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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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DYNAMICS OF AGGREGATE DEMAND FACTORS IN MACRO GROWTH: AN EUROPEAN PERSPECTIVE

The present study examines whether demand factors cause volatility in the economic growth of European Union (EU) with 28 member countries for the data from 1995 to 2016. The relative significance of household final consumption spending, investment, government spending and net exports has been tested by estimating linear regression model, running variance decomposition and applying impulse response function. Results indicate that all the four demand factors seem to be significant in the economic growth of EU. The consumption spending of the households influences the economic growth in the short run to medium run. While, investment and net exports are very significant to sustain growth in the medium to long run. It also appears from the result that too much interventions of national governments in Europe will de-stabilise the economic growth. It could be inferred that the sharp decline in the consumption spending of the households in Europe was the immediate cause of prolonged economic slowdown since 2008 which trickles down the investment, affects net exports and derails economic growth. Thus, the revival of marginal propensity to consume is the key factor for revival of European economy.
JEL: E12; E21; E22

Introduction

The fundamental economic theories conceptualise the balanced economy as a state of immense equality among the forces of demand and supply. The demand-side economics is held in opposition to supply-side economics of classical economists which argues that economic growth can be attributed to lowering tax rates and decreasing regulation. According to demand-side economics, output is determined by effective demand (Harvey, 2012). High consumer spending leads to business expansion resulting in greater employment opportunities. Higher levels of employment create a multiplier effect that further stimulates aggregate demand leading to greater economic growth (Liu & Nick, 2011). Keynes saw his theories successfully demonstrated in the 1930s when they helped to end the Great Depression and into the 1950s and 60s (Palley,1996). Since 2008 global economic crisis triggered by subprime crisis of USA, Europe is passing through deep

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contraction of the economy. The macro fundamentals of the region showing speedy and continuous downfall. Stagnancy in the GDP growth, low inflation, high unemployment and continued pessimism across the industries dampen Europe, though, there are signs of mild recovery in the recent past. Thinkers, economists and policymakers theorise demand as key factor in the business cycle of Europe. At this backdrop, the present study examines whether demand factors have impact on economic growth in European Union.

Review of Literature

Dreger & Hans (2011) investigated the long run relationship between private consumption, disposable income and wealth approximated by equity and house price indices for a panel of 15 industrialized countries. The study establishes a long-run equilibrium between consumption and income. The presence of wealth effects in consumption equations has been explored and it was also found that this arises from the global integration of asset markets and the relevance of risk sharing activities of agents.

Another study on the dynamics of relationship between private consumption spending and economic growth was carried out by Bouyon (2015). The focus of this study was to investigate whether the household consumption spending is a significant component in driving the growth of 28 countries in European Union. The study finds that the prolonged stagnancy in the European recovery since economic crisis was due to poor household consumption. It is also observed in the paper that the gradual recovery in consumption spending by the households in the recent years is the prime factor associated with the signs of economic growth recovery.

Specific studies are made on the relationship between the trade openness and the economic growth. Tekin (2012) found that a rise in exports has a positive effect on growth. Simuţ and Meşter (2014) studied the link between trade and growth for 10 East European states and traced a direct correlation and causality between exports and economic growth. Even Sultan and Haque (2011) studied Indian scenario and found that there is a long-run relationship between exports and growth. While a study by AL- Raimony (2011) investigating the relationship between real export and real import growth and economic growth in Jordan, finds that real export growth positively affects growth, while real import growth negatively affects economic growth. Abu-Eideh (2014) analyzed the effect of real domestic exports and imports on real GDP in Palestine. The result shows that real domestic exports have a positive impact on growth.

Lupu & Asandului (2017) studied the relationship between government expenditure and economic growth rate of 8 Eastern-European countries with data for 1995–2014 using the ARDL model. The result reveals that the current share of public spending exceeds the optimal level for Bulgaria, Hungary and Romania which affects the growth. The study concludes that the weight to government spending should be decreased in these countries since the public sector is not able to efficiently cope with its resources and that affects the growth.

There are also studies with multivariate analysis linking to growth. One of prominent among such studies is by Kalaitzidakis & Kalyvitis (2005). The result of the study shows that the government expenditure on factors such as infrastructure and transport, utilities, education and defence can promote long-term economic growth. Colombier (2011) and Sineviciene & Vasiliauskaite (2012) also explored other categories of government expenditure such as spending for social order, social security and health that support indirectly the economic growth. Shelton (2007) synthesises both the approaches to infer that there is a series of public expenditure that, directly or indirectly, using the adequate measures and during right moments, positively contribute to the creation of the gross domestic product and national wealth, promoting economic growth. This implies that the structure of public spending may be more relevant than its level.

Further, Mazurek (2017) examined the economic growth of 32 European countries from 2005 to 2015. The growth was measured through six socio-economic factors which include initial level of the gross domestic product, economic openness, democracy index, human capital, physical capital, and foreign direct investments. The study reflected that the growth was directly proportional to human and physical capital, and indirectly proportional to the initial level of GDP and the democracy index. Policy of openness and FDI seems to be not significant in impacting the growth.

Maradana et al. (2017) studied the long-run relationship between innovation and per capita economic growth in the 19 European countries over the period 1989–2014. This study uses six different indicators of innovation: patents-residents, patents-non-residents, research and development expenditure, researchers in research and development activities, high-technology exports, and scientific and technical journal articles. The cointegration results find evidence of a long-run relationship between innovation and per capita economic growth in most of the cases. The study also finds the presence of both unidirectional and bidirectional causality between innovation and per capita economic growth. These results vary from country to country, depending upon the types of innovation indicators that are used in the empirical investigation process. On the whole, the study reflects that innovation indicators are considerably linked with per capita economic growth.

It could be extracted from the earlier literature that economic growth is affected by various macroeconomic factors. None of the studies focussed on much needed empirical study on the impact of aggregate demand factors on economic growth and relative significance of demand factors. The present study fills this vacuum in the European Union context. The study has significance as the Europe has been passing through a prolonged economic slowdown and of late shows the signs of recovery. It is pertinent to investigate whether demand factors were significant for the slowdown since 2008 economic crisis and also in the recovery of the Europe do the demand factors individually and collectively.

Theoretical Framework

The framework of the present study is extracted from J.M. Keynes' (1936) model of measuring growth through aggregate demand. According to Keynes, balanced growth of the

economy is an important requirement to achieve macroeconomic stability. Macroeconomic balance requires the aggregate income is balanced by aggregate demand.

According to Keynesian economics, GDP is generated from the aggregate impact of all demand factors. The demand factors may be domestic as well as foreign for national goods. Domestic demand is generated by household final consumption spending (C), domestic investment (I) and government spending (G). While, foreign demand for national goods emerges from foreign buyers and will be registered in exports account (E). Domestic demand envelopes not only national goods but also foreign goods and this forms imports (M). The Keynesian aggregate demand is the aggregation of components of C, I, G and net exports (X-M). These four components of GDP interact to determine the aggregate demand and effectively result in the GDP. The Keynesian GDP identity, could be presented as in the equation (1):

(1) $$GDP = C + I + G + (X - M)$$

According to Kira (2013) Keynesian models not only provide an analytical framework to link the market forces and the resource allocation process in an economy but also may help in reducing fluctuations and enhancing the economic growth which are two major aspects of any economy. The suitability and applicability of these models are empirically tested by either macro-econometric simulations models, applied multi-sectoral general equilibrium models or by stochastic dynamic general equilibrium models (Kydland & Prescott, 1977). Though the model has been tested for validity and suitability, the empirical literature on measuring growth has very little application. Hence the present study employs Keynes aggregate demand model for examining the growth trends and the role of demand factors in determining the growth.

Trend Analysis

The analysis of the growth trends in European Union justifies the need to carry out a research on the underlying issue. The trends in growth of Europe could be analysed at two stages. The economic crisis of 2008 is the landmark which bifurcates the study into two stages. The first stage thus covers 1995 to 2007, while the second stage includes from 2008 to 2016. The trends clearly indicate that before economic crisis the economic growth of Europe was formidable. During this period the average annual GDP growth rate was 1.71 percent while the same was 0.58 percent in the post-crisis period of 2008-2016. European Union could not bear the shocks of subprime crisis triggered at U.S.A. All the four growth factors seem to be affected by the global economic crisis. Prior to the crisis, household consumption spending was very high and it was growing annually at the rate of 5.71 percent. Owing to the crisis, consumption spending fell drastically and the annual growth reached to a meagre 1.4 percent annually during 2008-2016. Poor consumption and absence of optimism in the market on future growth, new investments in European Union dried out completely from the annual growth of 6.86 percent before recession. Absence of fiscal stimulus in European Union region was evident during post-recession. The annual growth of government consumption spending declined sharply from 5.87 percent during pre-

recession period to 1.70 percent during the post-recession period. Since several European economies are debt-ridden and have high fiscal deficit, the reduced private consumption was not compensated by equi-proportional rise in government spending. Fall in domestic consumption increased exports from EU and reduced imports to EU in the post-crisis period. Net exports widened phenomenally since 2008. From the trends, it could be presumed that household consumption, investment, government spending and net exports share strong positive correlation with the economic growth of EU. However, this hypothesis framed from this discussion has to be tested and validated with the advanced empirical research. Also refer Annexure-1.

Table 1

Trends in growth factors of European Union (in %)

Duration	GDP	Annual Growth	C	Annual Growth	I	Annual Growth	G	Annual Growth	X-M	Annual Growth
1995-2007	22.29	1.71	74.29	5.71	89.12	6.860	76.36	5.87	-38.01	-2.92
2008-2016	5.25	0.58	12.58	1.40	0.76	0.084	15.33	1.70	1840.50	204.5

Source: Author's analysis of data sourced from CEIC data portal.

Research Methodology

Functional Variables

In order to meet the objectives, the present paper studies the nexus between economic growth and aggregate demand factors. The economic growth is measured by Gross Domestic Product (GDP) at 2010 prices. Whereas, the aggregate demand has been measured by household final consumption expenditure (PC), gross fixed capital formation as proxy for investment (I), government consumption expenditure (G) and net exports (X-M). The study considers the absolute values measured in billions of Euro of the selected variables. While estimating the econometric models, the absolute values are converted to log values. The selection of variables is largely guided by Keynes' framework of aggregate demand.

Data Source and Study Period

The data required for the current study are collected from the CEIC data portal. The study employs time series data on quarterly basis from January 1995 to September 2017. It covers data of last 23 years with 91 observations. The criteria approached to select the duration of data was the availability of the data.

Estimation Techniques

The present study has applied some econometric tools and techniques using E-views package to analyse the nature, direction and size of relationship between factors of aggregate demand and economic growth in European Union. Since the study adopts time

series data analysis, the stationarity of the data sets has to be tested and for which Augmented Dickey Fuller (ADF) unit root test has been approached. Upon confirming the stationarity of data, Ordinary Least Square (OLS) regression model has been estimated to test the impact of household consumption, investment, government spending and net exports on economic growth of European Union. To learn the relationship between demand factors and economic growth beyond the size and nature of impact as ascertained from regression model, the impulse response function (IRF) has been estimated. The IRF ascertains the response of one endogenous variable to the shocks of other endogenous variable. The study also runs variance de-composition to measure the degree of variability in an endogenous variable because of changes in its own value and also because of changes in the other endogenous variable.

1. Stationarity Test: An empirical research using time series data begins by testing the stationarity of the data series. This in other words means the underlying time series data does not have unit root problem. A data series is said to be stationary when its mean and variance are constant overtime and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed (Gujarati and Sangeetha, 2007). All the data series which are procured for the current study are tested for their stationarity.

Though there are many methods available to test the stationarity of time series, the Augmented Dickey Fuller (ADF) method is one among the most accepted methods. ADF test is the modified version of Dickey-Fuller (DF) test. The ADF makes a parametric correction in the original DF test for higher order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression. The ADF test, in the present study, consists of estimating the regression equation (2).

(2) $Yt = bo + \beta X Yt_{-1} + \mu_1 X Yt_{-1} + \mu_2 X Yt_{-2} + \sum_{i=1}^{n} \mu i X Yt_{-1} + et$

Y_t represents the series to be tested, bo is the intercept term, β is the coefficient of intercept in the unit root test, μ_1 is the parameter of the augmented lagged first difference of the dependent variable, Y_t represents the i^{th} order autoregressive process, it is the white noise error term. The number of lagged difference terms to include is determined empirically, the idea being to include enough terms so that the error term is serially uncorrelated (Gujarathi and Sangeetha, 2007).

The stationary condition under ADF test requires that: p-value is less than 1 (IpI <1). In other words, the computed t value should be more negative than the critical t value (t statistic < critical value). The computed t statistic will have a negative sign and large negative t value is generally an indication of stationarity (Gujarathi and Sangeetha, 2007).

One of the critical aspects in running the unit root test is determining the lag length. It is significant that the test results vary with the change in the lag length. The present study adopted Schwarz Info Criterion which is widely used by the researchers to decide the lag length.

2. Model Specification: In order to identify the size and nature of impact of different aggregate demand factors to the changes in economic growth, a linear multiple regression model has been estimated. Keynes' national accounting methodology provides appropriate theoretical framework in estimating regression model for the present study. The national income accounting methodology has three approaches such as product approach, income approach and expenditure. The expenditure method of estimating GDP as proposed by J.M.Keynes has been borrowed in the study. Adopting from Keynesian theory, the dynamics of different demand factors is tested in the study. For which a linear multiple regression model is estimated for equation (3). The estimated regression model has GDP as proxy variable to measure the economic growth of European Union. The components of economic growth or factors determining the economic growth which form the set of growth predictors are: household final consumption expenditure (PC), gross fixed capital formation (I) a proxy to investment spending, government consumption spending (G) and net exports (X-M). The regression equation estimated for the current study is as follows:

(3) $Y = ba+\beta_1X_1 + \beta_2X_2+ \beta_3X_3 +\beta_4X_4 + et$

Where, Y is GDP which is the dependent variable, X_1, X_2, X_3 and X_4 are the independent variables referring to household final consumption (PC), investment (I), government consumption spending (G) and net exports (X-M) respectively. β_1, β_2, β_3 and β_4 are coefficient values of independent variables and *et* is the error term. The ordinary Least Square (OLS) method of estimating the regression is applied using E-Views statistical package.

Theoretically, Keynesian framework advocates for positive relationship between dependent variable and the independent variables. Hence, the study expects positive sign preceding the estimated coefficient value of the predictor. The theory argues that increasing household final consumption, raising investment, expansionary government consumption spending and widening net exports contribute to faster growth of GDP and vice-versa.

3. Variance Decomposition: The regression model estimates only the impact of predictor on the dependent variable. It does not accurately measure how much variability in an endogenous variable is due to the changes or shocks in the other endogenous variable and how much is owing to its own shocks. Further, regression does not measure variability in an endogenous variable at different stages in a time horizon due to shocks in the other endogenous variable. Variance decomposition technique is applied in this study which measures accurately the proportion of variability in GDP caused by changes in household consumption, investment, government spending and net exports in the long run, and how much is owing to its own shocks. Further it also decomposes the variability in other endogenous variables used for the study. In the general linear model, the relationship between the two variables is captured by the linear equation:

(4) $Y = a + bX + c$

Y = dependent variable or response variable, and X = independent variable or explanatory factor.

With every unit change or shocks in X, there is a corresponding variation in Y. The variance decomposition focuses on the 'response variable' i.e. Y which responds to the

variations in the independent variable i.e. X. Specifically, the variance of Y for the shocks of other endogenous variable in the model can be presented as follows.

(5) $Var(Y) = E(Var[Y|X]) + Var(E[Y|X])$

In this equation Var(Y) is variance of Y, E(Var[Y|X]) is explained variation of Y directly due to changes in X and Var(E[Y|X]) reflects unexplained variation comes from somewhere other than X. Thus, the variance decomposition brings out the variance of Y owing to: (1) the expected variance of Y with respect to X, and (2) the variance of the "expected variance of Y" with respect to X. In other words, the variance of Y is its expected value plus the "variance of this expected value."

4. Impulse Response Function: Impulse response function provides even more accuracy on the relationship between the variables in the system. This econometric technique explains the responsiveness of the endogenous variable in the system to shocks to each of the other endogenous variables. For each endogenous variable in the system, a unit shock is applied to the error, and the effects over time are noted. Impulse response function estimates accurately the percentage change in GDP for a given percentage change in the government spending in the long run. It also measures the percentage change in government expenditure in the long run for a given shock administered to GDP. The impulse response function helps in visualising better picture on the direction, nature and size of relationship in the long run. This provides a dynamic analysis to the relationship of the variables in the model, unlike regression approach which is static in nature.

Analysis of Empirical Results

The study uses time series data for the variables selected under the study for analysis and it is statistically essential to ensure the stationarity of the data series. The Augmented Dickey Fuller (ADF) method of testing the unit root has been employed in the study and the results are presented in Tables 1. The ADF results indicate that none of the data series was stationary at level (I(0)). While in the first order differencing (I(1)) all the five sets of time series data are found stationary. The ADF test develops following hypotheses.

H1: GDP has a unit root

H2: C has a unit root

H3: I has a unit root

H4: G has a unit rot

H5: X-M has a unit root

The results of unit root test reject all the hypotheses. The rejection of hypotheses could be made only when the t value is smaller (more negative) than the critical value. All the hypotheses are rejected at 1st order differencing. In case of GDP, I and X-M, the hypotheses are rejected at 1% level of significance, hypothesis on G is rejected at 5% level of significance and hypothesis relating to C is rejected at 10% level of significance. Rejection of hypotheses confirms that none of the time series data have any unit root problem and they are stationary and hence could be

deployed for further econometric analysis. And as required all the data series are integrated at the same order (i.e. at I(1)). The detailed results are presented in Tabel-2.

Upon confirming the stationarity of the data series used for the study, a regression model has been estimated using ordinary least square method. The objective of estimating the linear regression model is to identify the dynamics of relationship between the demand factors and GDP. The results of the same is presented in Table- 3.

Table 2

Augmented Dickey –Fuller Test of Stationarity

Variables	Order	t-statistic	Critical Value		P-value	Order of Integration	Level of Significance	Decision
GDP	I(0)	-1.030790	1%	-3.509281	0.7391	I(1)	1%	Reject H0
			5%	-2.895924				
			10%	-2.585172				
	I(1)	-5.352178	1%	-3.509281	0.0000			
			5%	-2.895924				
			10%	-2.585172				
C	I(0)	-1.508926	1%	-3.512290	0.5242	I(1)	10%	Reject H0
			5%	-2.897223				
			10%	-2.585861				
	I(1)	-2.727142	1%	-3.512290	0.0738			
			5%	-2.897223				
			10%	-2.585861				
I	I(0)	-1.101021	1%	-3.510259	0.7123	I(1)	1%	Reject H0
			5%	-2.896346				
			10%	-2.585396				
	I(1)	-3.918980	1%	-3.510259	0.0029			
			5%	-2.896346				
			10%	-2.585396				
G	I(0)	-1.566572	1%	-3.508326	0.4952	I(1)	5%	Reject H0
			5%	-2.895512				
			10%	-2.584952				
	I(1)	-2.938044	1%	-3.508326	0.0452			
			5%	-2.895512				
			10%	-2.584952				
X-M	I(0)	-1.924311	1%	-3.504727	0.3199	I(1)	1%	Reject H0
			5%	-2.893956				
			10%	-2.584126				
	I(1)	-9.557610	1%	-3.506484	0.0000			
			5%	-2.894716				
			10%	-2.584529				

Table 3

Results of Ordinary Least Square Regression Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PC	3.038014	0.449546	6.757956	0.0000
I	0.975174	0.915468	1.065220	0.2897
G	-4.260342	0.850456	-5.009477	0.0000
X_M	-2.555020	0.948616	-2.693419	0.0085

R-squared	0.412781	Mean dependent var	3040.916
Adjusted R-squared	0.392532	S.D. dependent var	319.4351
S.E. of regression	248.9685	Akaike info criterion	13.91549
Sum squared resid	5392722.	Schwarz criterion	14.02586
Log-likelihood	-629.1548	Hannan-Quinn criter.	13.96002
Durbin-Watson stat	0.793516		

Dependent Variable: GDP Included observations: 91 after adjustments

Based on the Durbin-Watson stat value, it could be interpreted that the estimated model has a good fit. As reflected by the Adj R^2, the aggregate demand collectively explains 39 percent of changes in the GDP of European Union (EU). This makes us to understand that 61 percent of variation in GDP of EU is caused by factors outside the model. This raises the debate on the relevance of Keynesian framework as growth model in the current uncertain and volatile globally integrated world. It is also noteworthy that two of the four predictors namely government consumption spending and net exports are found influencing the GDP significantly but negatively. This result is much against to the theoretical predictions. In the EU scenario, government consumption expenditure seems to be negatively related to economic growth. This trend may be owing to the crowd out factor. In a high mass consumption economy (developed economy) the consumption potential grows very slowly and increasing government consumption spending results in proportionate decline in household consumption. Also the size of impact in this case is the largest among the variables. A one percent decrease in government consumption spending increases the economic growth of EU by four percent. The argument of lesser fiscal intervention of the national governments gains support from the result.

The global integration via trade in goods and services and the consequent trade balance is another factor pronouncing the domestic demand for global products and thereby influencing the domestic growth. This theoretical prediction does not get supported by the empirical evidences in EU context. The widening trade surplus does not seem to be boosting up the growth. During the current prolonged economic slowdown, the exports are not appreciated, rather the domestic demand of the households are expected to be met. When the exports are minimised and are flooded in the domestic market, they raise the percapita consumption and economic growth accelerates.

Keynes strongly argues that investment has positive multiplier effect on the growth of the economy. In European case, investment seems to be positively influencing the GDP, though it is statistically not significant. From the results it appears that a one percent injection of additional investment in the economy has the potential to raise the GDP by nearly one percent.

Household final consumption has very high statistically significant positive impact on GDP of Europe. The magnitude of impact is such that when the domestic final consumption of the households varies by one percent the GDP of EU varies by about three percent. The prolonged economic slowdown of EU could be attributed primarily to the household consumption. The reduced purchasing power of households pushed the European economy to the crises in 2008-09 and the slow recovery owes to marginal rise in household consumption. Lack of optimism about the future of the economy and job insecurity induce people to spend less and save more to the uncertain future. The household consumption is the only demand factor in the given model which has high statistically significant impact with expected sign preceding to the coefficient value of the variable.

The regression model estimated the nature and size of impact of one variable on the other. The regression analysis is static in nature and it does not incorporate the dynamics of the flow of relationship among the endogenous variables with the time lag. This estimation does not factor how much variability in a variable is caused by its own shocks and how much variation is caused by shocks in the other endogenous variable. Variance decomposition technique decomposes such variability factors in the endogenous variables and provide such analysis for a longer period. The results are presented in Table-4.

An analysis of results of variance decomposition decomposes the factors attributing to the variation in the GDP and other endogenous variables over the period of time. From the results it appears that 17 percent of variability in GDP of EU is caused by the shocks of household final consumption in the time horizon and the remaining 83 percent variability in GDP is caused by its own shocks. Though the size of variability in GDP for the shocks in household consumption is not substantial, but still it has a significant impact. Looking from the feedback angle, a shock in GDP attributes only close to seven percent of variation in household consumption. While shocks in investment attributes 27 percent of variation in GDP. A shock to government consumption spending owes 23 percent of variability in GDP over the 10 quarters. Shocks of net exports seem to be causing less variation in GDP. A unit shock of net exports has the potential to vary GDP by 13 percent and the remaining 87 percent of variation in GDP is caused by its own shocks. Thus, the variance decomposition reflects that the variability in GDP over the long run is positively and statistically significantly contributed by household consumption, investment, government spending and net exports in European context. The results of variance decomposition, which takes into account the time lag effect of the shock of an endogenous variable, slightly contradict with the regression results. The variance decomposition provides more realistic picture of the nature of relationship with reference to time lag. This result provides evidences to support Keynesian theory.

Table 4

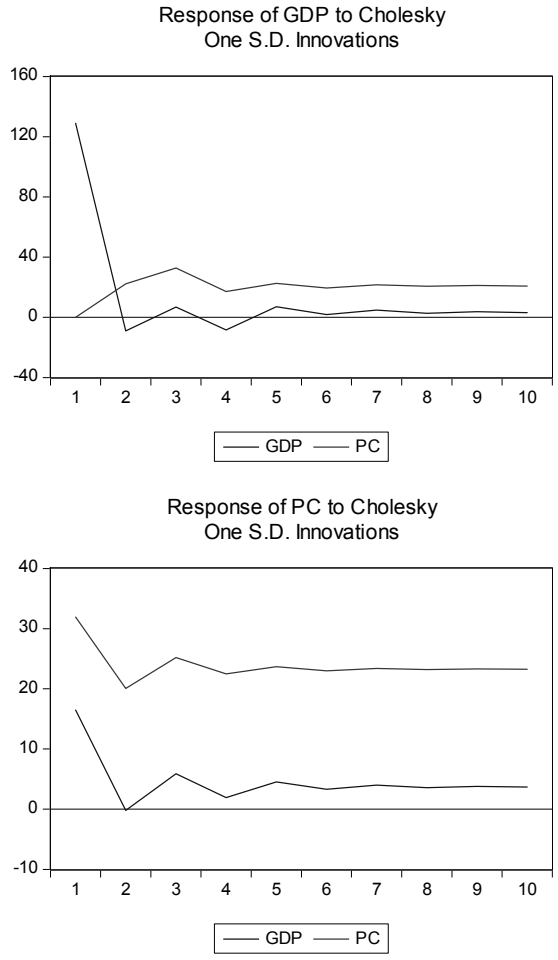
Results of Variance Decomposition of GDP

Variance Decomposition of GDP:			
Period	*S.E.*	*GDP*	*PC*
1	128.6312	100.0000	0.000000
2	129.9966	98.53906	1.460935
3	132.4037	95.23196	4.768044
4	133.7544	93.34244	6.657560
5	135.4505	91.11867	8.881329
6	136.9007	89.25140	10.74860
7	138.3838	87.41656	12.58344
8	139.7786	85.73759	14.26241
9	141.1439	84.14500	15.85500
10	142.4562	82.65585	17.34415
Variance Decomposition of GDP:			
Period	*S.E.*	*GDP*	*I*
1	141.3022	100.0000	0.000000
2	144.3338	98.73730	1.262696
3	157.1453	91.24126	8.758738
4	160.9410	88.82741	11.17259
5	169.1276	83.94003	16.05997
6	173.2184	81.68230	18.31770
7	179.2901	78.61140	21.38860
8	183.2745	76.74445	23.25555
9	188.1028	74.64671	25.35329
10	191.8011	73.14018	26.85982
Variance Decomposition of GDP:			
Period	*S.E.*	*GDP*	*G*
1	135.4078	100.0000	0.000000
2	137.1298	98.23511	1.764888
3	143.2756	93.19223	6.807773
4	145.4019	91.50781	8.492192
5	149.9301	88.47159	11.52841
6	152.5047	86.32857	13.67143
7	156.2335	83.48917	16.51083
8	159.2071	81.28396	18.71604
9	162.5538	78.98234	21.01766
10	165.5556	76.98584	23.01416
Variance Decomposition of GDP:			
Period	*S.E.*	*GDP*	*X-M*
1	152.8545	100.0000	0.000000
2	163.4884	98.31824	1.681758
3	188.3552	97.79995	2.200046
4	199.6946	96.09427	3.905728
5	212.4726	94.72694	5.273064
6	221.8858	92.98295	7.017051
7	230.8491	91.35160	8.648401
8	238.5476	89.65708	10.34292
9	245.6613	88.04739	11.95261
10	252.0896	86.48588	13.51412

Later, impulse response function has been estimated. It explains the responsiveness of the endogenous variable in the system to shocks to each of the other endogenous variables. So, for each endogenous variable in the system, a unit shock is applied to the error, and the effects over time are noted. Figure-1 provides evidence that the future values of GDP respond significantly and positively to the shocks of household final consumption spending in short to the medium run. One standard deviation innovations or a unit shock administered to the household consumption causes a response of 32 percent in GDP during the third lagged quarter. The response of GDP to the shocks of household consumption will be equi-proportional in the successive quarters. This, again supports the findings of regression and variance decomposition. Thus the significance of positive trend in domestic household consumption is reaffirmed for EU scenario.

Figure 1

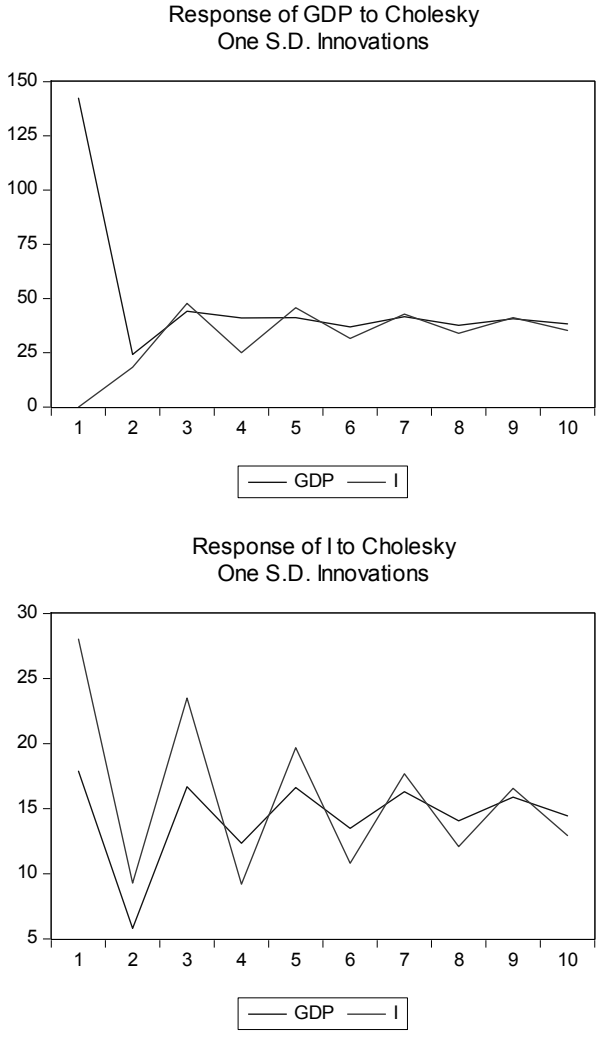
Impulse response of GDP to household consumption



The impulse response function reaffirms (Figure-2) the potential role being played by investment in Europe. A one standard deviation innovations in fixed capital formation in Europe at a given point of time creates a chain of impulse responses of economic growth from medium to the long run. For a shock in investment, the future values of GDP respond positively and it attributes 47 percent to the changes in GDP in the following third quarter. Even in the long run the positive impulse response of GDP for the given shock in investment sustains. This again, finds evidence in supporting regression result and also support to Keynesian theory of investment multiplier.

Figure 2

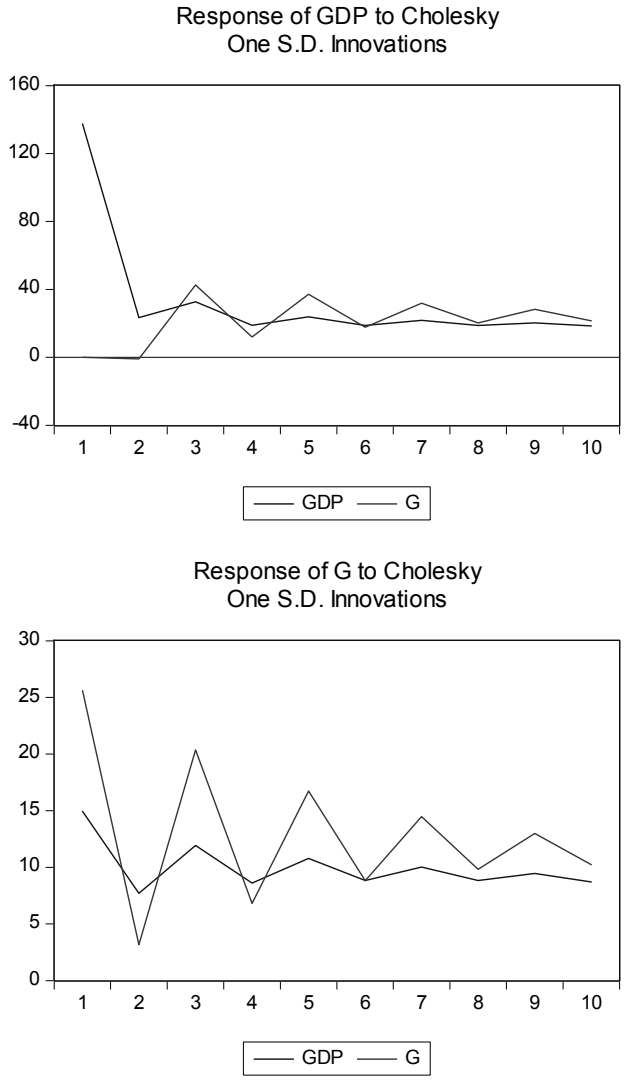
Impulse response of GDP to investment



The GDP responds negatively to the shocks of government spending initially (Figure-3). This supports regression. But impulse response function, unlike regression assesses the impulse response of GDP for the one standard deviation innovation in government spending and the result shows that the response turns positive in the medium term and highly volatile in the long run. In the free market economy, the role of the government seems to be restricted to be the regulator of market forces.

Figure 3

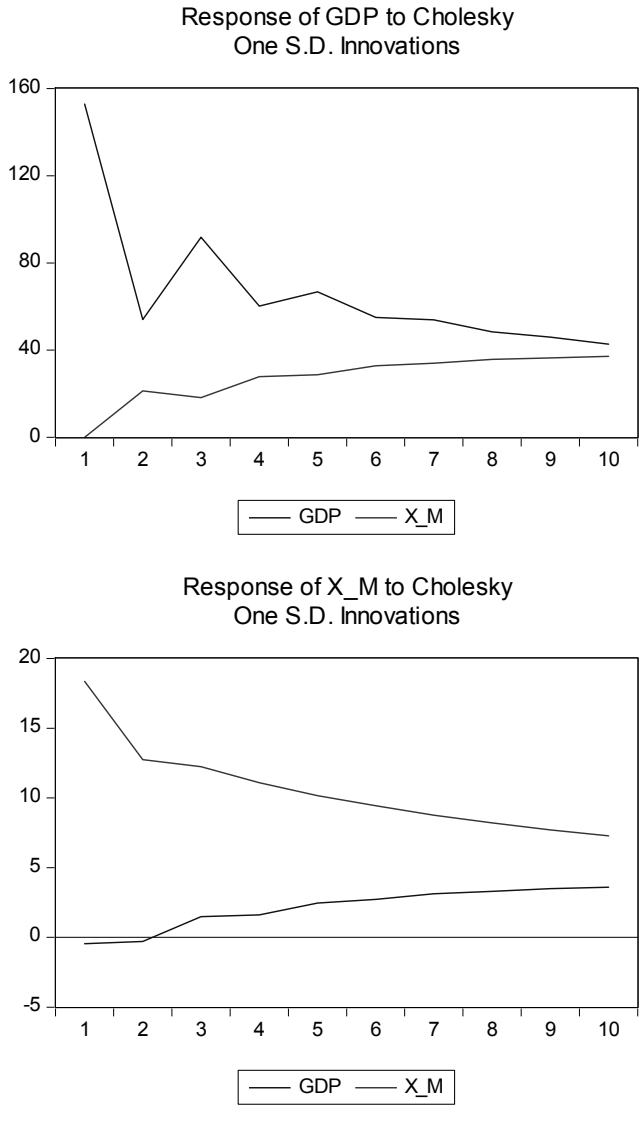
Impulse response of GDP to government consumption spending



For a given shock in the external sector i.e. net exports, the economic growth does not respond much initially (Figure-4). However, the response of economic growth is more visible in the medium to long run. For the sustained long-run growth, achieving positive net exports becomes significant in European Union.

Figure 4

Impulse response of GDP to net exports



Conclusion and Policy Implications

To summarise the findings of the study, variance decomposition and impulse response provide better insight to the dynamics of aggregate demand factors over the period of time than regression analysis. In the context of European Union, all the four demand factors seem to be significant in the economic growth. The consumption spending of the households influences the economic growth in the short run to medium run. This supports the findings of Lupu and Asandului (2017) who studied exclusive impact of public spending on economic growth of Eastern Europe. The present study also explores that investment and net exports are very significant to sustain growth in the medium to long run. It appears from the results that too much interventions of national governments in Europe will de-stabilise the economic growth. Even Bouyon (2015) identified that government spending negatively affects economic growth if exceeds the optimal level.

From the results it could be inferred that the sharp decline in the consumption spending of the households in Europe was the immediate cause of prolonged economic slowdown since 2008. During the period of growing uncertainties, households chose to save rather than spend, which in turn brought a halt in investment in the medium run. The absence of optimism on the future economy forced people to save more and spend less despite the monetary efforts of negative interest rate by the European Central Bank. For the quick recovery of Europe from the long-standing sluggish growth, boosting up consumption demand is the key as it has the potential to accelerate investment across several sectors, which in turn can create net exports. The marginal rise in consumption expenditure since 2014 has spurred up investment and net exports marginally. However, the rise in demand factors is very meagre and insufficient to trigger solid recovery from the slump. The negative interest rates are successful only to a limited extent to encourage spending and accelerate investment. With the understanding of interdependence of growth factors, the European national governments must pursue fiscal policies revising the income tax slabs and tax rates which releases more liquidity for spending. Rationalising the corporate tax will positively induce to revise investment with which even higher exports could also be achieved. In the market-driven economy, investment and export will have positive growth provided the consumption spending has healthy ratio. Thus, the revival of domestic consumption is the key factor for revival of European economy.

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Annexure 1

Trends in macro growth factors in EU – 1995 to 2016 annual series (figures in EUR bn)

Year	GDP	C	I	G	X	M	X-M
1995	10692.02	4219.71	1542.55	1443.70	2048.20	1939.87	108.33
1996	9872.44	4470.02	1621.94	1519.54	2185.67	2061.88	123.79
1997	10156.23	4741.63	1692.12	1574.78	2454.17	2304.71	149.46
1998	10457.49	4963.80	1809.22	1625.49	2587.89	2472.90	114.99
1999	10773.41	5229.42	1936.71	1718.16	2739.65	2665.38	74.27
2000	11186.01	5626.00	2108.88	1831.45	3254.17	3225.09	29.08
2001	11429.82	5849.80	2151.52	1924.58	3391.09	3311.66	79.43
2002	11584.37	6036.87	2179.10	2040.70	3445.50	3297.49	148.01
2003	11738.56	6118.65	2195.29	2114.57	3431.16	3312.30	118.86
2004	12033.10	6402.81	2314.06	2213.77	3747.11	3612.99	134.12
2005	12285.36	6698.09	2457.46	2322.41	4074.01	3984.65	89.36
2006	12689.92	7018.74	2681.28	2442.05	4715.04	4512.82	202.22
2007	13075.76	7354.63	2917.27	2546.02	4926.27	4849.53	76.74
2008	13134.12	7419.88	2928.52	2632.36	5082.24	5060.61	21.63
2009	12563.88	7087.68	2521.72	2677.26	4282.05	4161.34	120.71
2010	12828.98	7354.06	2569.24	2752.00	4947.65	4835.66	111.99
2011	13051.62	7537.25	2658.10	2771.17	5467.00	5325.26	141.74
2012	12990.73	7732.53	2649.47	2824.54	5730.79	5462.97	267.82
2013	13027.56	7756.83	2608.66	2847.52	5809.57	5459.93	349.64
2014	13255.79	7968.40	2718.94	2920.06	6052.29	5667.43	384.86
2015	13561.43	8328.65	2881.52	3023.32	6480.96	5965.74	515.22
2016	13824.16	8353.27	2950.78	3036.00	6457.23	6037.50	419.73

Source: Compiled by author from CEIC data portal.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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LEGAL COMPETENCE AND CONSUMER BEHAVIOUR

In line with European standards and international practice the current legislation in Bulgaria soundly guarantees the protection of consumer rights. Nevertheless, the consumers are not always familiar with it and don't always feel protected and it is a precondition for wrong decisions. Regarding that we analyse the correlation between the level of consumer's legal competence in the case of quality mismatch and his consumer behaviour when deciding a purchase and the warranty service of durable goods. Statistically we defend the thesis that the lack of legal knowledge influences the consumer behaviour in a negative way and favours the existence of unfair commercial practices. Proposals for increasing consumer legal awareness and guidelines for refinement of the legal base are highlighted.
JEL: D18; M31

1. Introduction

Regarded at large, consumers are the engine of modern economic development and have the power to determine its speed and direction. Out of this mass, however, the individual consumer is weak and vulnerable in the world of large business corporations which, driven by the desire for quick profit, often harm his interests. The lack of equilibrium in the strength, information and resources available to both parties puts consumers at a disadvantage (Lyubenova, 2013). The scale of this imbalance justifies the claims that consumer protection must be a top priority for the European Commission (Nancy, 2016). At the same time, the common examples of abuses by merchants and producers, the flooding of the market with poor quality goods and the constant attempts to mislead the consumer lead to the emergence of the unprecedented crisis of consumer trust that we are witnessing today (Bozic, 2017). Possible reasons for this trust deficit can be sought, on the one hand, in the lack of an adequate mechanism to protect consumer rights and, on the other hand, in the low legal competence of the consumers themselves. In this context, the

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analysis of the existing legal framework for the protection of consumer rights and the study of consumer awareness of their rights gains momentum.

Historically, the first consumer protection law in Bulgaria was drafted in 1992 but it was not submitted for discussion to the National Assembly, and only afterwards in 1999 the Law on Consumer Protection and Trading Rules was promulgated (Valchev, 2016). By 2006, when a new regulatory framework was drawn up and adopted with regards to Bulgaria's EU membership, this law guaranteed the protection of consumers' lives, health and property, their economic interests, access to judicial and extrajudicial protection, the right to association and the right to information. At present, a system of consumer protection laws is in force in Bulgaria, including the Constitution of the Republic of Bulgaria (1991) and the Consumer Protection Act (2005), and a number of sectoral laws such as the E-Commerce Act (2005), the Tourism Act (2013), the Energy Act (2003), etc. Although the Constitution uses the term "consumer protection", it refers not to the protection of the individual rights of a particular consumer but to the overall protection of consumers, the set of rules covering all possible areas of violation of their rights and legitimate interests (Constitutional Court Decision No. 4, 2007). Moreover, the obligation to provide adequate legal regulation of consumer rights stems also from Art. 38 of the Charter of Fundamental Rights of the European Union (2012) which provides for a high level of consumer protection in Union policies. Union law requires the development and strengthening of consumer rights, in particular through well thought-out regulatory measures and improved access to simple, efficient, expeditious and inexpensive means of redress, including out-of-court mechanisms for consumer protection (Regulation (EU) No. 254, 2014).

In the context of the gradual harmonization of the Bulgarian legal framework with the European one, an information campaign and two large-scale studies financed by the European Commission were made - Consumer Protection and Rights in Bulgaria, Wave 1 (Gallup, 2009) and Wave 2(Gallup, 2010). Although these studies reflect users' self-assessment of their basic legal knowledge and the effectiveness of the campaign, they do not analyse in detail the exact rights consumers are aware of and of which they are not. At the same time, despite the existence of a rich regulatory framework for the protection of consumers' rights, the insufficient knowledge about it and the lack of an adequate mechanism to control its compliance create prerequisites for unfair commercial practices, misleading the consumer and changing consumer behaviour (Kraleva and Dimitrova, 2017). Alarming data about the actual level of consumers' legal competence reveals the Consumer Empowerment Index conducted in 2011. According to the survey Bulgaria is on the bottom of the list with critically low levels of consumer skills, awareness and engagement (Nardo et al., 2011).

In response to the problems raised, an analysis of the relationship between consumer behaviour and the level of awareness of two general consumer rights - the right to guarantee compliance with the sales contract and the right to claim - has been made in this article. The main research goal is to reveal some of the mechanisms under which these rights are violated and to provide guidance for their adequate protection. Due to the significant differences in the pattern of behaviour in the purchase of various types of goods, the subject of the study is limited to consumer decisions in the choice and after-sales service of durable

goods only. For the purpose of the research goal an interpretation of the normative basis has been presented, an analysis of the results of an empirical research has been made and some general conclusions and recommendations for raising the awareness of the consumers and improving the normative basis in their defence have been proposed.

2. Legal definitions and terminological differences in the terms used. Discussion on the legal basis.

This article discusses two basic consumer rights regulated by the CPA, namely the right to guarantee compliance with the sale contract and the right to claim. These two rights are in full compliance with the general principles of civil law, which state that parties must act in good faith when signing contracts (OCA, Art.12, 1950). Given the general principles of contract law, the vendor is obliged to pass on to the buyer an item that corresponds to the contract of sale. The Consumer Protection Act also provides that the trader is responsible for any lack of conformity of consumer goods with the sales contract (CPA, Art.105, 2005). Moreover, the special law stipulates that the trader is responsible for any lack or inconsistency that existed at the time of delivery of the merchandise and occurred within two years of delivery even if he did not know about the non-compliance. It should be emphasized that CPA presumes that any non-conformity of the consumer merchandise with the sales contract, which occurs within 6 months after the delivery of the merchandise, is deemed to exist at the time of its delivery. The refusal of the legal presumption lies with the trader who has to prove that the lack of conformity is due to the nature of the merchandise or the nature of the non-compliance (CPA, Art.108, 2005).

In the interpretation of the legal provisions, it is important to specify that the term "consumer", according to § 13, point 1 of the CPA, should be understood as any natural person who acquires goods or uses services that are not intended to carry out commercial or professional activity and any natural person who, as a party to a contract under this Act, acts outside the scope of his commercial or professional activity. According to the above-mentioned legal definition, legal persons cannot be consumers at all, even if they do not have a commercial capacity (universities, non-profit associations, foundations, etc.).

For the purposes of § 13, point 2 of the CPA, a "trader" is any natural or legal person who sells or offers for sale goods, provides services or concludes a contract with a consumer as part of his trade or profession in the public or private sector, and any person acting on his behalf and at his own expense.

The law applies to each consumer contract. A consumer contract is a transaction whereby a commodity reaches its final recipient - a person who intends to use its utility rather than profit from it by re-introducing it to the market. Consequently, the categorization of a contract as a consumer contract depends only on the capacity of the parties in the particular case - "trader" and "consumer" within the meaning of the CPA.

It should be noted that the trader is the seller or the manufacturer party to the contract. As a seller, the law has defined any natural or legal person who, in the course of his professional or commercial activity and on the basis of a contract of sale, sells consumer goods. The

manufacturer is the person who makes the product, the importer of the product in the territory of the European Union or of a country party to the Agreement on the European Economic Area, and any person who presents himself as a manufacturer by affixing his name, trademark or other distinctive sign (CPA, Article 104, 2005).

In the context of the relationship between the trader and the consumer in the event of non-compliance of the consumer goods with the sale contract under Art.1 of the CPA, the right to claim arises. The claim is, in essence, a notification to the trader of the identified defect. It should be borne in mind that it is a matter of reducing the fitness of the merchandise, but not of total unfitness, which should be treated as a complete failure. The purpose of the claim is to restore the fair market equilibrium by providing the consumer with the opportunity to respond to qualitative and quantitative deviations of the product after its purchase or, respectively, in the service after its delivery.

When making a claim, the consumer may choose between repairing the merchandise and replacing it with a new one, unless this is impossible or the method of compensation chosen by him is disproportionate to the other. In practice, the trader will be able to dispose of liability for inconsistency of the merchandise / service with the agreed upon only in the following cases: 1) if he explicitly notified the consumer of the non-conformity or 2) the non-conformity is due to materials provided by the consumer.

Receipt of complaints takes place throughout the business hours at the place of purchase where the merchandise was purchased, respectively the service was ordered, either at the business address of the trader or at another place specified by him. The claim may also be made at any of the trader's premises on the territory of the country in which a similar commercial activity takes place, while the right to choose a place to make a claim belongs entirely to the consumer.

The law does not establish a requirement for a particular form in which the claim is to be made, but in practice it is necessary to make a request to the consumer in writing to submit a complaint. Pursuant to Art. 125, para. (2) to (4) of the CPA, the consumer must also attach certain documents proving the basis of his claim: (a) a receipt or invoice; (b) protocols, acts or other documents establishing the non-conformity of the merchandise or service with the contract; (c) other documents establishing the amount and the ground of claim. The trader, for his part, must write down the claim in his claim book. Within one month of submitting the claim, the trader is required to repair the merchandise free of charge or replace it with a new one. Otherwise, the consumer has the right to terminate the contract and to be reimbursed the amount paid or to demand a reduction in the price of the consumer product (CPA, Art.113, 2005). Of particular importance is the fact that, under the legal framework, the trader is obliged to reimburse the amount paid by the consumer when, after the same product has been repaired three times within the warranty period, there is a subsequent inconsistency of the merchandise with the contract of sale.

When making a claim, the consumer may refer to the legal guarantee or the commercial guarantee, whichever is better for him. The legal guarantee is the guarantee provided by the Consumer Protection Act. It entitles the consumer to a claim for all purchased goods, including second-hand products or products purchased through the Internet. The time limit for making it is two years, but not later than two months after the discovery of the non-

compliance for goods and 14 days for services, which cannot be shorter by agreement between the two parties. Upon expiry, the consumer may only make a claim if the purchased item is additionally protected by a commercial guarantee which provides for a warranty period longer than two years. The commercial guarantee is a written statement from the trader or the manufacturer of the commodity by which he undertakes to assume obligations to the consumer supplementary to those of the legal guarantee. It is not mandatory. The commercial guarantee binds the one who grants it to remove at his expense the defects and damages that occur within the warranty period. The additional guarantee may cover either the extension of warranty periods or additional rights and privileges granted to the consumer. However, it cannot "replace" or "displace" the rights of the consumer by law. Therefore, the consumer has the right to claim the merchandise or service regardless of whether the manufacturer or trader has provided a commercial guarantee for the goods or services (Kraleva and Dimitrova, 2017).

In many cases, traders provide a guarantee of 1 month, 6 months or 1 year. What is important here is that the two-year guarantee specified in the CPA also applies and consumers are misled by the incorrect behaviour of traders who refuse to accept a claim after the expiry of the shorter term of the commercial guarantee. That is where many of the problems come from, as consumers do not know that the commercial guarantee does not rule out the legal guarantee, and traders do not always fulfil their obligations under the special law. Furthermore, according to Art.119 of the CPA, the trader is obliged, in the framework of the application for the commercial guarantee, to inform the consumer in writing about the existence of a legal guarantee. This should be done in Bulgarian and be formulated in a clear, comprehensible and readable way.

For failure to fulfil these obligations, the trader bears administrative-criminal liability (CPA, Article 221, 2005). Consequently, regardless of the commercial guarantee, the trader is responsible for the lack of conformity of the consumer goods with the contract of sale under the legal guarantee under Art. 112-115 of the Consumer Protection Act. It is important to note that when the trader refuses to satisfy the consumer's claim as well as in breach of the obligations under the warranty provided, additional safeguards are provided for the consumer. The person concerned may seek the assistance of the Commission for Consumer Protection, as well as the competent court.

3. Legal competence and consumer behaviour – empirical research

The above interpretation of the CPA highlights two basic consumer rights - the right to a legal guarantee of compliance with the sales contract and the right to claim. In order to meet the research goal of determining the level of consumer information on these rights and the possibility of influencing their consumer behaviour before and after purchase, a study was conducted. Social networks were the main channel for distribution of the survey. The choice of the online method is based on the ability to reach a large number of geographically dispersed respondents within relatively short terms and at the lowest possible cost. The LimeSurvey platform was used to produce and disseminate the electronic questionnaire and the data were collected from 04 to 22 April 2017 using a convenience

sample. A total of 489 responses were received, of which 346 were complete. For the analysis only the full responses were used.

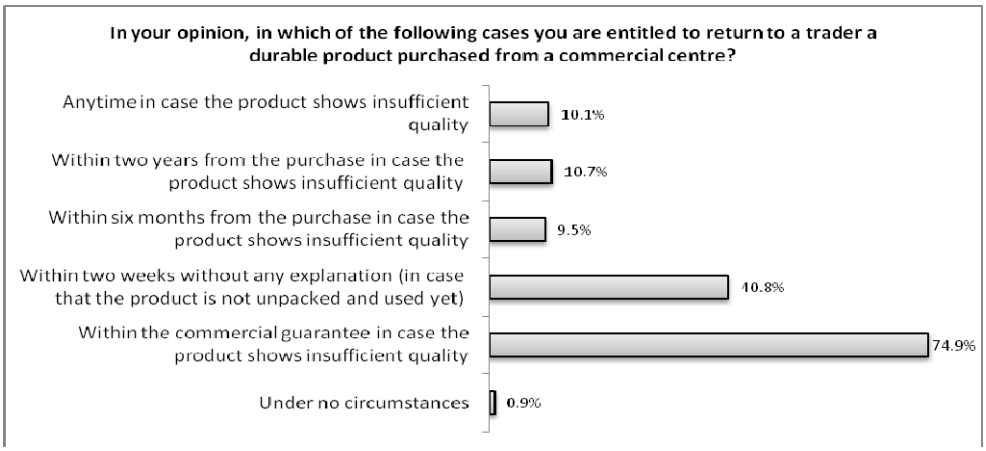
The profile of the surveyed respondents includes 77.2% women and 22.8% men. Higher education respondents predominate, with 55.5% holding a Master's degree and 25.1% a Bachelor's degree. The age structure has the following distribution: 16.2% are aged 18 to 25; 23.1% are between 26 and 35; 33.5% are from 36 to 45; 14.7% are aged 46 to 55 years and 12.4% are over 55.

The results of the survey show that despite the information campaigns conducted after the entry into force of the CPA, consumers are extremely poorly informed about their rights. Asked in which cases they believe they have the right to return a durable product purchased from a commercial centre, only 10.7% of the respondents indicate a two-year period after the purchase, provided the product shows insufficient quality (i.e. within the legal guarantee provided in Art. 112-115 of the CPA). At the same time, the relative share of those who responded affirmatively to the question asked once again at the end of the questionnaire, but with a slightly different wording, namely, "Do you know that within 2 years of the purchase you have the right to claim for quality mismatches of the merchandise?" is 33.2%. The difference in outcome can be attributed to the distortion caused by the inconvenience that some respondents feel confessing to their incompetence. For this reason, we believe that a more objective assessment of consumer awareness of their rights gives the first question.

Another sign of poor legal competence is the relatively low percentage of respondents (over 40%) who think they can return the merchandise within two weeks without any explanation, provided that they have not unpacked and used it - a right which is reserved only in case the product is purchased at a distance or over the Internet.

Figure 1

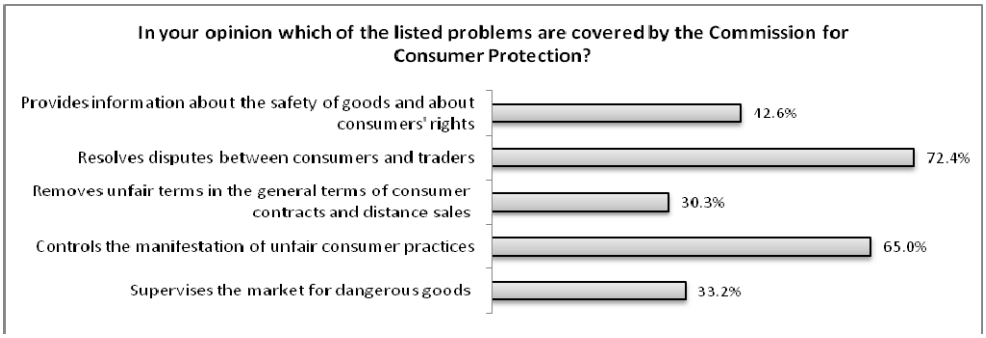
Consumer awareness regarding the right to claim



Unsatisfactory awareness is also demonstrated by consumers as regards to the responsibilities and powers of the Commission for Consumer Protection. The highest is the share of respondents who are aware that the Commission deals with resolving consumer disputes (72.4%) and with its role as an observer of unfair commercial practices (65%). Significantly lower is the proportion of those who recognize it as a body that supervises the market for dangerous goods, provides information about the safety of goods and consumers' rights and removes unfair terms in the general terms of consumer contracts and distance sales.

Figure 2

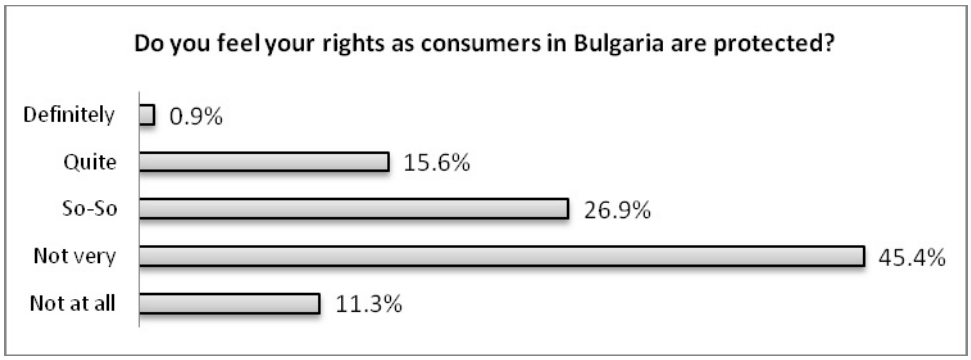
Consumer awareness of the Commission of Consumer Protection responsibilities and powers



Asked if they had addressed to the Commission for Consumer Protection in the past year because their claims had not been satisfied by a trader, 72% said they did not have to. A little over 10% have contacted the Commission - 18 people to get information and 19 people to file a complaint. The rest of the respondents remained passive in resolving the problem because they did not believe that filing a complaint would have an effect (12.7%) or because they did not know how to submit it (5.2%). The cross-sectional analysis of these data with the answers to the question "Do you feel your rights as consumers in Bulgaria are protected?" shows the existence of a weak but statistically significant correlation between the perception of security and the contact with the Commission for Consumer Protection (χ^2 тест: $\alpha = 0,05$; Asymp.Sig.(2-sided) = 0,000; Cramer's V = 0,181; Approx.Sig. = 0,000). In fact according to the data analysed only about 16% of the respondents fell that their rights as consumers are protected to a certain extent (Fig. 3). There is also a statistically significant correlation between the sense of security and the awareness of the right to a legal guarantee within 2 years (χ^2 тест: $\alpha = 0,05$; Asymp.Sig.(2-sided) = 0,003; Cramer's V = 0,214; Approx.Sig. = 0,003). These data show that the confidence in the consumer rights protection system is directly related to the fact that consumers in Bulgaria are poorly informed about their rights.

Figure 3

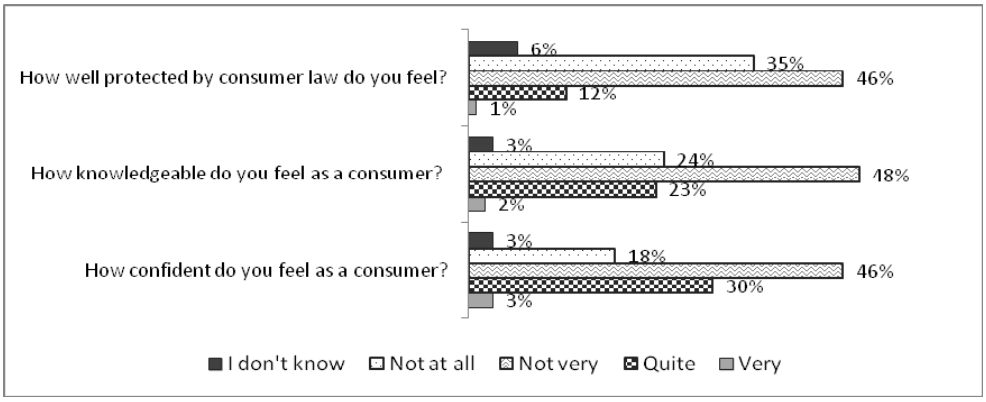
Perception of customer security



Compared to the official data from the Eurobarometer conducted in 2011 the results from this research show that regardless of the massive information campaigns the awareness of Bulgarian consumers of their rights, their confidence as consumers and their perception of being well protected have not improved at all (Fig. 4). In this sense, we can conclude that conducting additional campaigns to inform citizens about their rights as consumers would have a strong impact on their consumer self-esteem only if an out-of-the-box approach is used.

Figure 4

Consumer confidence according to Eurobarometer, 2011

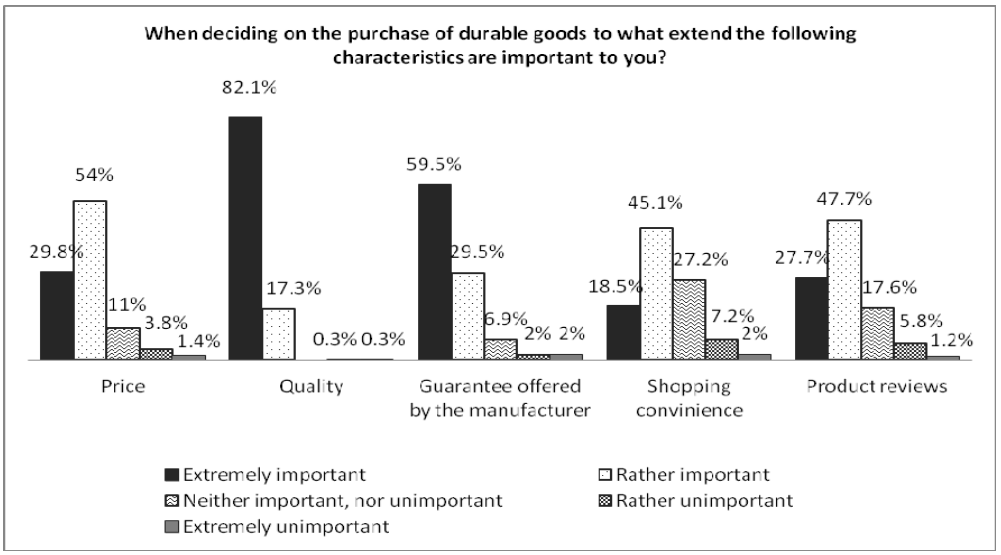


Source: NARDO, M., LOI, M., ROSATI, R. & MANCA, A. 2011. The Consumer Empowerment Index. *A measure of skills, awareness and engagement of European consumers.* Luxemburg: Publication Office of the European Union.

Concerning consumer behaviour, the study shows that the quality of the product is of utmost importance when deciding on the purchase of durable goods (82.1% indicate this characteristic as extremely important and 17.3% as rather important). Secondly, respondents point out the provision of a guarantee by the manufacturer, which is extremely important for nearly 60% and rather important for almost 30% of the survey participants. For the most part, consumers rate the price, convenience of shopping and product reviews as being rather important (Figure 5). A weak correlation between these characteristics and the demographic profile of the respondents is recorded only in terms of price as a selection factor on which the gross monthly income may affect (χ^2 тест: α = 0,1; Asymp.Sig.(2-sided) = 0,072; Cramer's V = 0,134; Approx.Sig. = 0,072), as well as with regard to the provision of a guarantee by the manufacturer that is more important to the ladies (χ^2 тест: α = 0,1; Asymp.Sig.(2-sided) = 0,068; Cramer's V = 0,159; Approx.Sig. = 0,068).

Figure 5

Key factors when choosing durable goods

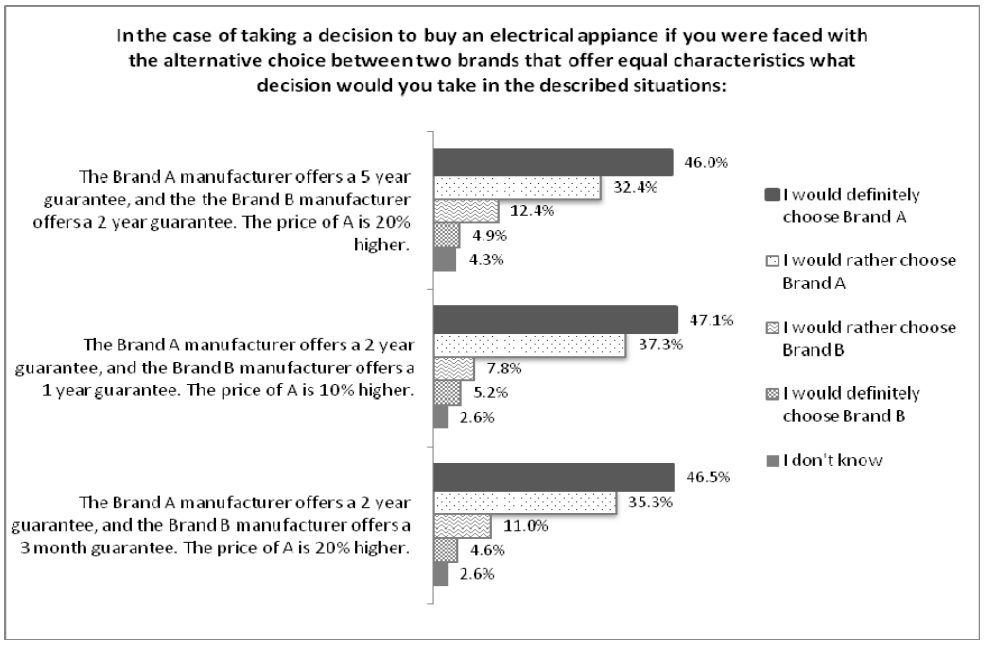


Indicative of the importance consumers place on security is also their willingness to pay a higher price for receiving warranty service. By comparing two alternative brands of electrical appliances that offer a different warranty period, around 80% of respondents would pay 20% higher price to get a longer warranty (Figure 6). These data testify that the provision of warranty service is a factor that strongly influences consumer behaviour. Consumers not only tend to prefer one brand to another based on the availability and duration of the warranty provided by the manufacturer but would also pay a higher price for it. At the same time, manufacturers offering warranty services with a duration close to or even shorter than the legal one may take advantage of this completely fictitious competitive advantage. In this sense, lack of information about the CPA allows for the development of

unfair commercial practices and consequently leads to a distortion of the market mechanism.

Figure 6

The period of warrantee service as a factor affecting the choice of durable goods



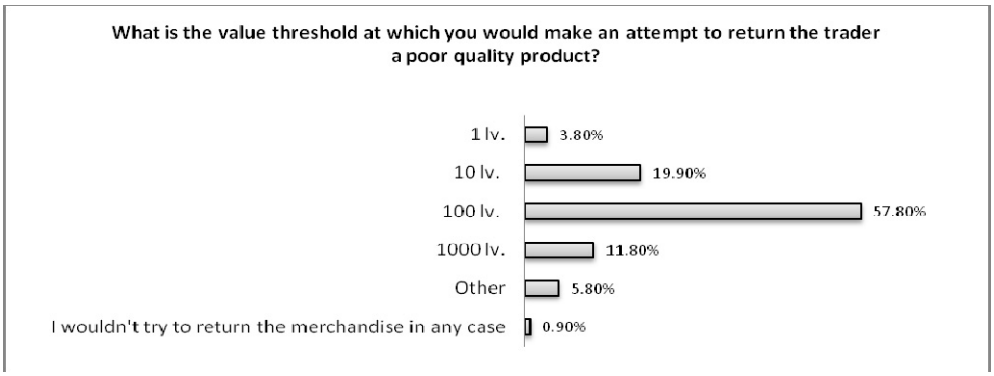
A major problem might also be the possibility of influencing consumer behaviour after purchase through the provision of warranty service shorter than 2 years. Asked what they would do if, after having purchased a durable product without warranty offered by the manufacturer, it turns out that a month later it was damaged by routine use, 56.6% of the respondents said they would try to return the product to the seller; 17.3% will contact the Commission for Consumer Protection, 11.3% would turn directly to the manufacturer, and 7.8% would directly dispose of the product. In case the purchased product had a 1-year warranty provided by the manufacturer but a week after it had expired the product got damaged, consumers' reactions would be as follows: 12.7% would try to return the merchandise to the seller, 32.4% would contact the service office indicated on the guarantee card with a request for warranty service despite the expired warranty period, and 50.9% would consult a service of their own choice and possibly repair the item on their own expenses. These data confirm that the provision of a commercial guarantee with a shorter than the legal guarantee period directly affects consumer behaviour. Notwithstanding the obligation of the trader / manufacturer implied by Art.119 of the CPA to inform in writing the consumer of his right to a legal two-year quality assurance guarantee in the warranty card, many traders intentionally ignore it. In the event that the commercial guarantee is

shorter than the legal and the information about it is missing, it obviously misleads the consumer. As a result, more than half of the consumers who participated in the survey stated that they would take over the repair of the goods for their own cost after the expiry of the term mentioned in the warranty card.

What might also be interesting is how the price of the product influences the readiness of consumers to seek their rights. The study shows that the threshold value at which respondents would attempt to return the trader a product with quality deviations, is usually 100 BGN (57.8%) or 10 BGN (19.9%). Surprisingly, there is no statistically significant relationship between the respondents' income level and the threshold value at which they would return a poor quality product (χ^2 тест: $\alpha = 0{,}05$; Asymp.Sig.(2-sided) = 0,551). Among the respondents, there are people who, although having an income higher than the maximum insurance threshold, are ready to return a poor quality even if it costs only 1 lev. At the same time, respondents with income close to the minimum salary are reluctant to the poor quality of much more expensive items. This could again be explained by the lack of confidence in the system for consumer rights protection and the feeling that the voice of the consumer is not heard.

Figure 7

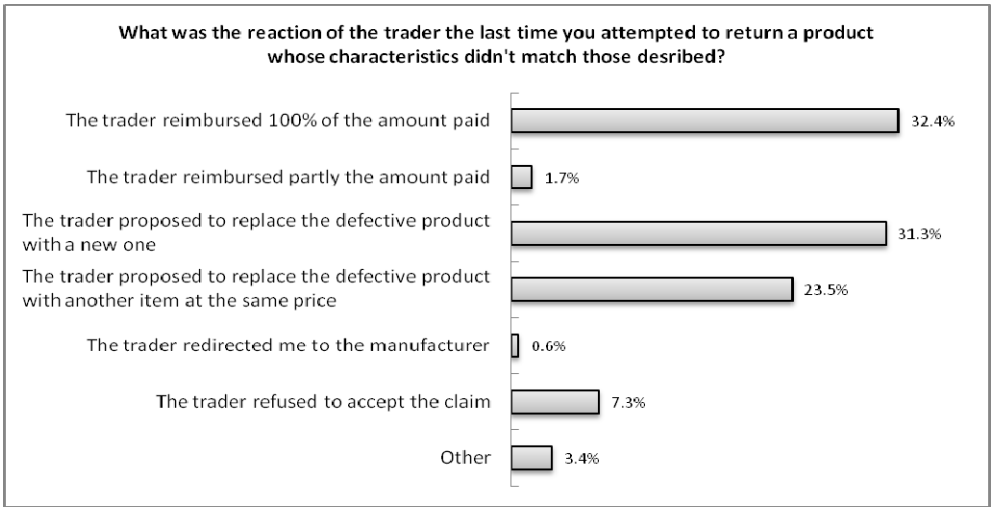
Value threshold of consumers' claims for poor quality goods



Over half of the respondents (51.7%) declare that they have returned a product to the store because it did not match the description. The survey shows that the most common commercial practice in this case is to reimburse the amount paid (33%), replace the defective product with a new one (31.8%) or with another item but at the same price (23.3%). In almost 10% of cases, the trader violated the law by refusing to accept the claim, reimbursing only part of the amount paid, or redirecting the consumer to the manufacturer.

Figure 8

Commercial practices in case of claims



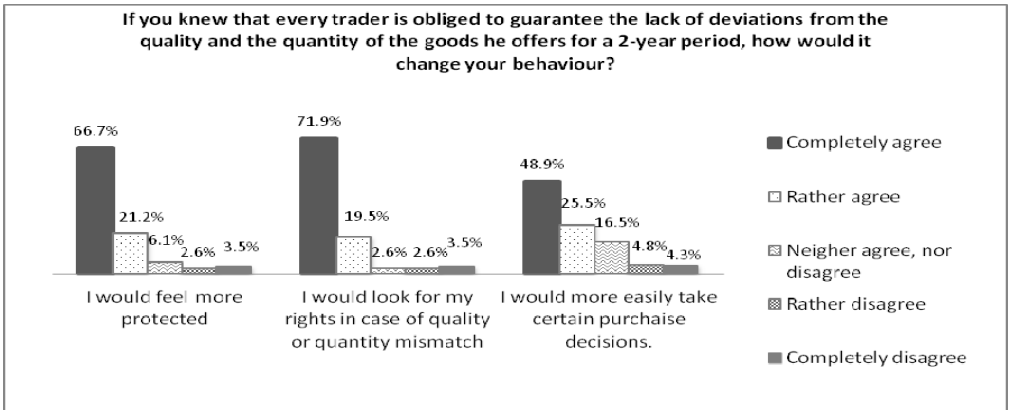
Significantly more often, traders breach another obligation, namely to inform consumers of the possibility of making a claim within two years in the event that the product shows quality deviations. Only 12.1% of survey respondents said that the last time they purchased a durable product they were informed by the trader of this particular right. In view of the fact that the lack of information on the legal guarantee has a significant impact on consumer behaviour before and after purchase (as evidenced by the analysis made here), it is of utmost importance that such information is to be provided in a timely and accessible manner. In the present text of the CPA, the trader is obliged to inform the consumer, but the actual compliance with this prescription can only be traced to the presence of a warranty card. In cases where the trader or manufacturer does not offer an additional guarantee, the consumer is expected to be informed orally about his right to claim. Analysis of the data from this study shows that this does not happen in most cases; therefore, there is no credible way to prove that the trader has not provided the required information. In this sense, we believe that it is appropriate even if a commercial guarantee is not provided, the trader to be obliged to inform the consumer of the existence of a legal guarantee in writing. It can be done for example by means of a notice placed in a prominent place on the commercial premises or as a requisite of the financial document certifying the purchase. This would make it easier for the staff and, above all, would enable control authorities to verify that the law is being respected. The absence of the opportunity to document misuse leads to the impossibility of imposing a sanction and by itself creates a prerequisite for non-compliance with the law. It may also provoke the manifestation of corrupt practices by the controlling authorities - an issue that has become an extreme malice in modern society.

At the same time, the study shows that if informed of the existence of a legal guarantee for two years after the purchase, nearly 88% of the respondents would feel more secure; over

90% would be looking for their rights in case of quality or quantity mismatch, and about 75% would more easily take certain purchase decisions.

Figure 9

Influence of the awareness of legal guarantee to consumer behaviour



These data show that consumers would significantly change their behaviour if they were better informed. This, on the other hand, would lead to a more adequate consumer response in case of deviations in the quality and quantity of goods marketed and, on the other hand, to an increase in the consumption of goods which up to that moment had caused some concern. In this sense, imposing an obligation on traders to display a notice board informing consumers about the existence of a legal guarantee or adding this text as a requisite of the financial document certifying the purchase would have a positive impact on both the consumers' confidence that their rights are protected and on the turnover of the trader himself.

4. Conclusion

The presented analysis of empirical data on the level of consumer awareness of their rights and the possibility of influencing their behaviour before and after purchase allows us to make three main conclusions. Firstly, despite the campaigns to inform consumers about the legal basis for the protection of their rights, the level of awareness among Bulgarians remains critically low. According to the Consumer Empowerment Index conducted in 2011 the share of consumers feeling confident, knowledgeable and protected is only about 11% which is the lowest value registered in the EU (Nardo et al., 2011). Unfortunately, the results from the current study reveal no progress since then. This has a significant impact on building a sense of security, a trust in the means of control, and hinders the attempts to claim consumer rights.

Secondly, poor consumer awareness of their rights has a direct negative impact on consumer behaviour, as it leads to purchasing decisions and after-sales service decisions that are detrimental to the consumer himself. Often it can result in paying extra for securing quality protection that is already provided by law, making a preference for a brand that offers longer warrantee even if it is fictitious or repairing faulty goods at consumers' own expenses. The lack of legal competence is a prerequisite for the manifestation of unfair commercial practices.

Thirdly, the current text of the CPA states that the trader is obliged to inform the consumer about the existence of a legal guarantee but in case a supplementary commercial guarantee is not provided it is supposed to be done only verbally. This does not provide an effective control mechanism for compliance with the law and leads to its non-observance.

In view of the conclusions drawn, we can summarise that effective measures are needed to raise consumer awareness of their fundamental rights, such as the right to a legal guarantee and the right to claim. This can be achieved by a minimal change in the legal framework that obliges traders to inform in writing, via a notice board or other appropriate means, about the existence of a two-year legal guarantee of compliance with the sales contract. This can have a positive impact on consumer confidence and would help Bulgaria catch up with the EU27 average on the legal awareness pillar of the Consumer Empowerment Index.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Wei-Bin Zhang[1]

GROWTH, RESEARCH, AND FREE TRADE WITH KNOWLEDGE AS GLOBAL PUBLIC CAPITAL

The purpose of this study is to explain dynamics of global growth and trade patterns with wealth and utilizing knowledge as basic determinants. It builds a multi-country growth model with economic structure and research. Global economy composes of any number of countries and each country has one production sector and one university. Knowledge is through learning by doing and research. Knowledge is global public good and is applied by countries with different utilization efficiencies. The production sector is the same as in the one-sector growth Solow model (Solow, 1956), while capital mobility and trade patterns are determined like in the Oniki-Uzawa model (Oniki and Uzawa, 1956). We use a utility function proposed by Zhang (1993) to determines saving and consumption. The movement of the system is given by differential equations. We simulate the model. Our comparative analysis provides some insights into the complexity of international trade with endogenous wealth and knowledge.
JEL: F11; O30

1. Introduction

Inequalities in income and wealth among different groups, regions, and nations and dynamics of inequalities are crucial issues for economics. We study effects of trade upon income distribution among nations in a globalizing world economy. Many studies demonstrate that productivity differences explain much of the variation in incomes across countries, and technology plays a key role in determining productivity (Krugman and Venables, 1995; Manasse and Turrini, 2001; Agénor, 2004; Aghion et al. 2009; Gersbach et al. 2013). The pattern of worldwide technical change is determined largely by international technology diffusion. Moreover, a few rich countries account for most of the world's creation of new technology. Obviously we need proper analytical frameworks for analyzing global economic interactions with microeconomic foundations. As developed, industrializing and developing economies are well connected with trades, it is important to examine how changes in preference or technology in one country can affect the country as well as other countries in a well-connected world economy. For instance, an underdeveloped economy with large population, like India or China, may affect different economies as its technology is improved or population is increased. We are also concerned with how trade patterns may be affected as

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technologies are further improved or propensities to save are reduced in developed economies like the US or Japan. It is well known that only a few formal economic theories properly address inequalities in income and wealth among nations with microeconomic foundation. The purpose of this study is to study inequalities among nations with endogenous wealth accumulation and knowledge dynamics. We emphasize effects of free trade and national governments' research policies on global growth and inequalities among nations.

As far as modelling production and trade patterns is concerned, we follow the neoclassical growth trade model, particularly the Oniki-Uzawa model (Oniki and Uzawa, 1965). As reviewed by Findlay (1984), the pure theory of international trade developed before the 1960s failed to properly analyze the connection between economic growth and international trade. The classical Ricardian theory of comparative advantage and the Heckscher-Ohlin theory did not consider labor and capital stocks (or land) as endogenously changeable variables. In the last three or four decades, trade theory has made some systematic treatment of capital accumulation or technological changes in the context of international economics. A dynamic model with endogenous capital accumulation and capital movements was initially developed by Oniki and Uzawa and others (e.g., Oniki and Uzawa, 1965; Johnson, 1971), in terms of the two-country, two-good, two-factor model of trade. The model has been extended and generalized to analyze the interdependence between trade patterns and economic growth (e.g., Jones and Kenen, 1984; Ethier and Svensson, 1986; Bhagwati, 1991; Wong, 1995; Sorger, 2002; Vellutini; 2003). Zhang (2008) provides an extensive review on the literature. Irrespective of analytical difficulties involved in analyzing two-country, dynamic-optimization models with capital accumulation, many efforts have been made to examine the impact of saving, technology, and various policies upon trade patterns within this framework (e.g., Frenkel and Razin, 1987; Jensen, 1994; Valdés, 1999; Nishimura and Shimomura, 2002). As far as capital accumulation and trade pattern determination are concerned, our study follows the Oniki-Uzawa framework (Ikeda and Ono, 1992), even though this study deviates from the traditional approach in modelling behavior of households.

In our model economic dynamics is fueled by public investment in research, learning by doing and physical investment. Our model is to integrate the basic economic growth mechanisms in the neoclassical growth theory with capital accumulation and growth theory with endogenous knowledge. We consider knowledge as an international public good in the sense that all countries access knowledge and the utilization of knowledge by one country does not affect that by others. Trade economists have recently developed different trade models endogenous knowledge (e.g., Chari and Hopenhayn, 1991; Martin and Ottaviano, 2001; Brecher *et al*. 2002; Nocco, 2005; Hinloopen, 2014). These studies attempted to formalize trade patterns with endogenous technological change and monopolistic competition. They often link trade theory with increasing-returns growth theory. These approaches deal with dynamic interdependence between trade patterns, R&D efforts, and various economic policies. Although these studies explore the relationship between trade policy and long-run growth either with knowledge or with capital, but in most of them not with both capital and knowledge in a unified framework. This paper examines interactions among physical accumulation, knowledge dynamics, trade, within a compact analytical framework.

A common limitation in most of trade models with endogenous capital and/or knowledge is that they deal with the world economy with only two national economies (e.g., Grossman and

Helpman, 1991; Wong, 1995; Jensen and Wong, 1998; Obstfeld and Rogoff, 1998). The world consists of different countries and different countries have different preferences, technologies and resources. Conclusions made from analyzing a two-country model might provide limited or even misleading insights into the complexity of multi-country economy. It is necessary to deal with a world economy with any number of national economies. It is well known that dynamic-optimization models with capital accumulation are associated with analytical difficulties. To avoid these difficulties, this study applies an alternative approach to consumer behavior. The model in this study is a further development of the studies by Zhang. Zhang (1992) proposed a multi-country model with capital accumulation and knowledge creation. The study does not consider research and does not simulate behavior of the model. Zhang Zhang (1993) develops an endogenous growth model with wealth accumulation and knowledge dynamics. This study does not simulate the model and is limited a national economy. Zhang (2012) considers different sources of knowledge dynamics for a national economy without interregional or international trade and simulates the model so that one can observe the dynamic behavior of the economic system. This study synthesizes the basic ideas in these study for a multi-country global economy with wealth accumulation and knowledge dynamics. This study models the behavior of households in an alternative way for a multi-country economy with free trade and assumes that knowledge creation is through learning by doing and research. This paper is organized as follows. Section 2 defines the multi-country model with capital accumulation and knowledge creation. Section 3 shows that the dynamics of the world economy with J countries can be described by $(J+1)$-dimensional differential equations. As mathematical analysis of the system is too complicated, we demonstrate some of the dynamic properties by simulation when the world economy consists of three countries. Section 4 carries out comparative dynamic analysis examine respectively effects of changes in each country's knowledge utilization efficiency and creativity, research policy, the propensity to save, and the population. Section 9 concludes the study. The analytical results in section 3 are confirmed in Appendix A1. Section A2 examines the case when all the countries have the same preference. We show that the motion of the global economy can be expressed by a two-dimensional differential equations system and we can explicitly determine the dynamic properties of the global economy.

2. The multi-country trade model with capital and knowledge

We consider a global economy with any number of countries. Each country has one production sector and one university. We use subscript indexes i and r to denote the production sector and the university, respectively. The university is financially supported by the government through taxing the production sector. The governments fix the tax rates and obtain tax incomes from the private sectors. The research sector employs labor and capital in such a way that the research output is maximized with the government's tax income. Knowledge growth is through learning by doing by the production sector and research activities by the university. In describing the production sector, we follow the neoclassical trade framework. Follows the Oniki-Uzawa trade model and its various extensions with one capital goods, we assume that the countries produce a homogenous commodity. Most aspects of production sectors in our model are similar to the neo-classical one-sector growth model (Burmeister and Dobell, 1970).

There is only one (durable) good in the global economy under consideration. Households own assets of the economy and distribute their incomes to consume and save. Production sectors or firms use knowledge, capital and labor. Exchanges take place in perfectly competitive markets. Production sectors sell their product to households or to other sectors and households sell their labor and assets to production sectors. Factor markets work well; factors are inelastically supplied and the available factors are fully utilized at every moment. Saving is undertaken only by households, which implies that all earnings of firms are distributed in the form of payments to factors of production. We omit the possibility of hoarding of output in the form of non-productive inventories held by households. All savings volunteered by households are absorbed by firms. We require savings and investment to be equal at any point of time. The system consists of multiple countries, indexed by $j = 1, ..., J$. Each country has a fixed labor force, N_j, ($j = 1, ..., J$). Let prices be measured in terms of the commodity and the price of the commodity be unity. We denote wage and interest rates by $w_j(t)$ and $r_j(t)$, respectively, in the j th country. In the free trade system, the interest rate is identical throughout the world economy, i.e., $r(t) = r_j(t)$. For convenience, we term the people working in the production sector as workers and the people working in the university as scientists. The population is classified into workers and scientists. Let $N_{qj}(t)$ and $K_{qj}(t)$ stand for the labor force and capital stocks employed by sector q, $q = i, r$, in country j.

Behavior of producers

First, we describe behavior of the production sections. We assume that there are three factors, physical capital, labor, and knowledge at each point of time t. We use $F_j(t)$ to stand for the output level of the production sector by country j. The production functions are given by

$$F_j(t) = A_j Z^{m_j}(t) K_{ij}^{\alpha_j}(t) N_{ij}^{\beta_j}(t), \quad A_j > 0, \quad \alpha_j + \beta_j = 1, \quad \alpha_j, \beta_j > 0, \quad j = 1, \cdots, J,$$

in which $Z(t)\,(>0)$ is the knowledge stock at time t. Here, we call m_j country j's knowledge utilization efficiency parameter. If we interpret $Z^{m_j/\beta}(t)N_j(t)$ as country j's human capital or qualified labor force (e.g., Iacopetta, 2011), we see that the production function is a neoclassical one and homogeneous of degree one with the inputs. Many studies show that basic research positively affects applied research (Nelson and Winter, 1982; Jaffe, 1989; Nelson, 2002; Adams, 1990; Acs et al. 1992; Mansfield, 1998). We may also interpret the above formation as follows. We consider that a company's applied knowledge is a nonlinear function of general knowledge. We consider that the total productivity factor is proportionally related to $Z^{m_j}(t)$. We thus have the above production function with knowledge as public capital.

Markets are competitive; thus labor and capital earn their marginal products, and firms earn zero profits. The rate of interest, $r(t)$, and wage rates, $w_j(t)$, are determined by markets. Hence, for any individual firm $r(t)$ and $w_j(t)$ are given at each point of time. The production sector chooses the two variables $K_{ij}(t)$ and $N_{ij}(t)$ to maximize its profit. The marginal conditions are given by

$$r(t) + \delta_{kj} = \bar{\tau}_j A_j \alpha_j Z^{m_j}(t) k_j^{-\beta_j}(t), \quad w_j(t) = \bar{\tau}_j A_j \beta_j Z^{m_j}(t) k_j^{\alpha_j}(t), \tag{1}$$

where δ_{kj} are the depreciation rate of physical capital in country j and

$$k_j(t) \equiv \frac{K_{ij}(t)}{N_{ij}(t)}, \quad \bar{\tau}_j \equiv 1 - \tau_j,$$

in which τ_j is country $j's$ tax rate on its production sector.

Behavior of consumers

Each household gets income from wealth ownership and wages. Consumers make decisions on consumption levels of goods as well as on how much to save. This study uses the approach to consumers' behavior proposed by Zhang in the early 1990s (Zhang, 1993). Let $\bar{k}_j(t)$ stand for the per capita wealth in country j. Each consumer of country j obtains income

$$y_j(t) = r(t)\bar{k}_j(t) + w_j(t), \quad j = 1, \cdots, J, \tag{2}$$

from the interest payment $r(t)\bar{k}_j(t)$ and the wage payment $w_j(t)$. We call $y_j(t)$ the current income in the sense that it comes from consumers' wages and consumers' current earnings from ownership of wealth. The disposable income that consumers are using for consuming, saving, or transferring are not necessarily equal to the current income because consumers can sell wealth to pay, for instance, the current consumption if the current income is not sufficient for buying food and touring the country. The maximum value of wealth that a consumer can sell to purchase goods equal to $\bar{k}_j(t)$. We define the disposable income as follows

$$\hat{y}_j(t) = y_j(t) + \bar{k}_j(t). \tag{3}$$

The disposable income is used for saving and consumption. It should be noted that the value, $\bar{k}_j(t)$, (i.e., $p(t)\bar{k}_j(t)$ with $p(t) = 1$), in the above equation is a flow variable. Under the assumption that selling wealth can be conducted instantaneously without any transaction cost,

we consider $\bar{k}_j(t)$ as the amount of the income that the consumer obtains at time t by selling all of his wealth. Hence, at time t the consumer has the total amount of income equaling $\hat{y}_j(t)$ to distribute between consuming and saving.

At each point of time, a consumer distributes the total available budget between savings, $s_j(t)$, and consumption of goods, $c_j(t)$. The budget constraint is

$$c_j(t) + s_j(t) = \hat{y}_j(t) = r\bar{k}_j(t) + w_j(t) + \bar{k}_j(t). \tag{4}$$

At each point of time, consumers have two variables to decide. Equation (4) means that consumption and savings exhaust the consumer's disposable income.

We assume that utility levels that the consumers obtain are dependent on the consumption level of commodity, $c_j(t)$, and the savings, $s_j(t)$. The utility level of the consumer in country j, $U_j(t)$, is specified as follows

$$U_j(t) = c_j^{\xi_{0j}}(t)s_j^{\lambda_{0j}}(t), \ \ \xi_{0j}, \lambda_{0j} > 0, \tag{5}$$

where ξ_{0j} and λ_{0j} are respectively household j's propensities to consume and to hold wealth. Here, for simplicity, we specify the utility function with the Cobb-Douglas from. In this study we fix the preference structure. It is quite reasonable to assume that one's attitude towards the future is dependent on factors such as capital gains, the stock of durables owned by oneself, income distribution and demographic factors.

Maximizing U_j subject to the budget constraints (4) yields

$$c_j(t) = \xi_j \hat{y}_j(t), \ \ s_j(t) = \lambda_j \hat{y}_j(t), \tag{6}$$

in which

$$\xi_j \equiv \frac{\xi_{0j}}{\xi_{0j} + \lambda_{0j}}, \ \ \lambda_j \equiv \frac{\lambda_{0j}}{\xi_{0j} + \lambda_{0j}}.$$

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

$$\dot{\bar{k}}_j(t) = s_j(t) - \bar{k}_j(t). \tag{7}$$

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

Knowledge creation

Bresnahan and Trajtenberg (1995) argued that technologies have a treelike structure, with a few prime movers located at the top and all other technologies radiating out from them. They characterize general purpose technologies by pervasiveness (which means that such a technology can be used in many downstream sectors), technological dynamism (which means that it can support continuous innovational efforts and learning), and innovational complementarities (which exist because productivity of R&D in downstream sectors increases as a consequence of innovation in the general purpose technology, and vice versa). Like capital, a refined classification of knowledge and technologies tend to lead new conceptions and modelling strategies. This study uses knowledge in a highly aggregated sense. We assume a conventional production function of knowledge in which labor, capital, and knowledge are combined to create new knowledge in a deterministic way. This is an approximate description of the idea that devoting more resources to research yields more rapidly new knowledge. There does not appear to have certain evidence for supporting any form of how increases in the stock of knowledge affect the creation of new knowledge. For simplicity, we consider that research is carried out only by the universities. It is more realistic to assume that the research sector consists of two sub-sectors: a private research sector and a government research sector as in, for instance, Park (1998). In Park's model, the government may create knowledge useful for defense, space, and environment and the private sector for industrial, agricultural, and consumption goods (see also Kline and Rosenberg, 1987; Porter, 1990, 1998; Jaffe et al. 1993; Anselin et al. 1997, 2000; Fujita and Thisse, 2002; Henderson, 2003). Some overlapping knowledge, like mathematical and scientific knowledge, may be tailored for research as particular activities. We propose the following equation for knowledge growth

$$\dot{Z}(t) = \sum_{j=1}^{J} \left\{ \frac{\tau_{ij} F_j(t)}{Z^{\varepsilon_{ij}}(t)} + \tau_{rj} Z^{\varepsilon_{rj}}(t) K_{rj}^{\alpha_{rj}}(t) N_{rj}^{\beta_{rj}}(t) \right\} - \delta_z Z(t), \tag{8}$$

in which δ_z (≥ 0) is the depreciation rate of knowledge, and ε_{qj}, τ_{qj}, α_{rj} and β_{rj} are parameters. We require τ_{qj}, α_{rj}, and β_{rj} to be non-negative. To interpret equation (8), first let us consider a special case that knowledge accumulation is through learning by doing. The parameters τ_{ij} and δ_z are non-negative. We interpret $\tau_{ij} F(t) / Z^{\varepsilon_{ij}}(t)$ as the contribution to knowledge accumulation through learning by doing by country $j's$ production sector. To see how learning by doing occurs, assume that knowledge is a function of country $j's$ total industrial output during some period

$$Z(t) = a_1 \left\{ \int_0^t F_j(\theta) d\theta \right\}^{a_2} + a_3$$

in which a_1, a_2 and a_3 are positive parameters. The above equation implies that the knowledge accumulation through learning by doing exhibits decreasing (increasing) returns to scale in the case of $a_2 < (>) 1$. We interpret a_1 and a_3 as the measurements of the

efficiency of learning by doing by the production sector. Taking the derivatives of the equation yields

$$\dot{Z}(t) = \frac{\tau_{ij} F_j(t)}{Z^{\varepsilon_{ij}}(t)}$$

in which $\tau_{ij} \equiv a_1 a_2$ and $\varepsilon_{ij} \equiv 1 - a_2$. The term, $\tau_{rj} Z^{\varepsilon_{rj}}(t) K_{rj}^{\alpha_{rj}}(t) N_{rj}^{\beta_{rj}}(t)$, is the contribution to knowledge growth by country $j's$ university. It means that knowledge production of the university is positively related to the capital stocks, $K_{rj}(t)$, employed by the university and the number of scientists $N_{rj}(t)$. To interpret the parameter, ε_{rj}, we notice that on the one hand, as the knowledge stock is increased, the university may more effectively utilize traditional knowledge to discover new theorems, but on the other hand, a large stock of knowledge may make discovery of new knowledge difficult. This implies that ε_{rj} may be either positive or negative. It is reasonable to assume that the more equipments, books, and buildings, and scientists in the university employs, the more productive it becomes. That is, α_{rj} and β_{rj}, are positive. We do not require that the creation function for knowledge have constant returns to scale in capital and labor. It is possible that doubling the number of computers and scientists increases three times of the knowledge creation than before – the university's knowledge creation exhibits increasing returns to scale in scientist and capital. It is also possible for the university to have decreasing returns to scale. We thus should allow three possibilities - increasing, constant, decreasing returns to scale in scientists and capital – in the university's knowledge creation.

The university maximizing its output with the research fund

The universities are financially supported by the governments. In our model, the governments collect taxes to support the universities. As tax income are used only for supporting the utilities, we have

$$\left(r(t) + \delta_{kj}\right) K_{rj}(t) + w_j(t) N_{rj}(t) = \tau_j F_j(t), \quad j = 1, ..., J. \tag{9}$$

The university pays the interest, $\left(r(t) + \delta_{kj}\right) K_{rj}(t)$, the scientists' wage, $w_j(t) N_{rj}(t)$, with the research fund, $\tau_j F_j(t)$. We determine $K_{rj}(t)$ and $N_{rj}(t)$ by assuming that country $j's$ university utilizes its financial resource, $\tau_j F_j(t)$, in such a way that its output – contribution to knowledge growth – is maximized. The behavior of the university is thus formulated by

$$Max\ \tau_{rj} Z^{\varepsilon_{rj}}(t) K_{rj}^{\alpha_{rj}}(t) N_{rj}^{\beta_{rj}}(t),$$

s.t.: $\left(r(t) + \delta_{kj}\right) K_{rj}(t) + w_j(t) N_{rj}(t) = \tau_j F_j(t).$

Country $j's$ university allocates the financial resource as follows

$$K_{rj}(t) = \frac{\overline{\alpha}_j \tau_j F_j(t)}{r(t) + \delta_{kj}},\ \ N_{rj}(t) = \frac{\overline{\beta}_j \tau_j F_j(t)}{w_j(t)}, \tag{10}$$

where

$$\overline{\alpha}_j \equiv \frac{\alpha_{rj}}{\alpha_{rj} + \beta_{jr}},\ \ \overline{\beta}_j \equiv \frac{\beta_{rj}}{\alpha_{rj} + \beta_{rj}}.$$

If the other conditions remain the same, an increase in the tax rate or output enables the university to utilize more equipments and to employ more people. An increase in factor price will reduce the employment level of the factor.

Full employment and the demand and supply balance

We use $K_j(t)$ and $\overline{K}_j(t)$ to stand for the capital stocks employed and the wealth owned by country j. The assumption that the labor force and capital are always fully employed in each country is represented by

$$N_{ij}(t) + N_{rj}(t) = N_j,\ \ K_{ij}(t) + K_{rj}(t) = K_j(t). \tag{11}$$

We use $K(t)$ to stand for the capital stocks of the world economy. The total capital stocks employed by the world is equal to the wealth owned by the world. That is

$$K(t) = \sum_{j=1}^{J} K_j(t)\ = \sum_{j=1}^{J} \overline{k}_j(t) N_j\,. \tag{12}$$

The world production is equal to the world consumption and world net savings. That is

$$C(t) + S(t) - K(t) + \sum_{j=1}^{J} \delta_{kj} K_j(t) = F(t),$$

where

$$C(t) \equiv \sum_{j=1}^{J} c_j(t) N_j,\ \ S(t) \equiv \sum_{j=1}^{J} s_j(t) N_j,\ \ F(t) \equiv \sum_{j=1}^{J} F_j(t).$$

We have thus built the model with trade, economic growth, capital accumulation, knowledge creation and utilization in the world economy in which the domestic markets of each country are perfectly competitive, international product and capital markets are freely mobile and labor is internationally immobile.

3. The economic dynamics of the global economy

In Appendix A2, we examine the dynamic properties when all the household in the global economy have identical preference. We can obtain analytical properties of the dynamic analysis as the world economy is controlled only by two-dimensional differential equations. We now examine the behavior of the system when the households have different preferences among countries. We first show that the dynamics of the world economy can be expressed by $(J+1)$ differential equations.

Lemma

The dynamics of the world economy is governed by the following $(J+1)$ differential equations with $Z(t)$, $k_1(t)$ and $\bar{k}_j(t)$, $j=2,\cdots,J$, as the variables

$$\dot{Z}(t)=\Lambda\left(k_1(t),\{\bar{k}_j(t)\},Z(t)\right),$$

$$\dot{k}_1(t)=\Lambda_1\left(k_1(t),\{\bar{k}_j(t)\},Z(t)\right),$$

$$\dot{\bar{k}}_j(t)=\Lambda_j\left(k_1(t),\bar{k}_j(t),Z(t)\right),\quad j=2,...,J,$$

in which $\{\bar{k}_j(t)\}\equiv\left(\bar{k}_2(t),\ ,\bar{k}_J(t)\right)$, and $\Lambda(t)$ and $\Lambda_j(t)$ are unique functions of $Z(t)$, $k_1(t)$ and $\bar{k}_j(t)$ at any point of time, defined in Appendix A1. For any given positive values of $Z(t)$, $k_1(t)$ and $\bar{k}_j(t)$ at any point of time, the other variables are uniquely determined by the following procedure: $\bar{k}_1(t)$ by (A7) $\rightarrow k_j(t)$, by (A1) $\rightarrow r(t)\rightarrow w_j(t)$ by (A2) $\rightarrow N_{qj}(t)$ by (A4) $\rightarrow K_j(t)$ by (A5) $\rightarrow K_{qj}(t)$ by (A4) $\rightarrow \hat{y}_j(t)$ by (A8) $\rightarrow$ $c_j(t)$ and $s_j(t)$ by (6) $\rightarrow F_j(t)$ by the definition $\rightarrow U_j(t)$ by (5).

We have the dynamic equations for the world economy with any number of countries. The system is nonlinear and is of high dimension. It is difficult to generally analyze behavior of the system. For Illustration, we simulate the motion of the global economy with three countries. We specify the parameters as follows:

$$\begin{pmatrix} N_1 \\ N_2 \\ N_3 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \\ 8 \end{pmatrix}, \begin{pmatrix} A_1 \\ A_2 \\ A_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 0.8 \\ 0.7 \end{pmatrix}, \begin{pmatrix} m_1 \\ m_2 \\ m_3 \end{pmatrix} = \begin{pmatrix} 0.4 \\ 0.2 \\ 0.1 \end{pmatrix}, \begin{pmatrix} \tau_1 \\ \tau_2 \\ \tau_3 \end{pmatrix} = \begin{pmatrix} 0.05 \\ 0.04 \\ 0.02 \end{pmatrix}, \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{pmatrix} = \begin{pmatrix} 0.3 \\ 0.32 \\ 0.31 \end{pmatrix}, \begin{pmatrix} \alpha_{1r} \\ \alpha_{2r} \\ \alpha_{3r} \end{pmatrix} = \begin{pmatrix} 0.4 \\ 0.4 \\ 0.4 \end{pmatrix},$$

$$\begin{pmatrix} \beta_{1r} \\ \beta_{2r} \\ \beta_{3r} \end{pmatrix} = \begin{pmatrix} 0.4 \\ 0.3 \\ 0.2 \end{pmatrix}, \begin{pmatrix} \tau_{i1} \\ \tau_{i2} \\ \tau_{i3} \end{pmatrix} = \begin{pmatrix} 0.02 \\ 0.01 \\ 0.01 \end{pmatrix}, \begin{pmatrix} \tau_{r1} \\ \tau_{r2} \\ \tau_{r3} \end{pmatrix} = \begin{pmatrix} 0.08 \\ 0.06 \\ 0.03 \end{pmatrix}, \begin{pmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ \varepsilon_{i3} \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.2 \\ 0.3 \end{pmatrix}, \begin{pmatrix} \varepsilon_{r1} \\ \varepsilon_{r2} \\ \varepsilon_{r3} \end{pmatrix} = \begin{pmatrix} 0.4 \\ 0.3 \\ 0.2 \end{pmatrix},$$

$$\begin{pmatrix} \xi_{01} \\ \xi_{02} \\ \xi_{0.3} \end{pmatrix} = \begin{pmatrix} 0.2 \\ 0.2 \\ 0.3 \end{pmatrix}, \begin{pmatrix} \lambda_{01} \\ \lambda_{02} \\ \lambda_{03} \end{pmatrix} = \begin{pmatrix} 0.75 \\ 0.7 \\ 0.65 \end{pmatrix}, \ \delta_k = 0.05, \ \delta_Z = 0.04. \tag{13}$$

Country $1, 2$ and $3's$ populations are respectively $3, 4$ and 8. Country 3 has the largest population. Country $1, 2$ and $3's$ total productivities, A_j, are respectively $1, 0.8$ and 0.7. Country $1, 2$ and $3's$ knowledge utilization efficiency parameters, m_j, are respectively 0.4, 0.2 and 0.1. Country 1 utilizes knowledge mostly effectively; country 2 next and country 3 utilizes knowledge lest effectively. We call the three countries respectively as developed, industrializing, and underdeveloped economies (DE, IE, UE). The DE has the highest tax rate for supporting research and the UE has the lowest tax rate. We require For simplicity, we require $\delta_k = \delta_{kj}$, $j = 1, 2, 3$. We specify the values of the parameters, α_j, in the Cobb-Douglas productions approximately equal to 0.3. The DE's learning by doing and university creativity parameters, τ_{i1} and τ_{r1}, are the highest among the countries. The returns to scale parameters in learning by doing, ε_{ij}, are all positive, which implies that knowledge exhibits decreasing returns to scale in learning by doing. The depreciation rates of physical capital and knowledge are specified respectively at 0.05 and 0.04. The DE's propensity to save is 0.75 and the UE's propensity to save is 0.65. The value of the IE's propensity is between the two other countries. In Figure 1, we plot the motion of the system with the following initial conditions

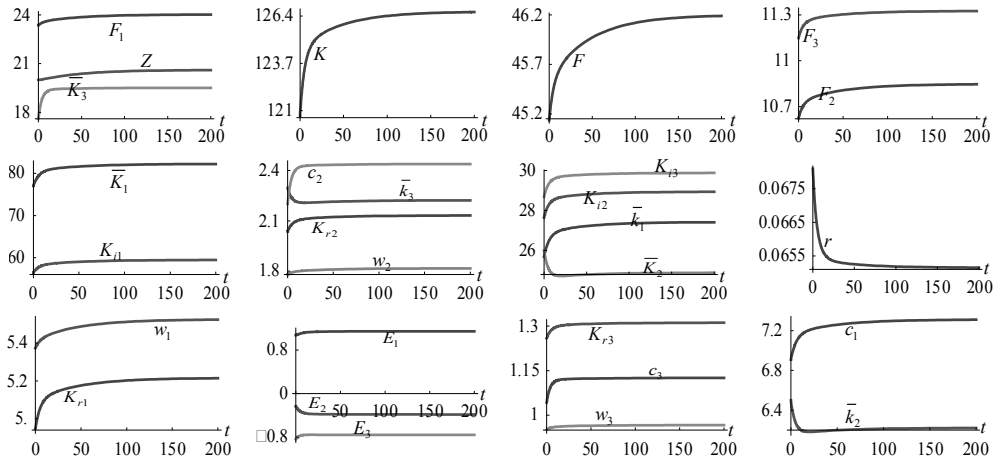
$$k_1(0) = 19.5, \ \bar{k}_2(0) = 6.5, \ \bar{k}_3(0) = 2.2, \ Z(0) = 20.$$

In Figure 1, the trade balances of the three countries are given by

$$E_j(t) = \left(\bar{K}_j(t) - K_j(t)\right) r(t), \ \ j = 1, 2, 3.$$

Figure 1

The Motion of the System



When $E_j(t)$ is positive (negative), we say that country j is in trade surplus (deficit). When $E_j(t)$ is zero, country $j's$ trade is in balance. The worker in the DE has the highest wage rate, and wealth and consumption levels, while the worker in the UE has the lowest wage rate, and wealth and consumption levels. The DE is in trade surplus, while the other two economies are in trade deficits. Due to their initial values, most of the variables in the system are increased over time till they approach their equilibrium values. From Figure 1, we see that the system is approaching its equilibrium point. Nevertheless, it is difficult to confirm whether this equilibrium point is unique. We further simplify equilibrium conditions so that we can discuss the uniqueness. First, from equations (A1) and (A2) we know that the equilibrium point is given by

$$k_j = \phi_j(k_1, Z) = \tau_{kj} Z^{\bar{m}_j} k_1^{\beta_1/\beta_j},$$

$$w_j = \bar{\phi}_j(k_1, Z) = \tau_{wj} Z^{m_{0j}} k_1^{\alpha_{wj}}, \quad j = 1, \cdots, J, \tag{14}$$

where

$$\tau_{kj} \equiv \left(\frac{\bar{\tau}_j A_j \alpha_j}{\bar{\tau}_1 A_1 \alpha_1}\right)^{1/\beta_j}, \quad \bar{m}_j \equiv \frac{m_j - m_1}{\beta_j}, \quad \tau_{wj} \equiv \bar{\tau}_j A_j \beta_j \tau_{kj}^{\alpha_j}, \quad m_{0j} \equiv m_j + \alpha_j \bar{m}_j, \quad \alpha_{wj} \equiv \frac{\beta_1 \alpha_j}{\beta_j}.$$

By equations (7), we have $s_j = \bar{k}_j$. By the definition of R and equations (1), we have

$$R(k_1, Z) = \lambda_1\left(\lambda_{u1} - \bar{\tau}_1 A_1 \alpha_1 Z^{m_1} k_1^{-\beta_1}\right), \tag{15}$$

in which $\lambda_{u1} \equiv 1/\lambda_1 - 1 + \delta_k$. From the equations for k_j in (14) and equations (A5), we have

$$K = \psi = \sum_{j=1}^{J} \frac{\tau_{kj} N_{ij} k_1^{\beta_1/\beta_j} Z^{\overline{m}_j}}{a_{ij}}. \tag{16}$$

From $s_j = \bar{k}_j$ and equations (6), we have $\hat{y}_j = \bar{k}_j / \lambda_j$. Substitute $\hat{y}_j = \bar{k}_j / \lambda_j$ into (A8)

$$\bar{k}_j = \frac{\tau_{wj} Z^{m_{0j}} k_1^{\alpha_{wj}}}{\lambda_{uj} - \bar{\tau}_1 \alpha_1 A_1 Z^{m_1} k_1^{-\beta_1}}, \quad j = 2, ..., J, \tag{17}$$

where we use equations (14) and (1) and $\lambda_{uj} \equiv 1/\lambda_j - 1 + \delta_k$. By equations (A12) we have

$$\Omega_k(k_1, Z) \equiv \sum_{j=1}^{J} \frac{\tau_{wj} n_j Z^{m_{0j}} k_1^{\alpha_{wj}}}{\lambda_{uj} - \bar{\tau}_1 \alpha_1 A_1 Z^{m_1} k_1^{-\beta_1}} - n_0 \sum_{j=1}^{J} \frac{\tau_{kj} N_{ij} k_1^{\beta_1/\beta_j} Z^{\overline{m}_j}}{a_{ij}} = 0, \tag{18}$$

in which $n_1 = 1$, we use $\Lambda = \Lambda_j = 0$, and equations (14)-(17). Substituting $\phi_j = \tau_{kj} Z^{\overline{m}_j} k_1^{\beta_1/\beta_j}$ into equation (A13) and setting the resulted equation at the equilibrium point, we have

$$\Omega_Z(k_1, Z) \equiv \sum_{j=1}^{J} \left(\bar{\tau}_{ij} \tau_{kj}^{\alpha_{ij}} Z^{x_{ij}} k_1^{\beta_1 \alpha_j / \beta_j} + \bar{\tau}_{rj} \tau_{kj}^{\alpha_{rj}} Z^{x_{rj}} k_1^{\beta_1 \alpha_{rj} / \beta_j} \right) - \delta_z = 0, \tag{19}$$

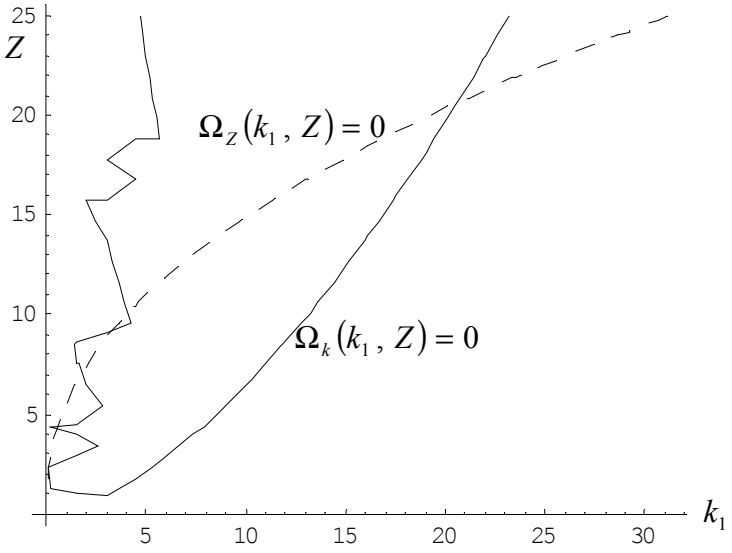
in which

$$x_{ij} \equiv m_j - \varepsilon_{ij} + \alpha_{ij} \overline{m}_j - 1, \quad x_{rj} \equiv \varepsilon_{rj} + \alpha_{rj} \overline{m}_j - 1.$$

We see that the two equations, $\Omega_k(k_1, Z) = 0$ and $\Omega_Z(k_1, Z) = 0$, contain two variables, k_1 and Z. The two equations determine equilibrium values of k_1 and Z. By equations (17), we determine $\bar{k}_j$ for $j = 2, ..., J$. Following the procedure in the lemma, we determine all the other variables at equilibrium point. We see that the main problem is to solve $\Omega_k(k_1, Z) = 0$ and $\Omega_Z(k_1, Z) = 0$, for $k_1 > 0$ and $Z > 0$. As we cannot explicitly solve the equilibrium values of k_1 and Z, we simulate the model to illustrate properties of the dynamic system. Figure 2 plots the two equations, $\Omega_k(k_1, Z) = 0$ and $\Omega_Z(k_1, Z) = 0$, for $k_1 > 0$ and $Z > 0$, under (13). The solid lines represent $\Omega_k(k_1, Z) = 0$ and the dashed line stands for $\Omega_Z(k_1, Z) = 0$.

Figure 2

Confirming the Uniqueness of Equilibrium



From Figure 2, we see that the two equations have multiple solutions. Nevertheless, it can be shown that only the following solution

$$k_1 = 20.567, \quad Z = 20.610.$$

is meaningful. All the other variables are economically meaningful. For instance, we also have a solution, $k_1 = 2.195$ and $Z = 7.726$. This point is economically meaningless because at this point we have

$$\bar{k}_1 = -34.230, \quad \bar{k}_2 = 22.546, \quad \bar{k}_3 = 3.557.$$

As $\hat{y}_1 = \lambda_1 \bar{k}_1 < 0$, we see that the disposable income is negative, which means negative consumption in country 1.

We confirmed that the dynamic system has a unique equilibrium. We calculate the other variables at $k_1 = 20.567$ and $Z = 20.610$, as in Table 1. The global output is 46.2 and the rate of interest is about 6.5 percent. The shares of the global outputs by the DE, IE, UE are respectively 8.31, 2.78 and 1.43. The differences in labor productivity are mainly due to the differences in knowledge utilization efficiency. The table also gives the labor and capital distributions between the sectors in each country and the capital distribution among the three countries. More than half of the global capital stocks is employed by the DE. The DE uses more capital stocks in research than the IE, even though its number of scientists is less than the

number in the IE. The wage rates in the DE, ID and UD are respectively 5.53, 1.82 and 0.97. We calculate the trade balances at equilibrium as follows

$$E_1 = 1.146,\ E_2 = -0.385,\ E_3 = -0.761.$$

The DE is in trade surplus and the other two economies in trade deficit.

Table 1

The Equilibrium Values of the Global Economy

Z		K		F		r	C
20.610		126.665		46.199		0.065	39.831
Country 1		Country 2		Country 3		National shares	
F_1	24.03	F_2	10.85	F_3	11.33	F_1/F	0.520
F_1/N_{i1}	8.310	F_2/N_{i2}	2.78	F_3/N_{i3}	1.43	F_2/F	0.235
K_1	64.68	K_2	30.791	K_3	31.19	F_3/F	0.245
K_{i1}	59.47	K_{i2}	28.94	K_{i3}	29.88	K_1/K	0.511
K_{r1}	5.22	K_{r2}	2.13	K_{r3}	1.31	K_2/K	0.243
N_{i1}	2.89	N_{i2}	3.90	N_{i3}	7.92	K_3/K	0.246
N_{r1}	0.11	N_{r2}	0.15	N_{r3}	0.078	$\overline{K}_1/\overline{K}$	0.649
$\overline{K}_1$	82.27	$\overline{K}_2$	24.89	$\overline{K}_3$	19.51	$\overline{K}_2/\overline{K}$	0.196
C_1	21.94	C_2	8.89	C_3	9.0	$\overline{K}_3/\overline{K}$	0.154
w_1	5.53	w_2	1.82	w_3	0.97	C_1/C	0.551
$\bar{k}_1$	27.42	$\bar{k}_2$	6.22	$\bar{k}_3$	2.44	C_2/C	0.223
$\hat{y}_1$	34.73	$\hat{y}_2$	8.44	$\hat{y}_3$	3.57	C_3/C	0.226
c_1	7.313	c_2	2.22	c_3	1.13		

It is straightforward to calculate the four eigenvalues as follows

$$\{-0.27,\ -0.21,\ -0.18,\ -0.02\}.$$

The equilibrium point is stable.

4. Comparative Dynamic Analysis

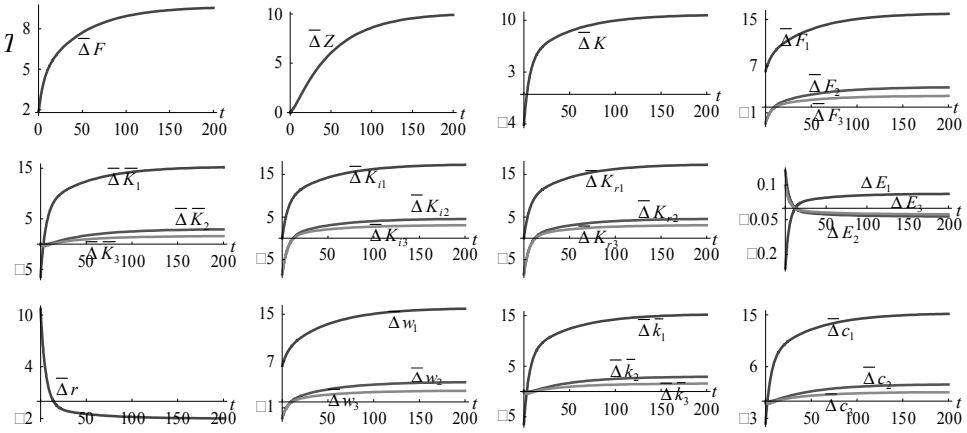
The previous section simulates the motion of the dynamic system. It is important to ask questions such as how a developing economy like India or China may affect the global economy as its technology is improved or population is enlarged; or how the global trade patterns may be affected as technologies are further improved or propensities to save are increased in developed economies like the USA or Japan. We now examine effects of changes in some parameters on the dynamic processes of the global economic system.

The DE's knowledge utilization efficiency being enhanced

First, we examine the case that the DE's knowledge utilization efficiency is increased as follows: $m_1 : 0.4 \Rightarrow 0.42$. The simulation results are plotted in Figure 3. We introduce a variable $\overline{\Delta} x_j(t)$ to stand for the change rate of the variable, $x_j(t)$, in percentage due to changes in the parameter. As the DE improves its knowledge utilization efficiency, the output, the knowledge and capital of the global economy are increased. The DE's output level rises; the other two countries' output levels fall initially and then rise. As the rate of interest rises initially and knowledge rises but not much initially, we see that the costs of production are high for the IE and UE and their productivities are not much improved, the two economies' output levels fall initially. As time passes, the world accumulates more knowledge and the rate of interest falls, the IE's and UE's output levels are increased. We see that in the long term the DE's trade balance is improved and the other two economies' trade balances slightly deteriorate. In the long term the wage rates and the levels of per capita consumptions and wealth in the three economies are all improved. Hence, we conclude that as UE improves its knowledge utilization efficiency, all the consumers in the globe benefit in the long term. We also conduct comparative dynamic analysis with regard to the UE's knowledge utilization efficiency. We observe that the effects on the global economy are similar.

Figure 3

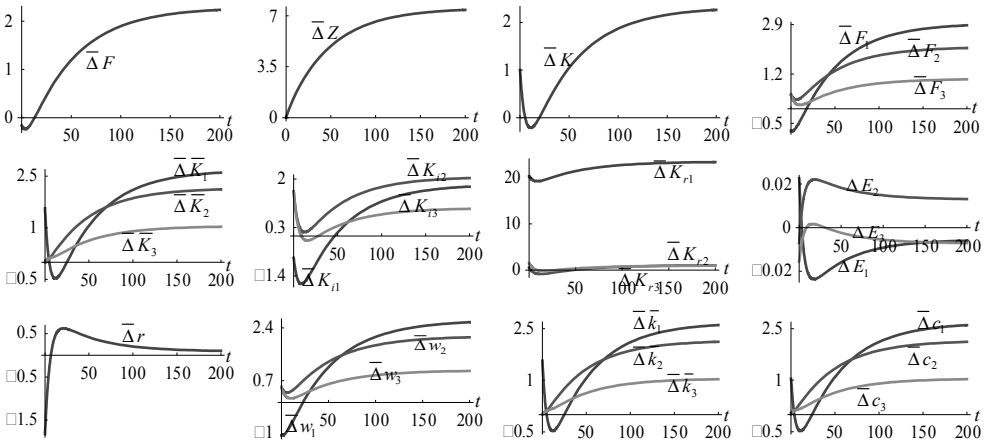
The DE's Knowledge Utilization Efficiency Being Enhanced



We now study how changes in the research policies affect the global economy. We consider that the DE increases its tax rate as follows: $\tau_1 : 0.05 \Rightarrow 0.06$. The simulation results are plotted in Figure 4. As the DE increases its tax rate to support its research activities, the knowledge, global wealth and output level are increased. The rate of interest is reduced initially and then increased in the long term. The DE's output level falls initially but rises in the long term. The other two countries' output levels are increased. As the DE's production sector has to pay more tax initially, its output level is reduced initially. As the world accumulates more knowledge and the DE applies knowledge mostly effectively, its output growth rate is higher than the other two countries' in the long term. The DE's wage rate, consumption level, and wealth level fall initially but rise in the long term. The other two countries' wage rates, consumption levels, and wealth levels are increased. The IE's trade balance is improved and the other two countries' trade balances deteriorate.

Figure 4

The DE's Tax Rate Being Enhanced



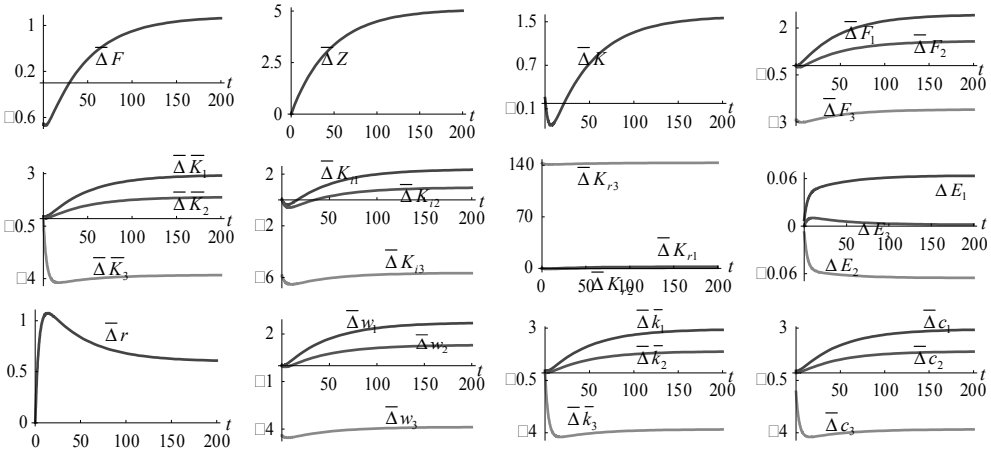
The UE's tax rate being enhanced

We study what happens to the global economy if the UE increases its tax rate as follows: $\tau_3 : 0.02 \Rightarrow 0.05$. As the UE strengthens its research policy, the knowledge stock is increased as more research is carried out by the UE. The global output and wealth are reduced initially as the UE puts more resources to research. Nevertheless, the global output and wealth are increased in the long term as a consequence of improved productivities in all the economies. The rate of interest is increased. This implies that capital costs are increased for all the economies. The UE increases its efforts in research as it increases capital and labor inputs. Nevertheless, the UE does not so effectively apply the knowledge as the other two economies. The net economic consequences on the UE are that its national output, national wealth and capital input of the production sector are all reduced. On micro level, the UE's wage rate and

per capita levels of consumption and wealth are reduced. These conclusions on the UE imply that it will benefit the UE if its research resources are targeted at the fields which increase its abilities to apply the international public capital rather than to make contribution to the public capital with low abilities to using it. Moreover, the efforts in increasing the public capital will enlarge the gaps in income and wealth between the UE and the other two economies. We also see that the UE's trade balance is slightly affected, the DE's trade balance is improved, and the IE's trade balance is deteriorated. The DE and IE benefit from the increased efforts in research by the UE in terms of wage rate, wealth, national wealth, and national output. It should be remarked that according to Gersbach et al. (2013), "higher investment in basic research for a particular generation has three effects on the economy. First, basic research draws skilled labor from the production sector, thereby making skilled labor more costly and reducing consumption. Second, as basic research fosters innovation, it has a positive effect on the productivity and consumption level of the economy. And third, by increasing innovation success basic research also helps to prevent foreign entry, thereby raising innovation rents and income." (see also Arnold, 1997; Cozzi and Galli, 2009, 2011). Our conclusions from analyzing effects of encouraging research for the DE and the UE also provides insights into the complexity of research and knowledge as global public capital.

Figure 5

The UE's Tax Rate Being Enhanced



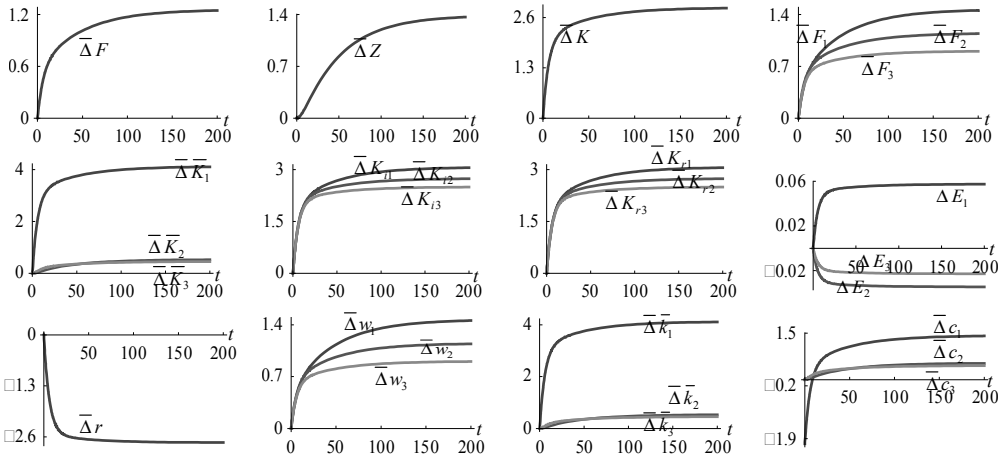
The DE's propensity to save being enhanced

We now study the effects of a rise in the DE's propensity to save as follows: $\lambda_{01} : 0.75 \Rightarrow 0.77$. The results are plotted in Figure 6. As the DE increases its propensity to save, the knowledge, global wealth, global output, and output of all the three economies are increased. The rate of interest is reduced and the wage rates of the three economies are increased. As the DE saves more out of its disposable income, its per capita consumption is

reduced initially. The consumption level as a consequence of increased productivities. The wealth levels of the three economies are all increased. The consumption levels of the other two economies are increased. The DE trade balance is slightly improved and the IE's and UE's trade balances are slightly deteriorated.

Figure 6

The DE's Propensity to Save Being Enhanced



5. Conclusions

This paper proposed a multi-country growth model with capital accumulation and knowledge dynamics. Capital accumulation is through saving, while knowledge is through learning by doing and research. Knowledge is international public good and research is financially supported and conducted nationally. Production is neoclassical and is the same as in the one-sector growth Solow model. International trade is free and trade patterns are determined like in the Oniki-Uzawa model. We used a utility function, which determines saving and consumption with utility optimization without leading to a higher dimensional dynamic system like by the traditional Ramsey approach. The dynamics of J-country world economy is controlled by a $(J+1)$-dimensional differential equations system. We simulated the motion of the model for three economies and identified the existence of a unique stable equilibrium. We and carried out comparative dynamic analysis with regards to the knowledge utilization efficiency, the rates of tax for encouraging research, and the propensity to save. Our comparative analysis provides some insights into the complexity of international trade with endogenous wealth and knowledge. For instance, we show that as the UE encourages research by increasing its tax rate, the knowledge stock is increased; the global output and wealth are reduced initially and are increased in the long term; the rate of interest is increased; the UE increases its efforts in research; the net economic consequences on the UE are that its national output, national wealth

and capital input of the production sector are all reduced; the UE's wage rate and per capita levels of consumption and wealth are reduced; the trade balances are slightly affected; the other economies benefit from the increased efforts in research by the UE in terms of wage rate, wealth, national wealth, and national output. These conclusions imply that it will benefit the UE if its resources are targeted at the fields which increase its abilities to apply the international public capital rather than to make contribution to the public capital with low abilities to using it. Moreover, the efforts in increasing the public capital will enlarge the gaps in income and wealth between the UE and the other economies. Our model may be extended and generalized in different directions. It is straightforward to develop the model in discrete time. It is possible to analyze behavior of the model with other forms of production or utility functions. In the contemporary literature, private research and endogenous population have been emphasized. We may also extend our model by learning from modelling some aspects of trade in the literature of gravity models (Yotov, et al. 2016).

Appendix A1: Proving the Lemma

First, from equations (1) we obtain

$$k_j = \phi_j(k_1, Z) \equiv \left(\frac{\overline{\tau}_j A_j \alpha_j Z^{m_j}}{\overline{\tau}_1 A_1 \alpha_1 Z^{m_1} k_1^{-\beta_1} + \delta_j} \right)^{1/\beta_j}, \quad j = 1, ..., J, \tag{A1}$$

where $\delta_j \equiv \delta_{k1} - \delta_{kj}$. It should be noted that $\phi_1 = k_1$. From (1) and (A1), we determine the wage rates as functions of $k_1(t)$ and $Z(t)$ as follows

$$w_j = \overline{\phi}_j(k_1, Z) \equiv \overline{\tau}_j A_j \beta_j Z^{m_j} \phi_j^{\alpha_j}(k_1, Z), \quad j = 1, \cdots, J. \tag{A2}$$

From (1) and (10), we have

$$\frac{K_{rj}}{K_{ij}} = \frac{\overline{\alpha}_j \tau_j}{\overline{\tau}_j \alpha_j}, \quad \frac{N_{rj}}{N_{ij}} = \frac{\overline{\beta}_j \tau_j}{\overline{\tau}_j \beta_j}. \tag{A3}$$

From (11) and (A3), we solve the capital and labor distribution between the production sector and the university in country j as follows

$$K_{qj} = a_{qj} K_j, \quad N_{qj} = b_{qj} N_j, \quad q = i, r, \quad j = 1, ..., J, \tag{A4}$$

where

$$a_{rj} \equiv \frac{\bar{\alpha}_j \tau_j}{\bar{\alpha}_j \tau_j + \bar{\tau}_j \alpha_j},\ a_{ij} \equiv \frac{\bar{\tau}_j \alpha_j}{\bar{\alpha}_j \tau_j + \bar{\tau}_j \alpha_j},\ b_{rj} \equiv \frac{\bar{\beta}_j \tau_j}{\bar{\beta}_j \tau_j + \bar{\tau}_j \beta_j},\ b_{ij} \equiv \frac{\bar{\tau}_j \beta_j}{\bar{\beta}_j \tau_j + \bar{\tau}_j \beta_j}.$$

We conclude that the labor distribution is constant as it is determined by the tax rate and capital distribution is proportional to the total capital stocks employed by the country.

By $k_j = K_{ij} / N_{ij}$ and (A4), we have

$$K_j = \frac{N_{ij} k_j}{a_{ij}},\ \ j = 1,..., J. \tag{A5}$$

As k_j are functions of $k_1(t)$ and $Z(t)$, we see that $K_j(t)$ are also functions of $k_1(t)$ and $Z(t)$. From (A4), we also solve $K_{rj}(t)$ as functions of $k_1(t)$ and $Z(t)$. We see that the capital distribution among the countries and between sectors in each country are uniquely determined as functions of $k_1(t)$ and $Z(t)$. By $K = \sum_{j=1}^{J} K_j$, we see that K is also uniquely determined as a function of k_1 and Z. We denote this function as follows

$$K = \psi(k_1, Z).$$

Substituting $F_j = Z^{m_j} K_{ij}^{\alpha_j} N_{ij}^{\beta_j}$ into (8), we have

$$\dot{Z} = \Lambda(k_1, Z) \equiv \sum_{j=1}^{J} \left(\tau_{ij} A_j N_{ij}^{\beta_j} Z^{m_j - \varepsilon_{ij}} K_{ij}^{\alpha_j} + \tau_{rj} N_{rj}^{\beta_{rj}} Z^{\varepsilon_{rj}} K_{rj}^{\alpha_{rj}} \right) - \delta_z Z. \tag{A6}$$

We see that the motion of Z can be described as a unique function of k_1 and Z.

From (12), we solve

$$\bar{k}_1 = n_0 \psi(k_1, Z) - \sum_{j=2}^{J} n_j \bar{k}_j, \tag{A7}$$

in which

$$n_0 \equiv \frac{1}{N_1},\ \ n_j \equiv \frac{N_j}{N_1},\ \ j = 2, ..., J.$$

We see that country 1's per capita wealth, $\bar{k}_1(t)$, can be expressed as a unique function of the knowledge, country 1's capital intensity of production function and the other countries' per capita wealth, $\{\bar{k}(t)\}$, at any point of time.

From (2) and (3), we have

$$\hat{y}_j = (1+r)\bar{k}_j + w_j . \tag{A8}$$

Substituting $s_j = \lambda_j \hat{y}_j$ and the above equations into (7), we have

$$\dot{\bar{k}}_1 = \Lambda_1(k_1, \bar{k}_1, Z) \equiv \lambda_1 w_1 - R(k_1, Z)\bar{k}_1, \tag{A9}$$

$$\dot{\bar{k}}_j = \Lambda_j(k_1, \bar{k}_j, Z) \equiv \lambda_j w_j - (1 - \lambda_j - \lambda_j r)\bar{k}_j, \quad j = 2, ..., J. \tag{A10}$$

in which $R(k_1, Z) \equiv 1 - \lambda_1 - \lambda_1 r$. Equations (A10) are the differential equations for $\bar{k}_j(t)$ in Lemma 2, $j = 2, ..., J$. Taking derivatives of (A7) with respect to t yields

$$\dot{\bar{k}}_1 = n_0 \psi_{k_1} \dot{k}_1 + n_0 \psi_Z \dot{Z} - \sum_{j=2}^{J} n_j \dot{\bar{k}}_j , \tag{A11}$$

where ψ_{k_1} and ψ_Z are the partial derivatives of $\psi(k_1, Z)$ with respect to k_1 and Z. Equaling the right-hand sizes of (A9) and (A11), we get

$$n_0 \psi_{k_1} \dot{k}_1 + n_0 \psi_Z \dot{Z} - \sum_{j=2}^{J} n_j \dot{\bar{k}}_j = \lambda_1 w_1 - R\bar{k}_1 .$$

Substitute (A7) into the above equation

$$\dot{k}_1 = \Lambda_1(k_1, \{\bar{k}_j\}, Z) \equiv \left[\sum_{j=2}^{J} n_j \Lambda_j + \lambda_1 w_1 - n_0 R \psi + R \sum_{j=2}^{J} n_j \bar{k}_j - n_0 \psi_Z \Lambda \right] \frac{1}{n_0 \psi_{k_1}}, \tag{A12}$$

where we use equations (A10) and (A6). This is the differential equation for $k_1(t)$ in Lemma 2. Substitute equations (A4), (A5), (A1) and (A12) into equation (A6), we have

$$\dot{Z} = \Lambda(k_1, Z) = \sum_{j=1}^{J} \left(\bar{\tau}_{ij} Z^{m_j - \varepsilon_{ij}} \phi_j^{\alpha_j} + \bar{\tau}_{rj} Z^{\varepsilon_{rj}} \phi_j^{\alpha_{rj}} \right) - \delta_z Z , \tag{A13}$$

where

$$\bar{\tau}_{ij} \equiv \tau_{ij} A_j N_{ij} , \quad \bar{\tau}_{rj} \equiv \tau_{rj} a_{rj}^{\alpha_{rj}} a_{ij}^{-\alpha_{rj}} N_{rj}^{\beta_{rj}} N_{ij}^{\alpha_{rj}} .$$

This is the differential equation for $Z(t)$ in the lemma. We proved the lemma.

Appendix A2: Examining the Dynamic Properties with Identical Preference

We now analyze a special case when all the households in the world have an identical preference and the depreciation rates are the same among the economies. That is

$$\xi = \xi_j, \;\; \lambda = \lambda_j, \;\; \delta_k = \delta_{kj}, \;\; \alpha = \alpha_j, \;\; j = 1, ..., J.$$

We are interested in this case because we can explicitly determine dynamic properties of the system. First, we show that all the variables in the dynamic system can be expressed as functions of $k_1(t)$ and $Z(t)$ at any point. From (1) we obtain

$$k_j(t) = M_j Z^{\overline{m}_j}(t) k_1(t), \;\; j = 1, ..., J, \tag{A14}$$

in which

$$M_j \equiv \left(\frac{A_j \overline{\tau}_j}{A_1 \overline{\tau}_1} \right)^{1/\beta}, \;\; \overline{m}_j \equiv \frac{m_j - m_1}{\beta}.$$

Country $j's$ capital intensity can be expressed as a unique function of the knowledge and country $1's$ capital intensity. The ratio between any two countries' capital intensities is related to the two countries' tax rates and the knowledge utilization efficiency. We determine the rate of interest and the wage rates as functions of $k_1(t)$ and $Z(t)$ as follows

$$\begin{aligned} r(t) &= \overline{\tau}_1(t) A_1 \alpha Z^{m_1}(t) k_1^{-\beta}(t) - \delta_k, \\ w_j(t) &= \overline{\tau}_j A_j \beta \overline{\alpha}_j^{\alpha} Z^{\alpha \overline{m}_j + m_j}(t) k_1^{\alpha}(t), \;\; j = 1, \cdots, J. \end{aligned} \tag{A15}$$

From (1) and (10), we have

$$\frac{K_{rj}(t)}{K_{ij}(t)} = \frac{\overline{\alpha}_j \tau_j(t)}{\overline{\tau}_j \alpha_j(t)}, \;\; \frac{N_{rj}(t)}{N_{ij}(t)} = \frac{\overline{\beta}_j \tau_j}{\overline{\tau}_j \beta_j}. \tag{A16}$$

From (11) and (A16), we solve the capital and labor distribution between the production sector and the university in country j as follows

$$K_{qj}(t) = \overline{a}_{qj} K_j(t), \;\; N_{qj} = \overline{b}_{qj} N_j, \;\; q = i, r, \;\; j = 1, ..., J, \tag{A17}$$

where

$$\bar{a}_{rj} \equiv \frac{\bar{\alpha}_j \tau_j}{\bar{\alpha}_j \tau_j + \bar{\tau}_j \alpha}, \quad \bar{a}_{ij} \equiv \frac{\bar{\tau}_j \alpha_j}{\bar{\alpha}_j \tau_j + \bar{\tau}_j \alpha}, \quad \bar{b}_{rj} \equiv \frac{\bar{\beta}_j \tau_j}{\bar{\beta}_j \tau_j + \bar{\tau}_j \beta}, \quad \bar{b}_{ij} \equiv \frac{\bar{\tau}_j \beta}{\bar{\beta}_j \tau_j + \bar{\tau}_j \beta}.$$

The labor distribution is constant as it is determined by the tax rate and capital distribution is proportional to the total capital stocks employed by the country. By $k_j(t) = K_{ij}(t)/N_{ij}$ and (A17) and (A14), we have

$$K_j(t) = \bar{M}_j Z^{\bar{m}_j}(t) k_1(t), \quad j = 1,..., J, \tag{A18}$$

where $\bar{M}_j = N_{ij} M_j / \bar{a}_{ij}$. Adding all the equations in (A18) yields

$$K(t) = k_1(t) \Lambda_0(Z(t)), \tag{A19}$$

where we use $K(t) = \sum_{j=1}^{J} K_j(t)$ and

$$\Lambda_0(Z(t)) \equiv \sum_{j=1}^{J} \bar{M}_j Z^{\bar{m}_j}(t).$$

From $F_j(t) = A_j Z^{m_j}(t) K_{ij}^{\alpha}(t) N_{ij}^{\beta}$ and (A17) and (A18), we have

$$F_j(t) = \bar{a}_{ij}^{\alpha} A_j N_{ij}^{\beta} \bar{M}_j^{\alpha} Z^{m_j + \alpha \bar{m}_j}(t) k_1^{\alpha}(t). \tag{A20}$$

Substituting (A17), (A18) and (A20) into (8), we have

$$\dot{Z}(t) = \Lambda(k_1(t), Z(t)), \tag{A21}$$

where

$$\Lambda \equiv$$

$$\sum_{j=1}^{J} \left\{ \tau_{ij} \bar{a}_{ij}^{\alpha} A_j N_{ij}^{\beta} \bar{M}_j^{\alpha}(t) Z^{m_j + \alpha \bar{m}_j - \varepsilon_{ij}}(t) k_1^{\alpha}(t) + \tau_{rj} \bar{a}_{rj}^{\alpha_{rj}} \bar{M}_j^{\alpha_{rj}} N_{rj}^{\beta_{rj}} Z^{\alpha_{rj} \bar{m}_j + \varepsilon_{rj}}(t) k_1^{\alpha_{rj}}(t) \right\} - \delta_z Z(t).$$

We see that the motion of $Z(t)$ can be described as a unique function of $k_1(t)$ and $Z(t)$.

From equations (2) and (3), we have $\hat{y}_j(t) = (1 + r(t)) \bar{k}_j(t) + w_j(t)$. Substituting $s_j(t) = \lambda \hat{y}_j(t)$ and the above equations into (7), we have

$$\dot{\bar{k}}_j(t) = \lambda w_j(t) - (1 - \lambda - \lambda r(t))\bar{k}_j(t). \tag{A22}$$

Multiplying the equation for $\bar{k}_j(t)$ by N_j and then adding the J resulted equations, we have

$$\dot{K}(t) = \lambda\beta k_1^{\alpha}(t)\sum_{j=1}^{J}\bar{\tau}_j A_j \bar{\alpha}_j^{\alpha} Z^{\alpha\bar{m}_j + m_j}(t) - \left(\bar{\lambda} - \bar{\tau}_1 A_1 \alpha\lambda Z^{m_1}(t)k_1^{-\beta}(t)\right)K(t), \tag{A23}$$

where we use (A15) and $K(t) = \sum_{j=1}^{J}\bar{k}_j(t)N_j$ and $\bar{\lambda} \equiv 1 - \lambda + \lambda\delta_k$.

Taking derivatives of (A19) with respect to t yields

$$\dot{K}(t) = \frac{K(t)\dot{k}_1(t)}{k_1(t)} + \left(k_1(t)\sum_{j=1}^{J}\bar{m}_1 \bar{M}_j Z^{\bar{m}_j - 1}(t)\right)\dot{Z}(t). \tag{A24}$$

Substituting (A23), (A19) and (A23) into (A24) yields

$$\dot{k}_1(t) = \tilde{\Lambda}(t) - \left(k_1(t)\sum_{j=1}^{J}\bar{m}_1 \bar{M}_j Z^{\bar{m}_j - 1}(t)\right)\frac{\Lambda(t)}{\Lambda_0(t)}, \tag{A25}$$

where

$$\tilde{\Lambda}(t) \equiv \frac{\lambda\beta k_1^{\alpha}(t)}{\Lambda_0(t)}\sum_{j=1}^{J}\bar{\tau}_j A_j \bar{\alpha}_j^{\alpha} Z^{\alpha\bar{m}_j + m_j}(t) - \left(\bar{\lambda} - \bar{\tau}_1 A_1 \alpha\lambda Z^{m_1}k_1^{-\beta}(t)\right)k_1(t).$$

Summarizing the above results, we obtain the following lemma.

Lemma A1

Assume that all the households in the world have the same preference. The motion of the two variables, $k_1(t)$ and $Z(t)$, are given by two differential equations, (A21) and (A25). For any given $k_1(t)$ and $Z(t)$, we determine $r(t)$ and $w_j(t)$, $j = 1, \cdots, J$, by (A15). The variables, $\bar{k}_j(t)$, are solved by equations (A22) as follows

$$\bar{k}_j(t) = e^{-\int(1 - \lambda - \lambda r)d\tau}\left(h_j + \lambda\int w_j(\tau)e^{\int(1 - \lambda - \lambda r)d\tau}\, d\tau\right), \quad j = 1, \cdots, J, \tag{A26}$$

where h_j are constants to be determined by initial conditions. For any given positive values of $Z(t)$, $k_1(t)$ and $\bar{k}_j(t)$ at any point of time, the other variables are uniquely determined by the following procedure: $k_j(t)$, $j=2,\cdots,J$ by (A14) $\rightarrow$ N_{qj}, $q=i,r$, $j=1,\cdots,J$ by (A17) $\rightarrow$ $K_j(t)$ by (A18) $\rightarrow$ $K_{qj}(t)$ by (A17) $\rightarrow$ $\hat{y}_j(t)=(1+r(t))\bar{k}_j(t)+w_j(t)$ by (A21) $\rightarrow$ $c_j(t)$ and $s_j(t)$ by (6) $\rightarrow$ $F_j(t)=Z^{m_j}(t)K_{ij}^{\alpha}(t)N_{ij}^{\beta}(t)$.

The dynamic properties of the world economy are determined by the two differential equations. Equilibrium is determined by

$$\sum_{j=1}^{J}\left\{\tau_{ij}\,\bar{a}_{ij}^{\alpha}\,A_j\,N_{ij}^{\beta}\,\overline{M}_j^{\alpha}\,Z^{m_j+\alpha\overline{m}_j-\varepsilon_{ij}}\,k_1^{\alpha}+\tau_{rj}\,\bar{a}_{rj}^{\alpha_{rj}}\,\overline{M}_j^{\alpha_{rj}}\,N_{rj}^{\beta_{rj}}\,Z^{\alpha_{rj}\overline{m}_j+\varepsilon_{rj}}\,k_1^{\alpha_{rj}}\right\}=\delta_z Z,$$

$$\lambda\beta k_1^{\alpha}\sum_{j=1}^{J}\bar{\tau}_j A_j\,\bar{\alpha}_j^{\alpha}\,Z^{\alpha\overline{m}_j+m_j}-\left(\bar{\lambda}-\bar{\tau}_1 A_1\,\alpha\lambda Z^{\,m_1}k_1^{-\beta}\right)k_1\Lambda_0=0. \tag{A27}$$

By the second equation in (A27), we solve

$$k_1=\Omega_0^{1/\beta}\left(\frac{\lambda}{\bar{\lambda}}\right)^{1/\beta}, \tag{A28}$$

where

$$\Omega_0(Z)\equiv\frac{\beta}{\Lambda_0}\sum_{j=1}^{J}\bar{\tau}_j A_j\bar{\alpha}_j^{\alpha}Z^{\alpha\overline{m}_j+m_j}+\bar{\tau}_1 A_1\alpha Z^{m_1}.$$

Substitute (A28) into the first equation in (A27)

$$\Omega(Z)\equiv\sum_{j=1}^{J}\left\{\bar{\tau}_{ij}Z^{m_j+\alpha\overline{m}_j-\varepsilon_{ij}-1}\Omega_0^{\alpha/\beta}+\bar{\tau}_{rj}Z^{\alpha_{rj}\overline{m}_j+\varepsilon_{rj}-1}\Omega_0^{\alpha_{rj}/\beta}\right\}-\delta_z=0, \tag{A29}$$

where

$$\bar{\tau}_{ij}\equiv\tau_{ij}\bar{a}_{ij}^{\alpha}A_j N_{ij}^{\beta}\overline{M}_j^{\alpha}\left(\frac{\lambda}{\bar{\lambda}}\right)^{\alpha/\beta}>0,\quad \bar{\tau}_{rj}\equiv\tau_{rj}\bar{a}_{rj}^{\alpha_{rj}}\overline{M}_j^{\alpha_{rj}}N_{rj}^{\beta_{rj}}\left(\frac{\lambda}{\bar{\lambda}}\right)^{\alpha_{rj}/\beta}>0.$$

From Lemma A1 and the above discussions, we have the following corollary.

Corollary A1

The number of equilibrium points is the same as the number of solutions of $\Omega(Z)=0$, for $Z>0$. For any solution $Z>0$, all the other variables are uniquely determined by the following procedure: k_1 by (A28) $\rightarrow$ r and w_j, $j=1,\cdots,J$, by (A15) $\rightarrow$ $\bar{k}_j=\lambda w_j/(1-\lambda-\lambda r)$ $\rightarrow$ k_j, $j=2,\cdots,J$ by (A14) $\rightarrow$ N_{qj}, $q=i,r$, $j=1,\cdots,J$ by (A17) $\rightarrow$ K_j by (A18) $\rightarrow$ K_{qj} by (A17) $\rightarrow$ $\hat{y}_j=(1+r)\bar{k}_j+w_j$ by (A21) $\rightarrow$ c_j and s_j by (6) $\rightarrow$ $F_j=A_jZ^{m_j}K_{ij}^{\alpha}N_{ij}^{\beta}$.

The number of equilibrium points is the same as the number of solutions of $\Omega(Z)=0$, for $Z>0$. As the expression is tedious, it is difficult to explicitly judge under what conditions the equation has a unique or multiple equilibrium points. To see that equation (A29) may have either a unique or multiple equilibrium points, we are concerned with a case that all the countries have identical population, identical production function, equal tax rate, and identical learning by doing and university's knowledge creation functions. In this case, the world economy is the same as a single economy. It is straightforward to show that in this case equation (A29) becomes

$$\Omega(Z)=\bar{\tau}_{0i}Z^{x_i}+\bar{\tau}_{0r}Z^{x_r}-\delta_z=0,$$

in which we omit index j as all the countries are identical and

$$x_i\equiv\frac{m}{\beta}-\varepsilon_i-1,\quad x_r\equiv\frac{\alpha_r m}{\beta}+\varepsilon_r-1,$$

$$\bar{\tau}_{0i}\equiv J\bar{\tau}_i A\left(\beta\bar{\alpha}^{\alpha}\bar{\tau}+\alpha\bar{\tau}\right)^{\alpha/\beta}>0,\quad \bar{\tau}_{0r}\equiv J\bar{\tau}_r\left(\beta\bar{\alpha}^{\alpha}\bar{\tau}+\alpha\bar{\tau}\right)^{\alpha_r/\beta}>0.$$

It can be shown that the model in this case is a special case of the national growth model proposed by Zhang (2005: Chap. 9). The dynamic properties of the model are thoroughly examined. The properties are summarized in the following corollary.

Corollary A2

If $x_i<0$ and $x_r<0$ (or $x_i>0$ and $x_r<0$), the system has a unique stable (unstable) equilibrium point; and if $x_i<0$ and $x_r<0$ ($x_i>0$ and $x_r<0$), the system may have none, one, or two equilibrium points. When the system has two equilibrium points, the one with the higher value of Z is unstable and the other one is stable.

We interpret x_i and x_r respectively as measurements of returns to scale of the production sector and university in the dynamic system. When $x_j < (>) 0$, we say that sector j displays decreasing (increasing) returns to scale in the dynamic economy. Hence, if the both sectors display decreasing (increasing) returns, the dynamic system has a unique equilibrium; if one sector displays decreasing (increasing) returns and the other sector exhibits increasing (decreasing), the system may have none, one, or two equilibrium points.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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STRATEGIC ANALYSIS THROUGH THE COMBINATION OF SWOT, AHP AND TOWS (A CASE STUDY ON THE NEUROLOGICAL WARD IN THE MHAT "SAINT PANTELEYMON" – PLOVDIV)

This study is an attempt to apply a hybrid model for a SWOT-AHP-TOWS strategic analysis. The methodology and results of a survey are presented, it was conducted with the subject – the Neurological Ward (NW) of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv. The combination of the methods SWOT (Strengths, Weaknesses, Opportunities, Threats) and AHP (Analytic Hierarchy Process) is infamous in the academic field, however it is weakly represented in the practice of health care management. The purpose of integrating AHP with SWOT is to reach an expert proportionality of every individual factor and the assessment of their significance. As a logical final phase of applying the SWOT-AHP, a TWOS analysis is carried out to determine the strengths, weaknesses, opportunities and threats. The strategic alternatives that were identified for the NW through the drawn up TOWS matrix may be used by the Senior Management of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv in the process of generating development ideas and to facilitate future decision-making.
JEL: M31; L22

1. Introduction

The health care reform that was initiated in 1999 implemented the public-private model, described as a "Public-private mix". Through it the state, insurance (public and corporate) and private sectors were integrated into the Bulgarian health care system (with different rights and responsibilities). The initiation of the reform was made by the National Assembly's acceptance of five laws on the Health Care system by the year 2000 – for healthy and safe working conditions; for health care insurance; for professional organizations of physicians and dentists; for medical institutions (MI); for medication and pharmacies in human medicine and one more regarding public health care in 2004 – the Health Act.

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Part of the change was the transition to a mixed system of financing (health insurances, private insurance, direct payment by patients and budget financing), aimed at a gradual linking of financing with actual results, achieving freedom in the offered health care services and accumulation of experience in the economic activities that accompany the process. The focus was on the **contractual beginning in the relationship between the medical institutions and the financing authorities** in the form of the National Health Insurance Fund (NHIF) for the volume of activities and the quality of services. Another important feature of the reform was providing a **freedom of choice to the patient –** since 2000, of a physician or a dentist for initial medical help and a medical institution for specialized outpatient care, since 2004 **–** for hospital care. It is precisely these two changes that proved to be key in achieving a market pressure and a exacerbated the competitive relations in the field of hospital care. In practice, the removal of administrative obstacles before a patient's choice and financing based on clinical pathways (where the resource used to fund a patient's treatment follows the patient's choice) turned patients into clients. This extremely significant transformation imposed a generally different management philosophy with the respective new requirements for the competences of hospital management. A part of this new knowledge and these new skills relate to the forming of ambitious and realistic strategies. However, before transitioning to a specific strategic choice, the health care manager should focus his attention to important questions such as:

- What are the strengths and weaknesses of the MI?
- What are the possibilities and threats in the environment?
- Are there any expected future changes in the market situation?
- Do enough resources exist to implement the decisions that have been made?
- Does the adopted competitive position correspond to the desired position?
- Which advantage(s) will the positioning be based on...

Guidance in finding the right answers to such questions can be provided by one of the most popular analytical instruments **–** the SWOT analysis. However, for it to be effective, it's components must undergo not only a qualitative, but also a quantitative assessment. In this sense the ***aim*** of the study is to present the application of a SWOT-AHP-TOWS analysis.

2. Theoretical Background

2.1. SWOT analysis

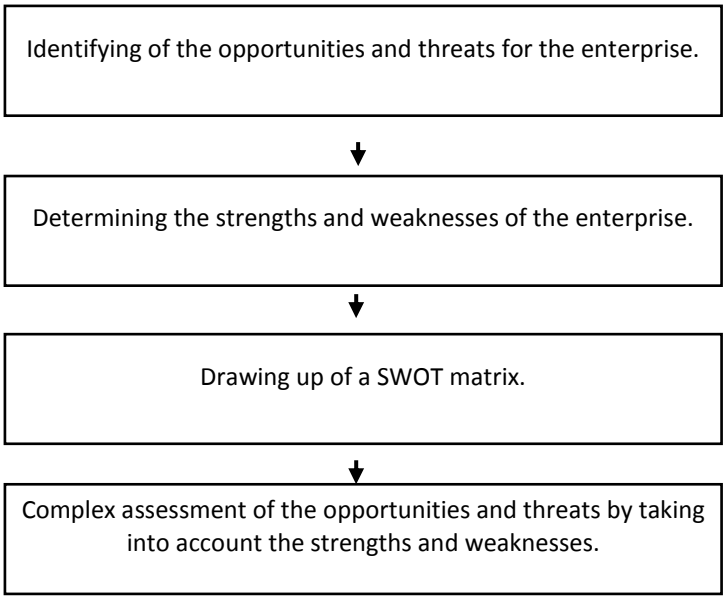
The SWOT analysis is one of the most popular instruments in the strategic planning for the activities of an organization and has been a long-standing staple in disciplines such as: Marketing (Faarup, 2010; Ferrell and Hartline, 2014; Lee and Kotler, 2016), Management (Koontz and Weihrich, 2008; Hill and Jones, 2010; Griffin, 2012) and business analysis (Carkenord, 2009; Cadle, Paul and Turner, 2010). Its essence lies in the identifying and

ranking (depending to their relative weight) of opportunities (O) and threats (T) from the external environment, as well as the strengths (S) and weaknesses (W) of the organization.

Four basic steps can be included while carrying out the modern SWOT analysis (Figure 1).

Figure 1

Stages of carrying out a SWOT analysis



Initially the SWOT analysis is used solely for the purpose of strategic management of the organization. Gradually it established itself as a popular practice of marketing planning. Finally, its subject was expanded out of the context of business practice and it began to include various socially-economic phenomena:

- countries (United Nations Development Program Cambodia, 2006; Jiang, 2013);
- cities (United Nations Human Settlements Programme, 2007; Bontje, Musterd and Pelzer, 2016);
- political parties (Lees-Marshment, 2001; Khawaja, 2013);
- public and non-profit organizations (Schulz and Johnson, 2003; Steiss, 2003);
- individual specialists, personnel, persons (Thomas, 2007; Kapoor and Kulshrestha, 2012).

The model of the SWOT analysis is universally applicable, because its methodology does not require the presence of a strict specific set of indicators in regards to the subject of the study. In addition, the SWOT factors are formulated in a conversational style, based on an expert assessment (for example: “Qualified medical specialists”; “Established very good

relationships with medical institutions from remote neighboring regions and business contacts with legal entities and institutional clients"; "Good material facilities ensuring the treatment process with a general and narrowly profiled medical equipment and furnishings, received as a result of systemically implemented investment policy for technical renovation and repair"). On the one hand, this is an advantage of the approach, because this allows for the analysis of factors, that have no formal expression and unequivocal assessment (as opposed to strictly objective indicators – net income from sales, profit, profitability, liquidity, etc.). On the other hand, such universality may also be seen as a flaw – a complication of the process of strategic analysis without any guarantee that all significant factors will actually be taken into account. Another important thing is – the SWOT analysis often ends with only a descriptive presentation of opportunities and threats from the external environment and strengths and weaknesses of an organization without a precise (or any whatsoever) quantitative assessment.

2.2. Analytical hierarchical process (AHP)

AHP is a Multi Criteria Decision Making (MCDM) method. It is one of the most reliable methods used to establish the degree of significance when assessing chosen factors. It was developed by Thomas L. Saaty in the 70s of the 20th century and is applied in various fields, including medicine, economics, environment, industry, etc. (Thungngern, Wijitkosum, Sriburi and Sukhsri, 2015). AHP is considered to be one of the most significant and widely used instruments that assist decision-making (Vachanadze, 2016) and has been established as a highly effective instrument for quantitative assessment and ranking of alternatives. Application of AHP consists of a subjective assessment of the weight of different criteria and subsequent use of mathematical tools. When it is applied a hierarchical structure is constructed, on top of which is the main objective, the criteria and sub-criteria are placed on the lower levels. The primary problem that it solves is the receipt of a quantitative assessment of alternatives that contain quantitative and/or qualitative features, which are measured in incomparable scales.

Some of the biggest advantages of AHP are:

- Presence of automatic software applications that assist its use process;
- Possibility to combine with other instruments, models and methodologies such as Fuzzy logic – FAHP (Radionovs and Užga-Rebrovs, 2016), Technique for Order of Preference by Similarity to Ideal Solution – TOPSIS (Berdie, Osaci, Muscalagiu and Barz, 2017), SWOT analysis (Kurttila Pesonen Kangas Kajanus, 2000);
- Allows the assessment of alternatives according to criteria that are mutually incomparable.

2.3. TOWS analysis

For decades the SWOT analysis was the most widely used method of identifying the strengths and weaknesses, the opportunities and threats of an organization. However, this

type of analysis characterizes the examined variables at a given time, i.e. It is static and seldom leads to the development of clear strategic alternatives, derived as future actions. Thus, in 1982 professor Heinz Weihrich offers a new instrument for situational analysis – the TOWS Matrix for analyzing the competitive situation. The TOWS model includes the familiar SWOT components, but places **T**hreats (**T** stands for threats, **O** for opportunities, **W** for weaknesses, and **S** for strengths) because in many situations a company undertakes strategic planning as a result of a perceived crisis, problem, or threat (Koontz and Weihrich, 2008). Apart from that he further develops the SWOT model by combining the company's weaknesses and especially its strengths – a similar combination is often neglected, while in most cases it requires distinct strategic choices.

The TOWS analysis makes an attempt to reorganize and integrate threats, opportunities, weaknesses and strengths more fully into the strategic planning process than another useful matrix for developing a firm's strategy (See Figure 2).

Weihrich proposes seven steps (which may vary) in the process of performing a TOWS analysis (Weihrich, 1982). Step 1, preparation of the enterprise profile, deals with some basic questions pertaining to the internal and external environments. This is about the description of the type of business, which the organization realizes; the geographic range of the offered production; the competitive situation, in which the organization is relative to its key competitors in the sector; what is management's vision for future development. Step 2 is related to the analysis and the assessment of the external environment. For the purpose it is necessary to identify the following factors – economic, social, political, demographic, production and technological, market and competition. It is important to note that the analysis is performed for a past and present period. This analysis ends with the Step 3 – drafting of a prognosis of the change in the factor in the future. The purpose is to determine future opportunities and threats from the external environment, which will influence the development of the organization. Step 4, the audit of strengths and weaknesses, focuses on the internal resources of the enterprise. It relates to the assessment of: management and the organization; production (operational management and technologies); finance; marketing and others (i.e. material resources, human resources, information systems, know-how, organizational culture, etc.). The purpose is to determine the strengths and weaknesses of the organization, as well as to foresee their development in the future. Strategic alternatives on the basis of the results of the analysis of the internal and external environment are developed in Step 5. The purpose is for the weaknesses and the threats to be minimized, while the strengths and opportunities are maximized. Step 6 is the strategic choice. This is a process, in which the manager has to make such an optimal decision that in the best possible way combines the internal opportunities of the organization with the external reality. During this process attention must be given to consistency of these decisions with the other steps in the strategy formulation process. Finally, since an organization operates in a dynamic environment, contingency plans must be prepared (Step 7).

Figure 2

Process of corporate strategy and the TOWS analysis

<table>
<tr><td colspan="4">Step 1: Prepare an Enterprise profile: (a) the Type of Business; (b) Geographic Domain; (c) Competitive Situation; (d) Top Management Orientation.</td></tr>
<tr><td></td><td colspan="3">Step 4: Prepare a Strengths and Weaknesses Audit of (a) the Management and Organization; (b) Operations; (c) Finance; (d) Marketing; and (e) the Other Parts of the Organization.</td></tr>
<tr><td>Internal Factors

External Factors</td><td>Step 5: Identify the Strategic Choices
Facing the Organization.

Step 6: Make the Strategic Choices.

Steps 1 to 6. Test for Consistency. Also Prepare the Contingency Plans (Step 7).</td><td>List Internal Strengths (S):
(1)</td><td>List Internal Weaknesses (W):
(1)</td></tr>
<tr><td rowspan="2">Step 2: Identify and Evaluate the Following Factors:
(a) Economic
(b) Social
(c) Political
(d) Demographic
(e) Products and Technology
(f) Market and Competition.

Step 3: Prepare a Forecast, Make Predictions and Assess of the Future.</td><td>List External Opportunities (O):
(1)</td><td>SO:
Maxi-Maxi</td><td>WO:
Mini-Maxi</td></tr>
<tr><td>List External Threats (T):
(1)</td><td>ST:
Maxi-Mini</td><td>WT:
Mini-Mini</td></tr>
</table>

Source: Adapted of Weihrich, 1982.

In practice, for the building of this TOWS Matrix the knowledge, received from the SWOT analysis to identify the strengths and weaknesses, threats or opportunities is employed. The SWOT components are cross-combined, to receive the four quadrants, containing the different strategic alternatives: **W-T quadrant** (from **W**eaknesses with **T**hreats), **W-O quadrant** (from **W**eaknesses with **O**pportunities), **S-T quadrant** (from **S**trengths with **T**hreats), **S-O quadrant** (from **S**trengths with **O**pportunities). Through this visual representation managers can trace idea generation process for the purposes of business development and be facilitated in making adequate management decisions, regarding the future of the organizations. Figure 3 represents the four strategic alternatives of the TOWS Matrix.

The strategies are based on the analysis of the external environment (threats and opportunities) and the internal environment (weaknesses and strengths) (Koontz and Weihrich, 2015):

1) **The W-T Strategy** (or Mini – Mini) aims to minimize both weaknesses and threats.

2) **The W-O Strategy** (or Mini – Maxi) attempts to minimize the weaknesses and maximize the opportunities. This strategy that constitutes a development plan with the intention of converting weaknesses into strengths, given the present opportunities in the external environment. Thus, an enterprise with weaknesses in some areas may either develop those areas within the enterprise or acquire the needed competencies (such as technology or human resources) from outside in order to enable it to take advantages of present opportunities in the external environment.

Figure 3

TOWS Matrix for Strategy Formulation

	Strengths (S) Strengths in the areas of Administration, Production, Finances, Marketing, R&D, Innovation and Engineering.	**Weaknesses (W)** Weaknesses in the areas shown in the quadrant corresponding to the Strengths.
Opportunities (O) **(Consider risks also)** The present and future economic conditions, political and social changes, new products, services, and technological changes.	**SO:** **Maxi-Maxi** Potentially the most successful strategy, utilizing the organization's Strengths to take advantages of the Opportunities.	**WO:** **Mini-Maxi** Strategy of development to overcome the Weaknesses in order to take advantages of Opportunities.
Threats (T) Competition, shortage of energy sources, and areas similar to those shown in the quadrant corresponding to the Opportunities.	**ST:** **Maxi-Mini** Strategy that concerns the use of Strengths to cope with Threats or to avoid Threats.	**WT:** **Mini-Mini** Strategy that contemplates a retrenchment, liquidation, or joint venture to minimize both Weaknesses and Threats.

Source: Adapted of Weihrich, 1982; Koontz and Weihrich, 2015.

3) **The S-T Strategy** (or Maxi – Mini) is based on using the organization's strengths to deal with threats in the environment. The aim is to maximize the former while minimizing the latter. Thus, an enterprise may use its technological, financial,

managerial, or marketing strengths to cope with the threats of a new product introduced by its competitor.

4) **The S-O Strategy** (or Maxi – Maxi), which represents the most desirable situation because it is one in which an enterprise can use its strengths to take advantage of opportunities presented by the external environment. Indeed, it is the aim of companies to move from other positions in the matrix to this one. If they have weaknesses, they will strive to overcome them, turning them into strengths. If they face threats, they will cope with them so that they can focus on opportunities.

The TOWS Matrix was originally introduced to assist in the formulation of enterprise strategies. Later, it was used as a conceptual framework for the development of career strategies for individuals, analyzing industries and identifying the competitive advantage of a region or nation (Weihrich, 1999; Ferreira, Leitão and Raposo, 2005; Bhattacharjee, 2012; Lin, 2016).

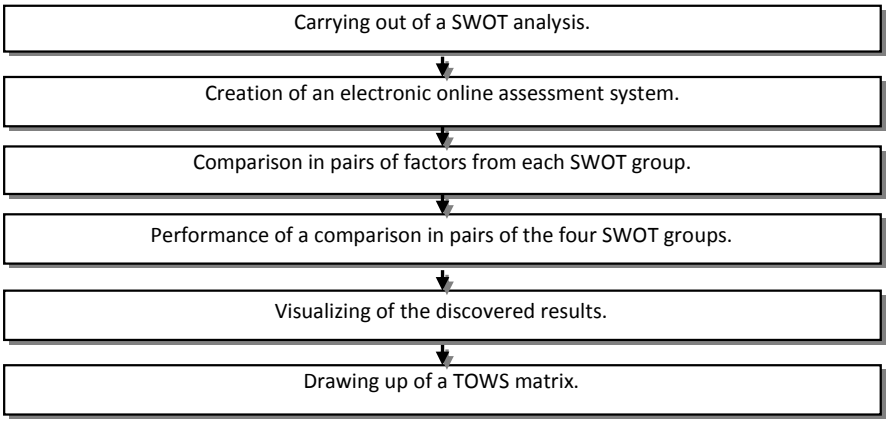
3. Methodology and Application

This study presents a hybrid model for strategic analysis that combines the methods SWOT, AHP and TOWS. This kind of integration is not a novelty in academic literature, which offers a series of examples of the joint application of AHP with other models such as **BSC** (Lee, Chen and Chang, 2008), **Gray-TOPSIS** (Oztaysi, 2014), **RealOptions** (Angelou and Economides, 2009), **SWOT** (Kurttila, Kangas and Kajunas, 2000), etc. The advantage of AHP lies in extracting quantitative features for the studied factors on the basis of expert assessments. Software applications were used for the purposes of this study, they are based on MS Excel, as well as the following languages and technologies: PHP, HTML, MySQL.

The sequence of the steps in the SWOT-AHP-TOWS model is presented in Figure 4.

Figure 4

SWOT-AHP-TOWS analysis model



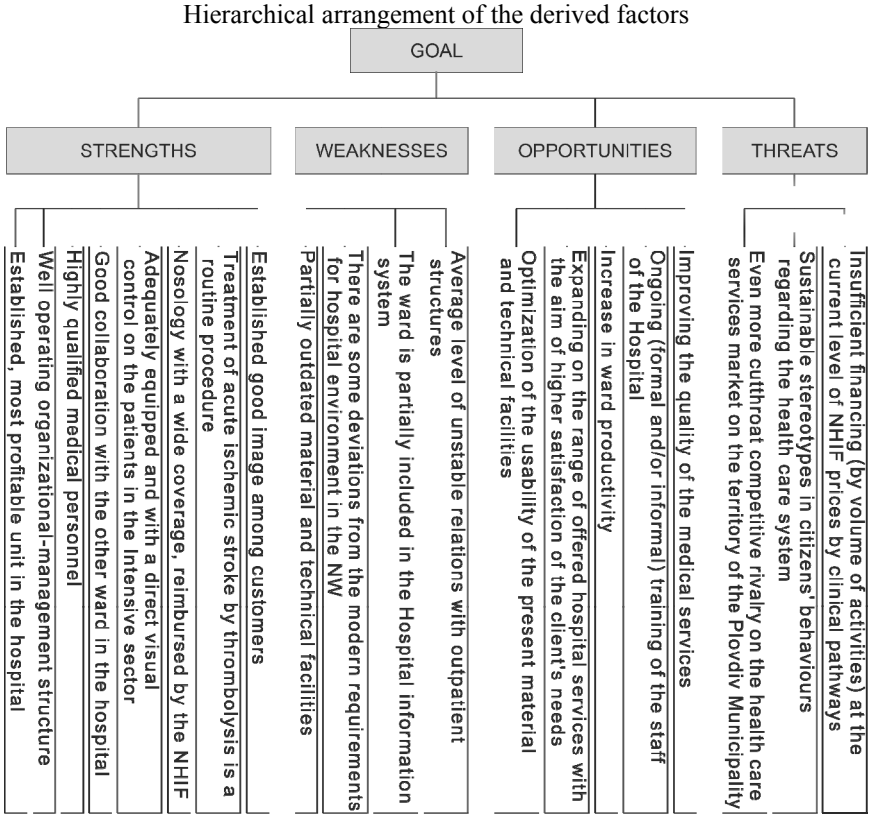
Stage 1. Carrying out of a SWOT analysis

The subject of the following survey study is the Neurological ward (NW) in the MHAT "Saint Panteleymon" – Plovdiv. The ward has existed since the founding of the hospital in 1960. At the moment, NW has 62 beds (including 12 beds in an Intensive Ward). Over the years, it has been repeatedly renewed both in terms of medical equipment, as well as living environment for the patients. In 2016, NW was accredited with an excellent grading of five stars for a term of five years. For more than fifteen years the ward has been the most profitable for the hospital and provides inpatient care to patients from the entire Plovdiv district. Precisely for that reason, treatment for ischemic stroke (IS) by thrombolysis was performed in this ward for the first time ever in Bulgaria.

With assistance from experts in the field – *the head of the ward*, *the senior physician* and one of the *interns* from the NW of Multi-profile Hospital for Active Treatment (MHAT) "Saint Panteleymon" – Plovdiv, an analysis was performed, from it 20 factors were derived that fall into one of the four groups, name Strengths, Weaknesses, Opportunities and Threats. The results from analysis are presented in Figure 5, whereas the elements are arranged hierarchically, reflecting the different stages on which the subsequent AHP method was carried out.

Figure 5

Hierarchical arrangement of the derived factors



Stage 2. Creation of an electronic online assessment system

At this stage a system to gather and store expert assessment was developed (it is active at this address: http://uni-research.eu/ahp/). The assessment in pairs of the factors was assisted by it. The following technologies and programming languages were used for its creation: PHP, MySQL and HTML. In the process of receiving the answers it was considered appropriate to perform additional personal interviews. That is how some of the specifics on the application of the AHP method were clarified and the questions raised regarding the factors being compared were answered. The assessments were received in written form, which is a printed copy of the developed interface from the information system.

Stage 3. Comparing factors from each SWOT group in pairs

The data received from the factor assessment allowed for the drawing up of assessment matrices, which represent:

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & \cdots & a_{2n} \\ 1/a_{13} & 1/a_{23} & 1 & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & 1/a_{3n} & \cdots & 1 \end{bmatrix}$$

Where a_{ij} characterizes the given assessment from the comparison between the *i* and *j* factors, or the $a_{ij} = w_i / w_j$ assessment was performed on a nine-step scale from 1 to 9, where 1 stands for equal significance of the two factors, while 9 shows that the one factor w_i is of much more significance than the other factor w_j .

The resulting matrices from the comparison of the three experts are presented in tables 1, 2, 3, 6, 7, 8, 11, 12, 13, 16, 17, 18, 21, 22 and 23. They cover the assessment of the factors from the four groups, as well as the assessment of the significance between the groups themselves. The matrices are with *n*x*n* dimensions, where *n* is the number of factors, while each element a_{ij} represents an assessment of the weight of the *i* factor relative to the *j* factor.

Table 1

Assessment matrix S1

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1/2	1/2	3	1/4	1/4	1/9	4
S2	2	1	6	4	3	2	1/8	1/4
S3	2	1/6	1	9	4	6	1	1
S4	1/3	1/4	1/9	1	1/4	1/4	1/5	1/6
S5	4	1/3	1/4	4	1	1	1/6	1/6
S6	4	1/2	1/6	4	1	1	1/7	1/5
S7	9	8	1	5	6	7	1	9
S8	1/4	4	1	6	6	5	1/9	1

Table 2

Assessment matrix S2

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1/7	1/6	1/5	1/7	1	1/8	1/8
S2	7	1	1	6	1	6	1	1/3
S3	6	1	1	5	4	5	4	1
S4	5	1/6	1/5	1	1/7	1/6	1/7	1/8
S5	7	1	1/4	7	1	4	1	1/3
S6	1	1/6	1/5	6	1/4	1	1/6	1/8
S7	8	1	1/4	7	1	6	1	1/4
S8	8	3	1	8	3	8	4	1

Table 3

Assessment matrix S3

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1	1	1	2	1	1	1
S2	1	1	1	1	1	1	1/2	3
S3	1	1	1	2	1	1	1	2
S4	1	1	1/2	1	1/2	1	1/5	2
S5	1/2	1	1	2	1	1	1/3	3
S6	1	1	1	1	1	1	1/5	1
S7	1	2	1	5	3	5	1	1
S8	1	1/3	1/2	1/2	1/3	1	1	1

Table 4

Consolidated matrix S

	S1	S2	S3	S4	S5	S6	S7	S8
S1		0.41	0.44	0.84	0.41	0.63	0.24	0.79
S2	2.41		1.82	2.88	1.44	2.29	0.4	0.63
S3	2.29	0.55		4.48	2.52	3.11	1.59	1.26
S4	1.19	0.35	0.22		0.26	0.35	0.18	0.35
S5	2.41	0.69	0.4	3.83		1.59	0.38	0.55
S6	1.59	0.44	0.32	2.88	0.63		0.17	0.29
S7	4.16	2.52	0.63	5.59	2.62	5.94		1.31
S8	1.26	1.59	0.79	2.88	1.82	3.42	0.76	

Table 5

Significance of the factors – strengths

STRENGTHS	Significance
(S1) Established, most profitable unit in the hospital	0,059
(S2) Well operating organizational-management structure	0,146
(S3) Highly qualified medical personnel	0,191
(S4) Good collaboration with the other ward in the hospital	0,041
(S5) Adequately equipped and with a direct visual control on the patients in the Intensive sector	0,101
(S6) Nosology with a wide coverage, reimbursed by the NHIF	0,065
(S7) Treatment of acute ischemic stroke by thrombolysis is a routine procedure	0,242
(S8) Established good image among customers	0,155
Eigenvalue : Lambda = 8.510; CR = 5.2%	

Table 6

Assessment matrix W1

	W1	W2	W3	W4
W1	1	1/9	1/4	1/3
W2	9	1	8	8
W3	4	1/8	1	3
W4	3	1/8	1/3	1

Table 7

Assessment matrix W2

	W1	W2	W3	W4
W1	1	1/3	1	1/3
W2	3	1	5	6
W3	1	1/5	1	1/3
W4	3	1/6	3	1

Table 8

Assessment matrix W3

	W1	W2	W3	W4
W1	1	1/4	3	1
W2	4	1	1	1
W3	1/3	1	1	1/4
W4	1	1	4	1

Table 9

Consolidated matrix W

	W1	W2	W3	W4
W1		0.21	0.909	1
W2	4.762		3.42	1
W3	1.101	0.292		1
W4	2.08	0.275	1.587	

Table 10

Significance of the factors – weaknesses

WEAKNESSES	Significance
(W1) Partially outdated material and technical facilities	0,007
(W2) There are some deviations from the modern requirements for hospital environment in the	0,035
(W3) The ward is partially included in the Hospital information system	0,009
(W4) Average level of unstable relations with outpatient structures	0,012
Eigenvalue : Lambda = 4.036; CR = 1.3%	

Table 11

Assessment matrix O1

	O1	O2	O3	O4	O5
O1	1	1/6	4	2	1/5
O2	6	1	4	2	1/4
O3	1/4	1/4	1	1/4	1/5
O4	1/2	1/2	4	1	1/2
O5	5	4	5	2	1

Table 12

Assessment matrix O2

	O1	O2	O3	O4	O5
O1	1	3	4	1/9	1/7
O2	1/3	1	1/3	1/9	1/8
O3	1/4	3	1	1/9	1/8
O4	9	9	9	1	3
O5	7	8	8	1/3	1

Table 13

Assessment matrix O3

	O1	O2	O3	O4	O5
O1	1	1/5	1	1	1
O2	5	1	½	1	1
O3	1	2	1	1/5	1/5
O4	1	1	5	1	1
O5	1	1	5	1	1

Table 14

Consolidated matrix O

	O1	O2	O3	O4	O5
O1		0.464	2.52	0.606	0.306
O2	2.154		0.874	0.606	0.315
O3	0.397	1.145		0.177	0.171
O4	1.651	1.651	5.646		1.145
O5	3.271	3.175	5.848	0.874	

Table 15

Significance of the factors – opportunities

OPPORTUNITIES	Significance
(O1) Optimization of the usability of the present material and technical facilities	0,125
(O2) Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs	0,144
(O3) Increase in ward productivity	0,075
(O4) Ongoing (formal and/or informal) training of the staff	0,295
(O5) Improving the quality of the medical services	0,36
Eigenvalue : Lambda = 5.533; CR = 7.9%	

Table 16
Assessment matrix T1

	T1	T2	T3
T1	1	4	1/5
T2	1/4	1	1/5
T3	5	5	1

Table 17
Assessment matrix T2

	T1	T2	T3
T1	1	4	3
T2	1/4	1	4
T3	1/3	1/4	1

Table 18
Assessment matrix T3

	T1	T2	T3
T1	1	1/5	1/9
T2	5	1	1
T3	9	1	1

Table 19
Consolidated matrix T

	T1	T2	T3
T1		1.47	0.41
T2	0.68		0.93
T3	2.47	1.08	

Table 20

Significance of the factors – threats

THREATS	Significance
(T1) Even more cutthroat competitive rivalry on the health care services market on the territory of the Plovdiv Municipality	0,273
(T2) Sustainable stereotypes in citizens' behaviours regarding the health care system	0,278
(T3) Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways	0,449
Eigenvalue : Lambda = 3.167; CR = 17.4%	

Stage 4. Performing a comparison of the four SWOT groups in pairs

Table 21
Assessment matrix SWOT1

	S	W	O	T
S	1	9	1	6
W	1/9	1	1/5	1/3
O	1	5	1	9
T	1/6	3	1/9	1

Table 22
Assessment matrix SWOT2

	S	W	O	T
S	1	6	4	6
W	1/6	1	1/5	4
O	1/4	5	1	5
T	1/6	1/4	1/5	1

Table 23
Assessment matrix SWOT3

	S	W	O	T
S	1	9	1	9
W	1/9	1	1/9	1
O	1	9	1	9
T	1/9	1	1/9	1

Table 24
Consolidated matrix SWOT

	S	W	O	T
S		7.862	1.587	6.868
W	0.127		0.164	1.101
O	0.63	6.082		7.399
T	0.146	0.909	0.135	

Table 25

Significance of the factors – SWOT

SWOT	(S)	(W)	(O)	(T)	Significance
(S) Strengths	-	7.86	1.59	6.87	0.499
(W) Weaknesses	0.13	-	0.16	1.1	0.063
(O) Opportunities	0.63	6.08	-	7.4	0.378
(T) Threats	0.15	0.91	0.14	-	0.06
Eigenvalue : Lambda = 4.025; CR = 0.9%					

Tables 4, 9, 14, 19 and 24 represent consolidated matrices in which the elements of the matrix are the geometrical average of the elements of the assessment matrices of the three experts. The elements were calculated with the formula:

$$A = \begin{bmatrix} & x_{12} & \cdots & x_{1n} \\ 1/x_{12} & & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/x_{1n} & 1/x_{2n} & \cdots & \end{bmatrix},$$

where

$$x_{ij} = \left(\prod_{k=1}^{3} a_{ij\,k} \right)^{\frac{1}{3}}$$

Using the consolidated matrices, the vectors of significance of the factors were calculated, they are presented in tables 5, 10, 15, 20 and 25. Calculation of the vectors of weights from matrices is performed via the following formula (Chang and Huang, 2006):

$$(A - \lambda_{\max} I)w = 0$$

Where $\lambda_{\max}$ is the highest (eigenvalue) internal value of Matrix A, w is a vector, representing the significance of the factors and I is an identical matrix.

In most cases the consolidated matrices are inconsistent due to the small probability for the expert assessment of the factors to be consistent at each comparison of the assessed factors.

The index and consistency degree in accordance of the AHP model of Saaty (1980) can be determined via the following formulas:

$$CI = \frac{\lambda_{\max} - n}{n-1}$$

Where n is the number of rows (columns) of the assessment matrix.

$$CR = \frac{CI}{RI}$$

RI depends on the number of rows (columns) of the matrix. The values according to Saaty are given in Table 26 (Gorner, Toker and Ulucay, 2012).

Table 26

RI values

n	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

A value of RI under 0.1 is deemed as acceptable. Despite this in practice it is permissible for higher values to be accepted (Tomar and Board, 2012; Anushiya and Illeperuma, 2016).

The meanings of $\lambda_{\max}$, CR, w are presented in tables 5, 10, 15, 20 and 25.

The actions of Stage 2 were automatically performed with the assistance of an electronic table, developed by Klaus D. Goepel, which is based on Microsoft Excel. The application can be found on the following link: http://bpmsg.com**.**

Stage 5. Visualizing of the discovered results

Table 27 presents the significance of the factors and factor groups. The factors with the most significance (weight) are bolded.

Table 27

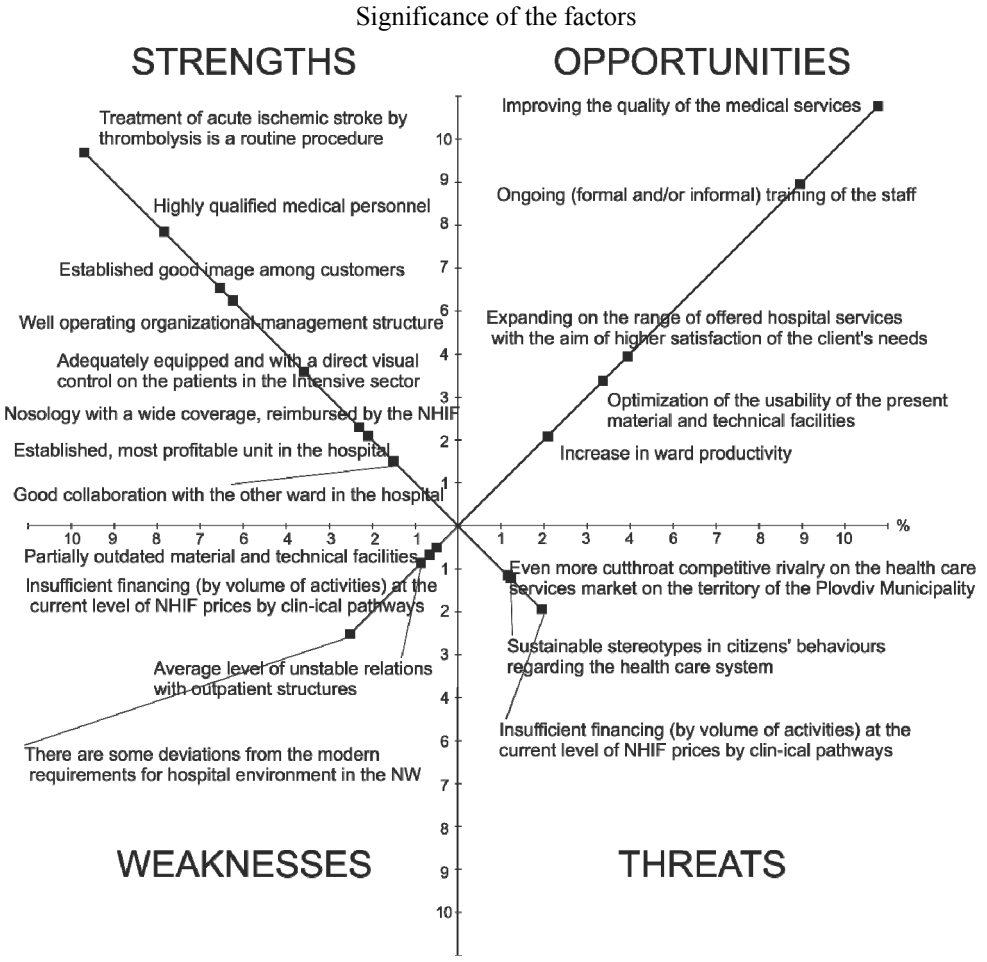
Total significance of the factors of the SWOT matrix

SWOT group	Significance of a group	Factor	Significance in the group	Total significance
Strengths	0.499	Established, most profitable unit in the hospital.	0.059	0.029
		Well operating organizational-management structure.	0.146	0.073
		Highly qualified medical personnel.	**0.191**	**0.095**
		Good collaboration with the other ward in the hospital.	0.041	0.021
		Adequately equipped and with a direct visual control on the patients in the Intensive sector.	0.101	0.050
		Nosology with a wide coverage, reimbursed by the NHIF.	0.065	0.032
		Treatment of acute ischemic stroke by thrombolysis is a routine procedure.	**0.242**	**0.121**
		Established good image among customers.	0.155	0.077
Weaknesses	0.063	Partially outdated material and technical facilities.	0.110	0.007
		There are some deviations from the modern requirements for hospital environment in the NW.	**0.559**	**0.035**

SWOT group	Significance of a group	Factor	Significance in the group	Total significance
		The ward is partially included in the Hospital information system.	0.134	0.009
		Average level of unstable relations with outpatient structures	0.196	0.012
Opportunities	0.378	Optimization of the usability of the present material and technical facilities.	0.125	0.047
		Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs.	0.144	0.055
		Increase inward productivity.	0.075	0.029
		Ongoing (formal and/or informal) training of the staff.	**0.295**	**0.111**
		Improving the quality of the medical services.	**0.360**	**0.136**
Threats	0.060	Even more cutthroat competitive rivalry on the healthcare services market on the territory of the Plovdiv Municipality.	0.273	0.016
		Sustainable stereotypes in citizens' behaviours regarding the health care system.	0.278	0.017
		Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways.	**0.449**	**0.027**

To illustrate the significance of the factors their respective weight relative to each other, the results are depicted in Figure 6. The figure clearly shows the dominating significance of the factors from the strengths and opportunities groups.

Figure 6



Stage 6. Drawing up of a TOWS matrix

The final stage of the suggested hybrid model focuses on combining the identified strengths/weaknesses and opportunities/threats for the NW. A TOWS matrix is designed for the purpose, it provides four strategic development alternatives (Figure 7).

Figure 7

TOWS matrix for the NW of MHAT "Saint Panteleymon" – Plovdiv

	Strengths *S1.*Established, most profitable unit in the hospital. *S2.*Well operating organizational-management structure. ***S3.*Highly qualified medical personnel.** *S4.*Good collaboration with the other ward in the hospital. *S5.*Adequately equipped and with a direct visual control on the patients in the IS. *S6.*Nosology with a wide coverage, reimbursed by the NHIF. ***S7.*Treatment of acute ischemic stroke by thrombolysis is a routine procedure.** *S8.*Established good image among customers.	**Weaknesses** *W1.*Partially outdated material and technical facilities. ***W2.*There are some deviations from the modern requirements for hospital environment in the NW.** *W3.*The ward is partially included in the Hospital information system. *W4.*Average level of unstable relations with outpatient structures.
Opportunities *O1.*Optimization of the usability of the present material and technical facilities. *O2.*Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs. *O3.* Increase inward productivity. ***O4.*Ongoing (formal and/or informal) training of the staff.** ***O5.* Improving the quality of the medical services.**	**SO:** **Maxi-Maxi** • *S1, S2,* ***S3,*** *S4, S6, O1.* • ***S3,*** *S4, S8, O2.* • *S1, S2,* ***S3,*** *S4,* ***S7,*** *O3.* • *S1,* ***S3, S7, O4.*** • *S2,* ***S3,*** *S4,* ***O5.***	**WO:** **Mini-Maxi** • *W1, O1, O2, O3.* • ***W2,*** *O1, O2.*
Threats *T1.*Even more cutthroat competitive rivalry on the healthcare services market on the territory of the Plovdiv Municipality. *T2.*Sustainable stereotypes in citizens' behaviours regarding the health care system. ***T3.*Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways.**	**ST:** **Maxi-Mini** • ***S3,*** *S4, S5,* ***S7,*** *S8, T1.* • ***S7,*** *T2.* • *S6,* ***T3.***	**WT:** **Mini-Mini** • *W1, T1.* • ***W2,*** *T1.* • *W4, T2.*

Figure 7 clearly shows the dominating position of quadrant – Maxi-Maxi strategy (S-O Strategy), which combines the factors from the strengths and opportunities groups of the NW. As it has already become clear, these SWOT components received the highest relative weight.

This strategic alternative is the most favorable for the subject of the study and should be a future priority. Therefore, in the following lines, we will solely focus on its description.

- S_1, S_2, S_4, S_6, O_1. The first combination of strengths with opportunities of the NW is a strategy of *optimizing the usability of the current material and technical facilities* based on:

  - *Over fifteen years of experience in providing the hospital's primary income.* If the leadership position is preserved (of primary source of income for MHAT "Saint Panteleymon" – Plovdiv) in the future, additional funds may be earmarked for the expansion and modernization of the material and technical facilities.

  - *Adequately operating organizational forms and the managerial relations between them* play and will continue to play a significant role in the improvement of the usability of the current material and technical facilities.

  - *Good collaboration with the other wards in the hospital.* The work organization created in the NW provides the necessary level of coordination with the other hospital wards (Clinical Laboratory, Microbiology, Pathoanatomic Laboratory, Physiotherapy and rehabilitation ward, Radiology ward, Technical Support Service, System Administrative for the Hospital Information System), which could assist the optimization activities of the usability of the current material and technical facilities. In addition, if necessary part of the wards can provide an exchange in bed capacity and equipment.

  - *Nosology with a wide coverage, reimbursed by the NHIF* The needs for the optimization of the material and technical facilities can be met only if the possibility to operate at the maximum volume of clinical pathways (CP) is supported.

- $\boldsymbol{S_3}, S_4, S_8, O_2$. The second strategy is *an expansion of the range of provided hospital services* through:

  - *The highly qualified hospital personnel* that has long-term work experience (after successfully specializing in "Neurology") and a number if certificates for highly specialized activities. It is directly engaged with the volume of provided diagnosis, treatment and prophylaxis of the patients. Of course, apart from the necessary knowledge and competencies of the hospital personnel it is necessary to account for its motivation and social responsibility. For this purpose, the senior management of MHAT "Saint Panteleymon" – Plovdiv has implemented a differentiated bonus awarding system for achieving results.

- *Good collaboration with the other wards* is necessary for the inclusion in new clinical pathways, as well as for the performance of additional activities out of the ones paid by the NHIF.

- *The established good image among customers* of the NW could stimulate its managing authorities to expand the product mix with additional hospital services, such as – prophylactic examinations, specialized testing (Electromyography, Electroencephalographs and Doppler Ultrasound), nutrition under the guidance of a professional dietitian according to an example menu.

- S_1, S_2, $\boldsymbol{S_3}$, S_4, $\boldsymbol{S_7}$, O_3. This third strategic alternative demonstrates the increase in productivity of the ward on account of:

  - *Experience as an established, most profitable unit of the hospital.* It is apparent from the data presented in Table 28 that over the last three years there is an attempt to reduce costs for medication and medical consumables in the NW. At the same time, there is also a tendency for a decrease in incomes from CP (for example, for 2016 there is a 80.24% decrease compared to the previous year). This fact is due to the imposed by the NHIF (for all MI) limit on financing for activities under clinical pathways. An increase of incoming cash flow can be achieved by the performance of a larger volume of paid services and the introduction of additional fees for better living environments for patients.

  - *Well operating organizational-management system* which provides efficiency of the social system of the NW as a whole.

  - *Highly qualified medical personnel* It is engaged not only with the quality provision of the hospital services, but also with reaching previously planned results.

  - *Good collaboration with the other wards of the hospital* in regards to the necessary quick and timely reaction in treating every patient.

  - *Treatment of acute IS by thrombolysis is a routine procedure.* It should be kept in mind that the costs for the performance of an intravenous thrombolysis (IT) in the case of acute ischemic stroke are high, but income from this clinical pathway is also high. That is, the good work organization and most of all the strict performance of each step of the regulated procedure have a significant impact on the final result of the treatment. The decade-long experience of the NW is associated with a relative share of more than 50% of patients with minimal/missing disability (after thrombolysis). However, the positive result of this most effective method (worldwide) for the treatment of IS depends on the time of initiation of the IT. Among reasons for delaying or postponing the start of the procedure are the weak awareness of patients and the insufficient coordination between the outpatient and hospital care. In this regard, NW must expand its activity on promoting the effect of the treatment, identifying the first symptoms of the IS, the emergency transportation of the patient to the hospital (before the third hour of manifestation of the initial symptoms)...

Table 28

Economic indicators of the NW for the period between 2014-2016 (BGN)

Year	Units	Costs	Medi-cations	Medi-cations per day	Med. Cons. per day	Total Med. Cons.	Bed-day	Income from CP, etc. payments	Income From CP
2014	NW	907,323	63,640	4.0	2.57	6.57	57.05	1,460,086	1,409,454
	Intensive Sector	660,015	89,455	22.42	6.80	29.22	165.43	417,069	417,069
	Total	**1,567,338**	**153,095**	**7.69**	**3.42**	**11.11**	**78.76**	**1,877,155**	**1,826,523**
2015	NW	1,001,768	79,612	5.02	2.10	7.12	63.15	1,267,986	1,225,372
	Intensive Sector	671,104	90,939	22.54	5.07	27.6	166.03	391,939	388,595
	Total	**1,672,872**	**170551**	**8.57**	**2.70**	**11.27**	**84.07**	**1,659,925**	**1,613,967**
2016	NW	775,209	57,896	4.78	2.05	6.82	63.97	1,017,845	981,296
	Intensive Sector	518,278	63,506	20.52	5.01	25.53	167.46	317,013	313,740
	Total	**1,293,487**	**121,402**	**7.17**	**3.10**	**10.27**	**76.38**	**1,334,858**	**1,295,036**

- S_1, $\boldsymbol{S_3}$, $\boldsymbol{S_7}$, $\boldsymbol{O_4}$. This fourth strategy present an *ongoing training of the staff* through:
  - *The position of an established, most profitable unit in the hospital* suggest the possibility of financing for the ongoing training of medical personnel to obtain certificates for the performance of highly specialized activities.
  - *Highly qualified medical personnel* It is one of the leading factors in the receipt of highest accreditation rating that entitles the NW to train "Neurology" postgraduates for a period of five years. To renew this possibility for subsequent periods it is necessary for the qualification status of the medical personnel to be continuously developed.
  - *Treatment of acute IS by thrombolysis is a routine procedure.* The NW is a participant in the "Angels" international program, which aims at the creation of a community of 1500 centres and hospitals in Europe for the treatment of strokes. Within the framework of the project medical specialists from the ward could exchange ideas, share valuable practical experience (in regard to achieving better therapeutic results), receive access to results from clinical trials, etc.
- S_2, $\boldsymbol{S_3}$, S_4, $\boldsymbol{O_5}$. This final strategic alternative shows the combination of *improving the quality of the medical services* through:
  - *Well operating organizational-management system.* Functioning of the organizational forms and the relations between them requires continuous improvement. In searching for alternatives for the improvement of the quality of medical services, the NW may undertake measures on improving the attitude towards the patient and the conditions of the patient environment.

- *Highly qualified medical personnel*, which is directly engaged with the provision of quality diagnosis, treatment, prophylaxis, etc. - observing the principles and rules of medical ethics (regarding all persons active in healthcare).

- *Good collaboration with the other wards in the hospital.* Expanding the volume of activities, performed by other wards/units of MHAT "Saint Panteleymon" – Plovdiv immediately reflects on an increase in diagnosis and treatment possibilities for the NW. For example, equipping the radiology ward with an MRI will significantly improve the diagnosis and will determine the correct attitude in regards to the patients.

4. Conclusion

Application of the AHP method in collaboration with the SWOT and TOWS analyses had the aim of providing a possibility for the studied factors to be expertly dimensioned and respectively prioritized. Through the established results it was discovered that the **factors-possibilities** with the most total significance for the subject chosen for the study are "Increase in the quality of medical services" and "Ongoing training of the staff", whereas the **factors-strengths** with the most total significance are "Treatment of acute ischemic stroke by thrombolysis is a routine procedure" and "Highly qualified medical personnel". It is precisely the combination of these two SWOT groups that is expressed in the suggestion of a specific strategic alternative – Maxi-Maxi from drawn up TOWS matrix.

The applied combination of a SWOT-TOWS-AHP methodology allowed for the performance of a quantitative assessment and an analysis of factors that are otherwise difficult to compare. In this regard, additional tools were provided to assist the senior management of the NW of the MHAT "Saint Panteleymon" – Plovdiv in the process of generating development ideas and to facilitate future decision-making.

A graphic interpretation of the results was also created based on the comparison in pairs of the four groups of SWOT factors.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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M&A AND CREDITING: THE HYBRID GROWTH STRATEGY SEEMS TO BE THE BEST FOR THE BANKS IN KAZAKHSTAN

The development of the banking sector in Kazakhstan after 2015 raises a number of questions regarding the growth strategies that should be applied to overcome the problems with its sustainable development in a business environment, influenced by low prices of crude oil and an underdeveloped real sector. The state policy for bank consolidation and the active support of the National Bank of the Republic of Kazakhstan in solving liquidity problems of particular banks, namely Qazkom and Halyk Bank, has not led to the expected results. This analysis shows that a combination of external factors with organic growth strategy through intensive innovation of the crediting process as well as training of the personnel to minimize the influence of biases in the decision-making process, should be applied as well. Based on our overall analysis it is suggested, that hybrid strategy, which combines the benefits of external and organic growth strategies, would be more suitable under the specific conditions of Kazakhstan, and probably in any other country with similar market environment.
JEL: G21; G28

Introduction

The analysis of the banking sector in the Republic of Kazakhstan (Shenker & Shinkeeva, 2016), as well as the data for the banks' assets and the credit portfolios of the banks (Ranking.kz., 2017) show that there are significant problems related to the growth strategies applied by the banks in Kazakhstan after the devaluation of the Kazakhstani currency Tenge in 2015.

The external growth strategy which was applied by Qazkom Bank in 2014 – acquiring BTA Bank, followed by Halyk Bank acquiring Qazkom in July 2017 (Central Asian Analytical Network, 2017; Danish Kazakh Society, n.d.) – does not seem to produce the desired effects. The banking sector continues to suffer from the same problems as in 2015 – insufficient credit levels and inability to guarantee the sustainable development of the

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sector without the financial support of the government. On the other hand, the support of the government, i.e. the National Bank's credits to provide liquidity to Qazkom –USD 1.2 billion in December 2016, and USD 616 million in February 2017 (Waweru, Munyoki & Uliana, 2008) – did not lead to the desired results.

The shrinking economy of Kazakhstan, which is the result of the dramatic drop in oil and gas prices in 2015, does not attract foreign investors anymore, with the consequence that foreign capital was, and is still being, withdrawn from the commercial banks of the country. This goes along with the underdeveloped, not oil-based economy, which of course negatively affects the crediting potential for banks, as there are not many well-developing companies in the real economy which could be credited at minimal risk. These conditions raise questions as to what growth strategy banks should set themselves and apply in order to bridge the gap in the short run.

The obvious options are, of course, external growth strategy, i.e. mergers and acquisitions, and internal growth strategy. This paper analyses the specifics of the development of the banking sector of the Republic of Kazakhstan (KazBS) in the period between 2016 and 2017, as well as the pros and cons of the two mainstream strategies for growth, with the aim to suggest the best option. It is understood that in theory either strategy could be successful. However, the development of the KazBS suggests that other factors should be taken into consideration as well, namely the impact of cultural factors (Hofstede, Hofstede & Minkov, 2010) in the decision-making process at banks. If the specific national culture matters in this – and it always does – we should consider very seriously the option for internal growth, looking for ways to intensify and optimize the contribution of the human factor in the decision-making process. If the analysis shows that external strategies for growth have bigger potential, the government policy for supporting the big banks should be pursued.

Methodology

Research approach and strategy

We started this research on the assumption that we can transfer to some extent the findings from the surveys of individual and institutional investors' behaviour in the decision-making process to the bank officers involved in the crediting process. The reasons for such a possible transfer are that both professional cohorts have similar education and work standards, and many work in the same financial institutions or conglomerates. On the other hand, the main biases that have been observed among investors (Byrne & Brooks, 2008; Kapoor & Prosad, 2017), such as: overcompetence and overoptimism, representativeness (assessing situations based on superficial characteristics rather than underlying probabilities), conservatism (overstating the probabilities of recently observed or experienced events), regret aversion (not getting too emotional about the decisions made), and of course – misguiding conviction (Byrne & Utkus, n.d.), cannot be transferred one-to-one, although some of them seem to be quite similar in the cases of credit inspectors. It is well known, that the credit process is subject of many specific regulations, quite strict,

starting with European Banking Authority's standards and guidelines, and ending up with the bank's policies and corporate governance. Still, the "credit appetite" and "the tone from the top", which play significant role in the decision-making process in every bank, should be considered also. Therefore, accepting the fact that specific biases exist in one area of the bank activities – investment banking, we presume that there are biases that influence the credit domain of the bank activities as well, although the crediting process in each bank is subject of specific rules and regulations, which make it different from the investment banking. From theoretical point of view such a presumption, that if there are proven biases in one area of the bank activities, there should be expected biases in the other area as well, seems quite logical.

First, we will analyse the findings of previous research, which are relevant to our **aim**: to suggest a strategy, or combination of strategies for growth, that might help the commercial banks in Kazakhstan to adapt to the market conditions for a sustainable development. Then, we will use secondary data to analyse the development of the banking sector in Kazakhstan in the period between 2016 and 2017 with the aim to determine if the strategy for growth was right or not. As criteria we will use the data about the banks' assets and the results from the crediting process.

Secondary research

The data about the development of the banking sector is from official sources, namely from the National bank [50] and from research agencies, such as RFCA Ratings, Rating.kz, Economics and others. As our analytical horizon is very short – the two years after the correction of the international oil and gas prices, which affected the banking sector severely, our analysis, and the results we arrive at, can only be preliminary. If market conditions in the oil and gas sector change, we will need to run the analysis again.

Limitations

As the time horizon, which is two years after 2015, is too short, and the data is about the bank sector only, we may expect some inaccuracies in the analysis and the results. However, we do not expect any significant problems, as the data is from official and other reliable sources.

Theoretical Background

Traditionally finance management in the banking institutions has been considered to include two absolutely separated areas – the credit and deposit area on the one hand, and financial investments on the other hand (Lavrushin, 2008-a; Glushak, 2017, Nikonets & Marchenko, 2015; Hamitov, 2005; Shustova, 2010). Crediting has always focused on finding reliable companies with sustainable profitable business, which would guarantee the regular repayment of instalments according to the credit plan. In line with this is, of course,

the minimization of the credit risk, e.g. with the provided collateral and strictly following the risk-minimizing policies and regulations (Lavrushin, 2008-a; Gruning, 2007; Lavrushin 2008-b; Rau & Shustova, 2014, Sadvokasova & Kodasheva, 2016; Shalabai, 2008; Shustova, 2011). The crediting process is subject of many different strict regulations, from the technical standards, guidelines and recommendations of EBA (European Banking Authority, n.d.), mandated to EBA and developed according to the Bank Recovery and Resolution Directive, to the national laws and other regulations, the policy of the national bank, and further down to the policies and corporate governance of the commercial banks at the other end of the risk-minimization vector. For this analysis of commercial banks, the most important elements are the corporate governance, the corporate culture, and of course – the risk management. Obviously, the compliance of the "risk appetite" at the credit department level, with "the tone from the top" (in the bank), and of course – with the regulations, is probably the most important issue.

Regarding the financial investments area, the theory is much more diverse as there are many more unforeseen risks. There we could consider the paradigm of the 'rational man' (homo economicus), applying the axioms of Expected Utility Theory (EUT) by von Neumann and Morgenstern (1947), which led to the development of a number of theories on finance, such as Efficient Market Hypothesis (EMH), the Sharpe - Lintner Capital Asset Pricing Model, the Miller-Modigliani Irrelevance Propositions, the Cox- Ingersoll-Ross theory of the term structure of interest rates (Gilson & Kraakman, 2003), only to mention a few. It is well known that none of these theories can be applied exclusively, i. e. that one of them is "the only one", as there are many anomalies which influence investors' behaviour in the decision-making process (Prast, 2004; Ivanova, 2010). In practice, the market equilibrium is some sort of weighted average of the behaviour of rational and irrational traders (Fama & French, 2007; Ivanova, 2010; Verma & Soydemir, 2009).

As a result, investors naturally develop some kinds of biases, which are both learned and experienced, and these biases seem to influence the decision-making process significantly.

Another consideration, which is important for us in this research, is that some of the biases which influence the decision-making process in financial investment are based on the national culture, as well as on certain subcultures, and it is very difficult, or even impossible, to avoid them, especially when the financial expert/investor is absolutely confident about his professional competence (Biais & Weber, 2009; Ivanova, 2010; Menkhoff & Nikiforow, 2009; Taleb, 2004). Obviously, if this is the case, such investors would not learn much from their previous experiences when they make investment decisions for the near future.

The above-mentioned research findings are mostly about the personal/individual investors. The question is - can we transpose them from the institutional investors to the credit inspectors? And if yes, can we also consider that the other bank officers, including those in the credit departments, have similar biases, and also that they would behave in a similar way when deciding on the credit lines to the real business agents? If yes, we can use the behavioural finance framework to analyse the results of the Kazakhstani banks in the last two years and look for better results as outcome of the crediting process.

The main idea of the behavioral finance is that the economic (rational) man does not exist in reality and in the decision-making process the finance/bank officers often deviate, sometimes - significantly from rationality. The behavioral finance studies the influence of emotions and cognitive errors on investors and thus opens up new vistas to influence the behavior of the decision-makers in finance and banking. To be more specific, the behavioural finance considers the differences between the cognitive biases and emotional biases (Ivanova, 2010; Pompian, 2009; Waweru, Munyoki & Uliana, 2008) stating that the knowledge-based biases might be corrected based on the personal experience, and of course through provision of comprehensive information. It is much more difficult to overcome the emotional biases, which are influenced by impulse and intuition. Still, through the intensive and systematic training it is possible to reduce to a minimum the effects of all those biases in the management process.

In a very interesting research of 46,969 brokerage accounts Chen, Kim, Nofsfinger and Riu (2007) found out that the institutional investors are equally affected by biases like the individual investors. They argue that a large number of such institutional investors are showing poor results because they are subject to biases. In other words, they do not learn much from their previous experience, attributing the negative results, if any, to other factors only, but not to their own biased decision-making. Here we talk about investors in emerging markets like those in Kazakhstan. Many researchers, e.g. Menkhoff & Nikiforow (2009), argue that training in behavioural finance makes investors aware of the biases other investors have, but at the same time this has minimal effect on their own behaviour and decision-making.

In the banks, however, the revenues are formed by the financial results of the investment process, as well as from those of the crediting process. Therefore, we have to consider the same issues through the lens of crediting. As stated above, the crediting process is controlled in a different way, and the procedures there are quite strict. In the EU it includes the directive, EBA's regulation and policy, technical standards, guidelines and recommendations, national laws and regulations, corporate governance and policy, credit policy and standards. As we discussed it above, all these policies and regulations would be of no significant value, if the „the tone from the top" and the "credit appetite" at the credit department level will not be in full compliance with the policies and regulations. If the "credit appetite" is not controlled by the top management, the regulations on their own would not guarantee acceptable risk levels, as we have seen in 2014 when The Corporate Commercial Bank in Bulgaria declared insolvency and was closed down. Officially all the risk control elements were there, but the implementation turned to be fatal. Such a possible development should not be taken as hypothetical only in an under-developed market, with a limited number of profitable companies with sustainable development. Under such conditions, e.g. in Kazakhstan, the credit inspectors, pressed by the goal to find new clients to increase the revenue, look for broader range of factors and often borrow investors considerations, accepting higher risk levels, when analysing the prospect companies. In Kazakhstan the human resource in the banks rarely change positions from one sector to another, and obviously this rarely leads to transfer of organisational culture - experience and good practices, from one department to another, e.g. from investors to crediting inspectors, and the other way around. The regular training process includes different models, practices etc. for the investment and crediting officers. This of course supports the

development of the specific organisational subculture of the bank officers. Above we discussed biases of the investment bankers, and here we could presume the crediting inspectors might develop their own biases. Hopefully in very rare cases, pressed by the market conditions the crediting inspectors and credit committee might think about "borrowing standards and practices" from the investment bankers. Altogether, these considerations raise the question - is the decision-making process in the crediting area (department, committee), free of biases, those, as discussed above about the investors, or other? This question does not have a clear answer, as the conditions differ from one country to another, and from one bank to another. The main issue here seems to be the degree of development of the economy and the availability of enough many sustainable business agents in the real economy. If the economic conditions are not very favourable for the banks, the crediting process might incorporate elements from the investment process, of course still following the rules and regulations, guidelines, bank policies about risk appetite, etc., as stated for the crediting process. We hypothesize that the credit inspectors also develop biases, different from those of their investment colleagues, or similar to some extent, as the type of work these two groups of finance specialist perform, is not identical, but still many of them have similar basic education and experiences. We will not discuss the specifics of the biases, as this is beyond the scope of our research. We only accept that as result of the not always clear influence of those many factors, which influence the financial markets and the economy, the financial specialists in the investment area develop biases, which influence their behaviour. We think that this should be similar in the sector of crediting, where the economic, and therefore – financial development is also unpredictable, at least for many industries and economic agents. We actually apply the Behavioural Market Hypothesis, which adds the human being to the idealised financial behaviour (Ivanova, 2010; Pompian, 2009; Waweru et al., 2008; Lo, 2005).

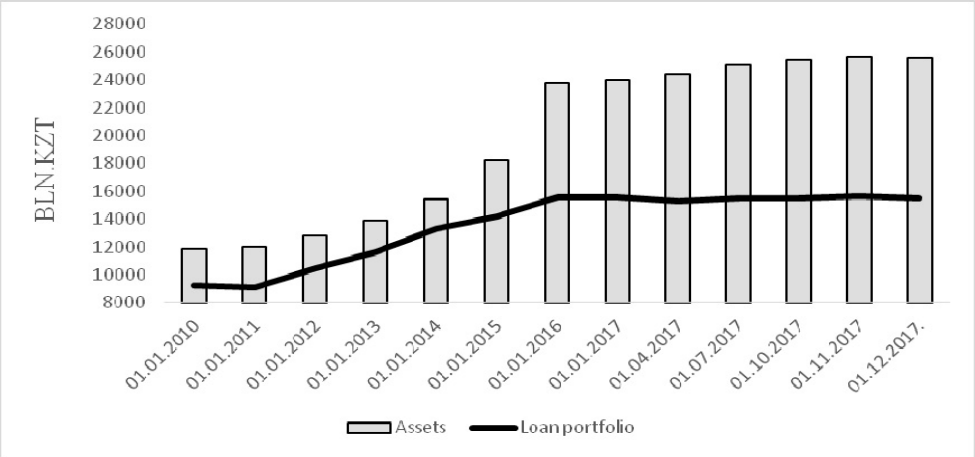
Analysis of the Kazakhstani Banking Sector 2016-2017

The findings of previous research discussed above, however, cannot suggest a strategy, or combination of strategies, for growth to help the commercial banks in Kazakhstan to adapt to the market conditions for a sustainable development. For that purpose, we need to analyse the development of the banking sector in Kazakhstan in the period between 2016 and 2017, assessing if the strategy for growth, which was applied by the National bank of Kazakhstan and by the commercial banks was right or not. As stated above, the criteria we use are the changes of the banks' assets and the results from the crediting process. If the results are positive – it will be clear that the external strategy for growth works well. Provided that the results are not entirely positive, we will discuss the possibility for applying internal strategies for growth.

The data of the National Bank of Kazakhstan (Figure 1) shows that after the correction of the rate of exchange of the local currency Tenge, as a result of the significant reduction in the oil and gas prices on the international markets in 2015, the banking sector was hit hard, too.

Figure 1

Dynamics of assets and loan portfolio of the banking sector of Kazakhstan in 2010-2017



Source: National bank of Kazakhstan (2018).

The reduction of the bank assets is obviously very frightening, but for the aims of this research we pay attention mostly to the crediting process, both to the credit amount and its dynamics. The reduction in the credit portfolio by 5 percentage points in 2017 and in the same period of 2016 shows quite a substantial drop in the banks' source of income. On the other hand, it shows a significant reduction of the clientele, that can be credited. The analysis of the results of the banking institutions (Table 1) adds points for thought.

Sixteen banks had negative change of the credit levels in 2016, including drops of 10%, 20% and even 62.8% for Kazkom bank. It is clear that with such a decline of the credits many banks will not be able to guarantee sustainable development, as the credits are the major source of revenues for the banks.

Special attention must also be paid to the structure of credit assets (Figure 2).

Even in the years of the high prices of the crude oil on the international markets the structure of the credits did not show substantial support for the real business. This trend seems to continue in 2017 as well, and the prospects are quite bleak, as the percentage of debtors who delayed their instalments over 90 days has increased to over 40% (KreditorPro, n.d.). It is very difficult for any banking institution to claim sustainability in such conditions.

Table 1

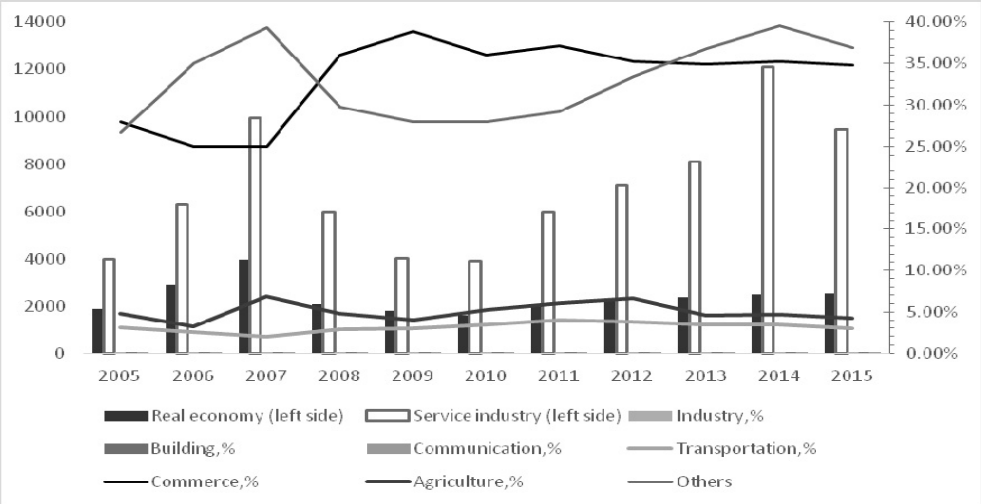
Credit portfolios of the commercial banks of Kazakhstan in 2016-2017 (KZT Billion)

Bank	Growth, %				Total credit portfolio			% of total		
	08 2017	09 2016	08 2017	09 2016	09 2017	08 2017	09 2016	09 2017	08 2017	09 2016
Banks,total	154,6	-1587,3	101,1	89,80	13902,9	13748,3	15490,2	100	100	100
Halyk Bank	102,2	227,1	104,3	110,00	2507,9	2405,6	2280,8	18	17,5	14,7
Sberbank	46,8	185,8	104,3	119,3	1147,4	1100,6	961,6	8,3	8	6,2
Bank CenterCredit	20,7	-11	102,4	98,8	891,4	870,6	902,4	6,4	6,3	5,8
ATFBank	18,4	152,8	102,3	123,1	815,1	797,7	662,2	5,9	5,8	4,3
Tsesnabank	16,6	138,3	101	108,80	1708,8	1692,2	1570,5	12,3	12,3	10,1
House Construction Savings Bank of Kazakhstan	13,8	114	103,4	137,90	415,1	401,2	301,1	3	2,9	1,9
ForteBank	8,2	83,1	101,4	116,7	580,4	572,2	497,3	4,2	4,2	3,2
Home Credit Bank	7,6	58,2	104,9	155,7	162,7	155,1	104,5	1,20	1,1	0,7
Astana Banki	6,7	25,6	103,4	114,5	202,5	195,7	176,8	1,50	1,4	1,1
Citibank	6,1	12,7	107	115,8	92,6	86,5	79,9	0,70	0,6	0,5
Eurasian Bank	6	-48,6	101	92,9	636,3	630,3	684,9	4,60	4,6	4,4
Tengri Bank	3,3	35,3	104	166,9	88	84,7	52,7	0,60	0,6	0,3
Qazaq Banki	2,5	24,7	107	107,6	347,6	345,2	322,9	2,50	2,5	2,1
Bank of China Kazakhstan	1,4	-0,5	112,9	96,1	12,3	10,9	12,8	0,1	0,1	0,1
KZI Bank	1,4	1,9	103,3	104,5	43,2	41,8	41,3	0,3	0,3	0,3
Delta Bank	1,3	-140,3	100,4	69,2	315,7	314,4	456	2,3	2,3	2,9
Capital Bank	1	-8,2	101,5	88,80	65	64	73,2	0,5	0,5	0,5
Kassa nova Bank	0,7	9,3	101,0	115,3	70	69,3	60,7	0,5	0,5	0,4
ETB Bank	0,4	-7	100,5	91,7	77,3	76,9	84,3	0,6	0,6	0,5
Al hilal Bank	0,3	0,4	105,9	107	5,7	5,4	5,3	0,00	0,0	0,0
Shinhan Bank	0,1	-0,1	101,2	99	11,9	11,7	12	0,1	0,1	0,1
Expocredit	0	0	99	85,9	0,1	0,1	0,1	0,0	0,0	0,0
NB of Pakistan	-0,1	-0,2	98	94,5	4,2	4,3	4,5	0,0	0,0	0,0
Alfa Bank	-0,1	27,5	99,9	117,7	182,9	183	155,4	1,3	1,3	1
Zaman Bank	-0,2	-0,6	98,3	95,2	11,9	12,2	12,6	0,1	0,1	0,0
Eximbank	-0,5	-2,3	99,1	95,6	49,5	50	51,8	0,4	0,40	0,0
NurBank	-2,4	17,5	98,9	109,2	207,8	210,2	190,3	1,5	1,50	1,2
TIB of China	-2,4	-6,8	92,4	81,2	29,3	31,7	36,1	0,2	0,20	0,2
AsiaCredit Bank	-2,5	-33,3	97,2	72,9	89,4	92	122,7	0,6	0,70	0,8
Altin Bank	-3,4	-10,1	96,7	90,7	98,9	102,3	109	0,7	0,70	0,7
Bank RBK	-5,3	-25,1	99,3	96,6	717,8	723	742,9	5,20	5,30	4,8
Kaspi Bank	-7,2	162,3	99,2	122,1	897	904,2	734,6	6,50	6,60	4,7
Qazcom Bank	-89,6	-2394,8	94,2	37,2	1417,4	1504,3	3812,2	10,2	10,9	24,6

Source: National bank of Kazakhstan (2018).

Figure 2

Structure of credit assets by industries 2005-2015 (KZT Billion)



Source: RFCA Ratings (2016).

Strategies for Growth

There are three possible strategies for growth: external, internal (organic), and hybrid (a combination of external and internal).

External growth strategy

In the banking sector the external growth strategies are based mostly on mergers and acquisitions (Johnson, Scholes and Wittington, 2008). These strategies have been applied for consolidating some of the banks to achieve a solid own capital. In 2014 Qazkom merged with BTA Bank, and as a result received obligations worth 750 million Euro. This merger practically lead Qazkom into insolvency, and in 2017 Halyk Bank acquired it – again with the idea to save the banking sector, in which Qazkom and Halyk Bank were the leading players (KreditorPro, n.d.).

In December 2016 The National bank lent to Qazkom USD 1.2 billion, followed by lending another USD 616 million in February 2017. Although these two examples cannot be used for drawing general conclusions, the acquisition of Qazkom Bank by Halyk Bank a few months later in 2017 should be considered proof that this strategy probably does not work well enough under the conditions of Kazakhstan.

We believe that the inflow of capital, provided twice by the National Bank, did not lead to substantial changes concerning the financial results of Qazkom, as the crediting process, both regarding decision-making and implementation, in combination with the weak real sector, could not provide a solid base for a sustainable development of the bank. An underdeveloped real sector always means higher credit risk (Brodeur et al., 2010), which no bank will take voluntarily. It must also be mentioned that the average interest rate in Kazakhstan in that period of time was between 20% and 30%, and there are few economic sectors that have margins which make such credits attractive. As bank interest rates in 2017-2018 still remain high - between 8% and 22% (KreditorPro, n.d.), it seems rather unlikely that external growth strategy will be successful in the foreseeable future.

Internal growth strategy

Internal growth strategy is based mostly on innovation and internal training (Ahuja, Segel & Perrey, 2017; Blagoev, 2018; Johnson, Scholes & Wittington, 2008). We consider this strategy quite appropriate for Kazakh banks, especially when taking into account cultural factors, which are likely to have an impact on crediting policies and their implementation. For example, the unsuccessful merger when two banks, Qazkom and BTA Bank, merged, and later when the National Bank of Kazakhstan and ALMEX Holding group became shareholders in it, Qazkom became part of the biggest financial group in Kazakhstan – Halyk Bank. The new shareholders increased the capital of Qazkom to 250.2 billion Tenge, which is a solid base for crediting, and therefore, sustainable development. At first glance it would have been a rational strategy to restructure the business units, in combination with intensive training of the personnel. This is more or less a traditional approach, or strategy, which has been used after almost every merger and acquisition, as obviously it is not possible to double one and the same manager's position, responsibilities and obligations, who performed identical or similar roles in the previous two business structures.

While restructuring is an organisational issue, training includes elements of corporate vision and strategy. In our view it should include innovation and corporate culture as well.

Innovation

Banks are conservative structures and innovation there is limited due to specific regulations. However, technological progress, i.e. Artificial Intelligence (AI) and robotization – only to mention the two most influential avenues of development in the last 5 years (National Science and Technology Council, October 2016; Deloitte Development, 2017), as well as the development of financial instruments, seem to point to the need to consider innovation process a first-class responsibility of bank managers.

With a view to the focus of this paper, we concentrate only on those innovative elements which are related to new possible ways of developing business under the specific conditions of Kazakhstan.

According to Evgeniy Dobinin of Scot Holland | CBRE, as a result of digitalization, "one of the Russian banks in Kazakhstan closed in 2017 more than 40 offices and reduced its

personnel by over one thousand employees" (Forbes Kazakhstan, 2017). The reason for this is that the new software for customer service, which we would rather define as robotization, allows banks to reduce to a minimum the number of rented premises, earlier used for bank offices, and organise all their activities from the main offices only. As MIT's report argues (Lipton, Shrier & Penjtland, 2017) there are "second wave digital hybrid" banks such as Fidor Bank (Germany), Atom Bank (UK), LHV Pank (Estonia), and DBS Digibank (Singapore), and we would add here Sberbank (Russia), which "enjoy purpose-built IT infrastructure that is 60-80% less expensive to build, and 30-50% less expensive to maintain, than legacy banks." This is probably the most promising and fast-developing field of innovation in bank services. However, these "digital hybrids", as MIT calls them, "still use centralized databases, cloud-based storage and primitive user data protocols". Hybrids or not, Piraeus Bank already opened a fully robotised bank office in Greece, in which there are no bank employees (Future Banking, 2017).

Among the best examples in Russia and Kazakhstan is Sberbank, which has active operations in Kazakhstan, and is a leader in AI-based banking services. According to Palatkin (Палаткин, 2016) in 2016 the system of Sberbank was analysing everyday information from 6300 bank offices and 15000 office managers, making over 300000 recommendations to the managers. They do not stop at using different mobile devices, including laptops and smartphones. This is more or less traditional innovation, which is offered by many banks nowadays. Sberbank, for example, in addition to the usual banking services, offers added value to its customers, e.g. bank cards for children, by means of which the children's purchases, such as buying food for breakfast or drinks, are reported to the parents by SMS via bank network. Obviously, this service offers very high added value to the parents, who are clients of the bank. Sberbank is also experimenting with face-recognising technology, which may fulfil the same purpose as in the example mentioned above, but with no need of bank cards. The survey of Frank Research Group (Chuvilo, 2017) shows that the banks plan to increase by 80% the investments in additional equipment for self-service in the bank offices, as well as by 87% for new technologies, which probably includes further digitalization and robotization of the bank operations, including the front-desk service to clients. Aznavur (Азнавур, 2018) argues that in the next several years the banks will use the so-called narrow AI (robots, chatbots) which can serve the clients in a friendly manner, without being involved in intuitive decisions.

Other banks in Kazakhstan are also intensively developing their digital services. According to Michail Kablashev, Director of the IT division of the National bank of Kazakhstan (Forbes Kazakhstan, 2017), these banks use OpenWay, Colvir, BSS software as well as their own software, to digitalize whatever the bank finds necessary. Kablashev underlines that in this process of digitalization the bank specialists dealing with this have to consider future developments rather than concentrate primarily on short-term tasks.

All these examples offer substantial added value to bank clients and, as a result, increase the clientele, both in terms of numbers, and in terms of active banking used by these clients. Obviously, these trends of digitalizing bank services will expand to servicing the so-called "digital natives", who can be expected to put new demands on financial/bank services.

Secondly, there is a large field for innovation related to B2B (bank-to-business) services. As Figure 2 reveals, we see in Kazakhstan a rather underdeveloped real sector, and it is

really not easy to find economic agents that have the characteristics of companies which could be credited with minimal or at least a reasonable risk.

This immediately raises the question of nurturing such economic agents, providing them with marketing, finance management, operations management and other consulting. They will probably have to be part of the innovative approach of banks to nurture new reliable clients. This is not a totally new revolutionary approach, as there are numerous examples of bank officers who provide mostly informal consultancy when they assess business plans, presented to them for crediting. Of course, it is clear, that bank officers cannot force their clients to accept and pursue this or that strategy, as this would violate the fundamental rule of splitting responsibility between the two businesses – real and banking. Still, a more active guiding practice through examples and consulting could be quite instrumental.

And there is one more avenue of thought. The banks should probably consider the possibility to share the responsibility with their clients, who cannot fulfil their obligations stemming from the credit agreements, by involving in their management process. In most countries, including Kazakhstan, the regulations of the bank sector do not allow the banks to be shareholders in the companies. However, this could be done by agreement with the shareholders/owners to nominate procurator/s, or executive adviser/s, who would represent the bank's interests at the executive level of management of the company that has cash flow difficulties. After stabilizing them the banks can either transfer the management to the owners or sell their shares to other shareholders, if this is stipulated in the agreement for joint management. This, however, is not a panacea. It depends very much on the corporate governance. For example, in the case of Bulgarian Corporate Commercial Bank in 2010-2014, technically everything (sending bank officers to join the management of the indebted companies and controlling their financial flows) was done *comme il faut*. However, the results were negative, partly because one and the same people have been sitting in the crediting bodies and company management, or at least were able to influence the decision-making. So, this internal strategy, as interesting and promising as it looks, has to be applied with care and making sure that the corporate governance is done as prescribed.

Training

As a substantial element of the behavioural finance, the training would require changes in the organisational culture. It is clear that the current cultural web (Johnson, Scholes & Wittington, 2008) in the banks does not correspond to the market requirements. According to Hofstede (Bechter & Grigoryants, 2011; Hofstede Insights, n.d.) Kazakhstan has a very high Power Distance index (70) and Collectivism index (71), and low Uncertainty Avoidance index (31). Their combination does not automatically lead to an unequivocal suggestion which management models should be applied to achieve the desired results. Ergo, systematic training to prepare the bank officers to accept and implement those adequate measures to bring about internal growth seems to be inevitable. From theory point of view, we would define this as behavioural finance model, which of course must be adapted to the specific conditions in the Kazakhstani banking sector.

It seems logical to include in the training program elements of cross-cultural analysis based on Hofstede's cultural dimensions, concentrating on Individualism index, Power Distance index and Uncertainty Avoidance index (Blagoev, 2010; Hofstede, Hofstede & Minkov, 2010; Minkov, Blagoev & Hofstede, 2013; Minkov & Blagoev, 2014). Of course, these have to be discussed addressing specifically the main ethnic groups of the population, which form the majority of the employees in the banking sector. Special attention should also be paid to the management and leadership models which the bank management considers most suitable for the particular bank.

The most important element of the training programs, to be developed and applied, seems to be a discussion related to specific biases that have been seen to affect the decision-making process, as well as the critical analysis of the encountered or possible consequences. Specific cases of decision-making, both leading to positive or negative results, that are known to the management, should be put on critical analysis with the aim to find out if the decision was influenced by some biases, and if yes – was the decision making process effective enough from the point of view of the bank's mission, vision and goals with respect to the crediting process.

Hybrid growth strategy

By Hybrid strategy we understand the combination of external and internal growth strategies, complementing each other in stabilizing the banks and providing the necessary conditions for sustainable development in the specific conditions of Kazakhstan. The mergers and acquisitions, which seem to be the mainstream policy of the government (Forbes Kazakhstan, 2017), will continue to be the necessary step to provide own capital and liquidity. According to Andrey Sustavov of SAS Kazakhstan only banks with own capital of over 45 Billion Tenge will be able to participate in this program, in which already participate Halyk Bank with Qazkom (already discussed above), Tengri Bank with Capital Bank, and Bank RBK with Qazaq Banki.

However, we believe that such capitalization of the banking sector will not lead to substantial results, if the banks will not develop, and where necessary improve their organic growth options, based on relevant innovation in the crediting process and intensive training of the personnel. As argued above, the banks have to consider the possibilities for supporting their potential clientele to develop to the level of companies with minimal, or at least acceptable credit risk.

This will hardly be achieved without intensive training of the personnel to minimize the effect of biases, if any, that may influence the decision-making in the crediting process.

Overall, under the conditions of Kazakhstan we consider the Hybrid strategy to be the most sustainable and therefore the most promising one.

Conclusions

The analysis of the development of the banking sector in Kazakhstan in the period 2005-2015, raises the issue of the limitations that the banks face in spite of the intensive support by the government, mainly through capitalization, and also by stimulating the consolidation of banks with over 45 billion Tenge of own capital.

The examples of the not very successful application of external growth strategy (mergers and acquisitions), e.g. Qazkom merger in 2016, followed by acquisition in 2017, can be explained partly by the underdeveloped real sector of the economy. Based on that we strongly support the view that the banks have to intensify their consulting activities, as more active guiding through examples and consulting could be quite instrumental.

We believe that in some cases the banks should go to an agreement with the shareholders/owners to nominate procurator/s, or executive adviser/s, who would represent the bank's interests at the executive level of management of the company that has cash flow difficulties. This of course has to be done in accordance with the corporate governance rules and regulations. After stabilizing their financial situation the banks can either transfer the management to the owners or sell them, acting as representatives of the shareholders/owners.

The analysis of the development of major Kazakh banks in the period 2016-2017 (Figure 1), and especially of their credit portfolios (Figure 2 and Table 1) raise the question how to change the crediting process, especially the decision-making process, to achieve better results with respect to the not very well developed real economy, at the same time minimizing the risks. Special attention has to be paid to the "credit appetite" and "tone from the top", as sometimes they might promote risky decision-making. Our analysis shows, that the banks have to start applying internal growth strategy. This would include innovation, and intensive training.

We hypothesize that if there are biases, which affect the decision-making process in the area of financial investments and affect the investors there, there are biases in the area of crediting as well. Our idea is that through applying behavioral finance with intensive innovation and training, the banks will be able to minimize the effects of biases in the decision-making process. This seems to be working very well in the case of Sberbank (Table 1), which shows substantial growth of its credit portfolio without mergers and acquisitions having been involved. However, there is not enough empirical data to confirm or reject this hypothesis. We can only state that the logical analysis seems to confirm it.

The findings of Chen, Kim, Nofsfinger & Riu (2007), as well as our analysis of the development of the banking sector in the period 2015-2017, lead us to the conclusion, that it is absolutely necessary to implement behavioural finance model in the bank management.

We agree with Pronin, Linn & Ross (2002), Menkhoff & Nikiforow (2009), and other authors, who argue that training in behavioral finance makes the investors aware of the biases the other investors have, but in the same time this has minimal effect on their own behavior and decision making. Obviously, such training requires a very good understanding and active role of the bank managers to organise it, as it would make the decision making

based on biases as rare as possible. The combination of specific market conditions in Kazakhstan, including weak real sector, high-interest rates, and specific combination of Hofstede's cultural indices, suggest organic growth strategy with additional services, offered to the companies, for nurturing own clientele. Such hybrid strategy could be a solid base for sustainable development as result of higher and more diversified crediting.

Finally, we conclude that the hybrid strategy, which combines the strong sides of the external, and internal (organic) growth strategies, will be the best option for the banking sector in Kazakhstan, as well as in any other country, which is facing similar market conditions. The hybrid strategy seems to maximise the possibilities for developing and maintaining a sustainable growth strategy, at minimal credit risk.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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TESTING FOR THE CAUSALITY BETWEEN INTEREST RATE AND STOCK MARKET PERFORMANCE IN NIGERIA

In this paper, the causal relationship between interest rate and stock market performance is investigated using a VECM-based Granger causality test on annual time series data from 1975 to 2016. The rationale for this study emanates from the unpredictable behaviour of the Nigerian stock exchange from the outset of the global financial economic crisis from 2007/8 till date couple to the increasingly high key policy rates like interest rate by the CBN that has refused to drop. The results reveal that the interest rate exerted a negative but statistically insignificant relation to stock market performance in the long run. In addition, Granger causality test result noted that there is no causality between interest rate and stock market performance. Thereby, advocating that other macroeconomic factors predict stock market activities better than the interest rate as suggested by the bi-directional causality between exchange rate and All Share index in the result. The implication is that a proper portfolio diversification should be ensued; via a fair exchange rate policy can stimulate the activities of the stock market and vice-versa. Consequently, the paper recommends that the government should do justice to her monetary policy by way of trimming down its interest rate in such a way that will encourage both local and foreign investors to borrow funds at a cheaper rate to invest in the stock market which in turn boost economic well being of the country.
JEL: C51; E52; E44; G10

1. Introduction

The stock market generally serves as a stimulus and propeller to any country's economy, be it developed or emerging as pinpointed by Charles and Adjasi (2008) and Quayes (2010). Little wonder the reason why authors like Olowe (2011) and Bassey (2013) are of the view that the Nigerian stock market has witnessed massive development since its inception. Though, it is still considered as an emerging market when compared to developed economies. This viewpoint was reaffirmed when Alile (1997) opined that the stock

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exchange market worldwide is a platform in which preservation for the efficient market with the attendant benefit of economic growth is inevitably ensured. This is because; it establishes the confidence of both domestic and foreign investor in the market. Particularly, the objective of any potential investor is to invest in an efficient market due to the inherent benefits that can be obtained at the end of the day. In contrast, the inefficient market is a market that gives room for few economic agents to make excessive earnings hence causing loss of confidence of the public about the market.

Even though, the measurement of the stock market is very significant to investors, policymakers and major stakeholders, its nexus with key monetary policy variables has been contentious and has invariably not been able to influence long-term real capital in an economy as accounted in the literature. Therefore, to ensure the growth of any stock market, a healthy interest rate should be guaranteed by the monetary authorities. There is no doubt that interest rate is one of the key macroeconomic fundamentals and hence, exerts a positive relation with/to economic growth of any country. As a matter of fact, the interest rate is considered as the cost of borrowing money which otherwise can be termed as borrowing rate according to UNCTAD (2012). On the other hand, the interest rate can also be seen as the fee paid for lending money from a lender and it is otherwise known as the lending rate OECD (2015).

Theoretically speaking, it is believed that there exists an inverse relationship between interest rates and stock returns. This is because when interest rate fall, fixed income investments become less competitive because of their lower yields, and therefore, stocks become more attractive as a result. On the contrary, when interest rate rise, fixed income investments become more competitive because of their higher returns, and therefore, stocks become less attractive as a result.

Over and above, interest rates assist in the decision of where and how to invest. If the interest rate paid by banks of depositors is increased, investors will patronize the banks more and fewer investors will invest in the stock market which will lead to a decrease in capital investment in the economy. Also, the disparity in interest rate might cause investors to either go to the bank or buy government development stock like bond. Modigliani (1971) and Mishkin (1977) identify that lower interest rates increase stock prices and later lead to increased business investment. Generally, it is believed that a reduction in interest rate results to lower cost of borrowing hence, boosting capital flows into the stock market with the expectation of the higher rate of return. Expectedly, on the other hand, higher interest rate encourages people to save more in the banks which in return reduce the flow of capital into the stock market. Bosworth (1975) agrees with the above although he adds that higher stock prices reduce the yield on stock and reduce the cost of financing investment spending through equity issuance.

Sequel to the above scenario, these issues would be inferred. The issue takes its root from the spuriousness of the financial systems of most developing countries which came under pressure because of the economic upset of the 1980s and more recently, the global financial meltdown which has made a lot of investors (foreign and national) to lose confidence in the capital market. Particularly, the interest rate policy in Nigeria lacked stability during the Structural Adjustment Program (SAP) as periods of liberalization were entangled with

impositions of some credit controls (IMF, 1997). The administration of low interest rate proposed to encourage investment permitted a dynamic interest rate regime where rates were more influenced by market forces, which failed to yield the desired result of stimulating the needed investment growth. Although, several factors has been identified to be responsible for the stock market problems which include: political instability, war, terrorist threats, boycotts and strikes, economic trends and international trade to mention few. Apart from the above, there is the argument as to what causes what between the variables of interest. That is, the contention whether interest rate granger causes stock market performance/return or not. This study is very important because, previous studies have focused on the lump sum of macroeconomic variables irrespective of the fact that interest rate stands to be one of the most relevant macroeconomic fundamentals that can stimulates economic growth.

To this end, the current study seeks to examine the causality between interest rate and stock market performance in Nigeria. To achieve the goal of the study, answers would be provided to some pivot and important questions that surround it. These questions among others include: What is the relationship between interest rate and stock market performance in Nigeria? Does causality exist between interest rate and stock market performance? Notably the answer to the above-raised questions would be the focal point of this study. This study is very important at this point in time in which Nigeria has narrowly escaped from recession although still enshrouded with slow aggregate demand, high inflation rate, high interest which has affected the growth rate of the country and has equally lead to policy collapse in the country.

Notably, the remaining part of the study would be structured as follows; section B showcases the theoretical framework and empirical evidence of the study while section C depicts the methodology and data sources. This would be followed by section D which analyses the data and interprets the results. Finally, section E, concludes and recommends policy implications of the study.

2. Literature review

Over the years, many researchers, policymakers and economists has relentlessly focused on the relation between selected or aggregate macroeconomic fundamentals on stock market returns; which include: exchange rate, money supply, interest rate, industrial productivity, treasury bills etc. to mention few as suggested by Aydemir and Demirhan (2009); Bhattacharya and Mukharjee (2002) among emerging economies. Thereby, paying less attention, to the disaggregated macroeconomic factors on stock market returns particularly in developing countries which Nigeria is inclusive. Frankly speaking, of all the macroeconomic variables, interest rate and exchange rate have been identified to be topmost among the other factors. This is because the variables under study have a key implication for economic growth of any country. Yet, it has received little attention, as only a few studies had focused on the causality between interest rate, exchange rate and stock market returns in Africa especially in Nigeria. Consequently, the reason why this study

intends to cover the gap existing in the literature by particularly investigating Granger causality between interest rate and stock returns in Nigeria.

Theoretically, many scholars and researchers assume that stock prices and interest rate are negatively correlated. Though, interest rate tends to be positively related to stock market returns both in the short and long run according to Fama (1981). Not surprisingly, the reason for the aforementioned is that, increase in interest rate possibly as a result of tight monetary policy usually has a negative effect on stock returns. This is not far-fetched from the fact that higher interest has a way of shaving the value of equity as pinpointed by the dividend discount model which in turn makes fixed-income securities more attractive as an alternative stock. Consequently, this may trim down the ability of investors to borrow for the purpose of investing in stocks. On the order hand, expansionary monetary policy which is evidence of low-interest rate has the capacity to boost stock market performances. As a matter of fact, interest rate is often attributed as a major source of uncertainty for companies.

For instance on the developed stock market, Graham and Harvey (2001) see interest rate of companies as the second most risk factor that is behind market risk in the U.S. To corroborate this, the study of Lynge and Zumwalt (1980), established that interest rate sensitivity to stock market returns can be in different form depending on whether, it is a short or medium or long-term horizons. Meaning that, the relevant extra market and extra interest rate are possibly not explained. In the same vein, Flannery and James (1984) examined, the underlying factors for the reaction of stock returns to interest rates in order to understand the distinctiveness of banks which confirms the negative relationship between stock returns and interest rates both in the short and long-term. They asserted that the mix of assets and liabilities with respect to maturity was a key factor in explaining sensitivity of stock returns to unexpected interest rate changes. Furthermore, Hassan et al. (2000) examined how interest rate proxy by Treasury bill rates is related to annual return of the Sri Lankan stock market during the 1990 – 1997 periods. The results of their study revealed that short-term interest rate of Sri Lankan stock market exert a positive correlation with future returns; thereby suggesting that it is plausible to re-tract returns on a monthly, quarterly or annual return basis. Similarly, the study of Bulmash and Trivoli (1991) noted that US current stock price is positively correlated with the previous month's stock price. More so that, there is a negative relationship between stock price and the Treasury bill rate. This was corroborated by the study of Abdullah and Hayworth (1993) which observed that the US stock returns are related negatively to short and long-term interest rates.

Nonetheless, Beire et al. (2009) examined the impact of interest rate on stock return in U.S. Their results found that interest rates had a negative impact on stock market. The above was confirmed by Khan and Yousuf (2013) which found a positive long-term relationship between interest rates and stock market. Although, in contrast with the study of Amara et al., (2013) which showcased a negative long-term association between interest rates and stock market. In a similar vein, Adel (2004) confirms the existence of a long run relationship between stock prices and variables like exchange rate and interest rates.

On the contrary, the results emanating from the study of Geske and Roll (1983) and Balmash and Trivoli (1991) suggest that stock returns have a significant positive

relationship with contemporaneous and previous lagged one year Treasury bill yield and both contemporaneous and lagged yield spread. They also documented that changes in the interest rate structure set off delayed reactions from investors and, seem to indicate inefficiency in the process of dissemination of market information although, the empirical results was not consistent with the previous studies. In a more general form, the study of Campbell (1985) revealed that the structure of interest rates envisage stock returns.

On emerging markets, Mahumudal and Gazi (2009) considered the relationship between interest rate and stock price in both developing and developed countries using monthly data from January 1988 to 2003. These countries include: interest rate, money supply, gross domestic product etc. Their results showed that, for all countries under consideration, it was discovered that there exist a negative significant association between interest rate and stock price. In addition, it was discovered that, six out of these countries found that changes in interest rate has a significant negative correlation with variation in the stock price. Therefore, connoting that, if interest rate is properly regulated for these countries, there is the tendency that it will benefit their stock exchange market immensely in two dimensions. First, by demand pull avenue of more investors in the share market and secondly, by supply push way of more extensional investment of companies.

In African markets, Strike (2015) inspected the connection between stock market performance, interest rate and exchange rate in Zimbabwe using monthly time series data for the periods of December 1986 to October 2015. The results showed that the impact of interest rate on stock market performance was mixed. In addition, it was discovered that stock market converged to long-run equilibrium with bank rates. Furthermore, the study identified a uni-directional causality which moves from stock market to exchange rate, Treasury bill rates and deposit rates. Meaning that, Bank rates granger causes stock market performances.

On the contrary, Michael et al., (2016) explored on the interest rate, liquidity and stock market performance in Ghana using a monthly data from the Ghana stock exchange and Bank of Ghana for the period of December 2010 to November 2013. Their results showed gripping evidence that the performance of the Ghana stock exchange market is highly influenced by liquidity, exchange rates and inflation. Disappointingly, the effect of interest rates was found to be insignificant despite its positive relationship with the stock market index for the period under consideration. Joel (2014) investigated the relation between interest rate and stock market return in Namibia for the period 1996 to 2012. Results revealed that, there is a negative relationship between stock market returns and interest rate in Namibia. The results suggested that contractionary monetary policy through higher interest rate decreases stock market returns in Namibia. In the same vein, Ehrmann and Fratzseter (2004), investigated the effect of monetary policy on stock returns and discovered that stock market return reacts negatively to interest rates. Meaning that, stock market returns react negatively to increase in interest rate. Still in Africa, Nsama and Mwaaga (2017) looked at the relationship between interest rate and stock market index in Zambia using annual data for the period 2004 to 2016. The results indicated the existence of both short and long run between interest rate and stock market index. The policy implication of this study is that if interest rate if interest rate is considerably controlled by reducing it, it will be of great benefit to the borrowers as they will access cheaper capital.

Another study by Khan et al., (2012) also investigated the relationship between interest rate and stock market performance using monthly time series data for the period January 2000 to December 2010. The results revealed a weak relationship between interest rate and stock market performance using monthly time series data for the period 2000 to 2010. Evidently, the results revealed a weak relationship between stock market performance and interest rates. Furthermore, Goodness et al. (2015) explored on how stock prices impacts consumption and interest rate in South Africa. The results showed that, the real impact of stock price shocks on consumption is in general positive, with long run and significant effects observed at the one quarter a-head horizon. Surprisingly, the study of Strokon (2013) examined the causal relationship between stock price and interest rates in Zambia using a weekly time series for the period January 2004 to December 2013. The results show that there is no significant causal association between interest rate and share price.

In Nigeria, many studies have investigated the nexus between some selected macroeconomic variables and stock market returns. These studies among others include Mbah et al (2017), Nkechukwu et al. (2013), Chude et al. (2015), Adaramola and Olugbenga (2010), (2014), Akujuobi (2014), Okoro (2015), and Osamwonyi, et al. (2012) to mention a few, though, their outcomes were with mixed feelings.

Surprisingly, only a few studies like that of Okpara (2010) and ologunde et al., (2006) have actually investigated the relationship between interest rate and stock market returns in the country. For instance, the study of Okpara (2010) examined monetary policy and stock market returns using time series data spanning from 1980 to 2008. Findings show that monetary policy exerted a significant long-run determinant on stock market returns in Nigeria. Furthermore, he discovered that high Treasury bill rate reduces stock market returns and thus show an evidence of monetary policy efforts to slow down the economy. In the same vein, Ologunde et al., (2006) investigated on the interrelationship between stock market capitalization and interest rate in Nigeria utilizing annual data from 1980 to 2004. They found that, the prevailing interest rate exerts positive influence on stock market capitalization rate. Similarly, they found that, government development stock rate exerts negative influence in the stock market's capitalization rate and prevailing interest rate in Nigeria. More recently, (Akpan & Chukwudum, 2014) studied the impact of interest rate on stock prices in Nigeria employing an annual data spanning from 1986 to 2011. The results revealed that All share index reacts differently to hikes and cuts of the controlled variables. Sequel to the aforementioned, the study also finds that the impact of interest rate is not relevant when other variables affecting interest rate are adequately controlled.

In line with the above literature, there is evidence that the relationship between interest rate and stock market performance is inconclusive. Particularly, in Nigeria, the foregoing has shown that little attention has been given to interest rate – stock market performance nexus. Therefore, it is on this note that this current study seeks to re-establish the relationship between interest rate and stock market performance and also verifies the causality between these variables as well in Nigeria. Hence, this study test for the causality between interest rate and stock market returns in Nigeria.

3. Research Methodology

Sources of Data and Model Specification

In order to check for causality between interest rate and stock market performance in Nigeria, we employ data from Central Bank of Nigeria (CBN) Statistical Bulletin and the Nigerian stock exchange market. The data used for this study spans from 1970 – 2016. After putting into consideration the empirical model specified by both (Ehrmann & Fratzscher, 2004) and Strokon et al. (2013) respectively, we specify that stock market performance proxy by All share price index (ASI) is a function of interest rate (INT) which is proxy by monetary policy rate. Therefore, the functional form of our model is specified in equation 1 below.

$$ASI_t = f(INT)_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (1).$$

Equation (1) is written in an econometric form as seen in equation 2.

$$ASI_t = \beta_0 + \beta_1(INT)_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In addition, to produce the most appropriate coefficient for ASI with respect to the independent variables, we transform the model above into a log-linear form as seen in equation 3.

$$InASI_t = \beta_0 + ln\beta_1 (INT)_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where; 'ln' represents natural logarithm. More so, the reason for log-linear transformation is that it will be helpful in the following ways; to reduce the problem of multicollinearity, heteroskedasticity, achieve a better fit which in turn ensures actualizing elasticity rather than slope hence making the variables to appear more symmetric according to Gujarati and Porter (2009).

Since, we have an interest in examining the impact of interest rate on stock market performance and their causal relation as well. We rely on the vector error correction Model (VECM), although, this is dependent on the outcome of the co-integration test. To perform the co-integration analysis we need to first satisfy the prerequisite of the presence of unit root of the variables under consideration. Routinely, it is required that the series must be integrated of the same order. The unit root test can be carried out by employing the Augmented Dickey-Fuller procedure as well as Phillips-Perron (PP) test. Similarly, after testing for the existence of long-run linear relationship between the variables, with the null hypothesis of no co-integration between them as specified in equation (3) thus: H0: $\beta1=0$ against the alternative hypothesis H1: $\beta1 \neq 0$. Furthermore, if the outcome of the above co-integration test shows that variables are co-integrated then we can proceed to the error correction mechanism and on to Granger causality test via the vector error correction model (VECM) and if otherwise, we utilize the traditional Granger causality approach as suggested by Engle and Granger (1987) and Rathinam & Raja, 2008) owing to the fact that it uses the F-test statistics vis-à-vis vector autoregressive approach (VAR) platform. More prominently, to avoid the problem of omission of important variable bias when estimating the causality between two variables, we included the exchange rate into the model since it is known theoretically as one of the variables that stimulate economic activities in an

economy. Therefore, the Granger causality test equation if the previous assertion follows is expressed as below.

$\Delta InASI_t = \alpha_j \Delta In\text{ASI}_{t-j} + \beta_j \Delta In\text{INT}_{t-j} + \varphi_j \Delta InEXR_{t-j} + \chi_1 \varepsilon_1^{t-1} + ʮ_t$ ……………...(4)

$\Delta InINT_t = ȡ_j \Delta InINT_{t-j} + €_j \Delta In\text{ASI}_{t-j} + \Omega_j \Delta InEXR_{t-j} + \chi_2 \varepsilon_2^{t-1} + V_t$ …………………..(5)

$\Delta InEXR_t = \ell_j \Delta InINT_{t-j} + \dot{\rho}_j \Delta In\text{ASI}_{t-j} + \prod_j \Delta InEXR_{t-j} + \chi_2 \varepsilon_2^{t-1} + \mu_t$ …………………..(6)

And if otherwise, the VAR approach will be utilized. The granger causality for this study is expressed as follows.

$ASI_t = \alpha_j \text{ASI}_{t-j} + \beta_j \text{INT}_{t-j} + \varphi_j EXR_{t-j} + \mu_{1t}$………………...(7)

$INT_t = \Omega j\, INT_{t-j} + €_j \text{ASI}_{t-j} + \Omega_j EXR_{t-j} + V_t$ …………………..(8)

$EXRI_t = \ell j\, INT_{t-j} + \dot{\rho}_j \text{ASI}_{t-j} + \prod_j EXR_{t-j} + u_t$ ……………..(9)

Where; 'In' denotes natural logarithm, P is the maximum lag length, ʮt, Vt & µt are the stochastic error terms (normally distributed with zero mean and constant variance) and Ɛ1t-1, Ɛ2t-1 and Ɛ3t-1 are the lagged values of the error term for the co-integration estimation.

4. Empirical Analysis and Discussion

This section would be broadly categorized into two. First, is the preliminary analysis and second, empirical analysis which will be accompanied with the necessary discussion?

4.1 Preliminary Analysis

These are the pre-analysis that is required before undertaking the real analysis. They include descriptive statistics, unit root test and co-integration test.

4.1.1 Descriptive statistics

Table 1

Descriptive Statistics of Variables in the Study Model

	LASI	LMPR	LRER
Mean	7.510380	2.369074	2.759231
Median	8.552284	2.525529	3.085852
Maximum	10.96803	3.258097	5.717028
Minimum	3.493473	1.252763	-0.604404
Std. Dev.	2.625730	0.462505	2.255568
Skewness	-0.285866	-0.687254	-0.366868
Kurtosis	1.480190	2.837187	1.556199
Jarque-Bera	4.614224	3.352619	4.590130
Probability	0.099548	0.187063	0.100755
Sum	315.4359	99.50110	115.8877
Sum Sq. Dev.	282.6727	8.770332	208.5911
Observations	42	42	42

Source: Authors computation from E-views 9.

Descriptive statistics establishes the unique features of the data used. For instance, in Table 1, the average mean value of LASI (7.51038) i.e. All Share price index is the highest among others (i.e. LMPR= 2.36907 and LRER) respectively. Table 1, also confirms that 10.96803 is the maximum and -0.604404 the minimum. It is clear that LASI (2.62573) is highly volatile with the highest standard deviation. Similarly, the values of skewness and kurtosis were likewise computed for 42 observations. Results exhibit that all variables are negatively skewed. Evidence from the Jarque – Bera (JB) test indicates that all variables utilized in the model are normally distributed. More so, that the variables are first differenced and computed by the ratio relative to prior observation.

4.1.2 Unit root test

Table 2

Result of Unit Root Test

Variable	AT LEVEL				AT FIRST DIFFERENCED			
	ADF-t stat	PP-t stat	CV at 5%	Decision	ADF-t stat	PP-t stat	CV at 5%	Decision
LASI	-0.997368	-0.997368	- 2.935001	NS	-4.963707	-.4.754322	-2.936942	*S*
LMPR	-2.128291	-2.128291	- 2.935001	NS	-3.751465	-7.528055	-2.936942	*S*
LRER	-0.626685	-0.626685	- 2.935001	NS	-6.568737	-5.236812	-2.936942	*S*

Source: Authors computation from E-views 9

4.1.3 Co-integration test

Table 3

Result of Johansen co-integration Test

Trace Test				Maximum Eigen Value Test			
Null	Alternative	Statistics	95% Critical Values	Null	Alternative	Statistics	95% Critical Values
r = 0	r ≥ 1	46.96759	29.79707	r = 0	r = 1	26.17735	21.13162
r ≤ 1	r ≥ 2	20.79023	15. 49471	r ≤ 1	r = 2	17.20551	14.26460
r ≤ 2	r ≥ 3	3.584720	3.841466	r ≤ 2	r = 3	3.584720	3.841466

Source: Authors computation from E-views 9

From the above table, it was observed that, the null hypothesis of no co-integration for r=0 and r ≤ 1 was rejected by the trace statistics method, although the null hypothesis r ≤ 2 were accepted by the maximum Eigenvalues statistics due to the fact that their statistical value was less than their critical values. The implication is that there is a long run relationship among the variables with 2 co-integrating equations at 5% level of significance in the model.

4.2 Empirical Analysis

4.2.1 Long run estimate

Table 4

Result of Regression estimate
Dependent Variable: LASPI

Variable	Coefficient	Std Error	t-Statistic	*Prob.*
C	5.098950	0.569630	8.951340	0.0000
MA(1)	0.737601	0.133864	5.510064	0.0000
LMPR	-0.335390	0.225447	-1.487667	0.1453
LRER	1.159904	0.058955	19.67428	0.0000
R^2 =0.98, Adj. R^2=0.97 F-Stat = 469.527, Prob. <F (0.0000), DW= 1.62				

Source: Authors computation from Eviews 9.

The result of the long run estimate in the above table 4 revealed that the interest rate has a negative but insignificant relationship with stock market performance proxy by All-Share Index in the Nigerian stock exchange market. Although, the result of this study, corroborates the outcome of the study carried out by Akpan and Chukwudum (2014), which established that the interest rate does not have any significant impact on stock market performance in Nigeria.

4.2.2 Granger causality test

Table 5

Result of VEC Granger Causality/Block Exogeneity Wald Tests

Direction of causality		Chi-sq	df	Probability	Decision
LASI	LMPR	2.22715	2	0.3284	Do not reject the null
LASI	LRER	5.19825	2	0.0743	Reject the null
LMPR	LASI	1.95002	2	0.3772	Do not reject the null
LMPR	LRER	0.09134	2	0.9554	Do not reject the null
LRER	LMPR	0.95224	2	0.6212	Do not reject the null
LRER	LASI	7.23441	2	0.0269	Reject the null

The Granger causality test of variables that are co-integrated is utilized to examine the long run causality among stock market index, interest rate and exchange rate in Nigeria. From the performed Granger test, the null hypothesis that INT does not Granger causes All Share index and vice-versa is accepted. Consequently, we can deduce that there is no long-run Granger causality between interest rate and All Share Indexes. On the other hand, it was discovered that changes in the control variable introduced into the model as a result of the inherent problem of omission of important variable bias associated to two variables granger causality test was found to exhibit a bi-directional causality running from exchange rate to All Share Index without a feedback response from All Share Index to exchange rate. Surprisingly, the result of this current study was found to be consistent with the study carried out by Alam and Uddin (2009) where the South African stock prices were found to be inversely related to the interest rate, though, causality could not be established. Thereby suggesting that movement in stock market return may be ascribed to other macroeconomic fundamentals other than interest rate *per-se* according to Aron and Muelbauer (2005). Furthermore, evidence of bi-directional causality suggests that variation in the exchange rate has an implication on stock market performance in Nigeria. Thereby, signifying the presence of the relationship between exchange rate and stock market performance which in turn showcases that the market has already incorporated the impact of the changes as postulated by the efficient market hypothesis theory.

5. Conclusion and Policy Recommendation

5.1 Conclusion

Against the focus of many studies in the literature carried out in both developing and developed economies especially in Nigeria with regards the relationship between stock market performance and aggregate macroeconomic fundamentals such as interest rate, inflation, exchange rate, Treasury bill rate, industrial productivity index, domestic lending rate, gross domestic product, capital inflows, unemployment rate etc. the objective of the current study is to investigate if causality exists between interest rate and stock market performances in Nigeria. This relation between these variables is explored by Granger causality framework. The investigation is of importance because it will give a signal of how investors generally (both at international and National level) behave towards risk. The result reveals that the interest rate exhibited a negative but statistically insignificant association with All-Share Index in the long run.

The salient factors liable for the above outcome in Nigeria are attributed to the actual fact that households and firms do not take advantage of increased interest rate nor reduced savings to enjoy the benefit of improved stock market performance and lack of informational efficiency of the market at large. This in turn may be owing to the fact that a large chunk of potential investors, economic agents etc. are illiterates, low-income earners and violation of the market efficiency hypothesis via the regularly fluctuating values of interest rate with respect to stock market performance. Additionally, this can be because; the same economic agents, investors etc. are typically excluded from the financial system. Couple with the actual fact that, few large investors incorrectly manipulate demand and supply of choice stocks through share buyback thence triggering a false increase in the values of those shares; afterwards, ensuing to their crash as shortly because the increased profits are withdrawn owing to the wealth effect as opined by Paiella (2007). Thereby, suggesting that contractionary monetary policy via increase in the interest rate has the potential to shave stock market performance within the country.

Moreover, the Granger causality test outcome indicates that there is no causal relation between interest rate and stock market performance. Implying that interest rate does not Granger causes stock market performances in Nigeria? It was equally discovered that a bi-directional causality exists between exchange rate and All Share Index. The implication of the same is that the government ought to enhance portfolio diversification vis-à-vis rate of exchange policy which might be used to predict stock prices in Nigeria and at the international environment respectively and vice-versa. In the international context, the reverse is the case, due to the actual fact that they have not violated the market efficiency hypothesis. No doubt, this result is different from results of earlier studies because they have been able to show that interest rate has either exhibited positive or/and negative effect or even no effect on stock market performances in the Nigeria which is contrary to the findings of our study possibly due to asymmetric information in the stock market of Nigeria.

5.2 Policy Recommendation

Based on the above conclusion, the study recommends that the government through the appropriate authorities should ensure an exchange rate policy that will foster the activities of the Nigerian stock exchange market. Also, the CBN should look inwards into its monetary policy stance and trim its interest rate to encourage both national and foreign investors from taking advantage of the market in order to enhance financial development at large in the country.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE INVESTMENT MODEL FORMATION OF RAILWAY INDUSTRY DEVELOPMENT IN UKRAINE IN THE CONDITIONS OF EUROINTEGRATION

The authors have studied the contemporary system and features of the railway industry reform in Ukraine and the preconditions for its development in the context of European integration. The main paper objective is to form strategic directions of an investment model for the railway industry development in the context of European integration processes in order to increase the competitiveness of the Ukrainian railway industry and to achieve an increase in its investment attractiveness. The conducted analysis of rail transport productivity with the use of international methods has proved the limited number of indicators of its assessment for Ukraine, which prevents the reliable assessment of the industry investment potential for foreign and domestic investors. The study of the investment attractiveness of the railway industry in the infrastructure section has determined that the development of Ukraine's rail infrastructure nowadays does not correspond to the best indicators of EU leaders and has weak dynamics, which has allowed to assert the low industry investment attractiveness. The authors have proposed the main elements of the investment model for the railway industry development in the conditions of European integration, which will lead to effective integration of the national rail transport system into the world transport space, improve the industry investment attractiveness and competitiveness, and increase the Ukrainian railway infrastructure productivity.
JEL: O12; O19; L92; R42

Introduction

The advancement of the country's social and economic development and its competitiveness is conditioned by the main and infrastructural sectors' efficient functioning, which is based on investment transformations in compliance with global trends.

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European integration is one of the main priorities of Ukrainian state policy. Ukraine declared its readiness to make every effort to modernize its transport system by signing and ratifying a number of relevant international conventions, as well as being a member of some international organizations, harmonizing domestic norms and standards for the domestic transport operation. Nowadays, there is a number of existing commitments of Ukraine, as well as political and economic initiatives that make it necessary to establish the transport system functioning parameters in compliance with European norms and standards. However, the country transport system, including the railway industry, still does not meet the standards, directives, regulations, norms and requirements of the European Union (EU); there is significant underdevelopment in the legislative and regulatory framework, infrastructure, traction rolling stock, equipment, spectrum and the quality of service.

The current state policy course to achieve economy sustainable development requires the formation of an investment development model, the main subjects of which ought to be active sectors of the economy, one of which is the railway industry in Ukraine.

Recent research and publications analysis

The financial instrument analysis for investing in the sustainable development of the economic sectors and the investment prerequisites for the national economic development are studied in the works of Britchenko, Sitnik, Styopochkina (Sytnyk, 2017; Stepochkyn, 2017). Different aspects of the rail transport investment potential development such as: state regulation of the railway industry, strategic directions for the Ukrainian rail transport development, the railway industry modernization in the context of its reform, are considered by Kirdina (2012), Kucherina (2013), Reiter (2015), Kulikova, Matvienko (2016), Ejtutis, Karpova, Nikiforuk (Ejtutis, 2014; Ejtutis, 2015), Nikolova (2017), Fitzová (2017), Canots Sánchez, Pastor, Serrano (2012). Taking into account the issues of the Ukrainian railway industry development, the unsatisfactory competitiveness level and transportation market industry attractiveness for investment, uncertainty in methodological approaches to assess the railway industry investment, the matter of an investment model formation for the railway industry development is relevant in the research and practical aspects. Today, there is a need to identify key elements of the investment model for the Ukrainian railway industry development in order to ensure the domestic railway industry competitiveness in terms of European integration.

The purpose of the article is to formulate the investment model strategic directions for the railway industry development in the context of European integration processes in order to increase the competitiveness of the Ukrainian railway industry development so as to achieve an increase in its investment attractiveness.

Results

The reform of rail transport in Ukraine is carried out in accordance with the State target programme for rail transport reform for 2010-2019, which was approved by the Cabinet of Ministers of Ukraine in 2009, as well as amenably plans for the implementation of certain EU legislation in the field of rail transport. The main objective of rail transport reform is to develop competition in the railway transport market and increase the industry efficiency.

The implementation of the state policy on the Ukrainian railway industry development is regulated by the Strategic Plan for the Rail Transport Development for the period up to 2020 (Ministry of Infrastructure of Ukraine, 2015), where the basic principles, strategic directions, goals and objectives of the railway industry development, terms of their implementation, ways and means of goals achievement together with task fulfillment indicators have been formulated.

The railway industry reform is under the influence of European integration processes, which were reflected in the following legislative acts:

- the transport strategy of Ukraine for the period up to 2020, which corresponds to the provisions of the White Paper on Transport by the European Union "Roadmap to a single European transport area-Towards a competitive and resource-efficient transport system" (Railway Transport of Ukraine, 2016);
- the State target program for rail transport reform for 2010-2019 and the Concept of rail transport reform;
- the Strategy for Sustainable Development "Ukraine 2020", approved by the Decree of the President of Ukraine dated January 12th, 2015, No. 5/2015, envisaging the implementation of transport infrastructure reform and Ukraine's participation in trans-European networks (Verkhovna Rada of Ukraine, 2015);
- the action plan to the implementation of the Association Agreement for 2014-2017 approved by the Government of Ukraine (Cabinet of Ministers of Ukraine, 2014).

The analysis of the legal system regulating the rail transport operation and related infrastructure, construction, energy, resource, environmental and other issues for their compliance with EU legislation, encourages its implementation so that during the formation and implementation of the state policy development strategy it could be possible to incorporate necessary changes for the industry’s effective development and guaranteed investment attraction.

European instruments open new opportunities for Ukraine by offering a large number of ways to achieve the goals and fulfill the commitments undertaken by Ukraine in accordance with the Association Agreement between Ukraine on the one hand, and the European Union, the European Atomic Energy Community and their member states on the other hand. In January 2016, the technical assistance project of the European Union "Support to the Implementation of the Association Agreement and of the National Strategy in the Transport Sector in Ukraine" was launched. The aim of the project is to promote the integration and modernization of the transport sector in Ukraine and certain sub-sectors of

the transport sector in accordance with the obligations under the Association Agreement between Ukraine and the EU, as well as the updating the National Transport Strategy of Ukraine in accordance with EU legislation, standards and requirements, and assistance in its further implementation.

In the first phase of railroad reform (2015-2017), a public joint stock company "Ukrainian Railways" was founded in Ukraine, 100% of which was set in state ownership, as well as enterprises, establishments and organizations of general rail transport, which were reorganized during merger. At the time, there were some procedures as for the public administration redistribution.

The purpose of industry reforming is the formation of organizational and legal and economic conditions for: attracting private and international investment and conducting industry technical and technological modernization; meeting the demand for rail transport services and ensure a significant improvement in the transport services quality for the economy and population; use the transit potential of Ukraine at its full capacity; economy of the nation-wide expenses on rail transportation; acceleration of the Ukraine's transport system integration into European and world transport systems, implementation of the Association Agreement and the World Trade Organization requirements in the state's international transport and economic relations (Ministry of Infrastructures of Ukraine, 2017a).

The key tool for the railway industry reforming is the problem of investing into the country's railway infrastructure, identifying areas for improving the management of railway companies' investment activities, offering conditions for creating favorable industry's investment attractiveness, encouraging investments and ensuring their efficient use. The solution of these issues will allow forming an effective investment model for the railway industry development in the context of the European integration process.

The high level of competition in the railway transport market and increase of the industry infrastructure efficiency are an integral part of the rail industry reform. The activation of cross-border cooperation is proportional to the existing infrastructure, which ought to ensure the widest range of marketing services, consulting and logistics. The process of the railway transport system development is to include innovative methods that provide competitive logistics and transportation, reduce the aggregate costs of the national economy in the interests of society and the state, as well as the effective integration of the national rail transport system into the world transport space (Kucheryna, 2013; Rejter, 2015).

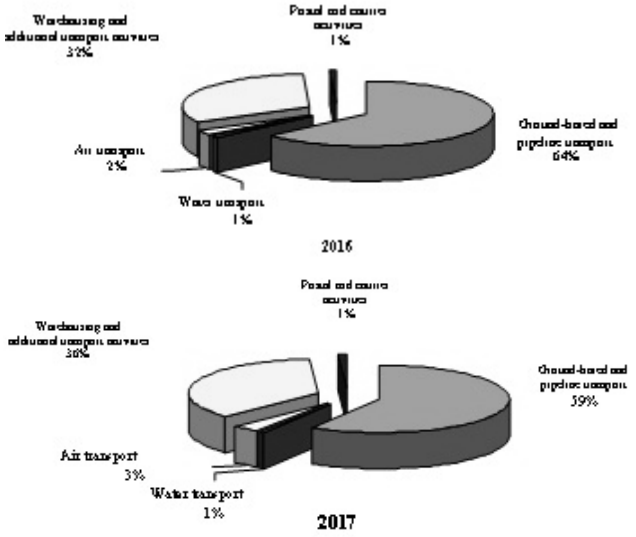
Rail transport occupies a leading position in transport infrastructure; it ought to meet the economy and Ukrainian population's needs in transportation; it is an important factor in ensuring social and economic growth and strengthening the state defense capabilities and foreign economic relations development. According to the size and transportation load the Ukrainian railways rank fourth in Europe after Germany, Poland and France.

The investment activity effectiveness is largely determined by the investment performance level of investment objects, therefore the railway industry investment attractiveness assessment becomes of particular importance.

In the Ukrainian economy, one of the leading industries is rail transport, which serves long-distance and mass transportation of almost all types of products and goods (Figure 1).

Figure 1

Structure of capital investments development in Ukraine in 2016-2017



Source: State Statistics Committee of Ukraine, 2017.

The largest amount of investments among the sectors of the Ukrainian transport system in 2016-2017 is typical for rail transport (64 and 59% respectively). The importance of rail transport lies in the fact that Ukraine is trying to reach to the rapidly developing countries level in Europe and Asia. Rail transport has such advantages as low tariffs, relative safety and regularity of transportation.

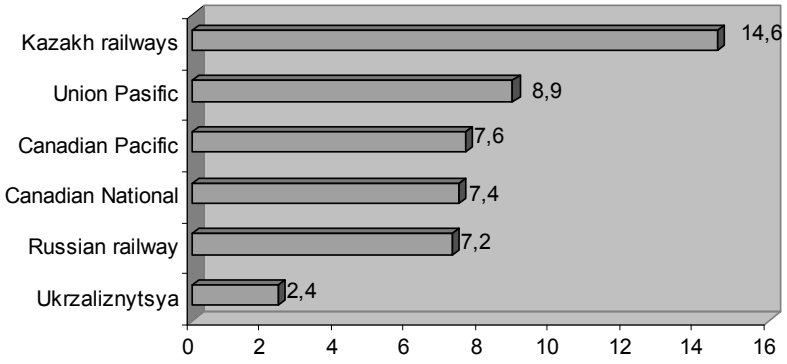
In comparison with other railway operators, the level of capital investments is 4 times lower and the required level of capital investments in Ukraine is 27 billion UAH.

The existing problems of domestic railways (wear and tear and obsolescence of traction rolling stock and infrastructure, mismatch of their technical and economic characteristics to modern requirements) prove the need to implement measures in order to increase the Ukrainian railway's productivity.

During the years of Ukraine's independence, the use of available assets without significant upgrading has been carried out on rail public transport, which allowed restraining the transportation tariffs growth and increasing the profitability of the economic sectors, usually the private ones. In recent decades, the renewal of fixed assets has been mainly provided at the expense of own railways funds (“Ukrzaliznytsia” meets the need for capital investments at own expense by only 5-6%) (Ejtutis, 2015).

Figure 2

The level of capital investment in rail transport in 2017 (%)



Source: Ukrzaliznytsya, 2017a.

The priority direction of investment activity is the railway rolling stock renewal (acquisition of new one, modernization and major repairs of the existing rail-park). Long-distance trunk lines with overdue capital repairs in Ukraine amount to 27% of the total length, track equipment with over normative service life comprises 78% of the total (Ukrzaliznytsya, 2017a).

Due to the catastrophic depreciation of rolling stock, exhausted reserves of wagging capacity, low productivity of passenger rolling stock, there is a threat of insecurity of the industrial sectors needs of the economy in the transport of goods, lowering the indicators of country economic development. Accelerating the renovation of the production potential of the railway enterprises in Ukraine on an investment basis will ensure their investment attractiveness, competitive functioning and sustainable development (Ministry of Infrastructure of Ukraine, 2017b).

Currently in Ukraine, the investment appeal of investment objects or industry as a whole is based on the EBITDA (Earnings before Interest, Taxes, Depreciation and Amortization), which shows the company's financial result, excluding the effect of the capital structure (i.e. interest paid on borrowed funds), tax rates and organization depreciation policy. Investors are guided by EBITDA as an indicator of the expected return on their investments, based on their investment returns. The profitability of PJSC "Ukrzaliznitsa" according to EBITDA in 2016 amounted to 31%, in 2017 – 27% (Table 1).

Thus it can be noted that the performance of rail transport activity is gradually decreasing. The determined financial indicators used in Ukraine in order to determine the investment attractiveness of the industry do not allow recreating the real picture of the industry investment potential for foreign and domestic investors.

Table 1

Financial performance of PJSC "Ukrzaliznytsia" according to EBITDA (%)

Financial indexes	2016	2017
Growth of net income (% to the corresponding period of the last year)	(-11)	0.15
EBITDA margin	31	27
Gross profitability	10.6	8.91
Return on equity	0.03	0.05
Return on assets	0.02	0.04
Profitability	0.1	0.15

Source: compiled by authors on the basis of Ukrzaliznytsya, 2017b, Ukrzaliznytsya, 2018a, Ukrzaliznytsya, 2017c.

Therefore, the use of European experience in assessing the industry investment attractiveness and its implementation remains a prerequisite for the investment model formation for the railway industry development in Ukraine.

The rail transport infrastructure, as a natural monopoly type of activity, is the most widely covered object by state regulation. The state, as an economic entity, is interested in increasing the efficiency of the railway infrastructure use. The infrastructure component analysis of the railway industry investment attractiveness provides a general view of the investor on the investment opportunities of the railway industry and the prospects for its development.

The Global Infrastructure Investment Index (GIII) helps analyze countries in terms of investor's attractiveness to infrastructure in the long run (over 5 years). This estimation is based on national statistics and data such as demand for infrastructure, easing while doing business and investment risk. The Global Infrastructure Index analysis identifies the most attractive markets for investors with the strongest growth potential, the safest business environment, well-established legislative and regulatory systems, and stable political conditions which are Singapore, Qatar, the United Arab Emirates, Canada, and Malaysia (Arcadis – Design & Consultancy for natural and built assets, 2016). There is no Calculation of the Global Infrastructure Index for Ukraine.

For a better overall picture of the potential for investing in the country's infrastructure, the main investment risks have been identified: currency devaluation, unstable raw material prices, loss of credit, and global slowdown in economic growth. The four risks of investing in the infrastructure are the most influential in business and the most important ones for securing the business environment. According to Arcadis-Design & Consultancy, the countries with the highest risk of investing in the infrastructure are Arab Emirates, Canada, Malaysia, Norway, and Medium – Qatar; with the lowest Singapore, Sweden, USA (Arcadis – Design & Consultancy for natural and built assets, 2016).

Competitiveness Index (The Global Competitiveness Index – GCI) shows, to date, progress in building an enabling environment for innovation remains the advantage of economies. The Competitiveness Index is based on 12 indicators: institutions, infrastructure, environment, education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, business, innovation, etc. GCI

defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can achieve (World Economic Forum, 2017).

Extensive and efficient infrastructure is critical for ensuring the effective functioning of the economy. Effective modes of transport – Including high-quality roads, railroads, ports, and air transport – enable entrepreneurs to get their goods and services to market in a secure and timely manner and facilitate the movement of workers to the most suitable jobs.

The transport infrastructure efficiency is determined on the basis of overall infrastructure quality, road quality, rail infrastructure quality, port infrastructure quality, air transport infrastructure quality indicators (Table 2).

Table 2

Global Competitiveness Index: Infrastructure dimension 2016-2017

Rating	Country	The general infrastructure quality	The roads quality	The railway infrastructure quality	The port infrastructure quality	The air transport quality
1	Hong Kong SAR	3	3	3	4	3
2	Singapore	2	2	5	2	1
3	Netherlands	5	4	7	1	4
4	United Arab Emirates	4	1	-	3	2
5	Japan	6	5	1	22	24
6	Switzerland	1	7	2	56	8
7	France	8	6	4	23	13
8	Germany	13	16	11	11	12
9	United Kingdom	24	27	19	12	18
10	Korea, Rep.	14	14	9	27	21
…	…	…	…	…	…	…
75	Ukraine	80	134	34	96	103

Source: complied by authors on the basis of World Economic Forum, 2017.

European countries remain among the most stable, mature and attractive investment markets. Strong deals and long-term experience with foreign direct investment mean that investors have the necessary confidence in these markets, in particular in the countries of Northern Europe, Great Britain, France, Germany and the Netherlands.

According to the general index of infrastructure Ukraine ranks 75th place among the countries of the world. Among all the components of Ukraine's infrastructure, the railway industry is the most competitive, despite the worsening competitiveness of Ukraine's rail infrastructure.

The operational network of Ukrainian railways is about 21 thousand km, of which 47.6% are electrified. Over 18,900 man-made structures are used on the network, of which: 7,600

are bridges (267 units are large and 34 units are extracurricular); 96 are road overpasses; 38 are railway tunnels (Ministry of Infrastructure of Ukraine, 2017b).

There are 1,510 separate sections with track development, 46 locomotive and 53 railroad depots, 103 distances, 66 signaling and communication distances, and 42 power supply districts on the railways. At the same time, the crossing capacity of individual sections and railroads is at a critical point and needs technical re-equipment and modernization (Ministry of Infrastructure of Ukraine, 2017b).

Due to limited funding and reduced volumes of planned repairs and modernization: 2186 km of trains and 1143 roundabouts were closed for trains; with overdue repairs, 7082.7 km of track are operated; over 40 years of operation 7.3 thousand kilometers of electrified tracks (70.8% of the total operational length) and 220 traction substations (71.7% of the total); defective 15 railway tunnels and 1500 railway bridges were recognized; 54 93.8% has reached the level of fixed assets deterioration in the alarm and communication system (Ministry of Infrastructure of Ukraine, 2017b).

The main infrastructure indicators of Ukrzaliznytsya's activity suggest that the productivity of using Ukraine's rail infrastructure is currently not in line with the best indicators of EU leaders and has weak dynamics. This financing condition cannot enhance the operation efficiency increase of the railway infrastructure.

The investment model formation for the railway industry development in the context of European integration in compliance with the aspects of national security, which can vary in different countries, ought to be taken into account. Firstly, countries use different concepts of national security that extend the scope of the investments approval in the life support infrastructure and strategic industries or the national interests' interpretation. Secondly, countries adopt different approaches in limiting foreign investment for the national security reasons. Thirdly, the control procedures may differ significantly in terms of their disclosure requirements by foreign investors. In most developing countries and countries with transition economies, the foreign direct investment outflow declined over the past year. It was due to a combination of problems, including lower prices on raw materials and depreciation of the national currency, as well as geopolitical risks. Europe became the world's largest investor region in 2015, with outflows of foreign direct investment of $ 576 billion (National Bank of Ukraine, 2017).

The credit rating of "Ukrzaliznytsia", which was assigned to it by major international rating agencies such as Standard & Poor's and Fitch, is included in the significant risk group C (in 2014 it was CCC +, in 2017 it was the SS level), indicating high investment risks for railway companies and ineffective mechanisms of using investment resources. However, foreign markets may become the main source of long-term borrowings for "Ukrzaliznytsya".

During 2014-2016, access to global debt markets was closed for Ukrainian public stock companies. The war and the economic crisis have led to a significant drop in prices and, consequently, a rise in the yield of government Eurobonds. As a result, Ukrainian corporations did not attract new external debt; instead they were engaged in restructuring the existing debt portfolio. Most public companies managed to restructure Eurobonds and

transfer the peak repayment from 2018 to 2021 and beyond (National Bank of Ukraine, 2017).

In 2018 PJSC "Ukrainian Railways" carried out a refinancing of bonds worth 500 million USD with a yield of 9.5% and redemption time in 2018 issued by Shortline plc (Ukrzaliznytsya, 2018b).

The infrastructure bonds mechanism application will promote the active construction and manufacturing infrastructure modernization, the public investments replacement by private ones, the mutually beneficial schemes of cooperation between the state and private business entities implementation. It will also enable large-scale attraction of conservative investors. Due to the investments of PJSC "Ukrzaliznytsya", the cars' production has continued to grow, but loads in absolute measurement are extremely low, about 15% from the figures in 2014. However, this sector can get an additional impetus if Russia intends to withdraw its own fleet of cars from Ukraine (Orlova, 2017).

The uncertainty and contradiction in the Ukrainian tax legislation application lead to an increase in the risk that significant additional amounts of taxes, fines and penalties may be charged. Those requirements, if applied, can have a significant effect on the financial situation of the railway industry, the results of operations and cash flows. Therefore, it is necessary to implement an effective risk management policy (Table 3).

Table 3

Risk Management Policy of PJSC "Ukrzaliznytsya"

Type	Risks	Factors of risk decrease
Economic risks	The risk of reducing freight traffic as a result of economic conditions deteriorating	Support of the investment program flexibility Measures to reduce costs and increase productivity to ensure growth in profitability Diversification of the rail-park in accordance with the clients' needs in order to increase users' service diversification
Essential investment needs	Relatively high level of infrastructure and rolling stock deterioration	Continued work on upgrading, modernizing and expanding the infrastructure, locomotive and cars park State support for the strategically significant infrastructure projects financing Diversification of funding sources
Personnel expenses	The high proportion of personnel expenses has a significant impact on financial results	Measures to increase productivity and optimize staff Professional retraining of employees in order to increase productivity
Currency risk	Part of expenses and liabilities are denominated in the foreign currency	"Natural hedge" of exporters: the weakening of the hryvnia rate increases the goods competitiveness produced within the country Part of the transit revenue is denominated in USD Treasury monitors the size of market risks
Refinancing risk and interest rate risk	The risk of refinancing short-term borrowings	Continuation of the debt obligations redemption time (including Eurobonds) Develop a sustainable funding and refinancing strategy

Source: Ukrzaliznytsya, 2018c.

Nowadays, the minimum required amount of investment in the PJSC "Ukrzaliznytsya" development for the period until 2025 is projected to comprise 40 billion UAH per year using the following basic sources:

1) increase the level of depreciation charges up to 24 billion UAH;

2) the introduction of an investment component in the tariff structure of the regulated services – 6 billion UAH;

3) state support and private investments – 15 billion UAH. (Ejtutis, 2015).

In today's economic conditions of Ukraine, the infrastructure facilities financing is a deterrent to the economic growth of the rail industry.

In the European integration context, Ukraine has the relevant experience of EU countries in the rail transport development, the main factors of which are infrastructure management issues, guaranteeing non-discriminatory access to railway networks, liberalization of freight transport, licensing of railway enterprises, and active involvement of private carriers in financing infrastructure development. The EU countries have not only upgraded the railway's technical equipment, but have also developed a standardized set of tools for managing the transport system and transition from a monopoly industry to a competitive one. As the main principles of rail transport reform in the European Union, the following have been distinguished: state control of the sector; decentralization of activities' management; the distinguishing between infrastructure and transportation; losses compensation from local and regional passenger transportations to corporate carrier by transferring part of the regional level budget funds; the introduction of universal technical standards in connection with the national markets emergence (Verkhovna Rada of Ukraine, 2015).

National investment projects involve the financial resources investment in priority sectors of the economy, business objects, targeted programs that provide the basic life-supporting industries, social sphere and industries of special state significance development. Ukraine has implemented a project approach for key investment projects, among which:

- a rolling stock renewal project in cooperation with General Electric – the acquisition of 30 diesel locomotives; the total cost is $ 1 billion; source of financing is financial leasing;
- electrification of the Dolinsky-Nikolaev-Kolosivka site – optimizing costs due to electrification and increasing the crossing capacity of one of the main routes for the transportation of grain to the seaport of Nikolaev. The total cost is UAH 7.5 billion, the source of financing: EBRD – 150 million Euros, EIB – 150 million Euros;
- renewal of the freight wagon fleet in cooperation with the EBRD. The total cost is 260 million USD; the source of funding: EBRD – EUR 150 million, own resources (Ukrzaliznytsya, 2017b).

Increasing the trains crossing capacity on the "Baltic-Black Sea" corridor, transfer of cheaper fuels to freight, passenger and suburban transport, saving fuel and energy resources and operating costs, increasing the train speed of all categories at this section will ensure

the realization of the national investment project "New construction of railway infrastructure with electrification of the Goskordon-Ovruch-Korosten-Zhytomyr-Berdichev section (total cost of the project is 3,970.0 million UAH). Investment project "Reconstruction of the 1435 km railway track at Kovel-Yagodin-Goskordon (with Poland) with further electrification" will provide an increase in passenger and freight transportation volumes between Ukraine and the states of the European Union. Total cost of the project is UAH 1.03 billion (or EUR 35.73 million). The deepening of social and economic relations between Ukraine and its neighbors, conditions creation for strengthening the international economic cooperation with the European Union will provide the "Traction substation equipment located on the Pan-European transport corridors III and IX ("Cretan"), means of reactive electricity compensation" project with the total cost of 206.7 million UAH (or € 7.2 million) (Ministry of Infrastructure of Ukraine, 2018).

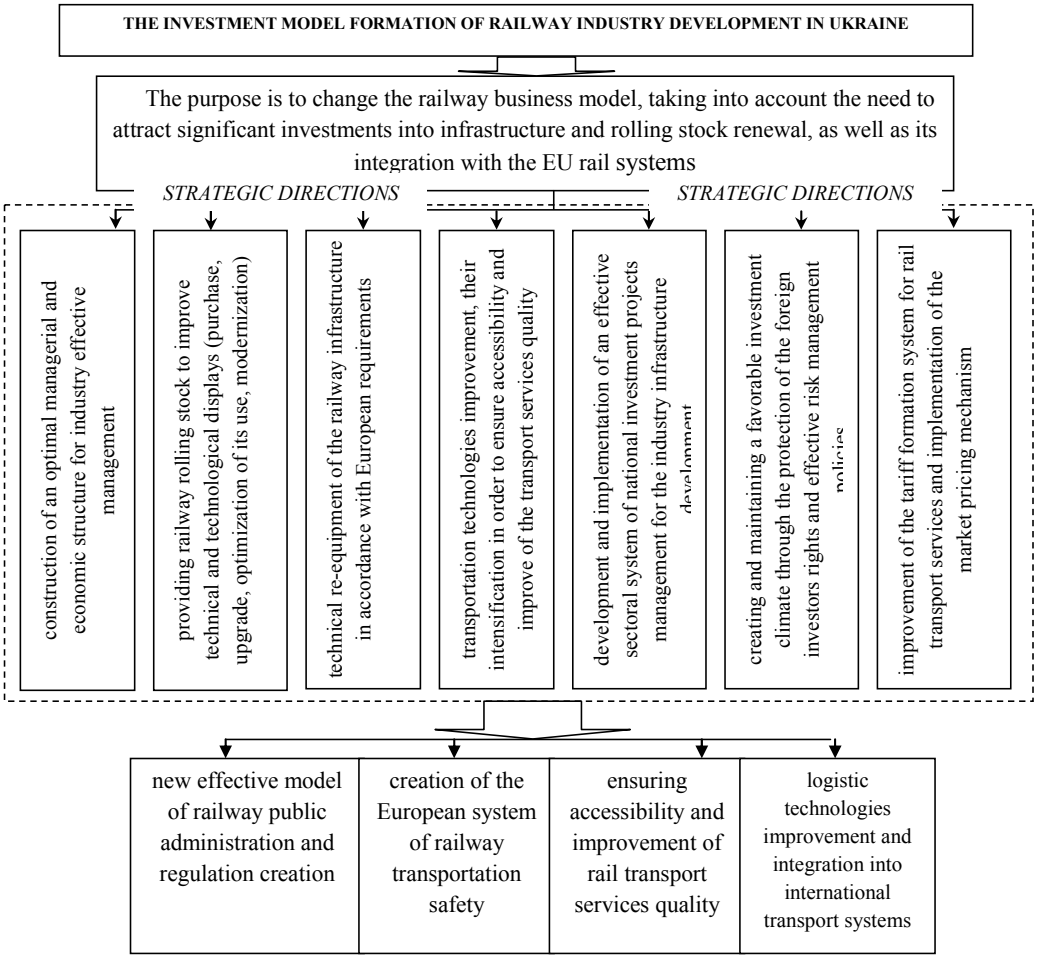
Based on the above-stated information, it is obvious that the source of resources for the national projects implementation ought to be a combination of budget funds direct spending and funds from private domestic and foreign investors attraction.

At this point the potential of Euroregional cooperation and the potential of trans-boundary regions are not sufficiently used in Ukraine; mechanisms for financing cross-border cooperation projects are considerably regulated which reduces the activity of the Ukrainian cross-border projects implementation and attracts financial support from the EU structural funds. So, most cross-border projects on the EU initiative need to attract own funding sources at least at 10%. One of the reasons for the impossibility to adhere to this parameter is the low level of local self-government bodies' authority, in particular with regard to budget support for regional development, which complicates the search for their own funding sources (Shevchenko, 2015). All these factors negatively affect the investment attractiveness of the railway industry in Ukraine.

Defining the key factors and prerequisites for increasing the investment of the Ukrainian railway industry attractiveness, the authors have proposed the main elements of the railway industry development investment model under the conditions of European integration, which ensure the implementation of strategic directions of the railway industry development in Ukraine (Figure 3).

Implementation of investment model of the railway industry development will allow effective integration of the national railway transport system into the world transport sector, the industry investment attractiveness improvement and its competitiveness, and increase the Ukrainian railway infrastructure productivity.

Figure 3
Investment model of the Ukrainian railway industry development in conditions of European integration



Conclusions

On the basis of the study of the Ukrainian railway industry development peculiarities it has been proved that it is in a difficult technological and economic condition and the most negative factors influencing the development of the railway industry have been highlighted.

The structure of the capital investment development shows that the largest amount of capital investment is directed specifically to the railway industry, but the investment is 4 times lower in comparison with foreign investment experience in this means of transport.

The use of European experience remains a prerequisite for the efficient and attractive development model formation of the railway industry in Ukraine in the following areas:

- construction of an optimal managerial and economic structure for the industry effective management
- providing railway rolling stock in order to improve technical and technological displays (purchase, upgrade, optimization of its use, modernization)
- technical re-equipment of railway infrastructure objects in accordance with European requirements
- improvement of transportation technologies, their intensification in order to ensure accessibility and improve the transport services quality
- development and implementation of an effective sectoral system of national investment projects management for the industry infrastructure development
- creating and maintaining a favorable investment climate through the protection of the foreign investors rights and effective risk management policies
- improvement of the tariff formation system for rail transport services and the introduction of a market pricing mechanism.

It has to be noted that the Ukraine's transition to the investment vector of the railway industry development is at an initial stage due to the European integration processes that began in 2015. System development of the investment model components of the railway industry development in Ukraine proposed by the authors will allow the rail industry to compete during the next few years and become a prerequisite for improving its investment attractiveness in the international transport system.

In order to implement the investment model of railway industry development, the state ought to give priority to the Ukrainian legislative acts improvement; their approximation to the relevant legislative acts of the European Union will contribute to the legal measures protection for the market relations formation, the competitive environment and favorable investment climate generation, the modern market infrastructure creation, entrepreneurial activity in priority sectors of the economy development, as well as the national technical regulations and standards development harmonized in accordance with European and international ones.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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EXPERT AND DIAGNOSTIC ASSESSMENT OF ECONOMIC SUSTAINABILITY THREATS OF SHIPBUILDING ENTERPRISES

The definition, classification and diagnostic-expert assessment of economic sustainability threats of the shipyards are presented in this article. The external factors suggested to divide into factors of direct and indirect impacts, and factors of the internal environment to classify as the factors shaping the economic sustainability, and the factors that affect it. Using this classification, it is possible to develop a set of indicators of assessing the economic sustainability of the enterprise in both the long and short term.
Using the method of expert estimations and Pareto's method the effect of exogenous and endogenous factors on the economic sustainability of the shipbuilding industry was determined; the most influential external and internal factors were established.
JEL: D21; L60; M21

Introduction

Shipbuilding is one of the priority sectors of the global economy, which is developing dynamically. Ukraine, as a Maritime state, has the necessary prerequisites to become one of the global leaders in the shipbuilding industry. Among them, the most important are the historical conditions and an advantageous geographical location. However, today the industry has seen a critical decline in production volumes, the absence of state orders and uncertain prospects, which in turn leads to a deterioration of the economic and financial situation of enterprises, in particular the reduction of economic sustainability.

Any process, including the activity of shipbuilding enterprises, is affected by many factors of internal and external environment that shape the economic sustainability of the entity. Consequently, the identification and assessment of factors of economic sustainability are two of the main stages of its provision.

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The aim of the article is definition, classification and diagnostic-expert assessment of threats of economic sustainability of the shipyards.

Recent Research and Publications Analysis

Domestic and foreign scholars in the scientific literature widely discuss the issues relating to factors influencing the economic sustainability of the enterprise. In particular, Krolenko (2011), Sipravska (2011) in their works investigated the influence of factors on the economic sustainability of enterprises; Bazarova (2012), Zinger, Iliiasova (2015), Miskhozhev (2010), Fedotov (2013), Tumin, Koryakov, Nikiforova (2013), Shmidt, Khudyakova (2015), Leszczewska (2014), Dyllick, Hockerts (2002) in general determined the factors which influence the sustainable development of enterprises. Zinger and Iliiasova have argued that sustainability factors are reasons which may cause its increase or decrease, based on classifying the environment of occurrence, the nature and direction of impacts, the object of impact, etc. (Zinger, Iliiasova, 2015). Krolenko in order to identify the factors of influence of economic sustainability, has proposed first of all to classify economic sustainability on the variety. He has clearly divided the factors of influence for each kind of stability, and then has identified the scorecard by which you can determine the degree of sustainability of each species (Krolenko, 2011). We follow this point of view, but we believe that in conditions of crisis and uncertainty in the society we need to improve this technique. Bazarova in the monograph has noted that in the current market conditions for enterprises more important are internal factors as they may affect (Bazarova, 2012). However, the studies that concern the factors in the downturn of the economy are virtually absent.

Research Results Presentation

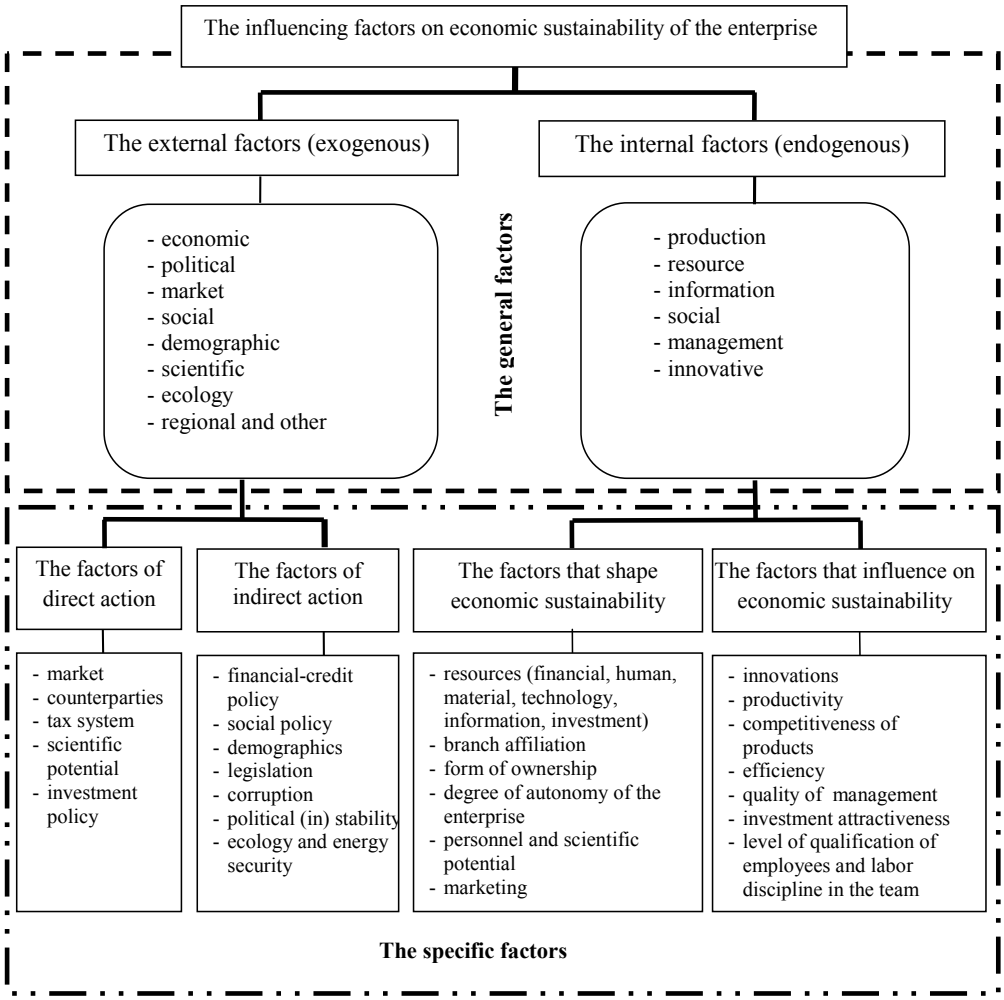
The internal environment of the enterprises is always under the scrutiny of interested users, in particular managers; the external factors are potential carriers of threats. The enterprise is able to manage its internal factors. Regarding environmental factors, it can be argued that the company is unable to influence on such factors, but can adapt to changes of the external environment.

Internal factors are under the control of the enterprise, and external – outside of accountability. However, according to the authors, it is advisable to divide the internal factors into the factors that shape the economic sustainability of the enterprise, and the factors that directly affect it; external factors to divide into direct and indirect action. First, factors that shape economic sustainability are the extensive factors, i.e. the factors that characterize the quantitative parameters of the company. The factors that affect economic sustainability are intensive factors, that is, qualitative factors of economic growth. The indirect factors of the external environment of the economic sustainability of the enterprise relate to the macroeconomic problems of the country, and the factors of direct influence of the external environment, of course, affect the decision-making legal entity. Thus, the

above factors can be predictable and unpredictable. In addition, we believe that factors that directly affect the economic sustainability of any enterprise should be divided into general and specific. General classification of factors influencing on the economic sustainability of enterprises is shown in Figure 1.

Figure 1

The classification of factors of influence on the economic sustainability of the enterprise



Source: developed by the authors.

We believe that this classification of factors will allow in the current economic conditions focus clearly, in a timely manner to determine the degree of risk and to adapt to the effects of external and internal environment. Using this classification, it is possible to identify a

number of indicators of assessing the economic sustainability of the enterprise in long term and short term.

In order to find an effective mechanism to ensure economic sustainability for the shipbuilding industry it is necessary to determine precisely those factors that directly affect the industry. For the mechanism of ensuring economic sustainability is not enough to outline the range of factors, but it is important to determine the extent of their influence. To determine these factors, their significance and degree of influence, the analysis of expert assessments using the method of pair comparisons based on the multidimensional ranking, (the form of the method used is questionnaires) was carried out. It can be used in the conditions of the impossibility of a mathematical formalization of the process of solving the problem, lack of information.

At the first stage of expert evaluation, different groups of experts, specialists in the field of shipbuilding were selected for questioning, namely: managers of different levels of management, engineers, brigadiers of the shipbuilding enterprises, employees of the accounting and economic departments, consumers of products and services of shipbuilding enterprises, etc. A total of 58 experts were interviewed.

For questioning of experts a questionnaire was developed where respondents were required to select from the proposed list 10 of the most influential factors of the external and internal environment, which influence the economic sustainability level of the shipbuilding enterprises, and evaluate them on a ten-point scale (10 is the most influential factor, 1 - the least influential factor).

Summarizing the results of the questionnaire, it was found that the experts' opinions do not completely coincide, namely, of the ten factors that should be chosen by the experts, each of them selected only eight. At the same time, the ranks put by the experts were different. Since the opinions of the experts did not completely coincide, the points were re-arranged and a new matrix was drawn up.

To assess the consistency and non-randomness of expert opinions, the adjusted coefficient of concordance was calculated using the following formula (1):

$$W = \frac{12\sum_{1}^{m}\left(Si - Scc\right)^2}{N^2\left(m^n - m\right) - N\sum_{1}^{N} Tj} \tag{1}$$

where N - the number of experts;

m- the number of evaluation options;

Si - the sum of ranks assigned to the Pi decision by all experts;

Scc - the sum of the arithmetic average of the ranks;

Tj - an indicator bound by (equal) ranks assigned by an expert.

According to the results of calculations in the initial ranked rows, there were bound ranks, therefore, using the method of Romashkina HT & Tatarova HH, correction factors were determined (Romashkina, Tatarova, 2005). The calculations determined the value of the coefficient of concordance at the level of 0.77734 for external factors of economic sustainability threats and 0.88235 – for internal ones. Calculated coefficients of concordance determine the high degree of coherence between experts.

Since the coefficient of concordance has a random value, its validity is checked by the Pearson criterion. Based on the calculations made it is possible to conclude that the coefficients of concordance are statistically significant, and the expert conclusions are consistent with each other.

The results of calculations have allowed evaluating the importance level of each factor that affects the level of economic sustainability of enterprises of the shipbuilding industry of Ukraine (Table 1, 2).

Table 1

The results of the evaluation of the degree of influence of factors of external environment on the economic sustainability of the shipbuilding industry

The factors	Weight of factor (%)
The insolvency of counterparties	22.2
The high level of tax burden, the inefficiency of stimulating functions of the tax system	17.6
The reduction of bank lending to industry, high cost of credits, overvalued exchange rate	15.8
The crisis in the industry	12.4
The loss of a customer from the state	11.4
The lack of qualified employees	10.3
Energy (in) dependence	5.7
The corruption	4.6

Source: calculated by the authors.

The most important exogenous factors have been identified the following: insolvency of counterparties (22.2%), high tax burden, the inefficiency of stimulating functions of the tax system (17.6%) and the reduction of Bank lending to industry, the high cost of loans, an overvalued exchange rate (15.8%).

The most influential external factor that determines the economic sustainability of the shipbuilding industry, we identified the insolvency of counterparties. In conditions of economic crisis, currency fluctuations, instability of the national currency, comes the probability of doubtful accounts receivable, or even the loss of customers.

The solvency and interest of counterparties affect the viability of economic units, in particular its economic sustainability. Indeed, in the absence of demand for shipbuilding and repair work, the company is unable to meet their needs and to obtain satisfactory financial results. This will certainly lead to the deterioration of the financial situation of the enterprise, loss of profit, and as a consequence, the deterioration of economic sustainability.

As a factor of direct influence of the external environment also was defined tax system. In conditions of the instability and variability of tax legislation the tax burden on the enterprise sector is constantly increasing, which in recent years suffered losses and was in the "doldrums". This consequently affects to the profitability of industrial enterprises. Therefore, in order to reduce the influence of the "tax system" on economic sustainability of industrial enterprises is necessary: the definition of priority sectors and providing for them tax breaks and incentives, the recognition of the shipbuilding sub-sector as a priority, ensuring a close connection of tax policy fiscal and monetary policy, the liberation of enterprises from VAT on purchases of imported components for export contracts. All these measures will reduce the tax burden of enterprises of shipbuilding and as a consequence, improve their economic sustainability.

The factor "financial and credit policy" also significantly affected the economic sustainability of shipyards. Manifestations of this impact is the rise in price of credit resources, the reduction of state funding due to limited budget finance, the discrepancy between the size of credit resources and the modern needs of Ukrainian enterprises, inflation, instability of currency and national hryvnia. The consequences of this situation are: growth of prices for products of shipbuilding industry; depreciation of assets; unprofitableness, bankruptcy and liquidation; the growth of prices for industrial products. For example, to improve the quality of the production, contract with Britain for the supply of appropriate equipment had been made.

Currency instability rapidly has increased the cost of the equipment and components that domestic enterprises purchased abroad, as a result, value of the contracts has raised and inability to compete with businesses in other countries has come.

Analyzing statistical data and taking into account the inflation processes in the economy of Ukraine, industrial production index and their connection with unprofitability industrial enterprises it is possible to argue that their dynamics are similar and they correlate with each other. Inflation of dynamics over the period 2009-2016 were not uniform, its significant reduction in 2013 changed to a sharp growth in 2014. So, the price policy of the enterprises of the industry depends on the inflation (rise of general price level), since with increasing prices of raw materials for the industry also increases the price of the industry product.

Therefore, to reduce the negative impact of fiscal policy on economic sustainability it is needed to restore bank lending to the real sector with favorable conditions for the shipbuilding industry, the state should be the guarantor of the loans and subsidize interest rates on loans to domestic banks.

An equally important environmental factor that affects on the economic stability of the enterprises of shipbuilding and ship repair is "the crisis in the industry". The most severe crisis over the past 10 years' experience not only Ukrainian shipbuilders, but also their colleagues around the world. The crisis in the industry due to both global and regional causes. The most influential global cause it is possible to determine the excess of fleet possessed by the shipowners; for a regional reason - competition.

The main problems of domestic shipbuilding and ship repair are an artificially created non-competitive position in the global shipbuilding market. As a result of inadequate implementation of tax and customs mechanisms for regulating the activities of domestic shipbuilding, the Ukrainian enterprises cannot compete in the price segment, not only with the cheapest shipbuilding which bases of China and South Korea, but even with the most expensive European shipbuilding companies. Moreover, in conditions of the global crisis, shipowners are not afraid of lower product quality of Chinese manufacturers, as they satisfy the ratio of price to quality. Therefore, the products of domestic shipbuilding present little interest to the market.

Domestic shipbuilding enterprises have sporadic production, are not competitive with companies in China, Korea, configured for batch production. However, opening of small businesses and enterprises "phony", which suggest not very high-quality services of ship repair. Also, most shipbuilding companies, because of lower demand for its products and increasing competition, have turned into ship repair.

This situation leads to an impact on the pricing of leading domestic businesses, loss of markets, loss of economic relations with contractors. In addition, the main contractors for the shipbuilding industry are suppliers that provide resources to the business. In turn, quality resources, price and technical and technological levels of production depend on suppliers. A lot of competition among providers of resources also generates price dependence. In a market environment, competition is an essential attribute but at the state level using geopolitical legislation for "healthy" competition is required.

The loss of a customer from the state is a factor of indirect influence of the external environment. Despite the existence of the law of Ukraine "About conducting economic experiment regarding state support of shipbuilding industry" and adopted by the Cabinet of Ministers Order "About approval of Strategy of development of shipbuilding for the period till 2020", the domestic shipbuilding companies have lost a customer from the state, because these laws were populist and incapable to implementation. Currently, there is a lack of state order, reduction of state funding due to limited budget finance.

Consequently, the reduced number of jobs, not full utilization of production capacities of enterprises of shipbuilding and the loss of income and profits. The lack of orders gives rise to an incomplete download of the shipyards and production facilities that are the heritage of many years of domestic enterprises. The smaller congestion of shipyard, the more the expenses on maintenance of production facilities. In this regard, it becomes immediately increase the cost, decrease the competitiveness, the company loses its staff, and as a consequence, the market. Solving this problem requires recovery of the domestic military shipbuilding, shipbuilding, creation of the program of development of the shipbuilding industry and its legislative support.

Another factor of direct action, which is a problem for the shipbuilding and ship-repair industry, is the lack of qualified personnel. The enterprises do not have enough workers in unique professions who cannot borrow from other industries. The sector lacks ship fitters, electricians, locksmiths. This fact leads to a decrease in the efficiency of production, inadequate quality of the shipbuilding and ship-repairing works. In terms of structural and market reforms has broken the cycle of reproduction of qualified personnel. Shipbuilding

needs not only welders and fitters, but also the designers. Therefore, it is important to revive and to ensure proper funding of vocational schools and universities, which specialize in training personnel for shipbuilding, to create the state orders training of highly qualified designers, to create industrial parks based on large shipbuilding enterprises.

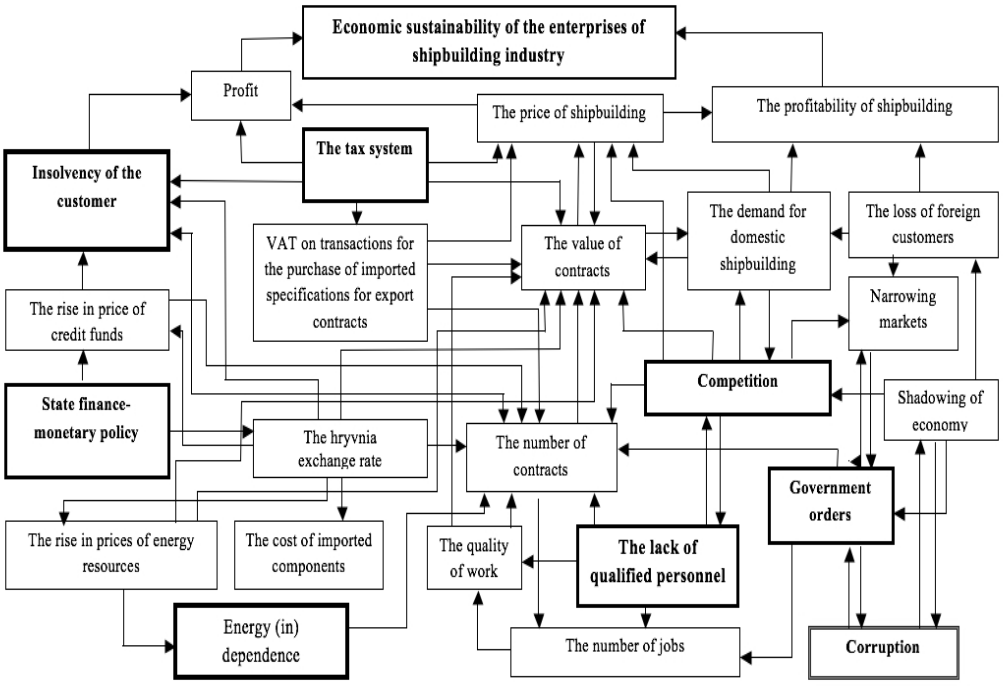
In Ukraine under present conditions of management statistical data indicate low social protection of workers in the industry, despite the fact that legislation directly or indirectly reglementary certain provisions of the social policy. For example, for employees who work in adverse conditions provide benefits in the form of additional holidays, increased rates of compensation, reduction of working time and more. However, due to the effects of a number of negative factors, there are involuntary part-time employment of employees in the industrial sector, arrears in the payment of wages, low level of safety and so on.

The factor of direct action, and equally important in modern conditions of managing, the experts have noted the energy (in) dependence of the enterprises of the shipbuilding industry. The manifestation of such factor is the shortage and significant price increase of energy resources. This factor affects the increase of costs, a reduction in the quality of works and services of shipbuilding and ship repair, lost customers, and as a consequence, the loss of income. Under these conditions, there is an urgent need for introduction of newest world technologies for resources and energy saving.

In relation to such factor of influence the economic sustainability of economic entities as corruption, the most revealing are studies of the Bleyzer foundation, which in their periodic studies monitors the state of the investment climate in Ukraine. During the study of the investment climate for 2016, 79% of surveyed companies believe that corruption is the following (after judicial-legal environment) the most significant factor of serious obstacles to doing business in Ukraine. In the section "Corruption" 98% of respondents pointed to corruption in the judicial system of Ukraine; 90% of the respondents found the great concern in administrative corruption on level of government officials, which require additional payments and bribes; 68% of surveyed companies said that corruption in private business with a raider attack on the enterprise is a significant factor in the serious problems in doing business in Ukraine.

Of course, if all of the above factors to consider as part of the macro environment, then, of course, between them it is possible to trace the relationship, interdependence and influence on each other. Thus, the change in one factor causes change in another. In addition, the degree of influence will depend on the size of the enterprise, its geographic location. In general, the dependence of economic sustainability of enterprises of the shipbuilding and ship-repairing industry from external factors can be represented in the following diagram (Figure 2), the main factors of economic sustainability in bold).

Figure 2
The map of interrelations of external factors of economic sustainability of enterprises of the shipbuilding industry



Source: developed by the authors.

Thus, the external factors are potential carriers of threats. For the purpose of timely elimination of negative trends is necessary at the national or sector level to monitor environmental factors. Under these conditions, the company will have the ability to react, to adapt, to revive their desired state and make correct decisions.

The internal environment for industrial enterprises can also be a source of problems. The calculation results in the original ranked lines, as in the case of external factors, were observed associated grades.

On the basis of calculations has defined the coefficient of concordance, which is statistically significant (of 0.8235); the expert opinions agreed among themselves.

The results of calculations allowed evaluating the importance level of each factor that affects to the level of economic sustainability of enterprises of the shipbuilding and ship-repairing industry (Table 2).

As the most important factors the experts have been identified the following: technical condition of production assets (17.8%), utilization of production assets and efficiency of use (17.68%), the efficiency of contracts (12.92%), duration of operating cycle (11%), the profitability of the process of ship-repair and assemble-welding production (10.2%).

Table 2

The results of the evaluation of the degree of influence of factors of the internal environment on the economic sustainability of the shipbuilding industry

The factors	Weight of factor (%)
The technical condition of fixed production assets	17.8
The utilization of production assets and efficiency of use	17.68
The efficiency of the contracts	12.92
The duration of the operating cycle	11.0
The profitability of production processes	10.2
The number of received adequate orders	8.9
The number of regular and new customers	6.9
The level of skills and efficiency of their use	5.9
The rhythms orders	4.8
The waiting period orders	3.9

Source: calculated by the authors.

So, for the normal operation of enterprises and market competitiveness of the shipbuilding and ship-repair services there must have the modern production equipment, which has high resource usage and not morally outdated and physically worn-out. For the industry, this is a very important problem, because of the difficult financial situation of the company is not able to restore, upgrade existing park equipment.

At the same time, the technical condition of the production capacity is affected by the level of deterioration, age, structure, recovery rates, the level of introduction of new technologies and automation of the production process. So, the level of deterioration of the production facilities of shipbuilding and ship repair industry exceeds 70%, and the rate of renewal does not exceed 10%. It is important to note that the production facilities of shipbuilding enterprises take a significant share in assets (as shown the analysis of the industry – up to 71%), which require the cost of their maintenance and service (even when the enterprise is idle), therefore the level of economic stability will depend on the degree of coverage of fixed assets with the value of the contracts.

The utilization of production assets and the effectiveness of their use directly affects onto the economic sustainability of the enterprises of shipbuilding, the degree of coverage of fixed assets with the value of the contracts. Unfortunately, in the current economic conditions, enterprises of industry load their main production resources less than 50%, their "portfolio of orders" is also small. On this basis, it can be argued that the enterprises of the shipbuilding industry cannot cover the costs to maintenance and service of fixed assets by the value of the contracts. As a result, receive a loss, losing income and economic sustainability.

In modern conditions of managing, the efficiency of contracts of shipbuilding enterprises is quite low. In conditions of high competition with foreign enterprises, often for the sake of "survival" the enterprises fulfill any orders, not even quite profitable. Consequently, the company loses profit and economic sustainability.

A feature of the enterprises of the shipbuilding industry is in the uniqueness of the production and duration of production and operating cycle. The operating cycle for shipyards is the period of time between the purchase of inventories for the implementation of the activities in obtaining the contract and receipt of money from its implementation. The production cycle for enterprises of shipbuilding will be equal to the duration of turnover of inventories of the enterprise that according to the calculations in the industry ranges from 15 to 1738 days. The results of the industry analysis revealed that the operating cycle for the shipbuilding industry ranges from 56 to 1738 days. It is clear that for enterprises making repair work the duration of the operating cycle is less (from 56 to 406 days). The duration of the operating cycle is affected by the period of encashment of receivables and inventory turnover. Slow turnovering of inventories and increasing the period of encashment of receivables lead to increasing of the period of the operating cycle and as a consequence the deterioration of economic sustainability.

For enterprises of the shipbuilding industry, it is inherent complexity of the technological and production processes. Typically, the production structure of the shipyard consists of the basic production and auxiliary shops and engineering services for the construction of modern ships. The structure of the ship repair production consists of mechanical, hull, electrical, wood-painting workshops, blanking and auxiliary production.

It is important to note that most of the profitability (loss-making) processes of production are different. It will depend on the cooperation of the shipbuilding industry and other industries that provide it, for example, iron and steel industry. Therefore, in modern conditions of managing of the enterprises of the domestic metallurgy that provide shipbuilding steel are mainly concentrated in the Donetsk and Lugansk regions. On this territory, the hostilities are taking place, and that is why shipbuilding companies are forced to wait or purchase steel in other countries at inflated prices, leading to loss of production processes. Getting a loss or lower profitability leads to the deterioration of the economic sustainability of the shipbuilding industry.

The number of received adequate and permanent orders, new customers is interrelated and has almost the same impact on economic sustainability. Adequate orders must be for the enterprise highly profitable and provide jobs for the long term. The stability of production depends on the number of loyal customers; however, preferably the number of new orders will ensure the workload of the production fixed assets of the company. Also, the quality of the management and marketing policy of the enterprise depends on the amount of received adequate orders, and regular and new customers. In the presence of these characteristics increases the enterprise income, profits, and, consequently, the level of economic sustainability.

An important role in ensuring the economic sustainability of the shipbuilding industry plays a skill level of workers and the efficiency of their use. Workers in shipyards must have a high enough qualification required by the conditions of production. The preparation of such

skilled workers requires a significant investment of time and money, their skills and experience are essential for productivity. The efficiency of workers who service management and production processes should be based on the principles of rational organization of working time; receiving of high and stable wages that ensure a decent standard of living; the rational selection and staffing professional and qualification composition of employees, turnover of professional staff, improving work processes through the implementation of the most rational methods of work, etc.

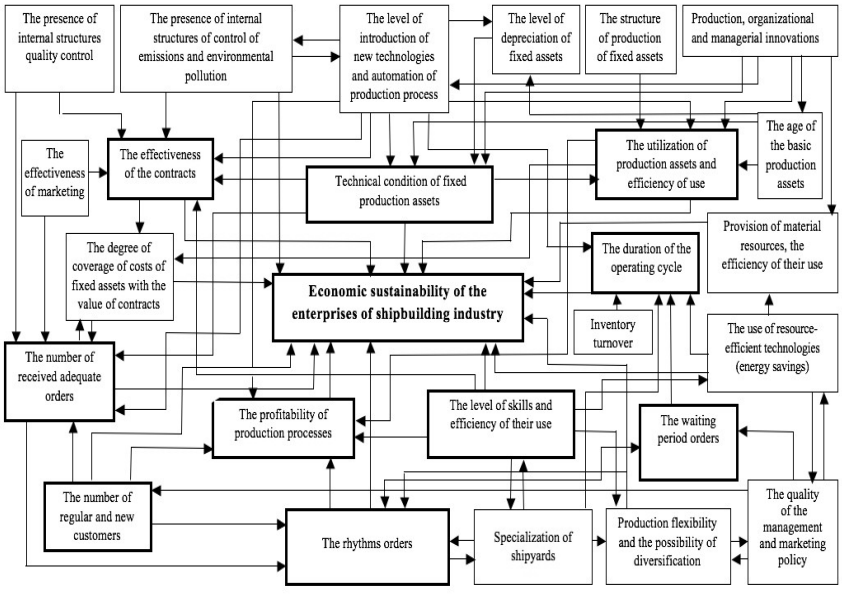
The rhythm of incoming orders and the waiting period orders for ship repair industries are mutually dependent and have a similar share of influence. Rhythm is an important qualitative indicator of production activity, which indicates a uniform output. The period of waiting of orders in the current economic conditions of the shipbuilding enterprises is quite important. The reduction of the waiting period depends in turn on the level of quality of the management and marketing policy of the enterprise.

In general, the dependence of economic sustainability of enterprises of the shipbuilding and ship-repairing industry on internal factors can be represented in the following diagram (Figure 3), the main factors of economic sustainability in bold).

So, in any process, including shipbuilding activities, there is a large number of factors external and internal environments, influencing on the economic sustainability of the entity, but only a few have a decisive influence.

Figure 3

The map of interrelations of internal factors of economic sustainability of enterprises of the shipbuilding industry



Source: developed by the authors.

To identify factors that have a decisive influence on economic sustainability, used the Pareto's principle, the basic postulate of which treats: 20% of efforts give 80% of the result, and the remaining 80% of effort only add 20% of the result. In this framework, the application of the Pareto's Law has developed principles of interaction of factors and desired results. Factors of the internal and external environment are compiled in a common matrix: their complex effects are identified, respectively, 100% and carried out by ranking according to the criterion of a share of influence on economic sustainability. The matrix of the combined factors is presented in Table 3.

Table 3

The ranking of factors by the percentage impact on the economic sustainability of the shipbuilding industry

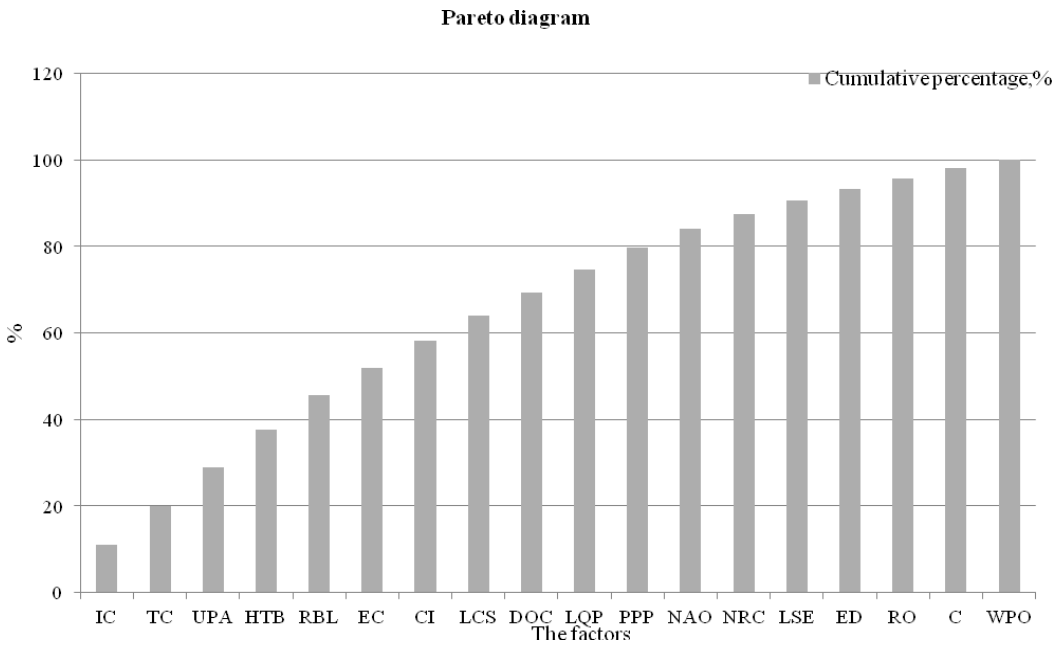
Factors	Abbrev	Group	Share of factor groups (external/ internal)	Ranking percentage	Cumulative percentage
The insolvency of counterparties	IC	E	22.20	11.10	11.10
Technical condition of fixed production assets	TC	I	17.80	8.90	20.00
The utilization of production assets and efficiency of use	UPA	I	17.68	8.84	28.84
The high level of tax burden, the inefficiency of stimulating functions of the tax system	HTB	E	17.60	8.80	37.64
The reduction of bank lending to industry, the high cost of loans, an overvalued exchange rate	RBL	E	15.80	7.90	45.54
The effectiveness of the contracts	EC	I	12.92	6.46	52.00
The crisis in the industry	CI	E	12.40	6.20	58.20
The loss of a customer from the state	LCS	E	11.40	5.70	63.90
The duration of the operating cycle	DOC	I	11.00	5.50	69.40
The lack of qualified personnel	LQP	E	10.50	5.25	74.65
The profitability of production processes	PPP	I	10.20	5.00	79.65
The number of received adequate orders	NAO	I	8.90	4.45	84.10
The number of regular and new customers	NRC	I	6.90	3.45	87.55
The level of skills and efficiency of their use	LSE	I	5.90	2.95	90.50
Energy (in) dependence	ED	E	5.70	2.85	93.35
The rhythms orders	RO	I	4.80	2.40	95.75
Corruption	C	E	4.60	2.30	98.05
The waiting period orders	WPO	I	3.90	1.95	100.00

E – external factor; I – internal factor.
Source: calculated by the authors.

All of the factors in the sum are 100% influence. The distribution shows that two powerful factors (insolvency of contractors and the technical condition of production facilities) in the sum influence on 20% that means – 20% of these factors shape 80% impact on economic sustainability, and the remaining 80% only add 20% of the result. Cumulative distribution of the factors of external and internal environment, which influence on the economic sustainability of the enterprises of the shipbuilding industry, by the Pareto's principle is presented in figure 4 (the abbreviation for the factors, look table 3).

Figure 4

Cumulative distribution of the factors of external and internal environment, which influence on the economic sustainability of the enterprises of the shipbuilding industry, by the Pareto principle



As can be seen, the most significant impact on the economic sustainability of the enterprises of the shipbuilding and repair industry will have the following: insolvency of contractors, technical condition of fixed assets, utilization of production assets and efficiency of their use. It should also be noted that the combined effect of all factors leads to a synergistic effect, i.e. improving the effectiveness of the joint action of factors in comparison with those, which operate separately. Therefore, the combined effect of the most important factors has a significant impact on the economic sustainability of industrial enterprises.

Research Conclusions and Outlook

Thus, the economic sustainability of enterprises of shipbuilding and ship repair industry is affected by many external and internal factors.

The identification of the factors and measure their impact on economic sustainability is a necessary component of it. Based on studies the external factors proposed to divide on the factors of direct and indirect impacts, and factors of the internal environment to classify on the factors shaping the economic sustainability, and the factors that affect it. This classification of factors will allow in the current economic conditions focus clearly, in a timely manner to determine the degree of risk and to adapt to the effects of the external and internal environment. Using this classification, it is possible to develop a set of indicators of assessing the economic sustainability of the enterprise in both the long and short term.

Using the method of expert estimations, the influence of exogenous and endogenous factors on the economic sustainability of the shipbuilding industry has been determined. So, the most significant external factors have been revealed the following: insolvency of counterparties (22.2%), high tax burden, the inefficiency of stimulating functions of the tax system (17.6%) and the reduction of bank lending to industry, the high cost of loans, an overvalued exchange rate (15.8%). The most significant internal factors have been identified: technical condition of fixed production assets (17.8%), utilization of production assets and efficiency of their use (17.7%), the efficiency of contracts (12.9%), duration of operating cycle (11%), the profitability of production processes (10.2%). Based on the Pareto's principle the most influential factors of the external and internal environment have been identified and assessed their impact. It was revealed that 80% impact on the economic sustainability of the enterprises supported by two powerful factors - the insolvency of contractors and the technical condition of production facilities, which total 20%, and the remaining 80% factors are added, only 20% of the influence.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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FEATURES, CHARACTERISTICS AND METHODOLOGY OF INTERNAL CONTROL OVER NANOTECH MANUFACTURING AND NANO-PRODUCTION IN FOOD INDUSTRY

Over the last years, the rapid pace of development of the nanotechnology industry has placed it as one of the leading industries, which occupies a significant part of the total world production share. The specific technology used in the nanotechnology industry, the distinctive features and characteristics of the final nano-production are prerequisites to seek for the proper mechanisms and methods of the implementation of internal control in nanotechnology enterprises. Therefore, the main objective of this study is to present the major control problems that exist and can be found in a nanotech company and the main control stages, procedures and methods for the implementation of internal control. Based on everything stated hereto, it can be assumed that the main objects of internal control in food-related enterprises which apply nanotechnology are: nanotech production; nanoproducts and products of nanotechnology development. Regarding the research problem of internal control of nanotechnology manufacturing and nano-production and internal control of research and development, the following main conclusions and recommendations can be drawn: 1) Internal control of the research control objects - nanotechnology manufacturing, nano-production, research and development - has not yet been established as the main means of revealing the behavior and modification of these objects; 2) No particular attention is paid to the analysis as a means of internal control. With the help of the analysis, the control process achieves a better diagnosis of the actual state of the controlled object, its planned and expected state. Applying the approved methodology of the internal financial analysis, together with the published data from the management accounting, the controllers can determine the reasons and the factors that influence the change of the controlled objects; 3) There is no interaction between internal control and controlling in the control practice, which in turn targets management and optimization of expenses, revenue management and management of the financial result of the enterprise. The two control concepts concerning internal control and controlling are still considered in isolation from each other. Because of the complexity of intertwining these two types of control (internal and controlling), the scope of the report has not been studied for their mutual application.
JEL: M40; M42; L65

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In recent decades a dynamic change has been seen in all spheres and fields of knowledge due to the introduction of many new cutting-edge technologies on the one hand and the attainment of good results and achievements in the scientific field on the other hand. The European Union contributes to progress in the development of nanotechnology, consequent to which the nanotechnology industry has been financed by various European programs and funds since 2004. According to *O. Mamedov* (Mamedov, 2011), one of the main reasons for this is that "Nanoscience and nanotechnologies have the potential to lead to more growth and more jobs in Europe and their development should not slow down, distort or leave without control". These events affect the development of accounting and auditing practice in the following areas:

1. There are new accounting and control objects, one such object being nanotechnology, which is a prerequisite for the formation of a separate new industry – the nanotechnological industry, requiring relevant legal regulations covering its specifics and peculiarities.
2. The establishment of new business units in the form of companies or centers, which shall adopt and approve the relevant accounting system and financial management and control system.
3. The availability of highly qualified staff, which requires promoting educational training programmes for maintenance and further development in the respective field.
4. The introduction of high-tech machinery and equipment, which may consist of individual production components considered as a separate reporting and control object.

Taking into account all the above, the ***objective*** of this study is to present and investigate the major problems and characteristics of the methodology of internal control over nanotechnology and nanoproduction in the food industry. To achieve such a set objective, we are addressing the following tasks:

1. To clarify nanotechnology process and nanoproduction as an object of internal control in the food industry.
2. To present the methodology of internal control over nanotechnology process, nanoproduction and objects (assets) resulting from research and development activities.

1. Nanotech manufacturing and nanotechnology products as objects of internal control

Nanotechnology as a modern, cutting-edge technology was introduced by the physicist Richard Feynman from the California Institute of Technology (CalTech). On December 29, 1959 during a scientific conference, he described a process in which scientists could manipulate and control individual atoms and molecules. Later in 1969 professor Norio Taniguchi coined the term nanotechnology and in 1981 with the advanced development of the microscope individual atoms were examined. In 1989, in Warsaw, a Congress of the Polish Psychotronic Association was held, where Assoc. Prof. Ivo Lozenski, PhD together

with Slava Sevryukova (Lozenski, 1991) and other Bulgarian scientists introduced a new atom model in their report "A Psychotronic model of the atom and atomic nuclei", which gave a strong impetus for the development of nanotechnology."

In terms of control, nanotech manufacturing processes and nanoproduction are relatively new control objects. From the standpoint of control, within the scope of object control, nanoparticles that are the basis for the realization of this production can be included in the scope of control, but may not be involved as well. This is due to the specific characteristics of nanoparticles (also called quantum dots), which are objects smaller than 100nm and some scientists consider that they are "all around us" (Treder, 2004) In terms of internal control, to characterize things as *objects of internal control* they should meet the following requirements:

1. *They must be available and really exist for an enterprise* – for manufacturing and production itself, undoubtedly they must be present and exist for the relevant enterprise. From the perspective of nanoparticles, when they are available to the enterprise and actually owned by an entity they are considered as objects of internal control. Otherwise, they are not subject to internal control, as the requirement for belonging is not satisfied.
2. *They must be measurable and comparable* – in the control practice, the measurability and comparability of objects are essential to determine the deviations and changes in the inspected object. In the control practice, natural, labour and value measures are applied, but this cannot be accomplished if the objects themselves are not natural, labour or value visualized and reflected. Accordingly, the connection and relationship between accounting and control practice are seen when an object is accounted for using quantitative and value metrics, then in the control practice the object will be also audited and analyzed with the help of these measures.
3. *They must be distinguishable from all other controlled objects* – distinguishability of the control object is a current condition, it is determined by the specific characteristics of the controlled object by identifying the object itself, but also the right to use and the ownership of the object itself.
4. *The object must be part of the operating cycle of the enterprise* – the accurate determination of the operating cycle duration in nanotechnology activity is essential, rather than the duration of the reporting period. According to IAS 1, the operating cycle of an entity is the time between the acquisition of assets for processing and their realization. The standard specifies that when the operating cycle is not clearly identifiable, it is assumed to be twelve months. In internal control, when the form of preliminary control is concerned, it can be determined whether the object is part of the operating cycle or not, which is the responsibility of internal auditors or internal control authorities. But when it comes to determining the term during which an economic advantage is gained from the relevant object, this is entirely an organizational and management decision, therefore in IAS 1 it is specified that the available objects (current assets) of an entity shall be grouped as current when:

a) the entity expects to realise the asset, or intends to sell or consume it, in its normal operating cycle;

b) it is held primarily for the purpose of trading;

c) it is expected to be realized within 12 months of the balance sheet date; or

d) the asset is cash or a cash equivalent (as defined in IAS 7 *Statement of Cash Flows*) unless the asset is restricted from being exchanged or used to settle a liability for at least twelve months after the reporting period.

All other assets should be classified as non-current.

5. *The object (asset) is within the scope of internal control* – when the object is within the scope of internal control, this means that it can be monitored by control actions, which represent a combination of different processes involved in the direct implementation of the control function.

Taking into account the above requirements, it can be assumed that the nanotech manufacturing process and nano-production in one nanotech company are subject to internal control. The *Nanotech manufacturing process* is a combination of all the actions, procedures and processes that take place in the nanotech company and are directly or indirectly related to the creation of a nanoproduct. Accordingly, the *nanotech manufacturing cycle* is the time needed to accomplish the production process (i.e. the period from the start of the production to the completion of finished products). Nanotechnology products may be in any form and variety, such as cosmetic products, medical products, food products, clothing and fabrics (such as water repellent fabrics, do not pollute the environment, or maintain a certain body temperature). Today, these products are widespread and used in the aerospace environment and military activity.

In recent years, nanotechnology has been rapidly introduced into the food production industry. One of the main reasons is that food resources worldwide are limited in their quantity. For example, in third world countries, food supply apart from being limited, is also of poor quality and not fit for human consumption. In terms of the food industry, more and more applications are being found for nanotechnologies using biologically engineered molecules and nanomaterials that have properties and functions other than the already known biological and natural molecules. It is by these biologically engineered molecules that qualities and properties of the food products are improved. On the other hand, "nanomaterials allow better encapsulation and release efficiency of the active food ingredients compared to traditional encapsulating agents, and the development of nano-emulsions, liposomes, micelles, biopolymer complexes and cubosomes have led to improved properties for bioactive compounds protection.

Nanotechnology also has the potential to improve food processes that use enzymes to confer nutrition and health benefits. For example, enzymes are often added to food to hydrolyze anti-nutritive components and hence increase the bio-availability of essential nutrients such as minerals and vitamins. To make these enzymes highly active, long-lived and cost-effective, nanomaterials can be used to provide superior enzyme-support systems

due to their large surface-to-volume ratios compared to traditional macroscale support materials.

Other benefits of nanotechnology in the food industry are:

- The processing of nanostructured food or supplements. The aim of this processing is to reduce fat and enzymes in products. For example, the fat used in mayonnaise, which is a high-fat product, is reduced by various emulsifiers.
- The application of biopolymers that improve nanoacid environment in the body for the delivery of nutrients and supplements in the form of liposomes or nanoencapsulated substances.
- The application of inorganic additives for the manufacture of food products that enhance the health benefits of the final food products. For example, food additives such as silica, titanium dioxide, selenium, platinum, calcium, magnesium, etc. are often included in the production of health foods.
- The application of degradable polymers, i.e. so-called bio-compostable plastics. For these plastic polymers containing or coated with nanomaterials for quick and organic decomposition, an increasing number of areas of application are being found in the food industry.
- The application of nanoscale sensors for food labeling - thus monitoring more easily the shelf life of the products.
- The decontamination of water resources. Many Western companies, especially those in the production of baby foods and drinks, such as Nestlé, Acorelle, Alphanova, Babybay etc., apply various nanotechnologies to reduce the content of heavy metals in the water, which is one of the main resources for baby food production.

The food industry is the largest manufacturing sector in the world, and statistics show that the annual net turnover from the sale of food and food products amounts to over $ 4 trillion. This sector has an enterprising and innovative nature from the perspective that it combines chemical and pharmaceutical industries, introducing new technologies and the implementation of innovative methods for processing food raw materials. The specific feature of the food industry lies in the fact that, globally, a considerable amount of food is consumed after being processed (thermal or non-thermal), such as fruits, vegetables, grains, etc., which changes their natural qualities. Another specific feature is that the majority of companies in the food industry are still low-tech, are small and medium enterprises and do not apply advanced nanotechnologies.

Whether food industry entities apply high-tech nanotechnology or not, they have one thing in common – their activity has three main stages, which have an impact on the implementation of the internal control, namely:

- The first stage is the delivery of the raw materials needed for production.
- The second stage is the production activity.
- The third stage is the realization of finished products.

The differences between high-tech and low-tech entities in the food industry are in the level of technological production risk. Nanotechnology, however significant and beneficial, still has "knowledge gaps" regarding the safe use of these technologies in the food industry. The safety of each potential use of nanotechnology in food products should be demonstrated and evaluated by the European Regulators before they can be used by food production entities in the European Union. In this respect, the European Food Safety Authority annually issues risk assessment guidance on nanotechnology in food and the feed chain (EFSA, 2011).

Nanotechnology enterprises have an essential feature that affects the conduct and implementation of internal control - nanotechnology-manufacturing activity makes it possible to produce a relatively new technological product that can be considered as a product as from development. In other manufacturing industries (energy, chemical, forestry, wood, etc.) such end production results cannot be seen or are relatively limited.

Based on everything stated hereto, it can be assumed that the main objects of internal control in food-related enterprises which apply nanotechnology are: nanotech production; nanoproducts and products of nanotechnology development.

2. Methodology of internal control over nanotechnology process, nanoproduction, research and development activity

In the previous part of this study it was clarified that nanotechnology process, nanoproduction and products that result from research and development activities are three different objects of internal control. What they have in common is that the control activities follow the successive stages of the control process. The stages of the control process are: identifying the object of control; determination of control requirements; determining the current state of the controlled object; comparison and collation of the state of the controlled object with the control requirements (rate); deviations in the nature and the result of the object of control from the control rate; and the final stage is the implementation of an impact system, just in case there is a deviation between control rates and the established state of the controlled object. The presence of three different objects requires a set of specific procedures, techniques, tools and methods for the implementation of internal control. Using various methodologies for control makes it possible to clarify the current problems of controlled objects, as well as to improve the entity's activity, through the opening of new production and management capabilities.

Taking into account the significant differences between the control objects under consideration, it can be assumed that the methodology of internal control differs in terms of:

1. identification of the essential characteristics of the controlled object;
2. determination of the qualitative and quantitative modification of the controlled object under the influence of various factors;

3. establishing and determining the irregular deviations and changes in the controlled object from the pre-planned and normally defined conditions;
4. application of different techniques, approaches and control procedures to the specifics of the controlled object;
5. the selection of appropriate controllable parameters that distinguish, characterize and describe the individual controllable objects;
6. the control tool needed to achieve the predetermined control tasks.
7. providing relevant information about the control process – for various control sites, as in the case under consideration, the information process will differ in terms of collecting information that is sufficient in volume and quality. It is necessary for the collected information to be synthesized and processed in a suitable and convenient manner to obtain the most accurate and precise control decision. This process does not end until the control decision is taken, proper identification and subsequent dissemination of information to affected and involved parties by control actions is necessary.
8. the complexity of the control process - the applied methodology shall depend on the technical security of the control process, as well as on the qualifications and professional training of controllers.
9. the interaction between the units and the elements that make up the organization and control environment in which the organization operates.

2.1. Methodology of internal control over the nanotechnological production process

The methodology of internal control over the nanotechnological production process represents a set of techniques, procedures, means and methods of control that help to properly ensure the legality and expedience of the production process. The main task of controlling the nanotechnological production process is to verify that the requirements for the production of the relevant nanotechnology product are properly applied, by checking and controlling all stages and activities in the production chain (process). According to *M. Dinev* (Dinev, 1984), the control over the production activity is carried out in relation to a production program and in this connection, it is necessary to carry out both the control of the production program and to control the realization and the implementation of the production program. Other researchers assume that control over the production process should not only be limited to the development and implementation of the production program, but should also cover how the cost of finished products is determined (Belov, 1988). We stick to this opinion, as cost is a monetary expression of the means actually used for the production of the respective finished products. The cost is a monetary representation of the expenses for raw materials, energy, labor costs, etc. incurred by a given nanotechnology entity for the production of a certain product. The cost is also an indicator for determining the profitability of manufactured goods and is one of the main indicators of production efficiency. The production profitability is calculated as "the ratio of the profit to the cost" (Pehlivanov, 1988).

In terms of better clarification of problems, namely control of nanotechnological production and control of the cost of nano-production, the two control processes shall be examined successively and separately from each other. The production process in the food industry is divided into three main stages, namely planning and organization of production, technological production and production management. Each stage is important, so much so that the raw materials and materials needed to produce the product shall be properly identified. Usually, nanomaterials and nanosupplies, if they are not produced by the entity itself, cost much more than normal substitutes or alternative materials and supplies. This is a prerequisite for requiring greater accuracy and precision in planning the quantities of raw materials delivered, as well as proper planning of their subsequent input into the production process.

Therefore, ***the tasks of internal control over the nanotechnological production process are:***

1. ***To inspect the elaboration of the production program*** – From a historical point of view, the approaches to achieving this task have significantly changed over the years. This is due to the fact that the two parties, namely the higher authorities (ministries, departments and the respective economic associations) and the organizations themselves (entities), actively participated in drawing up the production programs until 1990. Since 1990, when the transition processes for the accession of Bulgaria as part of the EU and the consolidation of the market mechanisms and the achievement of a stable market economy was carried out, the elaboration of a production program is within the competence and scope of the respective production entity. The state, as an institution, represented by the relevant organizations, agencies, ministries, departments, etc., is not involved in the individual development of the respective production entities, and therefore it is not a party that participates in and controls the production program. In the case of state-owned entities, which are formed by competent state bodies (municipalities, ministries, etc.) with the respective state-owned property, the state can influence the development processes of production programs by an approved management system or through the appointed supervisory board or the board of directors, only in cases where the production program concerned may affect the change of state-owned property.

The production program, as part of the business plan of the company, includes a system of quantitative and qualitative production indicators, the defined production objectives, the planned production volume, the planned assortment, the time set for production and the approaches for the realization of the production under a particular nomenclature. Therefore, in order to inspect the development of the production program, each constituent element shall be checked.

When inspecting the nanotechnology production program, it is essential to first determine whether it is product-oriented or market-oriented. In the food industry, the two approaches are frequently applied in the development of the production program, as for some products a market-oriented production program is applied and for others it is product-oriented. In nanotechnology production, the production program is product-oriented, as it is mainly aimed at creating new products with new uses or products with significantly improved

quality. Therefore, internal control over the development of the nanotechnology production program should mainly aim at assessing the production considerations concerning the production volume and assortment. There are cases in practice where the nanotechnology production program is market-oriented. In terms of internal control, much more information is needed in these cases - in the form of enquiries, reports, etc., concerning the needs of the market for which production is intended. This internal control information is needed to determine the intended use of the finished product, to define the scope of the production program, and to identify the raw materials needed to produce the type of production concerned. In addition, when it comes to controls on the production of nanotechnological food products, unlike the production of other food products, its scope and purpose is much more important. During the "inspection of the development of the production program for nanofood products " (IRGC,2011), internal control shall consider:

- the planned uses of nanomaterials in the production of food products;
- how the indicators for the ongoing risk assessment of the use of nanomaterials and raw materials in the production of food products are determined;
- the comparison between different assessments of acceptable levels for the presence of nanomaterials in food products.
- whether the production program allows for ongoing risk management and a review of approved regulatory activities on the current production of food products.

2. ***The second main task is to inspect the implementation of the production program*** – According to *M. Dinev*, the technological control over the implementation of the production program refers to the examination of the predetermined and defined volume indicators (quantity, range and volume) (Dinev, 1984). The initial stages of the control relate to the comparison of the actual results obtained for the volumes produced with the plan, i.e. it is necessary to draw up an estimate of the finished goods produced, of the goods sold and of the work in progress during the period. This information should be duly documented by the accounting departments of the entity, the warehouses and the production departments (especially as regards the determination of the volume of work in progress). When analyzing the indicators of finished goods and work in progress, the established data on the implementation of the production program may have the following meanings:

    - when the indicator for finished goods produced is above the defined rate specified in the production program, it means that the production program is overachieved. Which in turn means that further analytical and managerial clarifications shall be made, namely: whether this overachievement of the plan results in finished goods being stored too long in warehouses or whether this production is distributed in good time and together with planned production.
    - when the indicator for work in progress exceeds the previously planned rate for the relevant controlled period, this means that there is a substantial delay in the production process, which in turn can lead to additional production costs and subsequent losses of the production plant. This, in turn, is a condition for the indicator of finished goods produced to be below the defined production rates,

which may, in turn, slow down the current production revenues generated by the enterprise.

Therefore, on the basis of the above, it can be assumed that taking into account the indicators of finished goods produced and work in progress, the production program will be implemented in terms of quality and quantity only in cases where the relevant controlled indicators have reached the predetermined rates. In the manufacture of nanotechnology foods, when inspecting the implementation of the production program, internal controllers, in addition to indicators of finished production and work in progress, whether the relevant production program complies with a number of international regulations and requirements should be inspected, such as (Cross, 2010):

- Global Core Principles of Responsible Care
- European Commission Code for nanosciences and nanotechnologies research.
- A code of conduct for responsible nanosciences and nanotechnologies research (***Code of Conduct for Responsible Nanotechnology***: (***Responsible Nano Code***) – the code was approved in 2006 by three non-governmental organizations, namely ***Insight Investment*** *(one of the largest global investment management companies), the* ***Royal Society*** *(the Royal Society of London for the Improvement of Natural Knowledge and the international* ***Nanotechnology Industries Association***. The Code is based principally on the achievement of a responsible and safe nanotech production.
- The established nanoproduction framework (***The Nano Risk Framework)*** **–** The framework focuses on engineered nanoscale materials that exhibit novel properties of nanomaterials and consist of particles or physically discrete entities, that are below 100 nanometers (nm) in one or more dimensions. The term "nanomaterial", as used in this document applies to such components, either in their original form or as ingredients in products from which they could be released during the activities.

These four statutory requirements shall be observed during the nanotechnological production process. Otherwise, it is assumed that the finished nanoproduction is harmful and significantly endangers human health. In order to verify that the regulatory requirements for the implementation of the production program have been complied with, it is necessary:

- To verify that the established safety principles of production have been followed.
- To inspect the specific direct actions taken to examine the inputs of nanomaterials, as well as to review the risk assessment.
- To verify the information provided on the individual production units in view of the adequate dissemination of the results of the research carried out in the enterprise itself (in the cases where the enterprise also performs research).
- To verify the existence of new production processes, whether they are included in the approved production program or it is necessary to adopt an individual production program, respectively.

- To ensure compliance with the requirements of Standard ISO/TS 27687:2010 regarding standard requirements for nanotechnology production.
- To ensure compliance with the approved ISO 22000 standards on the implementation of the Food Safety Management System as well as compliance with the recommendations of the standard on the production of food products that are safe.
- To ensure compliance with approved Occupational health and safety management systems for nanomaterials, as required by ISO 18002:2008.
- To ensure compliance with the uniform criteria for contaminants in foodstuffs under Regulation 420/2011, which sets maximum levels for contaminants in foodstuffs. It is permissible to allow the presence of contaminants in foodstuffs within the limits of the production program, i.e. "substances which are swallowed with foodstuffs have no nutritional value, are not typical of the products concerned and have a detrimental effect on the organism" (Dineva, 2016). In the food industry, the permitted levels of contaminants, which may be contained in a ready-made food product, are preliminarily prioritized in the production programs. With the aid of laboratory analysis, as a means of control, it can be ascertained whether there are deviations from the predetermined contamination limits.
- To inspect the levels of radioactive contamination in food products. Such contamination may occur in the presence of a nuclear accident or radiological contamination, as "the maximum permitted levels of radioactive contamination in foodstuffs are determined in accordance with Commission Regulation (Euratom) No 944/89 of 12 April 1989" (Dineva, 2016). The last nuclear accident was in March 2011 in Fukushima. According to the physicist *Uwe Stoll*, "16,700 PBq (Petabecquerel) and xenon-133 (1PBq equals one trillion becquerels) were released into the atmosphere for the period from March 11th to March 15th. This is the largest leak of radioactive noble gases in history that is not related to military nuclear experiments" (Dineva, 2016). In recent years, scientists have agreed on the idea that even the smallest radioactive contamination levels are conditions for the presence of cancer diseases among the population.

The main internal control tool to determine the performance of the production nanotechnology program in the nanotechnology manufacturing process is analysis. In this regard, internal controllers should perform an analysis of the production program in the following order:

- *Analysis of the change in finished goods produced*– the analysis of the change in finished goods produced allows for timely determination of the state of the production program in terms of change in the production capacity and change of inputs and raw materials. The absolute change in finished goods produced can be defined as the difference between the ***finished goods actually produced (Fgap)*** *and the planned quantities of* ***finished products defined in the production program (PqFpdpp),*** i.e. ***P= Fgap - PqFpdpp***.

Accordingly, the relative change in the production program can be determined in relation to the relative change in finished goods produced. The exact relationship and dependence between the two indexes – ***finished goods actually produced (Fgap)*** *and the* ***planned***

quantities of finished products defined in the production program (PqFpdpp) shall be determined by the indicator for relative change in finished goods produced. The indication shall be calculated as the ratio of ***Fgap*** to ***PqFpdpp*** multiplied by 100, i.e. ***Po = (Fgap: PqFpdpp)*100***

- *Analysis of the rhythm of the production activity* – the rhythm of the production of finished goods is subject to a separate assessment by the controllers. Production is rhythmic when an equal production volume is manufactured at equal intervals. Rhythmic production is a prerequisite for the efficient and qualitative input of resources and materials. When controlling compliance with the production program, controllers should analyze the rhythm of production activity in relation to the defined indicators in the production program. For this purpose, it is necessary to apply the comparison method by distinguishing the production activity of separate periods that shall be further compared with the data and indicators laid down in the production program. According to *M. Dinev*, "the comparison between the plans and the reporting data for the individual interim periods shall be combined with the comparison of the volume of the finished goods and the volume of goods to be sold. The difference between these dimensions will point to some inconveniences that need to be carefully and thoroughly examined" (Dinev, 1984).
- *Analysis of the production intensity* – In order to analyze the implementation of the production program, a general assessment of the production intensity is required, as for this purpose it is necessary to "calculate the intensity coefficient of the production program"(Sokolov, 2006) according to the following formulas:

$$Cpi = \frac{Pvgp}{Nvgp}$$

$$Cai = \frac{Avgp}{Nvgp}$$

Where:

Cpi – planned intensity coefficient;

Cai – actual intensity coefficient;

Pvgp – planned volume of goods produced;

Avgp – actual volume of goods produced;

Nvgp – normative volume of goods produced, determined according to the normal production capacities of the enterprise.

The intensity coefficient of the production program has its technical and economic importance as it is based on the actual production capacity of the plant and not on the maximum allowable power. Determining the intensity of the production program depends on the organizational and technical production conditions, the methods and the type of technical organization. Controlling the intensity of the production program is entirely within the power of internal control. The intensity of production compared to the normal

production capacity of the plant is also relevant in order to determine the production efficiency. In control practice, the audit is the main method of actual control, establishing the status and implementation of the production program. When monitoring the implementation of the nanotechnology production program, the audit can identify:

1. The technological organization of the overall nanotechnological production process.
2. Provisioning of nanomaterials and nanoresources for the manufacture of nano-products.
3. The state of the technical and laboratory control, especially as regards compliance with the normative requirements for safe working conditions.
4. The state of the technical and laboratory control, regarding the compliance with the normative requirements for the production of quality and harmless nanotechnological food products.
5. The normal and maximum allowable production capacity required for the manufacture of nano-products.
6. Staffing for nanomanufacturing of nanoproducts.

3. ***The third main task of internal control over the nanotechnological production process is to achieve an optimal combination of production factors*** *in terms of minimizing inputs of raw materials and utilization of production capacities and staff* (Simeonov, 2004).
4. ***The fourth main task is to minimize the utilization parameters of staff and production capacities*** (Simeonov, 2004).
5. ***The fifth main task of internal control is to considerably minimize the volume of defective goods,*** *and if there are such defective goods, they should be properly used either in the same main production or in other ancillary production activities*.
6. ***The sixth main task is to achieve the required quality standards for the production process.***
7. ***The seventh task of internal control over the nanotechnological production process is to achieve a consistent execution of operations*** within the technological process, including the optimization of the process for obtaining the intermediate goods.
8. ***The eighth main task of internal control over the nanotechnology production process is to promote an accurate and precise definition of nanotechnological expenses of raw materials in the cost of finished products.***

The most common infringements found while monitoring compliance with the nanotechnology production program are:

1. Failure to periodically update amendments to the Nanotechnology Production Program.
2. The planned production results are not achieved or maintained, because the planned quantitative and qualitative indicators are not achieved.

3. Substitutes of the raw materials and resources are used in the manufacturing process instead of nanomaterials and nanosciences determined in accordance with the technological requirements and plans.
4. The minimum standard production volume is not maintained and in most cases the production volume is below or above acceptable limits.
5. Additional raw materials and resources, that are not planned and determined, are used in the production.
6. Incorrect storage of raw materials and resources, as well as improper maintenance and observance of certain sterile requirements for the nanotechnology production.
7. A large quantity of unfinished production for the period under review or increased quantity of manufactured finished products.

Based on the above, it can be assumed that internal control over the nanotechnological production program is a good management mechanism for compliance with the production rules that are regulated by relevant internal and external regulatory instructions, regulations and laws. With the help of internal control over the nanotechnology production program, the long-term strategic objectives and tasks of the food industry can be defined. In addition, internal control allows for an industrial monitoring of emissions, pollution and sterility levels in production facilities. The complex nature of internal control over the observance of the production program is manifested in the simultaneous application of the means of documentary and factual control, and is revealed in the complex interaction between the different control bodies and individuals.

2.2 Methodology of internal control over nano-production

Internal control over nano-production reveals the links between the implementation of the predetermined production program, the company's current priorities and the relationship between costs, the volume of goods sold and the profit of the enterprise. On the other hand, the sales of finished products are one of the important mechanisms for the realization of the circular turnover of the existing capital of the enterprise. The qualitative transformation of the available capital into the production process and its realization in commodity capital is possible through the realization of the finished products in the sphere of the circulation. Therefore, not only the production of finished products but also their realization must be subject to ongoing internal control in order to ensure the efficiency and effectiveness of the circular turnover of the available production capital.

The main tasks of controls over the production and the realization of nano-production are:

1. *To establish compliance of the production nanotechnology plan data and the implementation of the finished nanotechnology production cost plan* - In order to accomplish this objective, controllers should have good professional and theoretical knowledge of the production of nano-products, including good knowledge of the approved admissible regulations for the consumption of nanoresources, nanomaterials

and nanosciences. Therefore, internal controllers should comply with regulatory requirements. The regulatory bodies in each country, respectively the regulatory bodies of each industry and in each production plant, shall adopt their normative requirements for the consumption of nanoresources and nanomaterials, according to the European directives and decisions. In all cases, the main purpose of "each authority is to establish a regulatory framework and maintain/enforce regulations to ensure that food consumed and sold within their respective countries is safe. There is a move towards harmonization of food regulations, as illustrated by Australia and New Zealand and by Mercosur"(Magnuson, 2013).

The European Union has also laid down rules applicable to all Member States, to establish a general authorization procedure for direct food additives, flavorings and enzymes which are considered as nanomaterials and nanoresources. Although the path of approval of the different categories of food additives varies due to the different jurisdictions of the countries concerned, there are still many common data and safety considerations among them for assessing the safety of the use of food supplements, including the use of positive lists of approved substances. Each regulatory authority should approve the production of a nanotechnology product before it is placed on the market and this decision can and must be based on scientific decisions (otherwise the health and lives of consumers of food products would be endangered) and should be separate from the political decisions on the introduction and expansion of the state's productive activity.

In Bulgaria, the main regulatory authority empowered to control food safety and quality is the Bulgarian Food Safety Agency (BSAF). BSAF is the primary agency that has the power of an external control body (for companies within the food industry) to control the use of nanomaterials in the form of additives, flavorings, enzymes, etc. in the production of food products. Under the Food Act in Bulgaria the use of nanoresources, nanomaterials and nanosciences is only allowed in cases where the need for their use has been proven to achieve a certain technological effect, there is no danger to the health of consumers in the quantities in which they are used and their use also does not mislead the consumer as to the type and characteristics of the food. In the cases when BSAF carries out external control, the internal controllers approved by the company itself should assist in the performance of the control activities.

From the point of view of internal control, the inspection of the implementation of the cost plan of the finished product is part of the inspection of the implementation of the nanotechnological production program. The planned cost of the finished nano-production is included as a component in the overall planned production program. Therefore, both the plan calculations and the plan parameters determining the change in cost are the subject of the inspection. The comparison of the planned data with the actual established data is carried out by comparative analysis. The existence of a discrepancy between the planned production nanotechnology program and the cost performance may be due to a number of factors, such as: changes in the volume of manufactured goods; change in the rate of cost savings; changes in the assortment variety of produced finished products; change in the supply price of used raw materials, incl. changes in the cost of nanoresources and nanomaterials.

In order to control the execution of the planned cost, at all stages of its determination, internal controllers should implement the analysis as a means of control. *In this regard, it is necessary to perform:*

- *Analysis of production (direct) cost* – the production cost is determined by the value of the raw materials and supplies used, the processing costs and other costs related to the manufacturing of the products (Dimitrov, 2015). In the Additional Provisions to the old Accountancy Act in Bulgaria (i.e. until 2016), cost was defined as "the measurement of assets produced (created) at an enterprise not including any administrative expenses, sales expenses, financial or extraordinary expense". In other words, from a normative point of view, the legislator has determined that the goods manufactured by the enterprise shall be assessed by the production cost. The new Accountancy Act in Bulgaria (effective as of 2016) does not provide a normative definition of the concept of cost. Article 26 of the new Accountancy Act states only that "the measurement of items which are recognised on the financial statements is carried at cost, which may be the purchase price or production cost, or by some other method when this is required by the applicable accounting standards".Therefore, the legislator presents the cost as not only the valuation of assets produced (created) at an enterprise but also as an option to measure the items presented on the financial statements. One important advantage of the new Accountancy Act is that, once it has not been specified what the legislator implies under the notion of cost, it might be acceptable to include the items in the financial statements through each of the approved types of cost (production, trade and total cost). From the point of view of national accounting standards, the latest **Decree No 394 of the Council of Ministers 2015** for the Amendment and Supplementation of the National Financial Reporting Standards for Small and Medium-sized Enterprises adopted by Decree No 46 of the Council of Ministers of 2005 (promulgated, SG 30/2005, amended and supplemented 86 of 2007), specifies that the measurement is "a process of determining the values by which the enterprise recognizes its assets, liabilities, income and expenses on its financial statements. The measurement includes a selection of measurement bases. **Measurement bases may be*: purchase price, cost or fair value***". Pursuant to that Decree, the term "cost" means " the measurement of assets and services produced (created) at an enterprise, which is determined by the value of raw materials and supplies used, the processing costs and other costs directly related to the manufacturing of the product concerned or the service rendered. Costs do not include administrative, financial, storage, sales and other costs not directly related to the manufacturing of the product concerned or the service rendered". Therefore, from the point of view of the National Financial Reporting Standards for Small and Medium-sized Enterprises, the valuation of the goods produced by the enterprise should be carried out at their cost, and in the preparation of the financial statement according to the requirements of Accounting Standard 2, the inventories (to which the goods produced also refer) should be measured at the lower value between the historical cost (purchase price, cost or fair value) and the net realizable value, the difference being accounted for as current operating expense. By comparing the requirements of IAS 2 and Accounting Standard 2, it is found that the International Accounting Standard does not use the term value added (i.e. historical cost) but the term cost. For this reason, IAS

2 states that the inventories shall be measured at the lower of either the cost or the net realizable value.

As the object of the control is the production cost of the nano-production, it is necessary to identify and distinguish the expenses that are directly related to the manufacturing of the respective nano-production, from the costs that relate to the total and the trade cost. In this respect, in the control process, expenses shall be grouped and analyzed by economic elements if this is not done by the enterprise itself. It is also necessary to group the expenses by stage of calculation, those related to the manufacturing of the respective nano-production, namely: expenses for basic raw materials and supplies; expenses for nanomaterials and nanosupplies; the salaries and social security expenses of staff employed in the manufacturing of nano-production; depreciation costs of machinery and equipment employed in the production of the relevant nanotechnology product; other production expenses related to the manufacturing of the relevant nano-product.

- *Commercial cost analysis* – obtained when the sale and realization expenses are added to the production cost (Dimitrov, 2015). According to *R. Ivanova* (Ivanova, 2016), „on grounds of the "*Production sale expenses*" item, the absolute and relative economy is determined, or over-expenditure of costs on individual calculation items in the sales activity. On the grounds of this information, their influence on full cost dynamics is determined on 100 levs of production, the profits from production sale and sale profitableness".

- *Full cost analysis* – obtained when the administrative expenses, i.e. the organization and management expenses, are added to the commercial cost. According to *R.Ivanova*, ***the full cost index on 100 levs of production*** „describes the cost of production sold, borne by 100 levs of net income from production sales to industrial enterprises. It is calculated as a percentage relation between the full cost and the cost of production sold, presented by net sale prices". In control practice, there are cases in which full cost is determined out from the accounting, i.e. no calculation accounts are applied, but calculations for the accounting of production sale are applied directly. This vicious practice is observed in cases when enterprises have concluded preliminary contracts for sale and the entire planned production quantity is accounted in advance as already sold.

- *Analysis of the absolute sum of economies from cost reduction* - When determining the amount of the absolute sum of economies from cost reduction, the following is required:

- *First,* to distinguish the meaning of value and cost. The main difference between these concepts is that "value is measured in time, while the cost is determined indirectly through the prices of the means spent for the manufacturing " (Timchev, 2011). This means that not the value, but the prices of the means used for the manufacturing exercise a permanent influence on the cost level and dynamics.

- *Second,* during the control process it is necessary to determine if the production manufactures is comparable (with a previous period of accounting) or if it is incomparable (i.e. the respective assortment and type have not been manufactured in the previous periods)).

- *Third,* in order to determine if there is an economy from cost reduction, the accounted production volume must be multiplied by the previous cost (from a previous period of accounting) and compared with this production which is exactly accounted but determined by the accounted current value. The difference between these creates an economy by accounting, i.e. when the difference is positive and at the same production volume, this creates a positive economy, as during the previous accounting period the cost was higher than the cost during the current accounting period. And vice versa, if the difference is negative, this means that the cost during the previous accounting period at preserved production volume was lower in value than that of the current period of accounting.
- *Fourth,* determination of the absolute sum of the economy from cost reduction as the difference between the manufactured production volume, determined by value according to the actual cost during the accounted period, and the same manufactured production volume, but determined by value according to the planned cost. From the point of view of the enterprise itself, the absolute cost economy is a prerequisite for increasing the current company profit, increasing the manufacture profitability, and prerequisites are created for expanding the manufacturing capacity. In addition, systematical reduction of cost leads to releasing raw materials and energy, it is a precondition for the better use of equipment and other means of work and leads to accelerating the working capital turnover and to releasing financial resources.
- *Analysis of the relative size in percentage of the economies from cost reduction* - this index is obtained by dividing the absolute sum of cost economy by the planned cost and the result is multiplied by 100 (i.e. to get a %). The internal controllers should take into consideration the fact that the relevant change of cost reduction may be due to some impermanence due to enterprise factors, such as for example a temporary change of manufactured production volume, a temporary change of production capacity etc. In this connection, the controllers can indicate to the enterprise management, how and in what way this relative economy size can be preserved against a permanent cost reduction.
- *Analysis of the cost index per 100 levs of production* – this index is determined as a percentage relation between the full cost of the production and the production cost per sale prices, not taking into consideration the indirect taxes. From the internal control point of view, the results determined from this index for the respective year shall be compared to the planned production cost, determined in the production program. Thus, during the nanoproduction manufacturing, by the analysis of the cost index per 100 levs of production, it will be determined if there is a negative trend for cost increase compared with previous accounting periods. This index is directly related to the production profitableness, since the profitableness represents the profitability, and by the cost index per 100 levs of production, the company profit is determined from the respective production sale. For more qualitative and effective control on the ready nanoproduction cost, the controllers should make a factor analysis of all the three (3) basic factors influencing the index change, and namely: To determine and to analyze change in volume and assortment of ready manufactured nanoproduction; changes in raw materials prices and changes in a single article cost, respectively.

- *Product structure analysis* – During the last years, increased interest in internal control of manufacturing structures has been observed, as a possibility for the development of manufacturing enterprises. Product structure is a component of the management structure of a given enterprise. Its implementation and approval is suitable for large corporations and enterprises which have a significant market share and which are present in many market segments in various geographic regions. Companies such as *Coca-Cola, Danone, Nestle, Mondelēz International etc.* have an approved product structure. Product structure is always oriented to the consumer himself, it is created to cover the needs of respective consumers of products under the required product quantities and terms. According to *Philip Kotler* (Kotler, 2009), items in the product structure are united in a product series, which consist of groups of products, closely related because of their similar function. These products are sold to the same groups of customers, they are offered in the same way or are grouped according to their similar price range.

Disposal analysis – Disposal is "an aggregate of functions for the provision and realization of the sale (exchange) of manufactured goods and services," (Simeonov, 2004) i.e., disposal can be considered as an aggregate of actions and relations between market subjects relating to transferring the ownership of manufactured production from manufacturer to consumer. It can be accepted that disposal is the final stage of the manufacturing process, by which the return on invested raw materials is achieved, by cash revenues from the sales and ready products realized. In the nanotechnological manufacturing process, unlike the other types of manufacturing processes, the enterprise should develop and implement relevant disposal policies. This requirement must be maintained as the nanoproduction value is much higher than the other types of manufacturing productions that are offered by the food industry enterprises. With the aid of disposal policies, the distribution policy is regulated as well, which includes the entire activity of the distribution, delivery and transfer of the ready product to the final consumer.

2. *The second main task of the internal control is to check if the method chosen for cost calculation is suitable for the respective type of nanoproduct* – in order to fulfil this task, the internal controllers shall:

    - *determine the specifics of the finished nanoproduction* – i.e. whether the manufactured production is monocomponent (simple) nanoproduction or multicomponent (complex) nanoproduction. When determining the cost of a monocomponent production, it is not necessary to use a complex method, since usually, a single product is manufactured (regardless of the fact that it may be intended for mass consumption), for which only one calculation is made. In multicomponent production, consisting of individual components, a calculation of the individual components is carried out. In the food industry, „85% of manufactured production is monocomponent. Only 15% of manufactured production is considered as multicomponent, for example, the manufacturing of infants' purées and foods for which the package (glass pot, glass bottle etc.) are accepted as a second component".

- *to determine the manufacturing cycle duration* – in the individual manufacturing sectors, the duration of the manufacturing process differs, from several hours to several days. For example, in machinery construction, shipbuilding etc., the manufacturing process could be months, for other manufactured products, the manufacturing process could be years, for example the creation of humanoid robots etc. The woodworking industry presents a seasonal manufacturing process. In the food industry, the years-long manufacturing process has changed, especially with the introduction of new technologies and the use of additional imported half-finished raw materials. Thus, for example, the brewery industry used to have a seasonal character because of the seasonal character of the raw materials (barley, hops and leaven), of which the beer is made. Today, the manufacturing process in the brewery industry is from several hours to several days, since the necessary quantities of raw materials are delivered both from Bulgarian manufacturers and, in winter, a significant part of the raw materials required are imported from abroad. Under this principle, enterprises such as Crosspoint EOOD, Kamenitsa AD, Zagorka AD, Carlsberg Bulgaria AD and others operate.

The duration of the manufacturing process is one of the main factors that influence the approval of a method for the calculation of the ready production cost. Hence, the internal controllers should examine very closely the influence and impact of this factor, since the cost calculation methods for productions received during manufacturing processes with a prolonged manufacturing cycle (months, years or seasons) is much more complicated than the calculation methods for manufactured productions whose duration is days or even hours. The complexity is determined by the large volume of uncompleted production obtained during the prolonged manufacturing process. During the control process, it has to be monitored if the administrative expenses, management expenses and expenses for the manufacturing process servicing are to be correctly distributed, as well as the expenses of a seasonal character when they refer to the manufacture of the respective product.

In the control practice, enterprises must implement not one but several methods for calculating the ready production cost, since various ready products are manufactured in the enterprises. For example, during the manufacture of homogeneous products that do not involve semi-manufactured goods, the direct method of calculating the cost of the ready products is used. During the manufacture of mass and serial production involving various and complex productions (consisting of multiple details and components), the normative method is used for calculating the cost of the ready items. A particular character of the "normative cost calculated during the normative method of calculation is the fact that its basis involves the norms of expenses sustained at the beginning of the period, which correspond to the manufacturing techniques and technology used at that moment" (Pehlivanov, 1988).

In nanofood production, mainly in the food industry, two methods for calculating the cost of the ready products are used. The first method is the phase method, which calculates the cost of the production of nanofood which is for mass consumption, since for its manufacture, physiochemical and thermal manufacturing processes for turning the nanomaterials into ready production prevail. The manufacturing process has several subsequent and permanent phases. Sometimes these phases are separated as individual

independent manufactured products. During the phase method, "the expenses for manufacture are formed in each workshop (phase), separated and calculated independently, including in each subsequent stage, the costs of the semi-manufactured components obtained from the previous workshop (phase)" (Pehlivanov, 1988).

The second method, which is frequently used for calculating the cost of ready nanoproducts manufactured, is the order method. This method is applied in the case of individual production and or the production of small series. From the internal control point of view, the contracts, by which the respective orders are placed, shall be examined; the nature of the order, and its technological and implementation time shall be determined, and the accounting of this order shall be checked. During the control of the execution in the order method for the calculation of the ready product cost, it has to be taken into consideration that „the performed manufacturing expenses for the particular order are accounted separately and approved calculation items are applied, and the expenses for raw stuff, materials, fuel and energy are in individual groups. For products for which no such detailed calculations are required for their actual cost, the expenses accounting can be performed only by calculation items without a detailed decoding of materials per groups" (Pehlivanov, 1988). According to the order method, the actual cost for each single product is calculated after the manufacturing of the entire order has been completed, whereas the total sum of the expenses is divided by the quantity of products manufactured for this particular order.

3. *The third main task of internal control is to help distinguish direct from indirect costs, as well as differentiating between constant and variable costs* – solving the problem of properly identifying production costs is not only within the power of internal control but it is mainly within the powers of business executives and accountants. The integration of the ERP and SAP systems has helped to solve this problem in production plants, and it can be assumed that it is now outdated. For example, the direct costs and indirect costs for the production of different products (Shumensko, Touborg, Erdinger, Karlsberg, Pirin, etc.) can be easily distinguished through the established ERP system in Carlsberg Bulgaria AD.

Direct costs explicitly and unambiguously refer to the cost of the finished product, as well as the costs of materials, salaries, social security, etc. In other words, these are expenses that are directly related to the production and the creation of the product concerned. Due to its specificity, indirect costs cannot be uniquely attributed to the production of a product because they are common or refer to several calculation items (Brezoeva, 2005). The ERP system provides a very good option for including indirect costs in the cost of the finished production by automatically allocating these costs to a specific production basis (man-hours, machine hours, processed meters, etc.) or distributing them equally between all units produced during the time period. Indirect costs can be production costs (such as maintenance, repair, depreciation, insurance, etc.), organizational and management costs, distribution costs (when different assortments are delivered to the respective customers at the same time), and advertising costs (for example, when different products offered by the same producer are simultaneously advertised by one and the same media) etc.

Another specific feature of internal control is that it is necessary to determine what part of ***the indirect production costs are variable*** and what part are ***constant***. With regard to ***direct cost control***, its realization is significantly easier in view of the fact that the **direct costs**

are always variable because their value directly depends on the change in volume of goods produced. Unlike direct cost control, *the control over indirect costs of production* requires the monitoring and control of the processes by which the indirect costs are distinguished as variable (i.e. costs that are dependent on changes in production volume) or constant (i.e. costs that remain relatively constant irrespective of the volume of production, such as: depreciation costs (if the linear depreciation method is applied), maintenance costs of the factory buildings, etc.) and various methods, such as mathematical methods, planning methods, accounting methods, etc., can be applied.

4. *The fourth main task of the internal control of the finished nanofood products is to inspect the contractual relations between the manufacturer (the seller) and the recipient of the finished goods produced* – in order to accomplish this objective, controllers shall examine the content of the concluded contracts, in addition to inspecting the fulfillment of the contractual obligations. The contract may contain a set of rights and corresponding obligations. Thus, in the sale and purchase agreement, the "right of the buyer to request the delivery of the goods and the corresponding obligation of the seller to deliver the goods" can be identified " (Ivanov,2009). From a legal perspective, this is the first contractual obligation between the two parties. Under the relevant contract, the seller has the right to demand payment for the goods and the buyer has the obligation to pay for them. In this sense, this is the second contractual obligation between seller and buyer. In the contracts between the parties, there may be a provision for the transfer of the claim if the payer cannot cover it. Normally, the whole procedure is governed by a separate contract (cession) for transferring the claim from one holder to another. Accordingly, the time limits and methods for the payment of the receivable between the new holder and the manufacturer shall be legally defined.

5. *The fifth main task of internal control is to react promptly in the event of detected violations and infringements relating to the production and sale of the finished products* – The proper application of methods, approaches, methodologies and control instruments by the internal controllers is a prerequisite for establishing deviations in the actual state of the controlled object from the pre-established and defined standards. The application of methods such as analysis, synthesis, induction, deduction, testing, etc., in internal control practice, are often interrelated and used to detect infringements, misuses and mistakes. This is one of the meanings of internal control, which has been assigned the task of regulating the behavior of the controlled object by developing a correction program. The internal controllers cannot impose sanctions and hold liable the persons guilty of the incorrect and poor quality (deviation) of the controlled object. The corrective program shall contain prescriptions, guidelines and also a description of the legislative and appropriate procedures for regulating the status of the controlled object. At the core of the correction program is the information feedback between the controlled entities and the management of the enterprise, regarding the formulation and adoption of the right organizational and management decisions.

6. *The sixth main task is to provide methodological assistance to the financial and accounting department of the enterprise regarding the provision of timely and accurate information on the results of the control activity*. For this purpose, the reports that are prepared during the control activities shall not only contain descriptive information

about the controlled object but also the information that is derived using the mathematical and statistical control methods.

The main sources of information for the internal control of finished nano-production are:

1. Nonaccounting sources of information: distribution policy; strategic estimates for sales policies; information on competitive products; graphs and charts for the competitiveness of manufactured products - nanofood; agreements with contractors; certificates of quality of the manufactured finished goods (nanofood) and other documents.
2. Accounting sources of information: schedules for the sale of the finished nanotechnology products; reports and references of customer payments; chart of accounts of production plants; the spending norms of reference for the direct costs of raw materials and supplies; protocols for finished products; protocols for the acceptance and delivery of finished goods from the production workshops to the warehouses of the enterprise; information from the accounting records; inventory book; inventory list; comparative lists; documentation of the availability of the finished products; invoices; documentation of the waste of finished products; goods received note; warehouse receipt note; protocols for the free receipt of raw materials; sales report; a cost-accounting registry; annual depreciation plan of the assets engaged in the production activity; payroll for the persons employed in the production and sale of the finished products; a book on inventories and other reporting sources of information.

The most common and detected violations in the control of finished nano production are:

1. The method for calculating the cost of finished products is incorrectly applied.
2. The direct and indirect costs, as well as the variable and constant costs, are incorrectly distinguished.
3. The incorrect distribution of accrued costs according to cost centre, i.e. whether they fall within the scope of cost centers for the manufacturing of nano-products (respectively the production of nanofood) or within the scope of cost centers for the other types of finished products.
4. Indirect costs are improperly allocated between cost centers for the main activity and costs centres for the ancillary activities.
5. The indirect cost allocation bases, which allocation is a cost-determining component of the finished nano-production, are incorrectly applied.
6. The production costs involved in determining the cost of the finished nano-productions are improperly grouped.
7. The planned production cost of the manufactured nano-production has not been correctly determined and the cost plan has not been properly drawn up - the plan calculations have not been drawn up based on the system of technical and economic norms and standards for the use of the production machinery and equipment. In the valuation of the nanomaterials necessary for the production of the planned nano-production, the delivery prices of the nanomaterials are not determined and not used

properly, since the value of the waste generated in the production of the nano-production is not deducted.

8. The object of calculation and the unit of calculation are not properly defined for each type or group of produce according to the particularities of the produced nano-product.
9. The sub-product segments and product groups are not properly defined, which therefore negatively affects the defining and implementation of the distribution policy.
10. The relationships between the parties involved in the purchase and sale of nano-production are not properly negotiated or regulated.
11. Business transactions relating to the production and sale of the finished nano-production are not accounted for.
12. Business operations relating to the production and realization of the produced nano-production are not documented.

3. Methodology of internal control of products from research and development

The manufacture of nanoproduction, in the form of nanofood and nanoproducts, cannot be carried out without the existence of well-established research and development departments in the enterprise. The research and development departments have a definite purpose and the departments' powers are limited in terms of the production process itself. The main purpose of the departments is:

1. The development of an optimal innovation idea and realization of this idea in the form of an exemplary model that shall serve as a sample during the production process. The execution of separate tests and examinations on the new product according to the proposed new model (product).
2. The creation of new innovative technology and the technological production line.
3. The design of tools, fittings, installations that would otherwise not be applicable. The design and creation of new materials and supplies.
4. The execution of analyzes, drawing up various innovative options for improving the quality of production.

In control practice, one of the requirements is to first determine the specificity and nature of the controlled object, to then begin the control process itself. This is a necessary condition to ensure the safety, consistency and creative performance of the control procedures. The main problem in control practice is to determine what will actually be the subject of control when it comes to research and development. In particular, whether the object of control will be the overall research process or the results obtained from the development and research activities. With the help of research and development activities, additional facilities for the enterprise can be created, that meet the requirements of an intangible asset, or objects can

be created that cannot be recognized as an intangible asset. This is a second major problem, namely, what are the specifics of the controlled object, whether the object under control meets the requirements for an accounting object and whether an economic entity falls within the scope of control. The clarification of these problems and their quick resolution is important, in order to determine the correct methodology and methods for control.

The differentiation of accounting objects from economic objects, from a theoretical and practical point of view, is not so clear, and the majority of practitioners consider it unnecessary in most cases. From the point of view of control practice, however, this is essential in order for the control process to take place swiftly and without delay and waste of significant resources. Accounting objects are primarily economic entities that meet the economic and accounting requirements set out in the accounting standards and in the Financial Reporting Framework. According to the Conceptual Framework for Financial Reporting, accounting objects shall meet the following requirements:

1. They must act as elements that directly relate to the measurement of the entity's financial position (such as assets, liabilities and equity).
2. It must be possible to reliably measure and determine their value.
3. They must evidently be resources that are controlled and owned by the enterprise.
4. They must be obtained as a result of past events or arising from past events, the expense of which is expected to give rise to an outflow of resources from the entity which outflow results in economic benefits.
5. They must be received as a residual interest on the assets of the entity after deducting all of its liabilities.
6. They must be a prerequisite for obtaining another resource or a prerequisite for reducing the economic resource that is available to the enterprise.

It should be clarified that if an economic object does not meet the requirements for classification as an accounting object it is not excluded and not ignored by the scope of the accounting. The accounting theory has proven the place and importance of economic objects, and it is determined that they are part of the subject of accounting together with the accounting objects. The legislator also examines the economic and accounting objects together, as the financial performance of the enterprise and other events or transactions affect the change in the economic resources available to the enterprise. From the legislative point of view, the reasons for this amendment shall be faithfully presented to the users of the information on the financial statements. Therefore, information on economic objects shall be reflected in the notes to the financial statements and the information on accounting objects shall be reflected in the components of the financial statements.

This distinction between economic and accounting objects, from the point of view of control practice, is represented by the variety of types and forms of control that can be applied on the respective controlled object. When it comes to controlling an accounting object, it is of utmost importance to determine the scope, type and form of control according to the established legal frameworks for the recognition of the object as an accounting object. In controlling economic objects, due to the diversity of the existing types

of economic objects in practice, it is not always possible to apply all types and forms of control on the controlled object. For example, an internal audit of an economic object might be carried out depending on the audit engagements undertaken, as well as when the object has an impact on the financial position and financial performance of the entity.

The internal control over the development and research activities of the food industry, which is considered above all as continuous and consistent in terms of the actions and procedures, is carried out in the following order:

1. Preparatory actions and preliminary investigative actions to determine the specifics of the controlled object.
2. Preparing and issuing an order to entrust internal control over the implementation of the development and research activities of the enterprise. The order shall specify the scope, the term (i.e. the duration of the inspection) and the controllers assigned to carry out the internal control.
3. The implementation of the control itself, as a sequence of control actions, includes:
    - control of authorization and approval of research and development costs;
    - control of the selection and quality of research and development personnel;
    - control of the administrative actions taken by the persons responsible for the storage and preservation of the assets of the enterprise.
    - control, management and risk analysis in the controlled department in order to achieve the objectives and tasks of the said department.
    - control of information received and that generated by research and development activities;
    - performance of arithmetic control, in terms of the quantity and quality of the business operations that are carried out and which affect research and development activity.
    - control of the implementation of the approved internal regulations, which affects the fulfillment of the tasks and objectives of the research and development activity.
    - consistent documentation of control activities and processes by controllers. The presentation of duly drawn up documents proving the control actions taken. The presentation of evidence of detected violations and irregularities.
4. Completion of the control process - preparation of protocols of findings, findings reports and suggestions for improvement of the activity and quality of the implementation of the research and development activities in the enterprise.

2.3.1 Methodology of internal control over the results of the development activity

The research and development activity applied to the production of finished nano-products, in the form of nanofood and nanoproducts, is determined by the predefined objectives and tasks of the enterprise. Since the research and development activities may create reporting items that meet the requirements for accounting objects, the nature of these two separate activities is regulated in IAS 38 and in AS 38 in Bulgaria. Pursuant to IAS 38, Intangible Assets under Development, the activity is understood to be the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use". The same standard specifies that research is an "original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding" In view of the established national accounting standards for the financial reporting of small and medium-sized enterprises, according to AS 38 Intangible assets in Bulgaria - research is considered to be "original and planned research activity to achieve new scientific or technical knowledge". Examples of research activities are:

a) activities aimed at obtaining new knowledge;

b) the search for, evaluation and final selection of, applications of research findings or other knowledge;

c) the search for alternatives for materials, devices, products, processes, systems or services; and;

d) the formulation, design, evaluation and final selection of possible alternatives for new or improved materials, devices, products, processes, systems or services.

According to the requirements of the same standard AS 38 in Bulgaria, development is the "practical application of research findings or other knowledge in a plan or scheme for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use in the business of the enterprise". Examples of development activities are:

a) the design, construction and testing of pre-production prototypes and models;

b) the design of tools, jigs, moulds and dies involving new technology;

c) the design, construction and operation of a pilot machine that is not of a scale economically feasible for commercial production; and;

d) the design, construction and testing of a chosen alternative for new or improved materials, devices, products, processes, systems or services.

Therefore, taking into account the definitions set out in the relevant standards, it should be assumed that another object with a physical form can be created in the implementation of the research and development activities. However, they should be considered as intangible identifiable assets because the material prototype or model is a secondary product of knowledge, and the corresponding prototype is the primary result of that activity.

Referring to the precautionary principle, "accounting laws restrict the scope of intangible resources that can be recognized as such," (Petrova, 2012) this particularity is a prerequisite for the divergence of objects created as a result of research and development - some of them are recognized as accounting objects in the form of intangible assets and others are recognized as economic objects that do not meet the requirements of intangible assets. It is permissible not to recognize the expense immediately incurred as an intangible asset and capitalize these costs to the value of the asset. The precautionary principle should be adhered to and strictly applied when it comes to research and development, because the investment risks are high and are likely to fail. Therefore, from the point of view of internal control, there are two differences in the essence and meaning of objects that control bodies and persons shall inspect and for which an appropriate methodology and methods of internal control shall be applied.

From the point of view of internal control, controllers in controlling development activities should take into account that it is possible to account for the recognition of an intangible asset during (and not only after) the development phase according to IAS 38, provided that the enterprise can demonstrate ***all*** of the following:

- the technical feasibility of the project (completion of an intangible asset) so that it will be available for use or sale;
- the intention to complete the project and use or sell it;
- the ability to use or sell the intangible asset;
- how the intangible asset will generate probable future economic benefits;
- the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset;
- the ability to measure reliably the expenditure attributable to the intangible asset during its development.

In the food industry, intensive research efforts are focused on the development of polymeric materials from natural sources such as cellulose, lignin, plant pectin, plant and animal proteins, and polyesters from bacteria or plants, etc. They are aimed at developing materials that are persistent, biocompatible and biodegradable. The development of such materials usually requires "difficult and complex methods of processing the biological resources and there are specific characteristics in terms of their extraction, development and making them functioning, which can be costly, time-consuming and which do not yield significant returns for the enterprise itself" (Johansson, 2012).

The latest findings in the field of biotechnology, suitable for the food industry, which is the result of years of work, is the development of combined biomaterials with qualities that can be controlled and adjusted during their growth, that would be ready for use without the need for costly and complex methods of processing. This discovery is based on the basic qualities of mycelium, which is the lower vegetative part of a fungus. Mycelium is identified as the Earth's largest living organism. The patent for the production of these

combined biomaterials meets the requirements for an intangible asset because it is a distinct non-monetary asset without a physical substance.

The following discoveries and achievements relate to nanotechnology-based development in the food industry:

- Design and development of product lines for the production of food supplements - enzymes, minerals, silicon dioxide (to support youth), titanium dioxide (most commonly used in candy production, as well as in the cosmetics industry (e.g. in the production of toothpaste) and others.
- In recent years, the production of encapsulated active ingredients, which contain a mycelium, has been patented. These active ingredients are even used in the production of yoghurt as the mycelium is stable in terms of pH and temperature changes, i.e. they are used as a stabilizer. Also, the mycelium "is an optimum carrier system of hydrophobic substances for higher and faster intestinal and dermal resorption and it facilitates easier penetration of the other active ingredients" (Semo, 2006).
- Design and development of production lines for biodegradable packaging.
- Design and construction of a new information system for the users of nano-products and their producers;
- Design of sensor systems in food packaging, where sensors shall control moisture, gas permeation in packaging and the temperature conditions of the vacuum-packed food.
- The introduction of nano-biotechnology in the food industry, which involves the use of nanoparticulate vectors for carrying foreign DNA into cells. There is evidence that for the first time nanobiotechnology has been applied in the US food industry using tungsten particles, but at the level of microparticles. (Friends of the Earth, 2008). Based on this technology, cellular "injection" with carbon nanofibres containing foreign DNA has been used to genetically alter golden rice. (Chaudhry, 2008) Golden Rice is the result of the work of *Ingo Potrykus*, a professor at the Zurich Technical University and his colleague *Peter Beyer* of the University of Freiburg (Beyer, 2002). The rice that they have produced contains β-carotene - provitamin, which can be converted by the human body to vitamin A, a vitamin which influences the metabolic processes in the epithelial tissue, the deficiency of which leads to a number of health issues such as dry skin, brittle nails and fragile hair. However, this rice type has not been approved for mass production as it was developed with the help of genetic engineering.
- Development can also be related to designing tools and devices, as well the design and testing of new and improved production systems, etc.

All these discoveries and achievements are the result of the development of the food industry. They meet the requirements for recognition as Intangible Assets because: these discoveries and achievements are ready for use; the enterprise can reliably measure (assess) the costs associated with their development; the enterprise has sufficient technical, financial and other resources to complete the development activity; there are future economic benefits from the respective discoveries and achievements. Consequently, the final result of

the development activity is an intangible asset when the development activities are carried out according to the preliminary plans and the realization of the development activity is not influenced by unforeseen events and factors, namely:

- the enterprise does not transfer rights to the use of resources for the remuneration of third parties. Resources used in the development are intended, that is, to realize discoveries and innovations for the needs of the enterprise itself;
- investment costs are focused on development, producing good, high-quality results;
- interested competitors do not have information about the enterprise's innovative technologies, the new unknown knowledge, phenomena and processes are treated as a trade secret;
- discoveries and achievements can be duly evaluated, and future benefits for the enterprise can be determined;
- the enterprise controls the entire development process.

Objectives of internal control regarding the development results

1. To identify the stages, processes and procedures of the enterprise's overall development.
2. To identify any non-documented business operations related to the company's development.
3. To identify any non-reported intangible assets received in the development phase. In this respect, it should be checked whether the intangible asset actually meets the internally generated intangible asset criterion, in which case the research and development activity should therefore be divided.
4. To check whether the innovative idea uses resources and technology for single production rather than for mass production.
5. To ensure that the entity wisely assesses the degree of certainty attached to the flow of future economic benefits from research and development.
6. To inspect the assessment of the recognized intangible asset after its recognition. In this case, it should be checked whether the entity complies with the requirements of the accounting legislation, namely that in IAS 38 "after its initial recognition, intangible assets are measured at:
    - the cost of acquisition (i.e. acquisition cost less any accumulated amortization and impairment losses); or
    - according to the revaluation model (i.e. fair value at the date of revaluation less any subsequent accumulated amortization and revaluation losses)".
7. Where irregularities, inconsistencies or misconduct are identified, an appropriate system of impact based on the findings shall be suggested.

Problems, weaknesses, mistakes and deviations found in internal control regarding the development results

1. Incorrect determination of the cost of the internally generated intangible asset received during the development phase. As required by accounting standards, cost should be determined using the same principles that apply to the acquisition of tangible assets. The cost should include all costs that may be directly related to the creation, production and preparation of the asset for its intended use.
2. Identify irregularities regarding the approach adopted to determine the exact timing for discontinuing the capitalization of costs. According to the accounting standards, termination of capitalization of costs occurs when the intangible asset becomes ready for use in a manner provided by the management. For this purpose, a Protocol for commissioning shall be issued. This document is missing, or even if issued the date of its issue is not taken into account by most enterprises.
3. An intangible asset may be generated and created through the approved development activity in the enterprise, but in cases where the cost of creating this asset cannot be reliably measured, the value of the intangible asset cannot be reliably determined. For example, the good reputation of the enterprise among competitors is seen as a good center for the implementation and the development of new technologies.
4. One major problem is that the inherent administrative and other general costs that can be allocated to the intangible asset and included in its cost are not properly determined.
5. Internal control determines that not all resources involved in the creation of the respective intangible asset are included in the cost of the asset and accordingly do not participate in the capitalization of costs. Such resources are, for example, the quality and competence of the research and development personnel. This means that the enterprise has not implemented a system for determining wages by assessing the qualities and competencies of those engaged on development.

On the basis of all of the above, regarding the research problem of internal control of nanotechnology manufacturing and nano-production and internal control of research and development, the following main conclusions and recommendations can be drawn:

1. Internal control of the research control objects - nanotechnology manufacturing, nano-production, research and development - has not yet been established as the main means of revealing the behavior and modification of these objects. These objects are not considered as being interconnected, i.e. as bundle variables that generally affect the financial position and financial change of the entity.
2. No particular attention is paid to the analysis as a means of internal control. With the help of the analysis, the control process achieves a better diagnosis of the actual state of the controlled object, its planned and expected state. Applying the approved methodology of the internal financial analysis, together with the published data from the management accounting, the controllers can determine the reasons and the factors that influence the change of the controlled objects.

3. There is no interaction between internal control and controlling in the control practice, which in turn targets management and optimization of expenses, revenue management and management of the financial result of the enterprise. The two control concepts concerning internal control and controlling are still considered in isolation from each other. Because of the complexity of intertwining these two types of control (internal and controlling), the scope of the report has not been studied for their mutual application.

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SUMMARIES

B. Venkatraja

DYNAMICS OF AGGREGATE DEMAND FACTORS IN MACRO GROWTH: AN EUROPEAN PERSPECTIVE

The present study examines whether demand factors cause volatility in the economic growth of European Union (EU) with 28 member countries for the data from 1995 to 2016. The relative significance of household final consumption spending, investment, government spending and net exports has been tested by estimating linear regression model, running variance decomposition and applying impulse response function. Results indicate that all the four demand factors seem to be significant in the economic growth of EU. The consumption spending of the households influences the economic growth in the short run to medium run. While, investment and net exports are very significant to sustain growth in the medium to long run. It also appears from the result that too much interventions of national governments in Europe will de-stabilise the economic growth. It could be inferred that the sharp decline in the consumption spending of the households in Europe was the immediate cause of prolonged economic slowdown since 2008 which trickles down the investment, affects net exports and derails economic growth. Thus, the revival of marginal propensity to consume is the key factor for revival of European economy.
JEL: E12; E21; E22

Vanya Kraleva
Ivaila Dimitrova

LEGAL COMPETENCE AND CONSUMER BEHAVIOUR

In line with European standards and international practice the current legislation in Bulgaria soundly guarantees the protection of consumer rights. Nevertheless, the consumers are not always familiar with it and don't always feel protected and it is a precondition for wrong decisions. Regarding that we analyse the correlation between the level of consumer's legal competence in the case of quality mismatch and his consumer behaviour when deciding a purchase and the warranty service of durable goods. Statistically we defend the thesis that the lack of legal knowledge influences the consumer behaviour in a negative way and favours the existence of unfair commercial practices. Proposals for increasing consumer legal awareness and guidelines for refinement of the legal base are highlighted.
JEL: D18; M31

Wei-Bin Zhang

GROWTH, RESEARCH, AND FREE TRADE WITH KNOWLEDGE AS GLOBAL PUBLIC CAPITAL

The purpose of this study is to explain dynamics of global growth and trade patterns with wealth and utilizing knowledge as basic determinants. It builds a multi-country growth model with economic structure and research. Global economy composes of any number of countries and each country has one production sector and one university. Knowledge is through learning by doing and research. Knowledge is global public good and is applied by countries with different utilization efficiencies. The production sector is the same as in the one-sector growth Solow model (Solow, 1956), while capital mobility and trade

patterns are determined like in the Oniki-Uzawa model (Oniki and Uzawa, 1956). We use a utility function proposed by Zhang (1993) to determines saving and consumption. The movement of the system is given by differential equations. We simulate the model. Our comparative analysis provides some insights into the complexity of international trade with endogenous wealth and knowledge.
JEL: F11; O30

Teofana Dimitrova
Kiril Desev

STRATEGIC ANALYSIS THROUGH THE COMBINATION OF SWOT, AHP AND TOWS (A CASE STUDY ON THE NEUROLOGICAL WARD IN THE MHAT "SAINT PANTELEYMON" – PLOVDIV)

This study is an attempt to apply a hybrid model for a SWOT-AHP-TOWS strategic analysis. The methodology and results of a survey are presented, it was conducted with the subject – the Neurological Ward (NW) of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv. The combination of the methods SWOT (Strengths, Weaknesses, Opportunities, Threats) and AHP (Analytic Hierarchy Process) is infamous in the academic field, however it is weakly represented in the practice of health care management. The purpose of integrating AHP with SWOT is to reach an expert proportionality of every individual factor and the assessment of their significance. As a logical final phase of applying the SWOT-AHP, a TWOS analysis is carried out to determine the strengths, weaknesses, opportunities and threats. The strategic alternatives that were identified for the NW through the drawn up TOWS matrix may be used by the Senior Management of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv in the process of generating development ideas and to facilitate future decision-making.
JEL: M31; L22

Elena Shustova
Vesselin Blagoev

M&A AND CREDITING: THE HYBRID GROWTH STRATEGY SEEMS TO BE THE BEST FOR THE BANKS IN KAZAKHSTAN

The development of the banking sector in Kazakhstan after 2015 raises a number of questions regarding the growth strategies that should be applied to overcome the problems with its sustainable development in a business environment, influenced by low prices of crude oil and an underdeveloped real sector. The state policy for bank consolidation and the active support of the National Bank of the Republic of Kazakhstan in solving liquidity problems of particular banks, namely Qazkom and Halyk Bank, has not led to the expected results. This analysis shows that a combination of external factors with organic growth strategy through intensive innovation of the crediting process as well as training of the personnel to minimize the influence of biases in the decision-making process, should be applied as well. Based on our overall analysis it is suggested, that hybrid strategy, which combines the benefits of external and organic growth strategies, would be more suitable under the specific conditions of Kazakhstan, and probably in any other country with similar market environment.
JEL: G21; G28

Amassoma, Ditimi
Adeleke, O.

TESTING FOR THE CAUSALITY BETWEEN INTEREST RATE AND STOCK MARKET PERFORMANCE IN NIGERIA

In this paper, the causal relationship between interest rate and stock market performance is investigated using a VECM-based Granger causality test on annual time series data from 1975 to 2016. The rationale for this study emanates from the unpredictable behaviour of the Nigerian stock exchange from the outset of the global financial economic crisis from 2007/8 till date couple to the increasingly high key policy rates like interest rate by the CBN that has refused to drop. The results reveal that the interest rate exerted a negative but statistically insignificant relation to stock market performance in the long run. In addition, Granger causality test result noted that there is no causality between interest rate and stock market performance. Thereby, advocating that other macroeconomic factors predict stock market activities better than the interest rate as suggested by the bi-directional causality between exchange rate and All Share index in the result. The implication is that a proper portfolio diversification should be ensued; via a fair exchange rate policy can stimulate the activities of the stock market and vice-versa. Consequently, the paper recommends that the government should do justice to her monetary policy by way of trimming down its interest rate in such a way that will encourage both local and foreign investors to borrow funds at a cheaper rate to invest in the stock market which in turn boost economic well being of the country.
JEL: C51; E52; E44; G10

Nataliia Orlova
Iuliia Mokhova

THE INVESTMENT MODEL FORMATION OF RAILWAY INDUSTRY DEVELOPMENT IN UKRAINE IN THE CONDITIONS OF EUROINTEGRATION

The authors have studied the contemporary system and features of the railway industry reform in Ukraine and the preconditions for its development in the context of European integration. The main paper objective is to form strategic directions of an investment model for the railway industry development in the context of European integration processes in order to increase the competitiveness of the Ukrainian railway industry and to achieve an increase in its investment attractiveness. The conducted analysis of rail transport productivity with the use of international methods has proved the limited number of indicators of its assessment for Ukraine, which prevents the reliable assessment of the industry investment potential for foreign and domestic investors. The study of the investment attractiveness of the railway industry in the infrastructure section has determined that the development of Ukraine's rail infrastructure nowadays does not correspond to the best indicators of EU leaders and has weak dynamics, which has allowed to assert the low industry investment attractiveness. The authors have proposed the main elements of the investment model for the railway industry development in the conditions of European integration, which will lead to effective integration of the national rail transport system into the world transport space, improve the industry investment attractiveness and competitiveness, and increase the Ukrainian railway infrastructure productivity.
JEL: O12; O19; L92; R42

Matushevskaya, Elena A.
Katkova, Natalia V.

EXPERT AND DIAGNOSTIC ASSESSMENT OF ECONOMIC SUSTAINABILITY THREATS OF SHIPBUILDING ENTERPRISES

The definition, classification and diagnostic-expert assessment of economic sustainability threats of the shipyards are presented in this article. The external factors suggested to divide into factors of direct and indirect impacts, and factors of the internal environment to classify as the factors shaping the economic sustainability, and the factors that affect it. Using this classification, it is possible to develop a set of indicators of assessing the economic sustainability of the enterprise in both the long and short term.
Using the method of expert estimations and Pareto's method the effect of exogenous and endogenous factors on the economic sustainability of the shipbuilding industry was determined; the most influential external and internal factors were established.
JEL: D21; L60; M21

Plamena Nedyalkova

FEATURES, CHARACTERISTICS AND METHODOLOGY OF INTERNAL CONTROL OVER NANOTECH MANUFACTURING AND NANO-PRODUCTION IN FOOD INDUSTRY

Over the last years, the rapid pace of development of the nanotechnology industry has placed it as one of the leading industries, which occupies a significant part of the total world production share. The specific technology used in the nanotechnology industry, the distinctive features and characteristics of the final nano-production are prerequisites to seek for the proper mechanisms and methods of the implementation of internal control in nanotechnology enterprises. Therefore, the main objective of this study is to present the major control problems that exist and can be found in a nanotech company and the main control stages, procedures and methods for the implementation of internal control. Based on everything stated hereto, it can be assumed that the main objects of internal control in food-related enterprises which apply nanotechnology are: nanotech production; nanoproducts and products of nanotechnology development. Regarding the research problem of internal control of nanotechnology manufacturing and nano-production and internal control of research and development, the following main conclusions and recommendations can be drawn: 1) Internal control of the research control objects - nanotechnology manufacturing, nano-production, research and development - has not yet been established as the main means of revealing the behavior and modification of these objects; 2) No particular attention is paid to the analysis as a means of internal control. With the help of the analysis, the control process achieves a better diagnosis of the actual state of the controlled object, its planned and expected state. Applying the approved methodology of the internal financial analysis, together with the published data from the management accounting, the controllers can determine the reasons and the factors that influence the change of the controlled objects; 3) There is no interaction between internal control and controlling in the control practice, which in turn targets management and optimization of expenses, revenue management and management of the financial result of the enterprise. The two control concepts concerning internal control and controlling are still considered in isolation from each other. Because of the complexity of intertwining these two types of control (internal and controlling), the scope of the report has not been studied for their mutual application.
JEL: M40; M42; L65