIF is a hybrid form of organization that borrows features both from civil society AIFs (the attribute of collective investment in a certain structure of financial assets) and from joint-stock companies (legal personality, rights relevant to the shareholder quality).

Considering that in the AIFs industry the civil society contract is the most utilized form of legal organization of funds, the European legislator has imposed in the legislation applicable to AIFMs a series of obligations having to do with the identification, assessment and limitation of risks and, at the same time, left it up to each AIFM to develop its own risk management system.

In this article we propose such a system that could be used both by the industry (at micro level) and by the market regulators (both at micro and macro level) and that has the flexibility to accommodate the difficult situation that characterize the lack of long data series needed in a mechanical calibration of the risk scores.

2. Literature review

After the financial crisis, the newly established European Supervisory Authorities (ESAs) and many National Competent Authorities (NCAs) developed specific frameworks for assessing risks in different areas of the financial sector. The European Systemic Risk Board (ESRB) and the Financial Stability Board (FSB), together with the newly recently created national macro-prudential authorities were involved in harmonizing these practices.

Still, such frameworks are only developed for banks, insurers and to a certain extent to undertakings for collective investment in transferable securities. Given that AIFs are only recently recognized as a specific type of financial intermediaries and that their data reporting only comprise few data points (2014-2017), there is not yet a practice in realizing and publishing risk dashboards for this category. Also, the research in this field is still ongoing.

Most of the risk dashboards published quarterly by macro-prudential and supervisory authorities are based on expert judgement in assigning the risk scores for different categories. In some cases the approach also accommodates a partially mechanical approach for some indicators or categories of risk (ex. European Banking Authority) while others are exclusively based on professional opinion in relation with the evolution of set of key risk indicators (ex. ESRB, European Securities and Markets Authority - ESMA). The Romanian central bank follows a similar approach, with the difference that the risk dashboard is not published separately but is integrated in the semi-annual financial stability report.

The notable exception to the practices described above is made by the European Insurance and Occupational Pensions Authority (EIOPA), which uses a mechanical approach for the publishing of the quarterly European insurance market risk dashboard.

In Europe, ESRB was the first to publish an integrated assessment of the systemic risks in the financial sector (September 2012), at the same time that EIOPA also published the first sectoral assessment for the European insurance market. The first sectoral assessment for the European securities markets was published by ESMA soon after (February 2013).

Since then, the structure and complexity of the risk dashboards published by the supervisory and macro-prudential authorities evolved, accommodating the market developments, relevant new risk themes, incorporating new risk categories and new indicators.

Also, as the research progressed in different macro-prudential areas beyond banks (ex. insurance, asset management, investment funds), special chapters within the dashboards were dedicated to these specific categories of undertakings.

The Romanian central bank started to publish a financial stability report in 2006 but only included the risk dashboard in 2015.

Following the financial crisis many authors were interested to develop or to test the effectiveness of particular financial stability indicators, but the literature related to the development of an aggregated risk dashboard is still not very developed. Only institutions with a financial stability mandate remained interested in developing such tools, mostly for internal use but also to some extent for communicating with the public and the industry about the trends in risks and vulnerabilities.

Eppler and Aeschimann (2008) studied interactive graphic representations (ex. charts, diagrams) that could be applied to risk management. The authors reviewing the existing approaches and contributed to the literature by providing a conceptual framework illustrated with new applications and examples. They also developed a set of guidelines to be used for visualizing risk and to minimize the shortcomings inherent in graphic representations (ex. distortions, manipulations).

Our approach in this paper is, in essence, similar with the work of Scarlat, Chirita and Bradea (2012) who propose a risk

dashboard and a set of key risk indicators focused on enterprise risk management, while our attempt is to build a dashboard not for a non-financial corporation but for a sub-segment of the financial sector – the alternative investment funds.

An important reference in the literature for tools to assess risk over large parts of the financial system is the systemic risk monitor ('SysMo') toolkit developed by Blancher et al. (2013). The authors take stock of the existing systemic risk monitoring tools and systematize them accordingly with the six proposed key criteria. They also formulate suggestions on how to operationalize systemic risk monitoring and propose a systemic risk Dashboard that accommodates various country-specific particularities.

Sarlin (2016) discusses the role of visualization in risk communication as part of the macroprudential oversight and emphasize the importance of simple representations of complex data.

Doyle et al. (2016) as well as the annual 'EU Shadow Banking Monitor' (2016, 2017) published by ESRB highlight the structural features and the specific risks associated with shadow banking in the euro area, focusing on investment funds proposing indicators to identify and assess vulnerabilities and organizing them in categories.

One of the newest developments related to use of dashboards to monitor financial risks was made in relation with the central clearing parties (CCPs). Huang and Menkveld (2016) proposed a risk dashboard for this type of financial entities, which have become systemically important, with the aim to track their exposures to the clearing members in real time and to offer a decomposition that could enable the entity and its supervisor to be alerted by possible sudden large increases and to identify their causes.

3. Proposed AIF Risk Dashboard Methodology

In Romania the initial AIF population is composed of approximately 20 closed-end investment funds, 5 investment companies and the Ownership Fund.

Taking into account the particularities of this segment of the financial system, we propose a risk dashboard consisting of 8 risk categories, each with several risk indicators (Table 1)

Table 1

The structure of the proposed risk dashboard

Risk Category	Risk indicator
Macroeconomic risk	GDP gap
	Credit-to-GDP gap
	Monetary policy stance
	Budget deficit
	Current account deficit
	Public debt-to-GDP
	Foreign debt-to-GDP
Market Risk	Equity market volatility
	Equity market contagion
	Sovereign bonds yield volatility
	Corporate bonds yield volatility
	Monetary market volatility
	FX volatility
	Commodities market volatility
	Net Equity Delta (portfolio's sensitivity to movements in equity prices)
	Net DV01 (portfolio's sensitivity to a change in the yield curve)
	Net CS01 (portfolio's sensitivity to a change in credit spreads)
Credit Risk	Sovereign bonds CDS
	Corporate bonds CDS
	NFC leverage
	NFC debt service ratio
	Households leverage
	Households DSTI ratio
	Number of insolvencies
Liquidity Risk	Equity market liquidity
	Bond market liquidity
	Cash ratio
	Liquid assets ratio
	Portfolio
	Investor liquidity profile
Profitability Risk	Expenses ratio
	Gross change in NAV
Interlinkages and imbalances	Portfolio concentration on asset classes
	Top 5 counterparties (single name) exposures
Complexity	Number of transactions
	Number of counterparties / issuers in portfolio (single names)
	Number of (unique) financial instruments in portfolio
	Use of derivatives (notional as % of total assets)
Leverage	Gross leverage
	Net leverage

Source: proposals of the authors

Some of the risk indicators listed above are author's proposals given their relevance to the AIF sectors, while others are precisely indicators reported by the fund managers according with the Commission Delegated Regulation (EU) no. 231/2013 supplementing Directive 2011/61/EU of the European Parliament and of the Council.

Assigning the risk score for each indicator is done by selecting thresholds from the historical distribution of the values for the respective indicator (all the available data, or at least 20 observations – where available). The risk scores will be standardized to values from 1 to 10.

Since official data reports filed under the provisions of the Alternative Investment Funds Managers Directive (AIFMD) are relatively recent, and still have significant quality issues, in situations where the time series for some indicators are not long enough to allow for statistical derivation of the thresholds, expert judgement is used temporarily (until the necessary data becomes available).

To build a risk score starting from the reported indicators, we looked at the population of funds in comparison with two thresholds and at their cumulated assets as a percentage of the total assets.

This way, each indicator within the 8 categories tries to account for 2 dimensions:

- the absolute level of the indicator at the 10th percentile and at the median and
- the cumulated assets for the funds that communicated values below the two thresholds, from the entire population of funds.

The two thresholds mentioned are:

- threshold 1: P10 = the 10% most „riskier" values reported by the individual funds (10th percentile of the distribution)
- threshold 2: Median = the median of the values reported by the individual funds (50th percentile)

Each threshold received a risk score, computed based on the indicator level versus the quartiles selected and its cumulated assets:

- final score P10 = average (individual score P10, individual score of P10 cumulated assets % of total assets)
- final score Median = average (individual score Median, individual score of Median cumulated assets % of total assets)

The total final score for each risk indicator was calculated as the average of the selected thresholds scores:

Total Final Score = average (final score P10, final score Median)

The scores were assigned from 1 to 10, according to the historical distribution quartiles and to the risk direction:

The final score was the average of the 10% percentile and median scores and was ranked from (using 1 digit):

- score 1 – the lowest risk
- score 10 - the highest risk

The general risk framework proposed could be applied from a top-down perspective (Figure 1).

Figure 1

Top down approach of the proposed risk framework
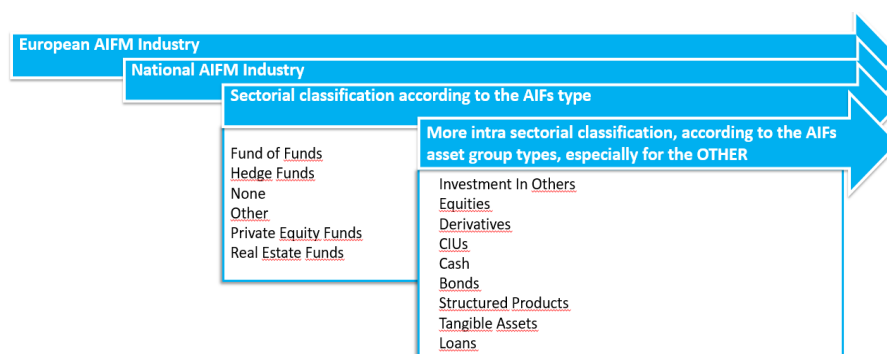
Source: proposals of the authors

The result could be exemplified as a risk map based on selected risk categories, that can be monitored evolving in time. The scorings can be also presented in graphical forms.

4. Simulated Data and Results

Because the legislation regarding AIF and their managers is still in process of being implemented, the local entities classified as AIF according to this legislation are still expected to fill their first reports during 2018. As a result of this, we were not able to use actual data in order to test our proposed methodology. Instead, we simulated data starting from stylized facts derived from the reports

filled by the open-end investment funds (classified as UCITS), taking the following steps:

- data was simulated for 100 AIFs and 20 time periods;
- all the indicators were expressed as % of NAV;
- to create the risk scores related to the dimension of the funds, total assets were simulated;
- for the liquidity risk profile, the selected indicators contained several buckets, summing to 100%. the aggregate risk score was a computed as a weighted average of the buckets, putting more weight on the riskiest liquidity buckets;
- the aggregated risk score for each category was computed as a weighted average of the risk scores of the risk indicators are included in that particular category (taking into account the share of total assets invested in each asset class, where applicable);
- an overall risk score for the industry can also be computed as a weighted average of the risk scores for each category.

The resulting evolution in time of the risk scores for each indicator and category can be presented in a table format and illustrated in colour codes as bellow (Figure 2).

Additionally, the evolution in time of the aggregated risk scores for each category can be illustrated using a radar chart (Figure 3).

Figure 2

Resulting risk dashboard using simulated data

Time	1. Market Risk Profile				2. Counterparty Risk Profile				3. Liquidity Profile			4. Operational risk and other aspects	
	1.1. Net Equity Delta	1.2. Net DV01	1.3. Net CS01	1. TOTAL *(average)*	2.1. Value of collateral and other credit support that the AIF has posted to all counterparties	2.2. Top 5 counterparties exposures (including CCPs)	2.3. Direct clearing through central counterparties (CCPs)	2. TOTAL *(average)*	3.1. Portfolio liquidity profile	3.2. Investor liquidity profile	3. TOTAL *(average)*	4.1. Change in NAV	4. TOTAL *(average)*
T1	1.5	2.8	1.5	1.9	2.8	3.0	3.3	3.0	2.5	2.2	2.4	2.5	2.5
T2	3.5	2.5	2.3	2.8	3.5	2.5	2.5	2.8	2.4	2.7	2.6	1.8	1.8
T3	1.5	2.0	1.5	1.7	3.5	2.3	3.8	3.2	2.3	2.7	2.5	3.0	3.0
T4	1.8	2.8	3.0	2.5	2.8	3.0	2.0	2.6	2.5	2.5	2.5	2.3	2.3
T5	2.5	3.3	3.3	3.0	3.0	2.5	2.3	2.6	2.4	2.4	2.4	3.0	3.0
T6	2.0	3.3	3.3	2.9	2.3	3.0	2.3	2.5	2.5	2.2	2.4	2.3	2.3
T7	3.0	2.8	3.0	2.9	2.8	3.3	2.3	2.8	2.2	2.5	2.4	2.8	2.8
T8	2.8	2.5	2.5	2.6	2.8	1.8	1.8	2.1	2.5	2.4	2.5	3.3	3.3
T9	2.5	2.8	3.5	2.9	3.8	3.3	4.0	3.7	2.5	2.4	2.5	1.8	1.8
T10	4.0	3.0	1.8	2.9	2.5	3.5	3.0	3.0	2.5	2.2	2.4	3.0	3.0
T11	3.0	3.0	1.8	2.6	2.5	2.0	2.3	2.3	2.8	2.3	2.6	4.0	4.0
T12	3.0	3.0	3.0	3.0	2.3	1.8	1.5	1.9	2.3	2.3	2.3	2.3	2.3
T13	3.3	1.5	3.0	2.6	2.8	1.0	1.8	1.9	2.4	2.6	2.5	1.5	1.5
T14	2.5	2.0	3.3	2.6	3.0	3.0	2.8	2.9	2.5	2.6	2.6	2.3	2.3
T15	2.5	1.3	1.8	1.9	1.3	2.8	3.3	2.5	2.7	2.4	2.6	1.5	1.5
T16	2.5	2.3	1.5	2.1	1.5	2.0	1.8	1.8	2.1	2.2	2.2	3.0	3.0
T17	2.0	2.3	2.5	2.3	1.5	1.8	2.3	1.9	2.5	2.6	2.6	3.3	3.3
T18	1.5	2.8	3.3	2.5	1.3	3.3	1.8	2.1	2.3	2.6	2.5	1.8	1.8
T19	2.3	2.3	2.0	2.2	2.3	2.0	2.5	2.3	2.4	2.3	2.4	3.0	3.0
T20	2.5	2.3	2.5	2.4	2.3	2.5	3.3	2.7	2.1	2.5	2.3	2.0	2.0

Source: authors' calculations using simulated data

Figure 3

Resulting risk dashboard using simulated data
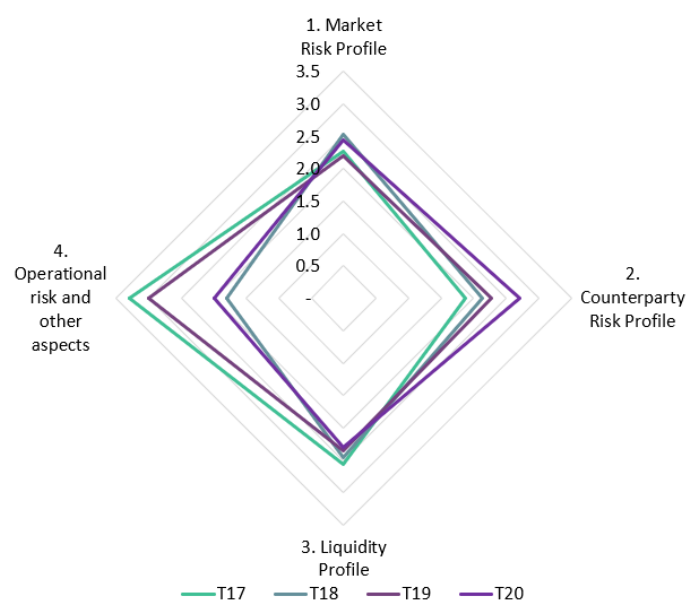
Source: authors' calculations using simulated data

5. Conclusions

In this paper we propose a framework for assessing risk for the alternative investment funds which are a new sub-category of the financial sector to be created in Romania as an effect of the application of the Commission Delegated Regulation (EU) no. 231/2013 supplementing Directive 2011/61/EU of the European Parliament and of the Council.

Our proposal include a structure of a risk dashboard (a list of categories and indicators), as well as a method to compute the risk scores for each indicator, each category and at aggregated level.

Since in Romania the AIFs are a new category, no reports were yet filled by these entities and as a result no actual data is available to test our proposed method. To offer a glimpse of the possible results, we used simulated data (starting with the stylized facts of the data reported by Romanian UCITS which are somewhat similar in functioning with the AIFs).

The potential benefits of the method that we proposed are:

- it can be implemented „as is" at a low complexity level and gradually developed and extended when more (quality) data is available;
- it can be relatively easy adapted (calibrated) and applied at the same time at European level, national level, sectorial level, fund level;
- selecting and calibrating the risk scores for each indicator can apply both expert judgement (at least in the beginning, before multiple reference dates are available and a time series can be constructed) from an aggregated view of the AIFM industry, or can be fully automated using thresholds derived with statistical calculation applied to the historical distributions of the values of the indicator (when at least 20 observation points are available);
- the method can be applied as soon as the first report filling is available, with a point-in-time approach, and further developed latter from a time series perspective when more reporting reference dates will be passed.

Our proposal could be useful both for asset managers of AIFs, in order to monitor and to compare the risk of their undertakings with the overall industry or with pears, and for industry regulators in order to monitor the risk at micro level (in comparison with the industry average or relevant percentiles) and also at macro level.

The method could be further improved once it will be possible to derive stylized facts of the industry variables, which could also permit to test the relevance of the proposed set of risk categories and risk indicators and if necessary to modify it.

References

1. Blancher, N., Mitra, S., Morsy, H., Otani, A., Severo, T. and Valderrama, L. (2013) 'Systemic Risk Monitoring ('SysMo') Toolkit - A User Guide', IMF Working Paper No. 13/168, available at SSRN: https://ssrn.com/abstract=2307411

2. Doyle, N., Hermans, L., Molitor, P.A.M. and Weistroffer, C. (2016) 'Shadow Banking in the Euro Area: Risks and Vulnerabilities in the Investment Fund Sector', ECB Occasional Paper No. 174, available at SSRN: https://ssrn.com/abstract=2804616

3. Eppler, M., Aeschimann, M. (2009) 'A systematic framework for risk visualization in risk management and communication', Risk Management, vol.11, issue 2, pp.67-89

4. Huang, W., Menkveld, A. J., (2016) 'Systemic Risk in Real Time: A Risk Dashboard for Central Clearing Parties (CCPs)', available at SSRN: https://ssrn.com/abstract=2886167

5. Sarlin, P. (2016) 'Macroprudential oversight, risk communication and visualization', Journal of Financial Stability, vol. 27, pp.160-179

6. Scarlat, E., Chirita, N., Bradea, I.A. (2012) 'Indicators and Metrics Used in the Enterprise Risk Management (ERM)', Economic Computation and Economic Cybernetics Studies and Research, issue 4, pp.5-18

7. *** European Insurance and Occupation Pensions Authority (2018) 'Risk Dashboard', available online at https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/risk-dashboard

8. *** European Banking Authority (2018) 'Risk Dashboard', available online at http://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard

9. *** European Securities and Markets Authorities (2018) 'Risk Dashboard', available online at https://www.esma.europa.eu/market-analysis/financial-stability

10. *** European Systemic Risk Board (2018) 'Risk Dashboard', available online at http://www.esrb.europa.eu/pub/rd/html/index.en.html

11. *** European Systemic Risk Board (2016, 2017) 'Shadow Banking Monitor', available online at https://www.esrb.europa.eu/pub/reports/html/index.en.html

12. *** Romanian National Bank (2017) 'Financial Stability Report', available online at http://www.bnr.ro/Publicatii-periodice 204.aspx#ctl00_ctl00_CPH1_CPH1_19966_lnkTitle

ROMANIA'S EXTERNAL DEBT: TREND AND CHARACTERISTICS AFTER THE ACCESSION TO THE EUROPEAN UNION[1]

Camelia MILEA, PhD[*]

Abstract

The paper aims to argue the importance of the external debt and of its structure for the management of macroeconomic policies. The survey focused on the period 2006-2017, in order to reveal the effects of Romania's joining the European Union on the trend of the external debt of and of its components. During the analysed period, the medium and long-term external debt held the majority within Romania's total external debt. The evolution of the external debt and of its components had a turning point in 2013 when, for the first time in the surveyed period, they started to diminish. The structure by creditors of the medium and long-term external direct public debt shows that the multilateral credits formed the majority of the debt in 2006-2012, while the share of bonds issues increased in 2013-2017. The almost continuous increase of NBR's (National Bank of Romania) reserve assets shows Romania's financial and banking solidity and credibility.

Keywords: external debt structure; external direct public debt, debt problems; creditors

JEL Classification: F21, F32, F34. H63

1. Introduction

The analysis of the external debt and of its components may be useful and necessary both in order to understand the realities from the economy, and especially to draw up proposals for a better allocation of the resources.

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[1] *The article is based on the chapter "The assessment of the external equilibrium", from the research project "The financial stance of Romania - 2017" elaborated in CFMR "Victor Slăvescu" in 2018, under the coordination of C. Marin, Ph.D*

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The author intends to deepen, from year to year, the analysis of external debt and its structure, trying to argue its importance for the management of macroeconomic policies. The research focused on the period 2006-2017, aiming to reveal the effects of Romania's EU joining on the trend of the external debt and of its components.

The paper analyses the situation of the short, medium and long-term external debt, the structure by creditors of the medium and long-term external direct public debt, as well as the structure of NBR's reserve assets. The article has comments and conclusions meant to help understanding the evolution of the indicators by showing the underlying causes.

2. Indicators concerning the short, medium and long-term external debt

The total external debt increased in 2006-2012, stronger up to 2010, followed by a moderate reduction in 2013-2015 and a not significant increase in 2016 and 2017. Compared to the reference year, 2006, the foreign debt reached 127.9% in 2017.

In 2007, when Romania has joined the European Union, the medium and long-term received foreign loans increased significantly. Also in 2009, the medium and long-term foreign credits had a peak due to the loans received from the International Monetary Fund, the World Bank and the European Union. The evolution of the medium and long-term credits received showed a turning point in 2011. While in 2005-2010 the medium and long-term credits were used to offset the current account deficit, as of 2011, within the context of partial paying back the previous loans, this indicator contributes to the formation of the balance of payments deficit, with decreasing absolute values in 2013-2017.

We may say that Romania pays, as of 2011, for the massive loans received the previous years. Thus the increase of the foreign debt generates microeconomic risks (higher exposure at a possible external shock and effects on the Romanian banking system), as well as macroeconomic implications in terms of foreign debt sustainability. The higher medium and long-term foreign debt can trigger problems through the exchange rate channel (the sudden depreciation of the national currency might increase significantly the cost of foreign loans), through the channel of trust (changed sentiment and perception of the investors, leading to the increase of the risk

premium, therefore to the cost of foreign financing), by contagion (by a regional economic, politic or social shock), or even by an internal conjuncture or structural shock of the national economy. We are at present confronted with some of these consequences (unfavourable perception of the investors, high cost of foreign funding).

In terms of external debt structure by maturity, one can notice that the share of the short-term foreign debt decreased in 2008 and 2009, after which it fluctuated around 20% until 2014, only to increase in 2015 and 2016, when it reached 25%. In conclusion, the structure of the foreign debt is rather adequate. A longer maturity supports sustainably the national economy, as the burden of the debt is spread on a longer period of time, which doesn't "overload" stringently the budget decisions of the government and endanger its development projects (Chart 1).

Chart 1

The trend of the short-term and of the medium and long-term foreign debt of Romania
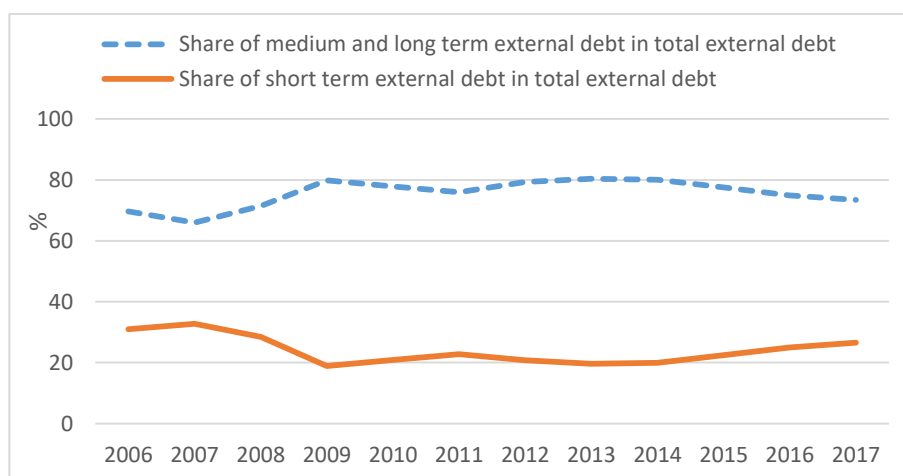
Source: NBR data.

In term of value, the short-term foreign debt increased in 2006-2011, except for 2009. Three years of decrease followed, 2012-2014, and an increase in 2015-2017.

Compared to the reference year, 2006, the short-term foreign debt was 95.7% in 2017.

During the surveyed period, the medium and long-term foreign debt represented the majority of the total external debt of Romania.

Compared to the reference year, 2006, the medium and long-term foreign debt was 140.2% in 2017.

The evolution of the external debt and of its components showed a turning point in 2013. Thus, 2013 is the first year from the surveyed period when the foreign debt and its components started to decrease, decreasing trend which continued in 2014 and 2015 (total foreign debt), in 2014 (short-term foreign debt) and in 2013-2017 (medium and long-term foreign debt).

The external direct public debt increased almost continuously in 2000-2017 (except for 2006 and 2015). The evolution of the medium and long-term foreign direct public debt showed a turning point in 2009, considering that it increased strongly from 2009 to 2013. This evolution is explained by the 20 billion Euro loan taken by Romania from the international financial organisations, received during these years and used for internal financing. The proportion of the foreign direct public debt within the total foreign debt increased as of 2009, until 2017 included.

Compared to 2006, the medium and long-term foreign direct public debt reached 377.6% in 2017.

The publicly guaranteed medium and long-term foreign debt decreased throughout 2006-2017, except for 2010. The same descending trend was noticed for the proportion of the publicly guaranteed medium and long-term foreign debt within the medium and long-term foreign debt, which was 0.6% in 2017. Comparing the 2017 value of the publicly guaranteed medium and long-term foreign debt with the 2006 value, one can notice the same decreasing trend (-88.5%).

The private non-guaranteed medium and long-term external debt slowed down its increasing trend in 2009, following a decrease in almost every year from 2010 to 2017 (except for 2012, when it barely increased), on the background of the effects of the international economic and financial crisis (liquidity shortage, significant shrinking of the economic activity, higher risk aversion of the creditors). This evolution occurred after a significant increase of the private non-guaranteed foreign debt in the years before the crisis, on the background of the economic boom. A negative situation for the Romanian economy refers to the high level of the lending interest rates, to the not quite adequate behaviour of the local banks in the lending process, to the overvalued real exchange rate of the national currency, which made the private sector to take loans from the foreign

markets, at rather advantageous costs compared to the cost of capitals on the local market.

Compared to 2006, the private non-guaranteed medium and long-term foreign debt was 85.3% in 2017.

From 2005 to 2010, included, the private non-guaranteed medium and long-term foreign debt held the majority within the total medium and long-term foreign debt of our country, which shows the significant increase of the dependence on the foreign financial market under conditions of of risk and uncertainty both for the debtors and for the creditors. The decrease of the share of the private non-guaranteed foreign debt as of 2009 was good in terms of external debt sustainability. The analysis shows that, in 2016, the proportion of the total public foreign debt was equal with the proportion of the private non-guaranteed foreign debt within the medium and long-term foreign debt, while in 2017, the public debt held a higher share than the private non-guaranteed foreign debt within the medium and long-term foreign debt (Chart 2).

Chart 2
The evolution of the medium and long-term external debt of Romania, by components
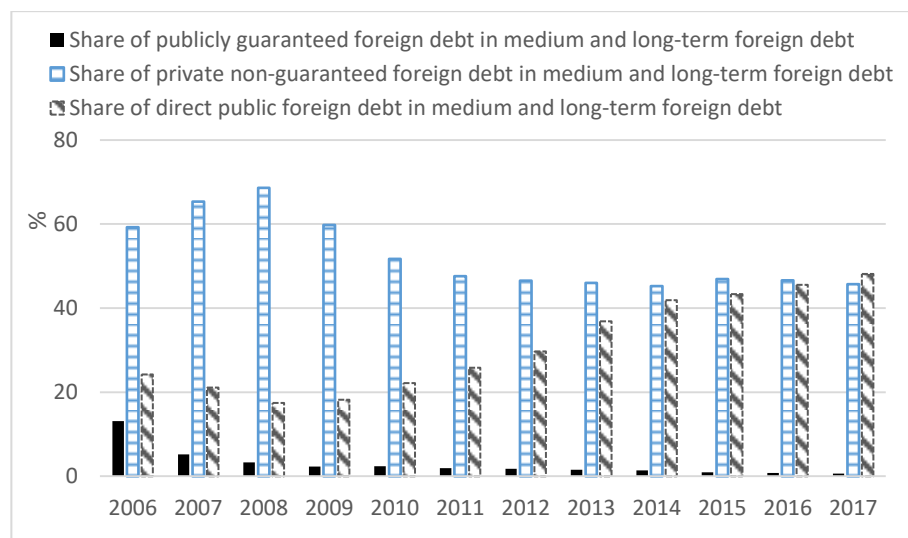
Source: NBR data.

3. Indicators regarding the structure by creditors of the medium and long-term external direct public debt

The multilateral credits represented, in 2006-2012, the bulk of the structure by creditors of the medium and long-term foreign direct public debt, while in 2013-2017, the share of the multilateral institutions within the medium and long-term foreign direct public debt decreased, reaching 31.7% in 2017, in favour of bonds issues. The high proportion of the multilateral institutions within the medium and long-term foreign direct public debt in 2006-2012, showed the interest of the international financial organisations towards the evolution of the Romanian economy, but also the needs of the Romanian economy for external financing during the period of economic boom and, particularly, within the context of the world economic and financial crisis, a strong increase being noticed in 2009-2010.

In terms of the importance of the institutional creditors, the proportion of loans from the European Union (EU) into the medium and long-term foreign direct public debt increased significantly in 2009-2011, due to the credit obtained by Romania from the European Union, and decreased in 2012-2017, when Romania paid back loans to the EU. Thus, the loans from the EU represented 1466.7% in 2017, compared to 2006.

The share of the loans from the European Union was important in 2009-2016, compared to the previous period (Chart 3).

The European International Bank (EIB) had high shares in 2006-2009; thereafter, the proportion of loans from this institution decreased gradually until present, with more significant annual increases in 2008, 2009 and 2011-2013. The loans from EIB started to be paid back in 2014. The loans from EIB represented 78.7% in 2017 compared to 2006.

The importance of loans from the International Bank for Reconstruction and Development (IBRD) decreased until 2010, fluctuating thereafter around 11% (Chart 3). From 2009 to 2017, the funds received from IBRD increased irregularly from one year to another (except in 2016). The loans from IBRD represented 141% in 2017 compared to 2006.

The proportion of the International Monetary Fund (IMF)'s loans increased significantly in 2009-2011, decreasing in 2012-2014, reaching 0 in 2015. The value of loans received from IMF increased strongly in 2010, decreasing thereafter in 2012-2014.

Despite the excessive media coverage of the IMF loans, their share in Romania's medium and long-term foreign direct public debt is lower compared to the loans from IBRD, EIB and EU (Chart 3).
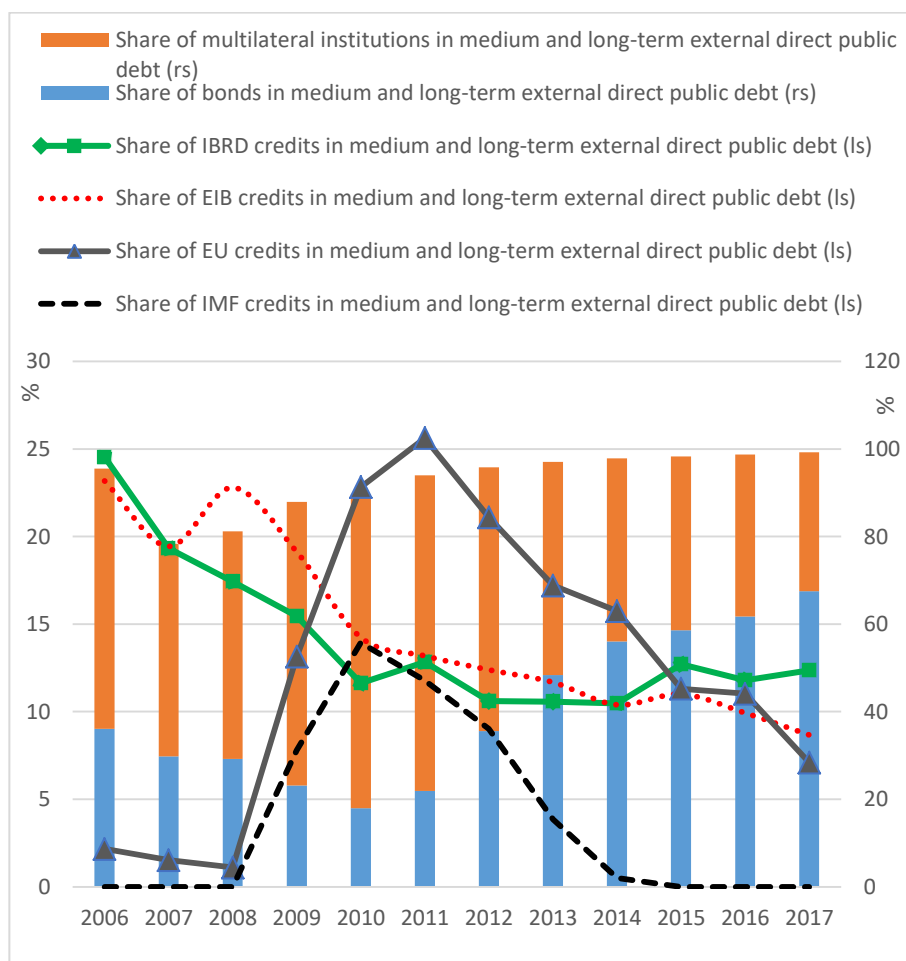
Analysing the structure by creditors of the medium and long-term foreign direct public debt, we may find the reason for its increase on the background of the partial refunding of the IMF loans. Thus, in 2009-2015, Romania took loans from IBRD, EIB (except in 2014), but also issued bonds on foreign markets, particularly as of 2011.

Starting with 2013, the balance of the capital and financial account had a completely different evolution compared to the previous years. Thus, the surplus of the capital and financial account decreased significantly under the conditions in which the positive balance of the capital account increased. This situation is explained for the first-time in the surveyed period, by the deficit of the financial account. This occurred in a year in which Romania has paid back 4.6 billion Euro to the IMF. We may also notice that in the same year, 2013, the currency reserves of the National Bank of Romania increased. Analysing the evolution of the other structural components of the financial account, we may find the explanation for this seemingly paradoxical evolution. Thus, although in 2012 and 2013, Romania has returned important amounts to the IMF, the foreign direct public debt didn't decrease, because Romania has borrowed capitals from the bonds market. This evolution is reflected by the balance of the portfolio investment, which was extremely high in 2011, 2012 and 2013 compared to the previous period.

The bond issues increased significantly in 2011-2014, trend which continued until 2017 included, contributing to the increase of the medium and long-term foreign direct public debt. Therefore, bond issues' share within the total medium and long-term foreign direct public debt increased in 2012, balanced out the proportion of the multilateral institutions in 2013, and became majority as of 2014, situation which continues up to the present (Chart 3).

Chart 3

The evolution of the structure by creditors of the medium and long-term external direct public debt of Romania

- Share of multilateral institutions in medium and long-term external direct public debt (rs)
- Share of bonds in medium and long-term external direct public debt (rs)
- Share of IBRD credits in medium and long-term external direct public debt (ls)
- Share of EIB credits in medium and long-term external direct public debt (ls)
- Share of EU credits in medium and long-term external direct public debt (ls)
- Share of IMF credits in medium and long-term external direct public debt (ls)

Source: NBR data.

It can be noticed that the institutional creditors were replaced by private creditors. Considering that the debt from the multilateral institutions involves lower costs, taking into account the interest rate charged for the countries perceived as having a high risk on the private market of international capitals; longer period of grace; longer total duration, the replacement of creditors is a deeply negative evolution for the Romanian economy in terms of reimbursement

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efforts. Instead of returning the foreign debt we contracted, we get more debt and under harsher credit conditions.

Nevertheless, the loans from the official creditors also have disadvantages: limited available volume, while the large scale use of such financing sends a negative message to the foreign investors, since the exceptional financing is intended to cover the current account deficit and to support the efforts of structural adjustment of the economy, this signal signifying efforts of economic reform never ended.

It is thus obvious the importance of a complex and coherent strategy of reimbursement of the foreign debt, in close connection with the reorganisation of the national economy and with the progress of economic reform, as well as the role of an indebtedness strategy, which should establish an optimal ratio between the medium and long-term debt and the short-term debt, between their due dates, so that the burden of the external debt is spread uniformly along the years, thus avoiding peak payments.

4. Indicators regarding the structure of the reserve assets of the National Bank of Romania

The reserve assets of the National Bank of Romania increased almost continuously throughout 2006-2017 (except for 2012, 2015 and 2017). This evolution shows Romania's financial-banking solidity and credibility, which should be further consolidated by adequate public policies, which should make the most of the reserve assets.

There was a period of strong growth of the indicator (2006-2010), followed by less significant fluctuations in 2013-2017 (except 2016).

The value of the reserve assets represented 61.8% in 2017, compared to the reference year 2006 (Chart 4).

The structure of NBR's reserve assets shows that the monetary gold represents a low proportion within the total. Its value increased in 2006-2012. The indicator had a fluctuant evolution in 2013-2017, with ups and downs (more significant in 2013).

Compared to the reference year 2006, the value of the monetary gold represented 122.3% in 2017 (Chart 4)

After the almost continuous increase in 2006-2012, the proportion of the monetary gold within the total reserve assets decreased in 2013, ranging around 9.5% in 2014-2017 (Chart 4).
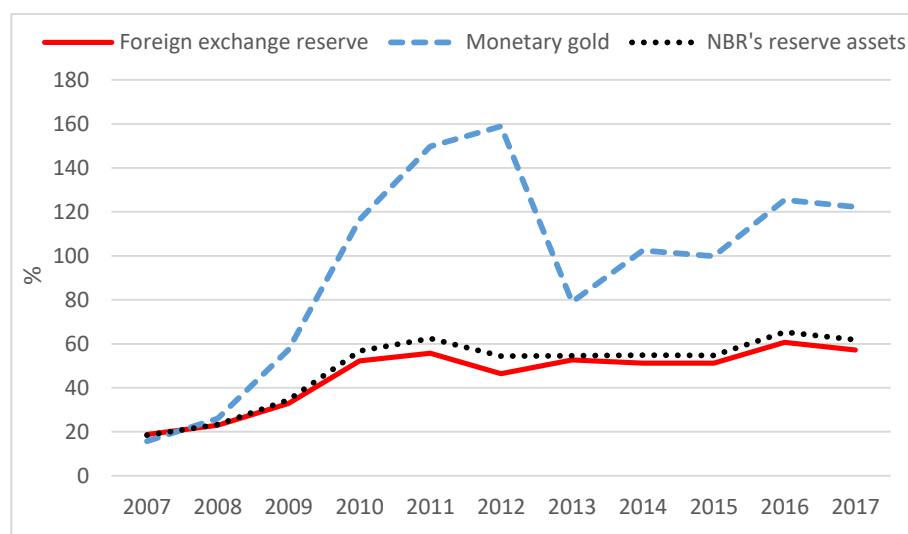
The foreign exchange reserve increased almost constantly in 2006-2017 (except in 2012, 2014 and 2017). The increase slowed as of 2011, while the decrease from 2012 is due to the paying back of a substantial amount of the foreign debt towards the IMF.

Compared to the reference year 2006, the value of the foreign exchange reserve amounted to 57.2% in 2017. The evolution of NBR's reserve assets is determined mainly by the evolution of the foreign exchange reserve (Chart 4).

The proportion of the foreign exchange reserve within NBR's reserve assets was rather constant, usually above 90%, except for 2011 and 2012.

Chart 4

The evolution of NBR's reserve assets and of their components (growth rate with 2006 as reference value)

Source: NBR data.

The foreign exchange reserve in months of import is large enough to be considered at a comfortable level for overlapping the imports. The foreign exchange reserve in months of import increased between 2006 and 2010, thereafter decreasing as of 2011 to the value of 6.3 in 2016.

5. Conclusions

During the surveyed period, the medium and long-term external debt represented most of the total foreign debt of Romania, which shows a rather adequate structure of Romania's external debt. A longer maturity supports sustainably the national economy, as the burden of the debt is spread on a longer time frame which doesn't "overload" stringently the budgetary decisions of the government and endanger its development projects.

In 2007, when Romania joined the European Union, the medium and long-term received foreign loans increased significantly, trend which continued until 2011. Thus, while in 2005-2010 the medium and long-term credits were used to offset the current account deficit, as of 2011, as part of the previous loans was returned, this indicator contributed to building-up the balance of payments deficit.

We may say that Romania has paid, starting with 2011, for the massive foreign loans taken in the previous years. Thus, the increase of the external debt generates risks at the microeconomic level (particularly on the Romanian banking system), as well as macroeconomic implications in terms of the foreign debt sustainability.

The evolution of the external debt and its components showed a turning point in 2013 when, for the first time in the analysed period, the foreign debt and its components started to decrease, trend which continued in 2014 and 2015 (for the total foreign debt), in 2015 (for the short-term foreign debt) and throughout 2013-2017, for the medium and long-term foreign debt.

A negative situation for the Romanian economy refers to the high level of the lending interest rates in Romania, to the not so adequate behaviour of the local banks in the lending process, to the overrated real exchange rate of the national currency. Therefore, many times the private sector took loans from the foreign markets at better costs than on the domestic market. This increased significantly the dependence on the foreign financial markets, under conditions of risk and uncertainty both for the debtors and for the creditors.

The private non-guaranteed external debt slowed down its increasing trend in 2009 and even decreased in the subsequent years on the background of liquidity shortage, of diminished economic activity and risk aversion of the creditors, caused by the economic-financial crisis and its effects. The decrease of the share of private

non-guaranteed external debt as of 2009 was good for the sustainability of the foreign debt.

The external direct public debt increased almost constantly in 2000-2017, with the strongest increase in 2009-2013, when Romania took a loan of almost 20 billion Euro from the international financial organisations. This loan was intended for the internal financing, as the economic-financial crisis increased the risk aversion of the investors, and the global liquidities became scarce, effects diffused through the financial channel, through the channel of trust and through the effect of contagion.

Thus, the loans from the EU represented 1466.7% in 2017, compared to 2006. The capitals received from the European Union increased after Romania has joined this organisation, within the context of the higher confidence in our country, as new member state of the EU.

The multilateral credits represented, in 2006-2012, the bulk of the medium and long-term foreign direct public debt, while in 2013-2017, the share of the multilateral institutions within the medium and long-term foreign direct public debt decreased, in favour of bonds issues, which became majority. Thus, starting from 2011, the institutional creditors were replaced by private creditors. As the loans from the multilateral institutions enjoy several advantages, the replacement of creditors has been a deeply negative evolution for the Romanian economy in terms of the effort of reimbursement. Instead of returning the foreign debt we already have, we get more debt, under harsher lending conditions.

This shows the need, in Romania, for a complex and coherent strategy of external debt reimbursement, in agreement with the reorganisation of the national economy and with the progress of the economic reform. Romania also needs a strategy of indebtedness, which should consider establishing an optimal ratio between the medium and long-term debt and the short-term debt, between their due dates, so that the burden of the external debt service is spread uniformly in time, with no peak payment moments.

The almost continuous increase of NBR's reserve assets shows the financial-banking solidity and credibility of Romania.

References

1. Milea, C. (2018), *The Financial Stance of Romania - 2017, The assessment of the external equilibrium*, Centre for Financial and Monetary Research – Victor Slăvescu, Bucharest,

2. National Bank of Romania (2008-2018), *Monthly Bulletin, December 2007*, *December 2010*, *January 2012*, *January 2013*, *January 2014*, *June 2014*, *December 2016, December 2017, January 2018, February 2018,* Bucharest;

3. National Bank of Romania (2011), *Annual Report 2010 – The balance of payments and the international investments position*, Bucharest;

4. National Bank of Romania (2014), *Annual Report 2013 – The balance of payments and the international investments position,* Bucharest;

5. National Bank of Romania (2017), *Annual Report 2016 – The balance of payments and the international investments position,* Bucharest

6. National Bank of Romania (2016), *Financial Stability Report 2016*, p.p. 163-180, ISSN 1843-3243 (online version), Bucharest,
    www.bnr.ro/files/d/Pubs_ro/RSF/RSF2016dec.pdf

7. * * *, http://www.bnro.ro/page.aspx?prid=10117

THEORETICAL AND PRACTICAL APPROACHES TO FISCAL CONSOLIDATION - THE EXPERIENCE OF ROMANIA

Ionel LEONIDA, PhD[*]

Abstract

Fiscal consolidation is a traditional concern, we can say at the European institutional level, ratified and gradually taken over by the member countries, implemented through the Stability and Growth Pact, and enshrined in the Treaty of Maastricht, which is part of the permanent bailouts of national governments of the national and anchor budgeting of the European Union's fiscal policy. The importance of fiscal consolidation was strengthened with the manifestation of the effects of the financial and economic crisis started in 2008, through the strengthening and monitoring of fiscal discipline, being regulated by the European fiscal framework, to which Romania has also joined. The proposed approach on the issue of fiscal consolidation aims in the first part to present some theoretical and scientific fundamentals of this concept, and in the second part, the progress registered in Romania based on a set of specific indicators will be presented and evaluated. From a methodological point of view, the conceptual, logical, analytical and deductive approach will prevail. The results obtained can be a benchmark for assessing progress on fiscal consolidation and fiscal status at national level.

Keywords: fiscal consolidation, fiscal stance, fiscal framework, fiscal rules

JEL Classification: E61, E62, H62

1. Introduction

Concerns about the limitation of public budget balances and debt ratios of member countries at European level, justified by the need to monitor national fiscal policies to achieve and maintain

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quantitative and institutional coordination, have intensified at Community level, have materialized in providing the fiscal framework with more complex mechanisms of monitoring, constraint, control and sanctions.

Alongside the concerns and institutional developments in the field of community tax, the concerns in the sphere of knowledge and scientific exploration of this field, specialized literature, have also intensified, offering studies oriented on several directions.

The literature offers studies with general approaches to fiscal consolidation that address specific issues (Agnello, Caporale, and Sousa, 2016; Alesina, Favero, and Francesco, 2015), but also the concern to highlight local, regional and community experiences prior to the financial and economic crisis (Afonso, 2010; Afonso, Nickel and Rother, 2005) that may be useful to substantiate current decisions and also to design fiscal-budgetary strategies. It also seeks, from the point of view of completeness and effectiveness, the tools used in the fiscal consolidation process (OECD, 2010).

At national level, the issue of fiscal consolidation is indirectly addressed by addressing related issues such as the lack of fiscal discipline (Dumitru and Stanca, 2010), frequent adjustments to the tax strategy, the manifestation and role of automatic fiscal stabilizers (Dinga, 2009), and from the perspective of fiscal governance.

The diversity of approaches and the abundance of work dealing directly or indirectly with the theme of fiscal consolidation confirms that it is a topic of interest for both the research environment and the institutional environment, and the authorities responsible for implementing fiscal policy and, implicitly, fiscal consolidation. This effervescence manifested around fiscal consolidation creates prerequisites for the appropriateness / adjustment of factors and instruments for substantiation and rationality of government institutional interventions through fiscal policy.

With these references provided by the literature, the present paper seeks, in the first part, to point out some conceptual and theoretical aspects of fiscal consolidation, and in the second part, the results recorded in Romania in the fiscal consolidation process, through in terms of conceptual and theoretical aspects, government interventions and a set of nominal and real convergence criteria of a fiscal and budgetary nature.

2. Theoretical approach to fiscal consolidation

In the process of governance of a country or community, of guiding the economy and of ensuring the sustainability of public finances, fiscal policy has a determining role given by its policy of adjustment. This character is generated by the traditional functions of the fiscal system: the financing function; the adjustment-stabilizing function of the economy, and the resource allocation function. Starting from these theoretical milestones on the role of taxation in the economy and society, we will theoretically tackle fiscal consolidation.

Fiscal consolidation occurs and manifests in particular through the capacity of the fiscal system, due to the existence of instruments / levers / means to stimulate or inhibit economic activity through the implementation of fiscal policy measures to mitigate economic cyclicality, governmental objectives of a quantitative nature, mainly but also qualitative, and / or economic constraints resulting from the ratification of Community / international treaties / agreements.

This process therefore seeks to achieve a quantitative goal based on intermediate objectives implemented through fiscal measures aimed at adjusting the size of tax revenues, budget expenditures (to narrow the gap between them) and, on this basis of reducing the size of government loans over a period of time.

Fiscal consolidation is currently considered a fiscal state to which it is aiming, and the achievement of this state is achieved on the basis of a desirable process that indirectly seeks to achieve economic convergence but, in particular, fiscal convergence within The European Union.

The desideratum of the fiscal consolidation process is, beyond the quantitative dimension of fiscal revenues and budget expenditures, the establishment of a (qualitative) discipline climate in the fiscal-budgetary process, starting from a good substantiation of the measures to be implemented, a good predicting anticipated results and avoiding frequent changes to tax rules embedded in specific codes. Fiscal discipline implies the transparency and even the public debate in the academic and university environments of the programs of measures promoted by the authorities and their passage through the institutional "filters" for the assessment of their consistency and convergence with the purpose of the fiscal consolidation, for the evaluation of the time horizon will be

implemented and will generate the anticipated effects for the possibility of implementing / designing signaling mechanisms and combating the potential fiscal and budgetary vulnerabilities generated by them.

An important aspect of the fiscal consolidation process is related to the administrative and institutional side, and the capacity to provide a favourable framework for fiscal consolidation by positively influencing behaviour in the economic sphere but also in the social sphere. An administrative and institutional apparatus with little capacity to create and support an optimal fiscal consolidation framework will alter the continuity and effectiveness of this process.

The impact of political decisions may also alter the process of fiscal consolidation, in the sense that they are not substantiated, but are geared to the political objectives / orientations of the governing party or to conjunctural issues (social, electoral, etc.). Such behaviours are present in most European countries, whereby mechanisms for limiting the impact of political decisions on the fiscal consolidation process have been introduced through the reform of the European fiscal framework. Generally speaking, these mechanisms aim at multi-annual planning of program-based budget expenditures, adoption of the fiscal responsibility law, additional constraints on budget deficit and public debt limits, and the creation of independent fiscal institutions at national level to monitor the fiscal and budgetary process, with an advisory role.

Summing up the issues outlined, we appreciate fiscal consolidation as a process of fiscal policy recovery by actions / measures aimed, in particular, at limiting the budget deficit, as well as acquiring good fiscal-budgetary discipline.

The assessment of the fiscal consolidation process is done by reporting the quantitative results, in terms of the budget balance, to the quantitative institutional set-up at the European level, implemented through the Stability and Growth Pact (SGP) and enshrined in the Maastricht Treaty (MT).

The general guideline for reaching this criterion is governed by the European fiscal framework, taken at national level, which aims at establishing fiscal policy co-ordinates applied by member countries in a given discipline and constraint on fiscal policies, expressed as fiscal indicators Budgeting.

Historically, the relative limitation and quantitative compliance of MT criteria, of a fiscal nature (the conventional budget deficit

account for at most 3% of GDP and the public debt to account for a maximum of 60% of GDP), proved to be insufficient to achieve the objective of tax discipline. On this background, there have been successive legal reforms of the fiscal framework that generally aimed to improve its effectiveness in consolidating fiscal positions through several objectives such as providing stronger economic bases to support the fiscal framework, increasing public debt, strengthening the mechanisms for implementing the fiscal framework and implementing more tax-friendly regulation.

This general tax framework is not a sure guarantee for completing the fiscal consolidation process, but is the starting point for each individual member state's "customization of the fiscal stance", its specificities, its history and economic present.

3. Practical aspects of fiscal consolidation - the experience of Romania

The monitoring and evaluation of the fiscal consolidation process is mainly based on the criterion of the balance of the conventional budget of the general consolidated budget, in terms of GDP.

Also, a number of other indicators derived from the operations between the conventional accountant and the structural balance can contribute to the consistency of the tax consolidation process. In this context, our analysis aims to include in the assessment a structural balance, fiscal position and fiscal impulse. Beyond the consistency or inconsistency of the fiscal consolidation process, these derived indicators can provide useful insight into the nature of fiscal consolidation measures, and in particular the fiscal nature of policy in general.

The conventional balance sheet budget balance indicator shows the general government deficit / surplus, based on the actual consolidated nominal consolidated general government data, excluding any revenue and / or expense categories.

The evolution of this indicator from the accession of Romania to the EU and until 2017, presented in figure 1, recorded a oscillating evolution following a cyclical trajectory. In the period 2008 - 2012, against the background of the reduced effectiveness of the fiscal framework implemented through the SGP, but also of the negative

manifestation of the effects of the economic and financial crisis, the limit set in the TM was marked by this indicator.

The effects of legislative changes taken over at national level and the prudence of tax authorities (post-crisis) have generated relatively immediate effects of adjusting the conventional balance, which is within the limits of MT, starting in 2013, which remains at the end of 2017.

A useful concept to support the nominal convergence criteria of a fiscal nature is the cyclically adjusted budget balance by which, from the conventional accounting budget balance, the economic activity fluctuations reflected in the variation of the revenues and the budgetary expenditures are eliminated. In practice and macroeconomic language, the name of structural balance is more commonly used, being associated with the structure of tax structures and budget expenditures.

Its phased calculation methodology, starting from the estimation of the actual GDP between GDP and the potential GDP, continuing with the estimation of the cyclical component based on the output gap and the deficit sensitivity and, finally, with the actual estimation of the structural component by removing the conventional balance accounting for the cyclical component, is useful for accurately assessing the budgetary and revenue targets, for a more specific assessment of the fiscal policy (expansionist or contractionist) and for providing information on the degree of economic stability.

Following the evolution of the structural balance over the whole period presented in figure 1, it is observed that it followed a cyclical trajectory, respectively the increase in the period 2006 - 2009, reduction in the period 2010-2015 and growth, starting with 2016.

Between 2011 and 2015, a period corresponding to the expansion of the economic cycle, as well as the consolidation of the structural balance, there were changes in the European fiscal framework, changes taking over Romania. Their implementation has created a mechanism for pursuing the consolidation, supervision and coordination of fiscal policy with a view to enhancing fiscal discipline.

The lack of these normative, even coercive, mechanisms regarding the structural balance in the first part of the analysed period led to a certain relaxation of the tax authorities regarding its evolution, but with their taking over in particular the requirement of a level of the structural balance and its convergence with the MTO, the level of the

structural balance has become a priority for the tax authorities. Against this background, it is noted that, from 2013 onwards, the structural balance reached the MTO target (-1%) faster than the target planning, which was maintained in 2014 and 2015. Moreover, synchronization is observed regarding the observance of the 3% of GDP limit of the conventional balance (the effect of the structural balance of "safety" on the limit of the conventional balance). This trend was supported by the economic growth recorded in that period (around 3% in 2014 and 4% in 2015), the increase in the level of tax revenue collection and the reduction of public investment expenditure, in particular in 2013 and 2014.

Since 2016, the structural balance has come out of the MTO target, in the light of the above-mentioned economic growth, expectations of the expansion of tax bases and potential tax multiplier effects, government authorities have implemented fiscal relaxation measures (reducing the share of CSS, the share of VAT) and the increase in budget expenditures (increase in wages in the public domain), measures that negatively affected the two budget balances (structural and conventional accounting).

Figure 1

The evolution of the structural balance, the conventional balance, the fiscal position and the fiscal impulse (% of GDP) during 2006-2017
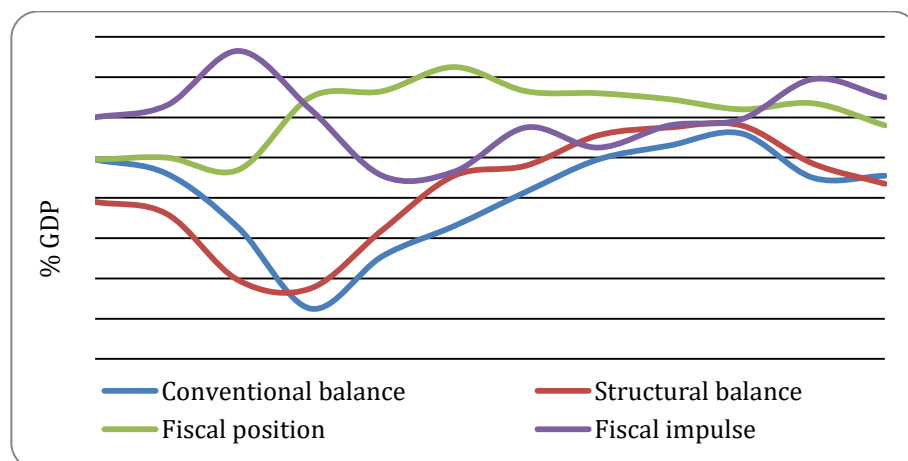
Source: Processed by the author based on the data in Appendix.

The fiscal position is an indicator showing the gap between the structural balance and the conventional balance, ie the current positioning of the conventional book balance against the potential benchmark. The usefulness of the information provided by this indicator refers to the type of fiscal policy that operates in an economy, from the point of view of the stabilization function of the economy. A positive value of the fiscal position indicator indicates a pro-cyclical fiscal policy, while a negative figure indicates an anti-cyclical fiscal policy.

Following the evolution of the fiscal position, during the reference period, presented in figure 1, it is noted that in the Romanian economy between 2009 and 2016 there was a procyclical fiscal policy, and in the period between 2006 and 2008 and in 2017 an anti-cyclical policy functioned. The pro-cyclical fiscal policy was more pronounced, according to the evolution of the fiscal position, between 2009 and 2013, after which, due to the constraints of the fiscal framework, the pro-cyclicality of the fiscal policy was moderate.

Another derived indicator is the fiscal impulse that shows the discretionary nature of fiscal policy and how it contributes to stimulating or inhibiting the economy. The fiscal impulse can be measured as a difference in the structural balance for two consecutive years or at two different times. A positive fiscal impulse indicates an expansionary fiscal policy, while a negative fiscal impulse suggests promoting a restrictive fiscal policy.

Following the evolution of the fiscal impulse in the reference period, presented in figure 1, it is observed that the fiscal policy has manifested oscillating tendencies of expansion and restrictiveness. The fiscal policy stance given by the information provided by the fiscal impulse indicator indicates that fiscal policy, in terms of stimulating / inhibiting economic processes, has been restrictive in the period of the economic and financial crisis (2007-2011) and expansionary since 2012.

The graphical representation of the four indicators in figure 1, which we consider to be a "scoreboard" of the progress made in the fiscal consolidation process, reveals at the same time that the fiscal-budgetary policy after a period of instability (2007-2012), characterized by excessive deficits, pro-cyclicality and restrictiveness, has generated a consolidation process from 2013 until 2016, with significant progress on budget balances, both the conventional and the structural balances were within the limits, but also in line with its

adjustment function macroeconomic, showing both anticyclical and expansionist tendencies. At the same time, the end of 2017 signals the tendency to deviate fiscal and budgetary indicators, especially balances, from the agreed targets.

4. Conclusions

In view of its purpose, fiscal consolidation aims at maintaining the conventional budget balance within predefined limits, both during economic and recession periods, in order to reduce government debt in the medium term and to establish a climate of fiscal discipline medium and long term.

The analysis revealed a general lack of stability in the evolution of the main indicator of the assessment of the fiscal consolidation process - the conventional budget balance - but also in the evolution of those derived from it, which means that there are certain vulnerabilities in the fiscal consolidation process.

A possible vulnerability arises from the composition of the measures implemented in the fiscal consolidation process, in which discretionary decisions are prevalent, less the elements of automatic fiscal stabilization.

The discretionary decisions, which have wide impact and effects, relatively immediate, but are generally weakly oriented and oriented, in particular, towards the increase of wage and social expenses, to the detriment of the investment ones, which, by their multiplier effect, will generate the expansion / consolidation of tax bases. Automatic stabilization elements integrated into the system of levy and public spending can generate slower action without creating vulnerabilities-generating shocks.

Another source of vulnerability is the relatively negligible, at the level of the tax-budgetary authorities, of the signals given both by the autochthonous independent tax organization and by the European bodies regarding a certain inconsistency of the governmental actions in the field of fiscal policy, in particular, with fiscal consolidation objectives (budget balances, relatively inadequate fiscal measures, etc.)

The progress obtained by Romania in the fiscal consolidation process is relatively inconsistent and lacking continuity and sustainability, and it is necessary to implement measures to strengthen fiscal discipline, to empower tax authorities in allocating

public resources, to education, to investment projects with multiplying effects tax and corruption mitigation in the sphere of public funds.

References

1. Afonso, A. (2010) „*Expansionary fiscal consolidations in Europe: new evidence",*Applied Economics Letters 17:2, 105-109, DOI: 10.1080/13504850701719892

2. Afonso, A. Nickel, C., Rother, P. (2005) "*Fiscal Consolidations in the Central and Eastern European Countries*", ECB Working Papers, No. 473/2005, available at http://www.ecb.int/ pub/pdf/scpwps/ecbwp473.pdf.

3. Agnello, L., Caporale, G. M., Sousa, R. M. (2016), *"How do fiscal consolidation and fiscal stimuli impact on the synchronization of business cycles?"*Bulletin of Economic Research,**https://doi.org/10.1111/boer.12101**

4. Alesina, A. Favero, C., Francesco, G. (2015) "*The output effect of fiscal consolidation plans",* Elsevier, Journal of International Economics 96 (2015) S19–S42.

5. Burgert, M. Hruzova, R. Lisicky, M., Monks, A., (2016) "*Composition Matters: Fiscal Consolidation and Economic Growth in the Czech Republic (2010-2013)",* European Economy, available at https://ec.europa.eu/info/sites/info/files/file_import/eb012_en _2.pdf.

6. Cournede, B.Goujard, A., Pina, A. (2013) „*Reconciling Fiscal Consolidation with Growth and Equity*", OECD Journal: Economic Studies, Vol. 2013, Issue 1. DOI: 10.1787/19952856.

7. Dinga, E. (2009), "*Studii de Economie. Contribuţii de analiză logică, epistemologică şi metodologică",* Editura Economică, Bucureşti.

8. Dluhopolskyi, O. (2016) "Fiscal Consolidation Effect in Theory and Practice", Czech Journal of Social Sciences, Business and Economics Vol.5, Issue 4.

9. Dumitru, I., Stanca, R. (2010) "*Fiscal discipline and economic growth - the case of Romania*", MPRA Paper No. 27300, online at http://mpra.ub.uni-muenchen.de/27300/.

10. OECD (2010), "*Fiscal Consolidation: Requirements, Timing, Instruments and Institutional Arrangements*", Economic Outlook Volume 2010/2.

Table 1

The evolution of the conventional budget balance, the structural balance, the fiscal position and the fiscal impulse in Romania, between 2006 and 2017 (% of GDP)

Year	Conventionalbalance	Structural balance	Fiscal position	Fiscal impulse
2006	-2,1	-4,2	-2,1	
2007	-2,8	-4,8	-2	0,6
2008	-5,5	-8,1	-2,6	3,3
2009	-9,5	-8,5	1	0,4
2010	-6,9	-5,6	1,3	-2,9
2011	-5,4	-2,9	2,5	-2,7
2012	-3,7	-2,4	1,3	-0,5
2013	-2,1	-0,9	1,2	-1,5
2014	-1,4	-0,5	0,9	-0,4
2015	-0,8	-0,4	0,4	-0,1
2016	-3	-2,3	0,7	1,9
2017	-2,9	-3,3	-0,4	1

Source: -conventional balance:
http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

- structural balance
http://ec.europa.eu/economy_finance/ameco/user/serie/ResultSerie.cfm. *(2010-2017) and the Fiscal Council for the period 2006-2009*

- fiscal position and fiscal impulse, calculations of the author, according to the methodology described in the paper.

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