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Performance Analysis Based on Adequate Risk-Adjusted Measures

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Abstract

There are many potential investment options for investors and they should be able to compare them on a risk-adjusted basis. If investors rely only on pure return they can be exposed to a high risk. Therefore, many investors rely on adequate performance measures to evaluate potential investment opportunities. In this paper, we describe widely used risk-adjusted performance measures and add correlation through the M3 measure. We apply described measures to real financial data in order to rank managers and compare rankings between measures. We also look at the following year measures to compare the results with predictions.

Keywords: performance measures; correlation; manager ranking

JEL classification G11, G17

Introduction

According to the Investment Company Institute (2018) in 2017 total net assets of worldwide regulated open-end funds was more than \$ 49 trillion and have more than doubled in the past decade. Therefore, investors need instruments to analyse and choose the best funds.

Investors rely on risk-adjusted measures. However, there are a lot of measures that can be used, and it is not clear which ones are better or worse since none of the investors uses the same measures. In addition, such variety can be explained by investors not being able to define risk in such a way that it would incorporate all necessary parameters. We present several performance measures discussing the advantages and disadvantages of each.

In addition, to giving different risk definitions we will incorporate a correlation using the M3 measure (see Muralidhar (2000)). Correlation is an important parameter when one wants to create a portfolio rather than investing in a single stock. If we define risk as a standard deviation of stock returns (as most investors do) or some sort of standard deviation, then if we have a portfolio of two or more stocks then the combined standard deviation is not a sum of single standard deviations. Instead, we have

a correlation term and a portfolio standard deviation looks like this

$$\sigma_{Portfolio}^2 = \sigma_A^2 \omega_A^2 + \sigma_B^2 \omega_B^2 + 2\rho_{A,B} \omega_A \omega_B \sigma_A \sigma_B,$$

where σ_A and σ_B are standard deviations of stocks A and B respectively, ω_A and ω_B are weights invested on stocks A and B respectively, $\rho_{A,B}$ is a correlation between stocks A and B.

It is clear from this equation that investors should seek negative or small correlation to decrease the portfolio risk. That is why it is important to be able to select new investments not only by their returns but also making an adjustment for correlation between new stock and an existing portfolio.

Another way to incorporate correlation is to use the approach that was proposed by Dowd (2000). His method shows how to adjust for correlation using the most popular and widely used risk-adjusted measure — Sharpe ratio. Dowd's basic idea is the following: calculate the Sharpe ratio before accepting new stock and calculate on the stock was accepted a while ago, then we can compare these two ratios and if it increased then we would proceed with the deal. In this case, we account for correlation when we calculate the new Sharpe Ratio.

In addition, in a recent research done by Ornelas, Silva Júnior, and Fernandes (2010) shows that performance ratios matter. Previously, Eling (2008) showed that some measures have a very high correlation in ranking with the Sharpe ratio and it might be enough just to look at Sharpe Ratio. However, Ornelas, Silva Júnior, and Fernandes (2010) exploited other measures in their research and agreed with Eling to some degree but not all measures produced a high correlation. Therefore, we should look at and compare measures and we cannot use only the Sharpe Ratio.

Risk-Adjusted Performance Measures

As was mentioned previously there are many risk-adjusted performance measures and their variations. In this paper, we describe some of the most commonly used measures and discuss their advantages and disadvantages. More detailed information can be found in Bacon (2013), Dowd (2000), Goodwin (1998), Grinold and Khan (1999), Harlow (1991), Lo (2002), Madgon-Ismail and Atiya (2004), Modigliani and Modigliani (1997), Muralidhar (2000, 2001, 2005), Papa-georgiou (2005), Rollinger and Hoffman (2015), Prokopczuk, Rachev, and Truck (2004), Sharpe (1966, 1994), Sortino and van der Meer (1991) and Young (1991). Table 1 shows some widely used measure.

As we can see from Table 1 there are multiple definitions of risk and it is almost impossible to choose one. However, investors can choose the one that suits their vision of the market the best. We will apply all these measures to real-life financial data and later we will describe how investors can incorporate correlation using Dowd's (2000) approach.

Fund case-studies

In this section, we describe the procedure that was used to calculate all ratios and the way funds were selected.

Article by Bill Harris "The 10 Biggest Mutual Funds: Are They Really Worth Your Money?" in Forbs brought our attention and 8 out of 10 funds presented were chosen for the illustration. Two funds from this article were eliminated because they are fixed income funds. To be able to compare apples to apples they were not selected because comparison would not be fair when we have to select a benchmark.

Monthly data was taken for the 11 years from 1/1/2006 up to 1/1/2017 for all 8 funds. First, ten years were used to analyse the risk-adjusted performance of all funds when the last year was used to compare the results for the previous 10 years and the following year. The data were obtained for all funds and for the benchmark which was chosen to be S&P500 because funds are different by their nature and we need a common benchmark. Also, one should note that the financial crisis of 2008–2010 was included in calculations. Therefore, some returns were small however we decided they are not outliers because it is a part of the risk of investing in a market.

Sharpe Ratio

First, let's show how the Sharpe Ratio can be applied to the 8 selected funds. As we know from the definition of the Sharpe ratio we need an appropriate risk-free rate. In this example, US 10 years T-Bond rate as of 12/31/2005 was chosen and equal to 4.39%. 10 years T-Bonds were chosen because we want to make sure we would make more on our investments rather than investing in a risk-free rate and leaving money there for 10 years. In Table 2 we can see the Sharpe ratio and all the information needed for all 8 funds:

As we can see from the Table 2 all funds produce positive returns and greater than the risk-free rate. Therefore, it would be more beneficial for investors in a long run to invest in any of these funds rather than risk-free rate even though the financial crisis of 2008–2010 are included in this dataset.

Table 2 allows us to make the following conclusions:

If we compared pure return without adjusting for risk, then the fund 3 would be the most attractive. Fund 3 was the best even after adjusting for the risk (standard deviation) because its return to risk had the best ratio.

Fund 6 produced a quite small annual return over the last 10 years comparing to the risk they took. They produced only 5.13% return per year, but they took 22.05% of the risk, which was the highest risk among all 8 funds.

In addition, maybe fund 5 did not produce the highest return but its risk was relatively small keeping in mind that the Financial Crisis period was included and fund 5 got the 5th rank.

Table 1
Risk-adjusted performance measures

Name	Definition	Advantages	Disadvantages
Sharpe Ratio	$SR = \frac{\mu - R_f}{\sigma}$	<ul style="list-style-type: none"> - Allows to compare and rank fund /managers - Most of its advantages and disadvantages are known 	<ul style="list-style-type: none"> - σ is not always an appropriate risk measure - σ punishes companies for upward momentum - no interpretation of the number
Information Ratio	$IR = \frac{\overline{ER}}{\hat{\sigma}}$	<ul style="list-style-type: none"> - Useful measure when the benchmark is carefully chosen 	<ul style="list-style-type: none"> - Not a complete statistic - Only maximizing IR can lead to wrong decisions
M3	$r(CAP) = a\mu + bR_B + (1-a-b)R_f$	<ul style="list-style-type: none"> - Adjust for correlation - Provide guidance on how to build a portfolio 	<ul style="list-style-type: none"> - Correlation is not stable over time - Hard to compare funds on the after-fee basis
Sortino Ratio	$S = \frac{\mu - R_f}{TDD}$	<ul style="list-style-type: none"> - Accounts only for the downside deviation - Accounts for risk better if the distribution is not symmetric 	<ul style="list-style-type: none"> - Does not account for correlation - No guidance on how to build a portfolio
Calmar Ratio	$Calmar = \frac{\mu - R_f}{MDD}$	<ul style="list-style-type: none"> - Shows a long-term perspective - Shows the cumulative loss investors can have - Not sensitive to momentum changes 	<ul style="list-style-type: none"> - No easy way to change frequencies - Needs a lot of time to reflect momentum changes
RAROC	$RAROC = \frac{\mu}{VaR}$	<ul style="list-style-type: none"> - Allows to compare businesses with different sources of risk - A powerful tool in asset allocation and risk control 	<ul style="list-style-type: none"> - Hard to determine Cost of Capital Rate - More accounting-based ratio - Hard to calculate VaR if a small number of returns are present

Source: the authors.

Note:

$$\mu = E(R_t) = \frac{1}{T} \sum_{t=1}^T R_t \text{ - mean return}$$

$$\sigma^2 = \frac{1}{T} \sum_{t=1}^T (R_t - \mu)^2 \text{ - variance of returns}$$

$$\overline{ER} = \frac{1}{T} \sum_{t=1}^T (R_{P_t} - R_{B_t}) \text{ - mean excess return over the benchmark, where } R_{P_t} \text{ - return of the portfolio, } R_{B_t} \text{ - return of}$$

the benchmark

$$\hat{\sigma} = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (ER_t - \overline{ER})^2} \text{ - standard deviation of excess return, where } ER_t = R_{P_t} - R_{B_t}$$

σ_i – standard deviation of stock i or portfolio i

σ_B – standard deviation of the benchmark

$$a = \sqrt{\frac{\sigma_B^2(1-\rho_{T,B}^2)}{\sigma_i^2(1-\rho_{i,B}^2)}} - \text{portion invested in a fund}$$

$$b = \rho_{T,B} - a \frac{\sigma_i}{\sigma_B} \rho_{i,B} - \text{portion invested in the benchmark}$$

R_T – target return

$$TDD = \sqrt{\frac{1}{T} \sum_{t=1}^T (\text{Min}(0, R_t - R_T))^2} - \text{target downside deviation}$$

$$MDD = \frac{\text{Through value} - \text{Peak value}}{\text{Peak value}} - \text{maximum drawdown}$$

$VaR: P(X < -VaR) = \alpha$ or $\int_{-\infty}^{-VaR} f(x)dx = \alpha$ – where X is a random variable that represents the profit and loss of the business.

Table 2

Sharpe ratio case-studies for 2006–2016

Fund	Return	Standard Deviation	Sharpe Ratio	Rank
F	4.39%	0		
1	6.56%	14.15%	0.15313	VI
2	6.33%	21.33%	0.09116	VII
3	10.00%	18.77%	0.29881	I
4	9.29%	19.83%	0.24690	IV
5	5.13%	4.54%	0.16248	V
6	5.51%	22.05%	0.05064	VIII
7	9.13%	18.38%	0.25801	III
8	9.60%	18.53%	0.28103	II

Source: the authors.

As we can see Sharpe ratio gives different ranking rather than a pure return. In addition, it allows easy calculations and comparison between the fund's return and risk.

Now let's compare the results for the following year. Risk-free rate was chosen as 1-year US rates of 0.89%.

As we can see from the Table 3 that all Sharpe ratios increased because in the previous examples Financial Crisis was included. Table 3 allows us to make the following conclusions:

If we compare just pure annual returns, then fund 2 would have the first place but fund 2 has

one of the highest risks among all 8 funds which brings fund 2 to the 4th place.

Previous Sharpe Ratio ranked fund 6 as the least attractive fund. However, as we can see from its performance in the following year fund 6 got one of the highest returns and one of the lowest risks. That is why Sharpe ratio ranked fund 6 as the first one.

Another big change was for fund 5. Even with Financial Crisis fund 5 had the average annual return of 5.13%. However, in 2017 it returns dropped to 2.4% which brought it to the last place even though it has the lowest risk among all 8 funds.

Table 3
Sharpe ratio case-studies for 2017

Fund	Return	Standard Deviation	Sharpe	Previous Sharpe	Ranking	Previous Ranking	Increase/Decrease
F	0.89%	0.00%					
1	8.99%	3.83%	2.12	0.1531	VI	VI	Increase
2	24.63%	7.17%	3.31	0.0912	IV	VII	Increase
3	24.39%	9.15%	2.57	0.2988	V	I	Increase
4	17.84%	8.94%	1.90	0.2469	VII	IV	Increase
5	2.39%	1.79%	0.84	0.1625	VIII	V	Increase
6	23.83%	4.42%	5.20	0.0506	I	VIII	Increase
7	19.48%	4.33%	4.30	0.2580	III	III	Increase
8	18.98%	4.18%	4.33	0.2810	II	II	Increase

Source: the authors.

Table 4
Information ratio case-studies for 2006–2016

Fund	Return/Excess Return	Standard Deviation	Information Ratio	Rank
B	7.25%	18.74%		
1	-0.69%	8.85%	-0.0781	VI
2	-0.91%	12.17%	-0.0750	V
3	2.75%	10.18%	0.2702	III
4	2.04%	8.50%	0.2399	IV
5	-2.12%	18.30%	-0.1158	VI
6	-1.74%	11.95%	-0.1456	VIII
7	1.88%	5.73%	0.3290	II
8	2.35%	5.53%	0.4251	I

Source: the authors.

Information Ratio

First, let's discuss how the benchmark was selected and the details of these calculations.

Since funds that were selected have different nature then it would be beneficial for all of them to select a benchmark which is a whole market or S&P500 since some of these funds are stock market indexes, some are growth funds, etc. Therefore, to be consistent, S&P500 was selected as a benchmark.

As we know from the definition of the Information ratio we need to have an average annual excess return and standard deviation of the excess return. Therefore, to obtain these values annual returns for each fund were used then S&P500 annual returns were subtracted from the fund's returns. Further, the average was taken and the

standard deviation for each fund. Hence, we can see the result of the calculations in Table 4.

As we can see from Table 4 not many funds managed to produce a positive excess return over the 10 years if the market (S&P500) was selected as a benchmark.

Table 4 allows us to make the following conclusions:

As in the Sharpe ratio fund, 3 managed to produce the highest excess return. However, in the relationship to a benchmark, this fund was exposed to one of the highest risks among all 8 funds.

Fund 8 produced almost the same excess return as fund 3. However, fund 8 did not take as much "extra" risk as fund 3. Therefore, now fund 8 has the highest Information ratio and the lowest tracking error among all funds. It means that

Table 5
Information ratio case-studies for 2017

Fund	Return/Excess Return	Standard Deviation	Information Ratio	Previous IR	Ranking	Previous Ranking	Increase/Decrease
B	17.32%	5.68%					
1	-12.64%	8.82%	-1.4333	-0.0781	VII	VI	Decrease
2	0.15%	10.65%	0.0137	-0.0750	I	V	Increase
3	-0.21%	13.23%	-0.0160	0.2702	II	III	Decrease
4	-5.54%	12.90%	-0.4294	0.2399	IV	IV	Decrease
5	-17.90%	6.04%	-2.9618	-0.1158	VIII	VI	Decrease
6	-0.39%	7.65%	-0.0515	-0.1456	III	VIII	Increase
7	-3.98%	8.09%	-0.4923	0.3290	V	II	Decrease
8	-4.39%	7.88%	-0.5569	0.4251	VI	I	Decrease

Source: the authors.

Table 6
M2 ratio case-studies for 2006–2016

Fund	Return	Standard Deviation	d	RAP	Rank
F	4.39%	0.00%			
B	7.25%	18.74%			
1	6.56%	14.15%	0.3247	7.26%	VI
2	6.33%	21.33%	-0.1214	6.10%	VII
3	10.00%	18.77%	-0.0015	9.99%	I
4	9.29%	19.83%	-0.0551	9.02%	IV
5	5.13%	4.54%	3.1264	7.43%	V
6	5.51%	22.05%	-0.1501	5.34%	VIII
7	9.13%	18.38%	0.0196	9.22%	III
8	9.60%	18.53%	0.0111	9.66%	II

Source: the authors.

funds 8 is more attractive for the investor rather than funds 3 if we compare it to the Sharpe ratio.

As we compare Information Ratio ranking with the Sharpe ratio overall there is a difference but most of the funds are changed places by one ranking. However, Information ratio allows us to compare returns not only with a risk-free rate but it can be interpreted as how much “additional” risk each fund brings to the market risk.

Finally, if we use Grinold and Khan (1999) approach and compare Information ratio with 0.5, 0.75, and 1.0 we can see that none of the funds produced even “good” Information ratio over the 10 years period.

Now let’s compare the results for the following year.

There are few things could be noted from the Table 5.

Almost all funds except for fund 2 had a negative excess return which means that all of them did not manage to beat the benchmark for the following year.

Fund 8 that was previously ranked the worst fund now got the third rank and it is one of two funds which information ratio increased even though it is still negative.

Since almost all funds have negative information ratio then based on the information ratio investor shouldn’t invest in any of the funds. Even fund 2 which have a positive information ratio have a ratio of 0.01.

Table 7
M2 ratio case-studies for 2017

Fund	Return	Standard Deviation	d	RAP	Previous RAP	Ranking	Previous Ranking	Increase/Decrease
F	0.89%	0.00%						
B	17.32%	5.68%						
1	8.99%	3.83%	0.4831	12.90%	7.26%	VI	VI	Increase
2	24.63%	7.17%	-0.2086	19.68%	6.10%	IV	VII	Increase
3	24.39%	9.15%	-0.3798	15.46%	9.99%	V	I	Increase
4	17.84%	8.94%	-0.3651	11.65%	9.02%	VII	IV	Increase
5	2.39%	1.79%	2.1761	5.66%	7.43%	VIII	V	Decrease
6	23.83%	4.42%	0.2854	30.38%	5.34%	I	VIII	Increase
7	19.48%	4.33%	0.3113	25.27%	9.22%	III	III	Increase
8	18.98%	4.18%	0.3591	25.48%	9.66%	II	II	Increase

Source: the authors.

M2 Ratio

As we know from the definition of M2 we need a benchmark and a risk-free rate. Risk-free rate and the benchmark were chosen the same way and the same values as in Sharpe and Information ratios. Results of the calculations can be found in Table 6.

As we know from the nature of M2 measure it produces the same ranking as a Sharpe Ratio but instead of having a number which can be hard or impossible to interpret (Sharpe ratio), RAP gives investors a risk-adjusted return that was calculated based on the leverage/deleverage of the portfolio.

Table 6 allows us to make the following conclusions:

Funds 1, 5, 7, and 8 produced higher risk-adjusted return rather than a pure return. However, funds 2, 3, 4, 6 produce a lower risk-adjusted return.

On a pure return fund, 5 did not look very attractive to the investors. However, it was not exposed to a lot of risks (just 4.54%) and after adjusting for risk fund 5 produced a 7.43% return.

Fund 6 was exposed to the highest risk among all funds which brought this fund to the 8th place.

Now let's compare the results with the following year:

There are few things could be noted from the Table 7:

Fund 6 had the highest risk-adjusted return of 30%.

Fund 5 had the only RAP measure that decreased for the following year in comparison to the previous year. However, its risk-adjusted return was 5.6% when the pure return was only 2.4%.

Fund 3 moved from the first place to the fifth having a risk-adjusted return of 15.46% when the pure return was 24.4%.

M3 Ratio

As we established, in the beginning, it is important to adjust for the correlation between a benchmark and a fund's return. One of the measures that adjust for the correlation is M3. It requires benchmark returns (S&P500), risk-free rate (US T-Bond) and a target tracking error. For the target tracking error was 7% selected. Which corresponds to 0.9302 of the target correlation

$$1 - \frac{0.07^2}{2 \times (0.1874)^2}$$

was made based on the risk-free return and the return of a benchmark. Investors always should seek a target return higher than a risk-free therefore it is higher than 4.4% but it is lower than the market because we want to be conservative and prepare for a lower return of the market than in previous years. Investors can choose any target tracking error, but calculations will be exactly the same.

Table 8 allows us to make the following conclusions:

Correlation influences ranking funds/managers. For example, the Sharpe ratio suggested that

Table 8
M3 ratio case-studies for 2006–2016

Fund	Return	Standard Deviation	$\rho_{1,B}$	d	TE	a	b	1-a-b	M3	Rank
F	4.39%	0.00%	0							
B	7.25%	18.74%	1	100%						
1	6.56%	14.15%	0.8921	132.47%	7.26%	1.0758	0.2057	-0.2815	7.31%	VI
2	6.33%	21.33%	0.8231	87.86%	6.10%	0.5678	0.3983	0.0339	6.63%	VII
3	10.00%	18.77%	0.8526	99.85%	9.99%	0.7014	0.3313	-0.0327	9.27%	III
4	9.29%	19.83%	0.9043	94.49%	9.02%	0.8125	0.1526	0.0349	8.80%	IV
5	5.13%	4.54%	0.2155	412.64%	7.43%	1.5509	0.8492	-1.4001	7.96%	V
6	5.51%	22.05%	0.8404	84.99%	5.34%	0.5755	0.3611	0.0634	6.06%	VIII
7	9.13%	18.38%	0.9525	101.96%	9.22%	1.2292	-0.2182	-0.0110	9.60%	II
8	9.60%	18.53%	0.9560	101.11%	9.66%	1.2653	-0.2661	0.0008	10.22%	I

Source: the authors.

Table 9
M3 ratio case-studies for 2017

Fund	Return	Standard Deviation	$\rho_{1,B}$	d	M3	Previous M3	Rank	Previous Rank	Increase/Decrease
F	0.89%	0.00%	0						
B	17.32%	5.68%	1	100%					
1	8.99%	3.83%	-71.22%	148.31%	37.62%	7.31%	I	VI	Increase
2	24.63%	7.17%	-36.59%	79.14%	30.69%	6.63%	VI	VII	Increase
3	24.39%	9.15%	-56.96%	62.02%	33.09%	9.27%	V	III	Increase
4	17.84%	8.94%	-53.50%	63.49%	27.30%	8.80%	VII	IV	Increase
5	2.39%	1.79%	-5.61%	317.61%	10.36%	7.96%	VIII	V	Increase
6	23.83%	4.42%	-13.54%	128.54%	35.90%	6.06%	II	VIII	Increase
7	19.48%	4.33%	-29.64%	131.13%	34.56%	9.60%	III	II	Increase
8	18.98%	4.18%	-26.33%	135.91%	33.92%	10.22%	IV	I	Increase

Fund	a	b	1-a-b	Previous a	Previous b	Previous 1-a-b	TE	Previous TE
1	2.051	1.224	-2.276	1.076	0.206	-0.282	12.90%	7.26%
2	0.826	0.621	-0.447	0.568	0.398	0.034	19.68%	6.10%
3	0.733	0.912	-0.645	0.701	0.331	-0.033	15.46%	9.99%
4	0.730	0.854	-0.584	0.813	0.153	0.035	11.65%	9.02%
5	3.089	0.294	-2.382	1.551	0.849	-1.400	5.66%	7.43%
6	1.260	0.372	-0.632	0.576	0.361	0.063	30.38%	5.34%
7	1.333	0.541	-0.874	1.229	-0.218	-0.011	25.27%	9.22%
8	1.368	0.504	-0.872	1.265	-0.266	0.001	25.48%	9.66%

Source: the authors.

Table 10
Sortino ratio case-studies for 2006–2016

Fund	Return	TDD	Sortino	Rank
B	4.39%	0.00%		
1	6.56%	14.39%	0.1505	VI
2	6.33%	20.13%	0.0966	VII
3	10.00%	17.07%	0.3285	I
4	9.29%	18.14%	0.2699	III
5	5.13%	3.35%	0.2203	V
6	5.51%	21.84%	0.0511	VIII
7	9.13%	17.59%	0.2695	IV
8	9.60%	17.05%	0.3054	II

Source: the authors.

the most attractive fund for investments is fund 3. However, if we adjust for the correlation the most attractive fund will be 8 the same as Information ratio suggested.

The M3 measure gives investors guidance on how to build a portfolio out of risk-free rate, benchmark and a fund. For example, if we used the strategy that M3 suggests we would get 10.2% of risk-adjusted return on fund 8. When its pure return was only 9.6%.

Some funds outperform on an unadjusted basis but underperform on an adjusted basis and *vice versa*. For example, fund 3 had 10% unadjusted return but only 9.3% adjusted return.

Fund 5 has one of the least attractive pure returns for the investors. However, after adjusting for risk and correlation it has the highest change to M3 of 64.4%.

For the following year, target correlations are calculated based on 7% which gives us $\rho_{T,B} = 23.9\%$. Now let's compare the results:

As we can see from the Table 9 the following conclusions can be drawn:

Fund 1 now has the first ranking most likely due to the fact that it has a very strong negative correlation with the benchmark for the following year.

Fund 1 has one of the lowest pure returns, however, after the adjustment for correlation gives it 37.62% of return after the correct allocation of investments between fund, benchmark, and a risk-free rate.

It makes sense that all ratio increased for the following year because for the previous crisis years of 2008–2010 was included. Therefore, return

adjusted for correlation is greater for the following year.

Sortino Ratio

Next ratio is a Sortino ratio that uses the Target Downside Deviation (TDD) as a risk measure. In the formula of the TDD, we need to use the target required rate of return. As a target rate risk-free rate was chosen because it is a minimum return that investors should require from funds.

In Table 10 calculations are presented for all 8 funds:

Table 10 allows us to make the following conclusions:

Fund 6 as in most of the previous measures is exposed to the highest risk among all 8 funds in addition to having very low return it brings it to the last place.

Fund 5 as in most of the previous measures has the lowest risk of only 3.35%. When the majority of funds have more than 15% of the risk. However, having a very low return gives fund 5 only the 5th place.

Fund 3 having the highest return among all 8 funds get the first place because it has a relatively low risk comparing to the other funds.

Now let's compare the results for the following year:

As we can see from the Table 11 that there is a big difference between previous Sortino ratio and a current one. This difference is because different annualization method was used. Since it was calculated only for a year monthly TDD was calculated and then multiplied by $\sqrt{12}$. Therefore, the comparison between ratios is not possible.

Table 11
Sortino ratio case-studies for 2017

Fund	Return	TDD	Sortino	Previous Sortino	Ranking	Previous Ranking	Increase/Decrease
F	0.89%	0.00%					
1	8.99%	1.60%	5.0665	0.1505	V	VI	Increase
2	24.63%	2.14%	11.1075	0.0912	IV	VII	Increase
3	24.39%	5.12%	4.5877	0.2988	VI	I	Increase
4	17.84%	5.56%	3.0471	0.2469	VII	III	Increase
5	2.39%	1.00%	1.5004	0.1625	VIII	V	Increase
6	23.83%	0.61%	37.5334	0.0506	III	VIII	Increase
7	19.48%	0.42%	44.5980	0.2580	I	IV	Increase
8	18.98%	0.43%	42.2068	0.2810	II	II	Increase

Source: the authors.

Table 12
Calmar ratio case-studies for 2006–2016

Fund	Return	MDD	Calmar	Rank
F	4.39%	0.00%		
1	6.56%	10.99%	0.1971	V
2	6.33%	19.49%	0.0998	VI
3	10.00%	13.23%	0.4238	III
4	9.29%	20.29%	0.2413	IV
5	5.13%	9.43%	0.0782	VII
6	5.51%	23.21%	0.0481	VIII
7	9.13%	9.14%	0.5185	II
8	9.60%	10.02%	0.5199	I

Source: the authors.

However, we can compare rankings and make the following conclusions:

Most of the funds have TDD around or less than 1%. However, two funds 3 and 4 have a risk higher than 5% and as we can see that the previous Sortino ratio ranked them as top 3 funds.

Funds 7 and 8 have large Sortino ratios because they have a high return comparing to a low risk which brings them to the top two places.

Fund 6 which was the least attractive fund based on past performance has the third rank in the following year.

Calmar Ratio

In the Calmar ratio Maximum Drawdown (MDD) is used as a risk measure. The basic idea of the MDD is a maximum cumulative loss over the entire period. Calculations are presented in Table 12.

The following conclusions can be made from Table 12:

Fund 5 again has the lowest risk among all 8 funds. However, as we can see from the ranking the difference in risk is not significant enough because the Calmar ratio gave it the 7th place.

Fund 3 losses it's first place again because it has 13.23% of risk which is not too high, however, fund 8 has approximately the same return but lower risk which brings fund 8 to the first place and fund 3 to the 3rd.

Fund 6 has the highest risk and one of the lowest returns among all 8 funds which bring it to the 8th place again.

Now let's compare the results for the following year:

Like the Sortino ratio, we cannot compare the previous and current Calmar ratio because pre-

Table 13
Calmar ratio case-studies for 2017

Fund	Return	MDD	Calmar	Previous Calmar	Ranking	Previous Ranking	Increase/Decrease
F	0.89%	0.00%					
1	8.99%	1.29%	6.2839	0.1971	V	V	Increase
2	24.63%	1.63%	14.5878	0.0998	IV	VI	Increase
3	24.39%	5.03%	4.6755	0.4238	VI	III	Increase
4	17.84%	5.48%	3.0953	0.2413	VII	IV	Increase
5	2.39%	1.35%	1.1132	0.0782	VIII	VII	Increase
6	23.83%	0.54%	42.7174	0.0481	III	VIII	Increase
7	19.48%	0.34%	54.2476	0.5185	I	II	Increase
8	18.98%	0.35%	51.0389	0.5199	II	I	Increase

Source: the authors.

Table 14
RAROC ratio case-studies for 2006–2016

Fund	Return	VaR	RAROC	Rank
1	0.50%	-5.29%	0.0948	IV
2	0.46%	-9.04%	0.0505	VII
3	0.74%	-6.72%	0.1104	II
4	0.68%	-7.12%	0.0959	III
5	0.42%	-1.43%	0.2909	I
6	0.40%	-10.00%	0.0396	VIII
7	0.69%	-7.47%	0.0918	VI
8	0.73%	-7.94%	0.0918	V

Source: the authors.

vious Calmar was calculated over the last three years but the current one only over the last year. However, we can compare rankings which will give us an idea of how funds did in comparison to each other and make the following conclusions:

Almost all funds have a risk of around 1% when funds 3 and 4 have a risk higher than 5% but in the previous Calmar ratio, they were in the top 4 funds.

Funds 6–8 have large Calmar ratio because they have a high return comparing to a very small risk which allows them to get the first three positions in the ranking. Also, if we compare their previous ranks we will see that funds 7 and 8 were in the top two, however, fund 6 was the last one.

Fund 1 did not change its ranking in comparison to other and fund 5 moved from the 7th position to the last one.

RAROC

As was discussed previously RAROC uses VaR as a measure of risk. In order, to determine VaR historical approach and monthly data was used in order to obtain VaR because 10 years are not enough to calculate the percentile carefully. Also, the 5th percentile was used to obtain Va R. Table 14 shows the calculations:

As we can see from Table 14 it gives very different results compared to other measures most likely because monthly data was used and not yearly. However, we still can make the following conclusions from Table 14.

All funds have negative VaR which means that none of the funds produced positive returns in the 5% of worst scenarios. Fund 6 has the highest risk among all funds. However, previously fund 6 had a lot higher risk than other

Table 15
RAROC ratio case-studies for 2017

Fund	Return	VaR	RAROC	Previous RAROC	Rank	Previous Rank	Increase/Decrease
1	0.75%	-1.00%	0.7502	0.0948	VI	IV	Increase
2	2.05%	-1.40%	1.4643	0.0505	IV	VII	Increase
3	2.03%	-2.48%	0.8188	0.1104	V	II	Increase
4	1.49%	-2.63%	0.5660	0.0959	VII	III	Increase
5	0.20%	-0.48%	0.4119	0.2909	VIII	I	Increase
6	1.99%	0.11%	18.1709	0.0396	III	VIII	Increase
7	1.62%	-0.05%	30.4743	0.0918	I	VI	Increase
8	1.58%	-0.08%	19.9601	0.0918	II	V	Increase

Table 16
Putting all measures together for the previous 10 years

Fund	Sharpe	Information	M2	M3	Sortino	Calmar	RAROC
1	VI	VI	VI	VI	VI	V	IV
2	VII	V	VII	VII	VII	VI	VII
3	I	III	I	III	I	III	II
4	IV	IV	IV	IV	III	IV	III
5	V	VI	V	V	V	VII	I
6	VIII	VIII	VIII	VIII	VIII	VIII	VIII
7	III	II	III	II	IV	II	VI
8	II	I	II	I	II	I	V

Source: the authors.

but using RAROC fund 2 has a risk almost as high as the fund's 6.

Fund 5 produced the lowest risk again and a relatively high monthly return which brings fund 5 to the first place.

Now let's compare the results for the following year:

RAROC was calculated based on a monthly basis because otherwise there is not enough data to calculate 5th percentile. From Table 15 we can draw the following conclusions:

Even though fund 6 has the third-ranking but it is the only fund which VaR is positive meaning that even the lowest 5% of returns is positive. That is why it is supposed to be the most attractive fund based on RAROC.

Fund 5 which had the first ranking before now has the lowest and it is the least attractive fund for investors.

If we compare the previous ranking and for the following year we can notice that it has a very

big difference. Previous ratios changed places for fund just a little bit but RAROC brought some funds from the top ranking to the lowest and *vice versa*.

Putting All Ratios Together

Now, we would like to look at all the measures together. It will provide an easier comparison between measures and their rankings.

As we can see from the Table 16 all measures have quite different results. However, RAROC has the most distinct ranking most likely because it used monthly data.

If we look at specific funds the following can be noted:

All ratios ranked fund 6 as the least attractive fund for the investments including RAROC.

All measures except RAROC put fund 5 on places 5–7 (most of them gave it 6th place). However, based on RAROC this fund got the first place.

Table 17
Putting all measures together for the following year

Fund	Sharpe	Information	M2	M3	Sortino	Calmar	RAROC
1	VI	VII	VI	I	V	V	VI
2	IV	I	IV	VI	IV	IV	IV
3	V	II	V	V	VI	VI	V
4	VII	IV	VII	VII	VII	VII	VII
5	VIII	VIII	VIII	VIII	VIII	VIII	VIII
6	I	III	I	II	III	III	III
7	III	V	III	III	I	I	I
8	II	VI	II	IV	II	II	II

All measures agree that fund 3 must be at the top of the list. However, only Sharpe, M2 and Sortino ratios put it on the first places. Others gave it either second or third places. Especially, if we look at M3 it gave it the third place and we know that fund 3 underperforms on a risk-adjusted basis if we add correlation and benchmark into account and into the portfolio. Therefore, fund 3 shouldn't take the first place.

An interesting observation is that all ratios except for RAROC agreed on which funds take places from 1–4, and 5–8. All ratios ranked funds 3, 4, 7, and 8 as the top 4 funds out of 8. Even though they had different rankings they all shared the first half of the ranking.

Now let's look at the following year measures ranking:

From Table 16 and Table 17 we can make the following conclusions:

As we can see from the Table 17 almost all ratios agree that fund 7 and 8 should be on the first 3–4 positions. It agrees with the ratios of the previous 10 years. Almost all ratios gave funds 7 and 8 the top rankings.

The same as for the past 10 years all measures agree on the worst fund which this year it happens

to be fund 5. Previously, all measures ranked fund 5 from 5–7th places except for RAROC which gave it the 1 place.

It is also interesting that all ratios except for M3 ranked fund 1 from 5–7th places. However, M3 gave it the first place which shows how much correlation affects the ranking. If we go back and look at Table 9 (3.8) we will see that fund 1 had the lowest negative correlation with the benchmark. Which proves our previous assumptions about correlation: investors seek investments with the negative correlation and the lower correlation the better because it helps to diversify the risk.

Conclusions

Risk-adjusted performance measures can play an important role when choosing new investments. Ranking managers can help to determine the best or the worst manager not only based on pure return but also adjusting for risk.

These measures can be applied not only while choosing new investments but also when hiring a new manager. If a fund wants to hire a new manager, they can calculate presented measures and select manager that attract them the most based on ratios between return and risk.

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Анализ инвестиционной деятельности на основе количественных мер, настроенных на риск

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Аннотация. Для инвесторов существует множество инвестиционных решений, и у них должна быть возможность сравнивать их эффективность с помощью количественных показателей, учитывающих риски. Если инвестор основывает свой выбор инвестиционного решения только на величине доходности, то он подвергается риску невозврата его инвестиций. Ввиду этого обстоятельства инвесторы основываются на таких количественных показателях качества своей инвестиционной деятельности, которые отражают возникающие при этом риски. В статье даются развернутые характеристики не только широко распространенных показателей такого типа, но и показателю М3, который учитывает корреляцию активов. Арсенал этих и других показателей применяется к реальным финансовым данным для более адекватного ранжирования инвестиционных менеджеров, позволяя при этом сравнивать полученные результаты с одногодичным прогнозом.

Ключевые слова: индикаторы эффективности; корреляция; ранжирование инвестиционных менеджеров
JEL classification G11, G17

The Instruments to Reform the World System of Currencies: Internationalising the Currencies of the BRICS

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Abstract

The general outcomes of this article come from a hypothesis that expanding the BRICS currencies in the contemporary World System of Currencies (WSC) is going to be a major driver of reinforcing financial stability and transforming the WSC by means of the internationalisation process as a result of direct international settlements as well as through purchasing them using currency vehicles at the national foreign exchange markets. As a result there emerges a need to analyse the BRICS currencies' circulation abroad, identifying the stages and directions of their internationalisation, considering the role they may play in the future development of the economies and near-by regions, their cooperation in mutual trade, investment flows, technology exchange, research and development, energy, financial stability and economic security. The article is especially time-relevant since the yuan is becoming a world reserve currency that may change the structure and the mechanism of the WSC.

Keywords: the currencies of the BRICS, currency internationalisation, financial globalisation, the reform of the International Financial Architecture, the World System of Currencies, the BRICS exchange rate regimes.

JEL Classification: F37

The Currency Internationalisation Theory

At the beginning of the 21st century, there appear certain changes in the views and ideas about the world economy and world economic relations. There are changes in the basis of their scientific and technological development. The globalisation process is being transformed. There emerges a new paradigm of social science. Multilateral initiatives of the emerging economies are becoming drivers of globalisation, and there arises a need to analyse, evaluate and forecast their role and future in the world economy (Kaufman, 2001). The paradigm of the existing world system of currencies (WSC) is undergoing a transformation process under the influence of many factors, including the internationalisation of some of the world's countries' currencies, especially the BRICS' currencies. Currency in-

ternationalisation has become a crucial part of financial globalisation. The BRICS' currencies, first of all, the Chinese yuan, or Renminbi (RMB), are aggressively penetrating the world market and are being built into the WSC (Yu, 2014). The yuan has been included in international reserves, the SDR currency basket and international liquidity (Avdokušin & Kovalenko, 2012).

New financial instruments are coming into being at the international financial markets. These new financial instruments formerly used to decrease the level of the currency risk. Now they cause systemic risk in the WSC which in the late 20th — early 21st century has become an important factor for financial crises to emerge, spread and repeat. Financial disparities and distortions led to the global financial crisis of 2008–2010 and a systemic crisis of the WSC. The world financial and economic crisis

destabilised the WSC as well as national systems of currencies in many countries of the world, which resulted in those currencies' devaluation and increased their volatility.

Due to financial globalisation, its development and intensification, the contagion effects started to spread via financial channels to hit many countries of the world (Schindler, 2009). This is because the countries of the world today are becoming more and more interconnected. And in case of a financial crisis in one country, there exists a strong possibility of its spreading over to other countries linked by a chain of international currency, international debt, international trade and other economic relations.

As world prices in the international trade are expressed in US dollars, this greatly affects the economic development of many countries, including the BRICS. For China, the world prices are critically important because it is a world factory and the largest exporter of goods as well as the greatest consumer of energy and other resources. India is a large importer of energy and exporter of goods and services with a high value added. Russia, Brazil and South Africa are one of the largest world exporters of raw materials, agricultural products and minerals. Therefore the instability of the WSC and world prices immediately affect the international competitiveness of the BRICS. For China and India, an increase in world raw materials' prices means more expensive imports, greater production costs, higher inflation rates and the devaluation of the yuan and rupee. In Russia, Brazil and South Africa growth in world prices of energy, agricultural products, minerals and other materials led to similar consequences. However, the three countries are less sensitive to these fluctuations because they are set off by export revenues of the extracting industries resulting in soaring government revenue in the form of taxes, customs duties and hard currency reserves. In contrast, China and India buying more expensive imports start to export their finished goods at higher prices, which is why their losses are significantly greater since their total exports are much larger than those of Brazil, Russia and South Africa. On the other hand, a drop in the world prices of raw materials and intermediate products reduces export revenues of the three countries, halts their economic

growth, makes them increase internal prices and taxes to compensate budget losses and leads to inflation and the devaluation of the real, rouble and rand. Whereas China and India get profited from decreasing world commodity prices because by importing cheaper inputs they will produce less expensive finished goods which are more price-competitive. And when exporting the finished goods, the two countries will get more profits. However, such externalities may result in extreme long-term unsustainability of economic growth in the BRICS as a whole, as their development is going to be constantly dependent upon external factors which they cannot change or make adjustments for.

Hence the problem of trying to find ways and instruments to reduce foreign exchange risks is becoming more and acuter. Traditionally, these risks have been hedged by means of currency derivatives such as futures, forwards, etc. But the international foreign exchange market and the international derivatives' market are dominated by the dollar. And more than 90% of both markets' total turnover is of speculative nature meaning that these markets' transactions do not practically serve the interests of the real economy. The virtual character of the transactions leads to more frequent and deeper crises (Lane & Milesi-Ferretti, 2011). Therefore the BRICS, besides being dependent upon world commodity prices, are vulnerable to the situation on the international foreign exchange market and the international derivatives' market. That means that to stabilize the commodity prices and the export revenues the BRICS need other approaches to dealing with the foreign currency risks.

One of such approaches may become the currency internationalisation which nowadays attracts much attention of many researchers both in Russia and elsewhere.

The Currency Internationalisation Phenomenon

The interest in the research on the currency internationalisation can be explained by the fact that it finds itself on the intersection of several scientific areas including world economics, international and national finance, international debt, currency circulation, and banking and stock exchange activities. The

currency internationalisation issue has become acuter due to the world financial crisis of 2008–2010 when there were fears of the dollar crash or the dollar bankruptcy. Some economists made pessimistic scenarios as to the dollar's future status in the WSC (Wade, 2008).

At the present, among the BRICS' currencies, only the yuan and to some extent rupee have good chances of being internationalised (Kadayan, 2014). The real, rouble and rand, in their turn, may only claim for regional currency status within the respective integration agreements (Kasekende, Brixova & Ndikumana, 2010). A major factor for their internationalisation or, better, regionalisation is the role the BRICS play in the global economy and in its certain areas. The currency regionalisation is part of the currency internationalisation. It stands on a lower level and is bounded to a certain territory.

By cooperating with China in the international and regional trade, investment, and foreign exchange transactions as well as by participating in the China-led financial institutions, Brazil, Russia, India and South Africa will be able to use their currencies more widely first at the regional level and then probably at the level of the global economy.

As a result of the yuan's vigorous rise, we expect transformations in the international financial architecture (IFA) and the WSC.

The contemporary WSC works on the basis of the agreements that were reached in Kingston, Jamaica, in 1976. These agreements ruled the free-floating exchange rate regime which since then brought about the ever increasing foreign exchange risk that started to seriously affect national currencies' stability. The world foreign exchange market became ungovernable, and the world prices began fluctuating very dramatically, destabilising the national systems of currencies in many sovereign states, especially the developing and emerging countries. The issue of international indebtedness has turned out to be very acute.

After decades of the existence of the system of fixed and free-floating exchange rates, the US dollar integrated into the WSC so deeply that it is almost impossible to imagine now that it may be pushed by some other currency. However, the discussions to find a substitute

to the dollar become usually quite acute during world crises. The most serious ones occurred in the 1970s, late 1990s and at the end of the first decade of the 21st century.

At first oil shocks of the 1970s and 80s led to the economic downturn in Western Europe and Japan as a result of a sharp rise in world oil prices and a drop in export competitiveness. Soaring world oil prices led to an increase in demand for the dollar because it is the currency in which all world commodity prices are quoted. Contrary to many expectations the situation eventually helped strengthen the dollar's exchange rate. And since more expensive oil brought more profit to the oil exporting countries, dollar-denominated accounts spread outside the US all across the globe concentrating in the largest international financial centres, which helped the development of the Eurodollar market.

The Asian financial crisis of 1997–1998, in its turn, forced the emerging markets to take loans from the International Monetary Fund (IMF) and the World Bank, which again created additional demand for the dollar and once more reinforced its position and status in the WSC.

Finally, as a result of the world financial crisis of 2008–2010 the deficit of liquid assets in the international financial market allowed the US to expand the dollar supply which in the end again strengthened its role in the WSC.

Furthermore, to prevent a crisis from happening, each nation in the world accumulates reserve funds that are mainly denominated in dollars. The BRICS are the largest keepers of the official reserves in dollars among the developing countries. And since they are overwhelmingly export-oriented economies, they still receive dollars in exchange for their produce, which again stimulates the demand for the dollar and supports its exchange rate and the positions in the WSC. This helps draw a conclusion that each new world crisis that follows and the fast development of a few countries needing huge amounts of foreign capital and loans for further economic growth will result in the dollar's reinforced position in the WSC. Thus perhaps the only way to break through this vicious circle is, as is suggested by the author, a long-term evolutionary period of accumulating negative differences in the WSC. These differences are becoming acuter due to systemic violations of

the international currency issuance rules by the US as the key world reserve currency sovereign. First, the US violated the principles of the Bretton Woods system, and later — those of the Kingston Agreement. The violations are expressed in the fact that the US allows inflation, devaluation, losing value against the gold, chronic deficit of the payment balance and current-account balance and a very big gap between the consumption and saving. The US finances its budget expenses at the expense of the dollar emission. The US has also accumulated the significant external debt (Goldberg & Cédric, 2008).

The WSC's transformation may also happen as a result of a gradual increase in the BRICS currencies' use in international and regional settlements when there will come into being the factors and drivers that will allow driving the dollar away from its key position.

Further to the analysis of the special features of the WSC's development, we conclude that it changes approximately each 30–40 years. The Jamaican monetary system is already more than forty years old. So, perhaps the new principles, goals, purposes and functions of the WSC which have been discussed during all the G20 summits starting from 2008 are a process of coming to a new international monetary agreement. It has not received a finished shape in the form of a common document yet, but it is quite probable that by the end of the second decade of the 21st century there will have been created a new WSC under a new name in the contemporary world economy. Therefore, to take a respectable position in the new emerging WSC it is necessary to negotiate now the conditions under which various countries are going to participate in it. These conditions will have to be negotiated as part of the WSC's far-reaching reform (Jordà, Schularick & Taylor, 2011).

Currently, the WSC's reform is about strengthening the IMF and the World Bank by means of increasing reserve funds, bilateral swap agreements between the biggest central banks and diversifying the credit instruments' portfolio in the international financial institutions (Griesgraber, 2009). However, there were no cardinal changes in the WSC since 2008, and the role of the developing countries in it remained practically the same because the ad-

vanced countries block the possibilities of the former through the IMF by actively pushing through their interests in the IMF (Burlačkov, 2012).

Nevertheless, the BRICS continue their search for the ways of expanding their participation in the WSC's institutions. The essence of their approach is to set up extra financial institutions and funds (such as the BRICS Development Bank) and to diversify international liquidity by first of all including the yuan in the international reserves (Binder, 2013). Brazil, Russia, India and South Africa thanks to cooperation with China in the sphere of international trade, investment, monetary policy and participation in the financial institutions created by China will be able to more widely use their national currencies first at the regional level and then, probably at some future moment, at the level of the global economy (Butorina, 2011).

Extra financial institutions' goals include looking for the sectors of the world debt market where the IMF's and World Bank's presence is small in order not to stimulate the competition and destabilize the WSC. This means the inclusion of the BRICS' financial institutions into the existing WSC and the emerging world financial stability network.

The Reform of WSC

The IMF's reform is a far-reaching process which may involve the increase in the use of a few countries' currencies in the international transactions and settlements as a result of the currency internationalisation. The creation of a new WSC may be preceded by the establishment of a transitional one which will be based on a few currencies such as the dollar, the euro, yuan, pound sterling, yen and special drawing rights (SDR). This may result in diversifying the international liquidity and a reduction in monetary and financial risks. The new WSC may include the currencies of the BRICS that enjoy high economic growth, wide possibilities of providing loans to foreign nations, massive expansion of capital onto the foreign markets and technological and military supremacy compared to other countries. None of the BRICS has such excellent qualities in a total. Therefore they are not able to

claim for hegemony in the world economy yet. This means that a deeper participation of the BRICS in the WSC today is only possible under the conditions of collectively making use of their specific competitive advantages.

The financial competitive advantages of the BRICS are made up of sovereign wealth funds and gold and foreign exchange reserves within the boundaries of the existing WSC. So, the refusal of the BRICS to use the international currencies such as the dollar and the euro will mean the loss of their competitive advantages.

Thus to take a more important position in the WSC, the BRICS have to export more capital and more goods and services; stimulate the process of their currencies' internationalisation; increase the use of these currencies in international, regional and sub-regional transactions and settlements and also in the border districts; provide loans to foreign countries in national currencies; improve monetary cooperation; and set up niches to trade in currency instruments denominated in the national currencies at the foreign exchange markets.

It is therefore important to turn now to analysing the general issues of the currency internationalisation and specific cases of the BRICS currencies' internationalisation.

The currency internationalisation is part of the financial globalisation and a good driver for the countries to integrate into the IFA and world capital markets that give wide access to liquid assets. On that basis the author concludes that the currency internationalisation significantly benefits the issuer country as follows:

a) It has the possibility of making use of seigniorage, i.e. it receives revenue as a result of the issuance. According to some estimates, approximately 60% of the dollar supply circulate outside the US, and if an interest rate in the country equals to, say, 4%, then the revenue from charging the interest rate will amount to about 0.1%, or more than 17 billion dollars a year

b) It may finance the deficit of the payment balance and current-account deficit

c) It may receive the emission rent which means an increase in clientele for the national banking sector and getting a competitive advantage in the national currency's trading abroad, for this industry gets a privileged access to the

funds of the issuance country's central bank and is able to create debt in the international currency

d) It may expect increasing demand on the part of non-residents for the banking and non-financial services expressed in an internationalised currency, including the services such as foreign exchange transactions and investor consulting. To this end the financial sector of the international currency's issuance country will support and sustain the development of the industrial sector, for then interest rates and the cost of capital in the economy will decrease and make real investments look more profitable a business

e) Its multinationals may benefit from internationalising the currency of the country of origin because their foreign exchange risk will be overloaded on to their foreign counterparts.

Since the financial globalisation is a factor of spreading the financial crises, then the currency internationalisation may also involve potential risks for the countries of issuance. These risks are:

a) More speculative capital inflows under the conditions of circulating any national currency and securities denominated in it abroad may destabilize the domestic currency system and the country of issuance

b) The lack of restrictions and legislation to use and circulate an international currency in foreign economic transactions does not allow to control and regulate the cross-border movement of capital

c) The issuance of government and private debt securities denominated in an international currency abroad may involve the significant growth of external government and private debt. Therefore, the issuer countries of the international currencies usually have serious negative positions in foreign assets and debt

d) Liberalizing capital transactions in absence of the flexible free-floating exchange rate regime leads to a situation where a fixed or tightly managed exchange rate of an international currency prevents automatic equalization and balancing capital's inflow and outflow

e) Lifting restrictions on capital movement without market principles as to setting interest rates in an issuer country of an international currency may make households withdraw their

deposits from the banking sector, which will cause the liquidity crisis and will help develop shadow banking

f) A country issuing an international currency may face the loss of independence in domestic monetary and macroeconomic policies. As a rule, an issuer country of an international currency is expected to observe certain exchange rate regime, sustain its fluctuations within some hard bounds, set limits on changes of the rate of refinancing, etc. The issues of independent macroeconomic policy find themselves in the theory of optimal currency zones. According to this theory, the exchange rate is a stabilisation instrument which can be used to cover the current-account deficit.

Nevertheless, when considering various schemes of the BRICS going over to direct settlements in national currencies, the author has found that the conditions of the optimal currency zones may be unacceptable in a situation of refusing national currencies in favour of the common one in the mutual trade. According to the results of the research, the conclusions of the optimal currency zones' theory point out at a very small possibility that within the BRICS there will be a currency union with a common currency. That means it is more rational for them to keep independent currencies. And sometimes it is quite beneficial to use the dollar or the currency of the strongest and largest economy of the regional integration grouping when transacting with each other.

The Results

The analysis which has been carried out by the author shows that the internationalisation of the BRICS' currencies may be divided into four stages: micro, medium, macro and mega levels (*Fig. 1*).

For the micro level of the BRICS currencies' internationalisation, the major conclusions and outcomes of the optimal currency zone's theory are true in the case only when one of them is used as a common currency. The examples include rupee which is used as a common currency in Bhutan and Nepal within the SAARC and rand that is a common currency for Lesotho, Namibia and Swaziland which are the member states of the SACCU/Z. The rationality of keeping independent currencies by the

member states of the integration groupings with the BRICS' participation is determined by a significant difference in the level of their economic development. And in case of a crisis, weak countries using a common currency will not be able to turn to conventional macroeconomic instruments such as exchange rate regulation, default on external government debt and currency devaluation to increase export competitiveness. Meanwhile, the BRICS currencies can be allowed to be used in circulation as units of account in the member states.

Medium-level internationalisation of the BRICS' currencies can proceed in near-border regions. Here the resident commercial banks of two countries (for example, China and Russia in the Far East) are given the right to open special accounts in the national currencies, particularly the rouble and the yuan, for companies and individuals to transact with each other in cross-border deals. Micro and medium level internationalisation of the BRICS' currencies is a stage on which a special foreign exchange infrastructure is being set up, first of all, a separate niche to trade in currency pairs of the national units of account.

On the basis of analysing the mutual trade within the integration blocs, we have found that the major mechanism of the currency internationalisation at the macro level is the establishment of the appropriate financial infrastructure including the creation of special niches at the foreign exchange markets to trade in the given currency. We have concluded that direct settlements in the BRICS' currencies will not bring a positive effect without the backing of trading in this currency at the foreign exchange markets of the regional integration groupings' member states. An incentive to make direct settlements happen may be beneficial and favourable conditions of purchasing the BRICS' currencies at the foreign exchange markets of the member states in compare to the conditions offered by their central banks.

We recommend therefore that the commercial exchange rates should be set separately for exports and imports in order to stabilize BRICS currencies exchange rates in the course of the internationalisation process, since the latter requires their free and unrestricted circulation when using the methods of government

regulation (e.g. central bank's intervention) is out of the question. Indirect regulation may be exercised only by means of setting less favourable commercial exchange rates for foreign countries with which the BRICS have current-account deficits and a more favourable one — for the foreign trade partners which are most attractive for the BRICS to trade and cooperate with.

For example, the rand's internationalisation is analysed at the level of SAACU/Z, which is a currency union without the common central bank and ultra-national currency. In South Africa, in addition to the monetary policy of setting the commercial exchange rate, there is a mechanism for fixing financial exchange rates to allow transactions with capital. We recommend, therefore, that the commercial and financial exchange rates of the national currencies should be used parallel to divide the foreign exchange market into a trade-oriented niche and a financially oriented one in order to prevent speculations. Such an approach may constitute one of the methods to internationalise the BRICS currencies in case of the government gradualist policies, meaning gradual liberalisation of transactions with capital and foreign exchange.

A very serious restraint on the rand's internationalisation is the domination of natural resources in the exports which are usually denominated in dollars. This is also true for the rouble and real. From this, you may draw a conclusion that if South Africa, Brazil and Russia continue to export raw materials in exchange for the dollars, it will be extremely difficult to increase the share of the national currencies' use in the foreign trade.

To this end in order to internationalise, say, the rouble at the macro level it is necessary to transform the Russian economy on a higher technological basis, diversify the structure of the industries, increase the use of the rouble in the transactions with the EEU to strengthen the competitive positions in contrast to China that is really active in its penetrating the member states' markets, stimulate rouble-denominated direct and portfolio investment abroad and try to make the EU's countries accumulate roubles and rouble-denominated government bonds in their reserves. To make this happen the Rus-

sian economy requires re-industrialization, the introduction of new technologies, attracting of foreign capital and an increase in the international competitiveness. Also, it is crucial to improving the rouble's purchasing power at the national, regional and international markets.

Major conditions for the BRICS currencies' internationalisation include free convertibility and free-floating exchange rate regime. To ensure the efficiency of this regime's performance in open economy conditions, a further and deeper development of the BRICS financial centres is needed that often involves diversifying the portfolio of foreign exchange market's instruments. The greatest share in the foreign exchange trading at the BRICS foreign exchange markets is taken by currency pair the dollar/national currency. Therefore it is necessary to expand the supply of the currency instruments in which an obligatory condition would be to trade in currency pairs with the BRICS currencies' participation. In the case of the BRICS currencies' internationalisation, it is also very important to understand at which level and in which sequence their circulation and use abroad is occurring. For example, the macro level of the currency internationalisation precedes entering the international markets, whereas the micro and medium levels require a deeper integration of currencies within the regional agreements by means of creating special niches to trade in national currencies at the local or domestic foreign exchange markets.

To improve the mutual foreign trade transactions between Russia and China due to the high volatility of the rouble's exchange rate and under the current free-floating exchange rate regime, the instruments for hedging foreign exchange risks are required to ensure the stability and positive dynamics of exports and imports between both countries. According to the author, such instruments can be timely-optimal and type-optimal contracts to deliver the yuan at the Moscow Exchange. A timely-optimal contract is a currency vehicle to purchase the yuan at the Moscow Exchange at the most favourable moment or period. A type-optimal contract, in its turn, is usually a derivative to purchase the yuan at the Moscow Exchange that provides a choice between several types of swap currency vehicles to do that.

The currency internationalisation at the mega-level is about creating a relevant infrastructure to help conclude foreign trade contracts in the BRICS' currencies. It can be done within an international financial centre or an offshore centre of some of the BRICS' currencies, e.g. the yuan, on the one hand, and commercial banks of continental China. For example, Hong Kong, Taiwan, Singapore, London and Luxembourg have become the yuan's offshore centres responsible for making possible Chinese foreign trade with overseas markets using a certain limited amount of the currency in the yuan as well as derivatives and international bonds denominated in the yuan. The leading position in the infrastructure to settle foreign trade deals and capital account transactions in the BRICS' currencies can be taken by the central clearing institutions such as the central banks and foreign exchange markets as well as accountable commercial banks which are allowed to open special accounts to conclude business contracts in one of the BRICS' currencies, with a coordinating centre — the BRICS Development Bank, for example, — as the supreme clearing establishment responsible for organising and controlling the movement of capital (*Fig. 2*).

The internationalisation of the BRICS' currencies at the mega-level is the uppermost phase of their territorial or horizontal expansion on to the foreign markets.

Conclusions

The problems and the prospects of the yuan as an international currency are first of all connected with its inclusion in the SDR basket. This is a crucial factor for the yuan's internationalization in its strive to go over to the mega-level. However, since the SDRs take a small share in the international liquidity, a decisive determinant in the future yuan's use in the WSC would be a deeper financial reform in China, including total convertibility, the development of the national market of government and corporate bonds, providing international investors with more opportunities to purchase stocks of Chinese enterprises, the establishment of free liquidity funds, further liberalisation and the abolishment of various restrictions for foreign investors to use the yuan as well as the creation of the common

channels between the national gross transfer settlement system and the payment systems of the other BRICS.

One of the major instruments to internationalise the yuan at the mega-level is to increase its share in China's credits abroad, first of all in the developing countries. The purpose of such loans is providing access to minerals needed for the Chinese industry as well as building infrastructure helping to extract and transport them.

As for the rouble's internationalisation at the mega-level, it must be said that this process is closely connected with the establishment of the yuan's offshore centre in Moscow. According to the author's hypothesis among the BRICS' international financial centres, Moscow has the brightest prospects in creating one, for there is a niche to trade in the yuan at the Moscow Exchange. No other BRICS' country has such a niche. Favourable conditions to purchase the yuan at the Moscow Exchange can be secured by means of diversifying the portfolio of special currency vehicles. The author has found that the most suitable currency vehicles denominated in the yuan for Brazilian, Indian and South African international businesses would be swaps in the yuan at the Moscow Exchange, whereas for the Russian exporters and importers a better solution would be purchasing the yuan on the spot market at the Moscow Exchange. So in case of realising the potential of Moscow as a new yuan's offshore centre, the rouble has more chances to internationalise, for this currency is intrinsic to all currency vehicles in the yuan traded at the Moscow Exchange. The rouble's mega-level internationalisation can also be driven by the further development of the rouble's offshore centre in Shanghai where there is a spot vehicle to trade in the currency pair rouble/yuan at the Chinese Foreign Exchange Trading System. A factor preventing the rouble from taking a better position in Shanghai, though, is weak diversification of Russian exports to China and an insufficient share of innovative products in them. Finally, the establishment and further deeper development of the rouble offshore centre in Shanghai and the yuan offshore centre in Moscow could be a transition stage in the latter's becoming a more important regional and later international financial centre.

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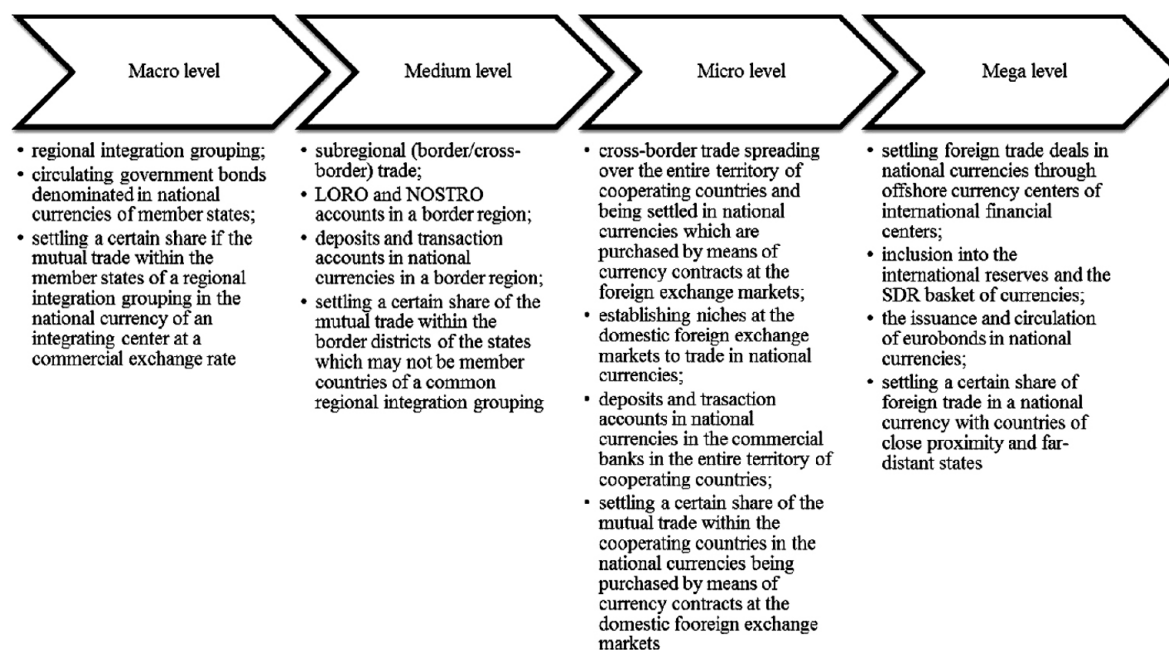


Figure 1. The multidimensional mechanism of the BRICS' currencies internationalisation.

Source: compiled by the author.

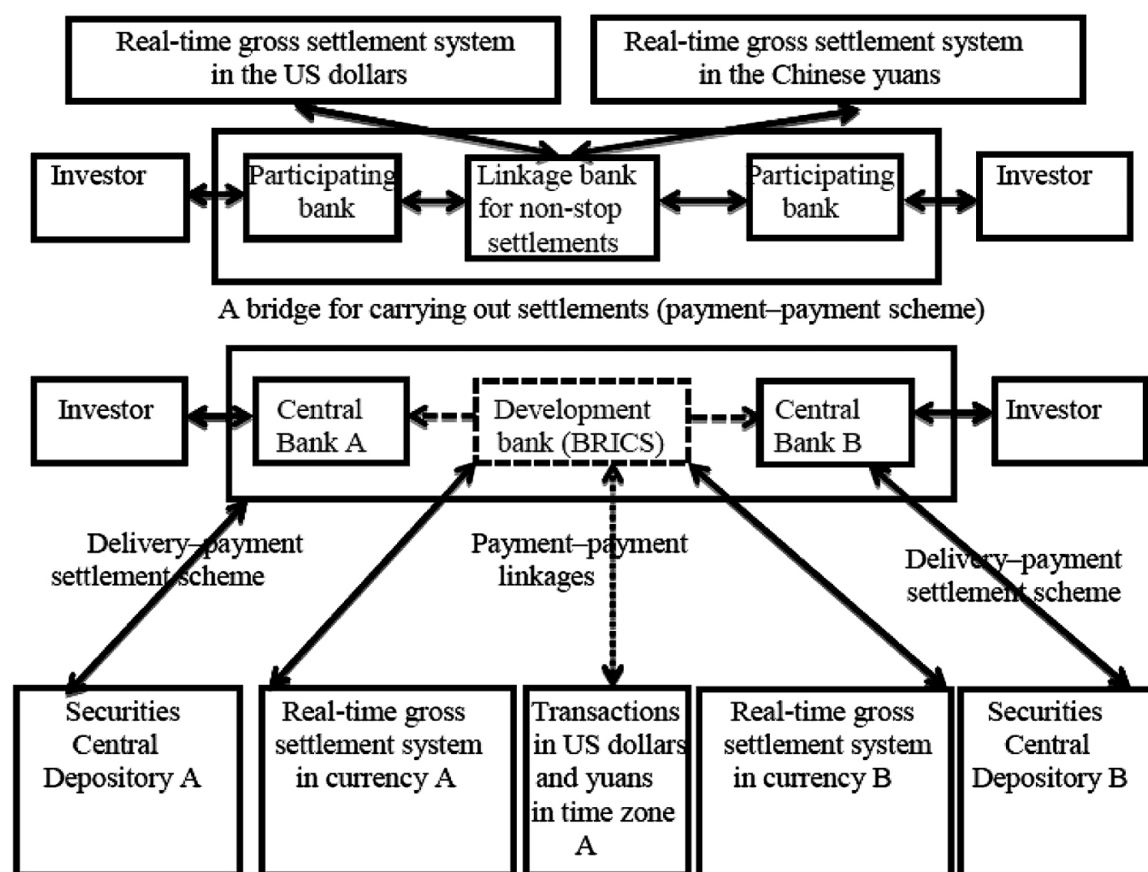


Figure 2. The mega-level internationalisation scheme of the BRICS' currencies.

Source: compiled by the author.

Инструменты реформы мировой валютной системы: интернационализация валют стран БРИКС

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Аннотация. Основные положения этой статьи исходят из гипотезы о том, что расширение использования валют стран БРИКС в современной мировой валютной системе (МВС) становится важнейшей движущей силой укрепления финансовой стабильности и трансформации МВС посредством процесса интернационализации, как результат организации прямых расчетов, а также с помощью их купли-продажи на базе валютных инструментов, обращающихся на валютных рынках. Вследствие этого возникает необходимость анализа обращения валют стран БРИКС за рубежом, выявления этапов и направлений их интернационализации с учетом роли, которую они могут играть в будущем развитии национальных экономик и приграничных территорий, сотрудничества во взаимной торговле, инвестиционных потоках, обмене технологиями, научных разработках, в сфере энергетики, финансовой стабильности и экономической безопасности. Проблематика статьи особенно актуальна в связи со становлением юаня как мировой резервной валюты, изменяющей структуру и функционирование МВС.
Ключевые слова: валюты стран БРИКС; валютная интернационализация; финансовая глобализация; реформа международной финансовой архитектуры; мировая валютная система; режимы обменных валютных курсов стран БРИКС

JEL Classification: F37

A Law of Social Development

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Abstract

Changes in the amount, structure and composition of the information factors point to future changes in a society. This makes it possible to formulate a hypothesis or a law of information impact on a society: increase of information speeds social development, and vice versa, a decrease of information inhibits it. A consequence of what can be called a sociological law of information is that an index of increase/decrease of the amount of information points to the changing direction of social developments, and especially to the turning points in seemingly stable trends. In this article, the above-mentioned conclusion is discussed on the basis of socio-political and financial and economic data.

Keywords: time; politics; economics; information; society

JEL Classification: D89, O10

The preservation of the volume of information or the size of the information space does not mean that there was no change in the amount of information available. For example, as soon as banks go into liquidation, and it becomes meaningless to these to position themselves in the financial information space, their participation turns into a burden for information space because these create *data smog* that replaces the actual information. At present, this situation is not purely theoretical as a number of financial organizations continue to act in information space although their main activity is suspended. Furthermore, examples from the history of the Central Bank point to the same direction. The most striking example is the information lull before the 1998 Russian default. In particular, during the course of 1998 the flow of information was slowly drying up, and not only that flowing from the Central bank to the bank system, but also the flows of information generated within the financial market, namely, in the segments of the state short-term bonds and inter-bank loans. The monitoring of bank policy by the Russian Central bank was also influenced by the collapse of information.

The same can be illustrated by the contemporary information war, which takes place be-

tween business and political elites in the US. It is possible that the US President slightly exaggerated the role and significance of data smog created in media space by newsmakers engaged by his political opponents, as well as by analysts and commentators, but the fact is that society is divided in its attitude to various things including the interpretation of this information. Each side sees the information provided by mass media as false and this leads to mounting risks of dangerous social and political instability.

Similar, although the less visible effect of the shrinking information space reveals itself in the activities of international organizations, which signals about the risk of growing international tensions. This, in the 2010s, information provided by international financial organizations, first of all, by the International Monetary Fund, decreased: the sample of periods in published prognoses was narrowed, only annual information was published, and quarterly data was dropped. This trend was compensated through the Organisation for Economic Co-operation and Development (OECD), MARKit Economics, as well as by international newsagents Thomson Reuters and Bloomberg by launching of leading indicators and consensus-prognoses on the quarterly and monthly level. But these agencies also began to wrap up the open

publication of data¹. It is not difficult to see that this preceded the sharp increase of international economic and political conflicts.

The speed of socio-economic processes depends directly on the increase of information and, to a certain extent, can even be measured by this increase. The change of information space, which reached a certain speed, is especially sensitive to attempts to curtail it forcefully. In mass conscience, defamation is used, but this is not possible in professional communities; thus, in those fields, other means are applied — either political persecution of the bearers of knowledge or the promotion of pseudo-science. Unfortunately, there are plenty of examples. Recently history is being re-written again for propaganda purposes, and attempts have been made to found “econophysics”, which attracted public attention, etc. This quasi-scientific grey data smog, together with obvious distortions of the idea of the search for plagiarism in academic disciplines lowers the prestige

¹ This phenomenon, which is relatively new, at least, in its scale, also emerged in Russian post-reform practice of monetary authorities. In the early 1990s, the Central Bank staff was of the opinion that crediting bodies could not have policies of their own. This opinion was voiced at the discussion of the programme of the monitoring of bank policy; its opponents appealed to a seemingly waterproof argument that commercial credit organizations lacked independent bank policy as opposed to a real monetary and credit policy of the Central Bank. It was stated, with no justification, that tool of monitoring was all nonsense because it did not look like bank statistics, and that banks would not report anything about their work. What the Central Bank wanted to know about the banks' policies — first of all, about currency policy, crediting policy, and the policy in the market of the state short-term bonds — was proclaimed unknowable because it was assumed that commercial banks had not and could not have any independent policies; in other words, it was implied that commercial credit organizations only followed the orders from the Central Bank, as it had happened, and thought to had happened, in the system of the state Bank of the USSR. Indeed, at that time, a chance for banks to deviate from the policy of the Central bank seemed negligible. The fate of monitoring remained unclear until the first poll took place. It demonstrated the need for a new communication channel between the regulator and the community of banks, important for the emerging two-tier bank system. About a year and a half after monitoring, the Russian Agricultural bank and the Incombank (two well-known and relatively large banks of the time) refused to participate in it. This was a danger signal, which could have been viewed as a risk of lowering level of information exchange within the bank system. Soon it emerged, that the said banks left the system of information exchange because by that time were, in fact, bankrupt. We will not go into the causes of the sharp decline of their financial health, and will only remark that the decrease of information flow proved to be very sensitive to the first signs of the crisis of the Russian bank system, which developed in the default of 1998.

of science and serves as an indirect justification for less investment into science and education, which, in the end, slows the social development.

There is as much information in the world as there has been produced. The danger of spreading of false information is that it distorts its real impact on the society, thus creating a deformation in its development. As soon as disinformation emerges in a society, unrecognizable risks grow. The addition of true information lessens risks (this is one underestimated tool for risk management), and, indeed, shrinking of real information increases risks.

One can only guess to what extent the authorities act consciously by implementing the policy of the “sterilization of information”. One should bear in mind, however, that all monetary reforms in the USSR and Russia were linked to both shrinking of information and defamation. Moreover, the history of modern wars saw false banknotes (money also provides information) as a dangerous weapon that could create chaos in national economies that already suffered from serious and sometimes fatal overload. Today, there is a heated debate about the interference of states in the world market of crypto-currencies, which are nothing but electronic information about money, but not the money itself.

Information holds an important component, and this is a mostly coded reference to future events. The even historical information contains the said component because it had been produced to know the future. The change in volume and structure of information, and in the composition of information factors point to future changes in the society. A striking example of this is a current turbulent political life in the US where false information replaces the real one, thus increasing risks of social instability considerably, not recognized by American elites.

Two examples mentioned above — financial information and information provided by mass media — do not exhaust the problem of the changes in its parameters seen as indicators for the early detection of system crises of the society. Other information flows are equally important — i.e., those produced in the intellectual sphere — in education, culture, finance, media, consulting. This aspect is now pushed into the background by problems of safety, survival and ecology. However, its actuality grows as it is being accepted as the

main driver of social development, which plays a core role in the new economic model of the economy of knowledge. With the rise of socio-political activism in the world, the role of social studies in education grows as well. The neglect of social studies, which in the past had been reduced to the propaganda of either “communism”, or the “consumerist society”, is the thing of the past.

Insertion

The characteristic of intellectual production is in its “natural” quality of self-growth, both literally, expressed in the increase of information space, and economically, shown in the self-growth of the price of intellectual resources (intellectual property). Moreover, information cannot be multiplied if it does not grow, in other words, the translation of “knowledge” is based on its ability to self-grow. To put it simply, the news is needed, and this is a basis for the media industry. Knowledge cannot be old; thus, it can only be new. This is the cornerstone of science. In a sense, the same can be said about art, which lives in the renewal of forms, meanings and aesthetics, and this is demonstrated in the fashion industry. Let us add that, unlike natural sciences where the object of physical world is relatively stable, at least, inhuman dimension (although even this postulate is being re-interpreted as a result of changes in physical condition of the Earth, which is happening in front of our eyes), in social sciences, the object — the society — evolves, thus creating a need for the corresponding development of new trends in academic studies².

The ecology of information requires keeping policies transparent, and this concerns not only the authorities but social life as a whole. Lowering the level of transparency even in one of society’s subsystems inevitably slows down all social development. The law of information for living systems is that a system is indifferent to any increase in information, but this does not apply to a more complex, social system where any decrease of information leads to its degradation, and vice versa, any increase of information determined its development. Studies in Economics have long confirmed that the rise of transparency is a necessary condition of the efficient policy. Clarity of aims and goals, programmes and controls — all of these in equal measure defined the efficiency of economic projects.

² Development is the way societies change, and it is revealed in laws of deepening social inequality, increasing social diversity and growing speed of social transformation.

Transparency is not just an idea, but a technology, which is reflected in corresponding internationally recognized demands to the actions of authorities, corporations and professional market players. American monetary authorities led the way in developing requirements to the disclosure of information, organization of the circulation of information within the code of corporate management, code of ethical market behaviour, international standards of reports, etc. Introduction of these technologies was necessary to provide for the US currency board, and not only for that, the state ensures access to business information for investors, regulators and law enforcers.

Development is connected to the increase of information because each innovation requires not only relevant information but maximum information. This condition is of great importance because it is difficult to say in advance, which of bits of information would dominate later, and which would be pushed to the background. One of the most obvious examples here is military technologies. These change quickly, and what seemed yesterday to cause unacceptable damage to the enemy, would become surpassed tomorrow. This happened to nuclear and conventional weapons, which are now being successfully supplanted by technologies of hybrid wars; this happened to words wars now replaced by local conflicts.

Another important aspect of this topic is that the volume of information is rising dynamically, and today it is not possible for one person even to comprehend, let alone process it, but even to comprehend it. Information can only be processed by formal and/or informal partnerships, through the use of the endless resource of the “collective consciousness” when information exchanges happen both on the verbal and descriptive level, and on subconscious one. From this point of view, it becomes clear the distortion of information space leads to unmanageability, and as a consequence, to slowing development.

No less, and perhaps even more important is the demand for maximum information in academic studies because it is not possible to produce new knowledge without correlating it to the existing one. Thus, academic disciplines tend to narrow research focus and to produce new knowledge at the overlapping margins of various academic subjects, fields and even disciplines.

Insertion

Adaptation of the Russian educational system to the requirements of Western universities (the so-called Bologna system) deforms information space on the lowest levels of professional education by moving the acquisition of the fundamental knowledge component to further, more advanced stages. It would seem that there is some sense in this — to begin with practice-oriented studies, and then add world-view-shaping knowledge on top of this. The problem is, the practice-oriented education, is in fact, far from real professional practice, and only at M St level, a considerable number of students combine work and studies, to the detriment of the latter.

Both decrease and increase of information are natural for society, thus, it is important to understand how sensitive this system is to even slightest changes — distortion of information space of a market or corporate management, or of government's policies. It should be taken into consideration that there was an interesting phenomenon in the USSR: as soon as problems emerged in the economy, the bureaucratic system suddenly sprang to action, and normative acts followed by propaganda campaigns abounded. This was defamation intended to work as social anaesthetics for growing social tensions. Something similar happens now in the developed countries, which suffer from ethno-

cultural shock caused by the arrival of migrants; these were pushed from their home countries by local conflicts provoked by the same Western countries to raise the competitiveness of their economies as these suffer from the rising cost of intellectual resources.

The above-said leads to the idea of the quantitative evaluation of the information dynamics, which would have pointed to an increase/decrease of risks in a society. One possible method is the registration of information events. Thus, experiments with news lines made by subject-oriented business analytics have demonstrated their stable correlation to the expectation of professional market players. This would have been a trivial conclusion; however, it appeared that not only the changes in information space shape expectations but also the expectation of professional market players shape subject-oriented information space. Upon consideration, this can also be seen as trivial. What is far from trivial, however, is that in both cases stochastic correlation between corresponding times series is inconstant. It could have been accepted that news flow shapes expectations more often than not. In the latter case, it can be said that the model of the behaviour of market players change, as if time slows, while in the former case the time seems to congest.

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Закон социального развития

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Аннотация. Изменения в объеме, структуре и составе информационных факторов указывают на будущие изменения в обществе. Это дает возможность сформулировать гипотезу или закон информационного воздействия на общество: увеличение информации ускоряет социальное развитие, и наоборот, уменьшение информации тормозит его. По мнению автора, следствием того, что можно назвать социологическим законом информации, является то, что индекс увеличения/уменьшения объема информации указывает на изменение направления социальных событий, особенно, на поворотные точки при, казалось бы, устойчивых тенденциях социально-политического и финансово-экономического развития страны.

Ключевые слова: время; политика; экономика; информация; общество; закон информационного воздействия; информационные факторы

JEL Classification: D89, O10

The Role of Personality Traits in Assessing the State of the Russian Society by Persons with Different Economic Behaviour

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Abstract

The article describes what indicators of the condition of society are used in Russia and abroad. Publications in which happiness, subjective economic well-being, life satisfaction, subjective quality of life and others are considered in this capacity, are reviewed. The question of the role of personality traits in assessing the situation in the country is raised, as well as the impact of these assessments on the economic behaviour of citizens. The results of the empirical study of 260 subjects using questionnaires, which include questions about the political, psychological, social, economic situation in the country, economic behaviour and psycho-diagnostic tests, are presented. The interrelations of assessments of the political and psychological situation in the country with personal traits and debt behaviour are revealed. Extraversion and openness to experience are negatively, and conscientiousness is positively interconnected with positive assessments of the state of the Russian society. The differences in assessments of the state of the Russian society among respondents with different investment preferences are described.

Keywords: political, social and psychological state of society; subjective assessment of the state of society; subjective economic well-being; personality traits; economic behaviour; investment behaviour, debt behaviour, crypto-currency mining

JEL Classification: C91, D14, D84

The Relevance of the Study and Background

In most international studies, quality of life, well-being and sustainable development are used as indicators of the state of society (Aisyah Abu Bakar et al., 2015; Aisyah Abu Bakar et al., 2016; Handan Turkoglu, 2015; Jakupov et al., 2012; Kelley & Evans, 2017; Proto & Rustichini, 2015; Firat & Boyer, 2015; Roland-Levy, Boumelki & Guillet, 2010). These concepts can relate differently to each other: to be analyzed independently, one concept to enter into another or to unite and create new terms. In research of Russian scientists, the situation is similar: life satisfaction considered as a psychological equivalent of happiness, or as its components and even as a prerequisite. In gen-

eral, happiness, subjective well-being, life satisfaction, subjective quality of life, the meaning of life — being different concepts cover one ontological field and are closely related to one another (Zhuravlyov & Yurevich, 2014). However, the high level of income does not guarantee life satisfaction (Ilin & Morev, 2016, p. 927).

The most detailed analysis of indicators of well-being and quality of life is given in Aisyah Abu Bakar et al. (2016): the article summarizes the data of The Malaysia Quality of Life Reports (MQLI) published in 1999, 2002, 2004 and 2011. The validity of the identified approaches to measuring the impact of economic development on the social development of Malaysia through a set of social indicators is evaluated. The Malaysia Quality of Life Reports (MQLI) and the Malaysia

Wellbeing Reports (MWI) welfare reports claim a holistic, balanced approach that includes a variety of indicators.

The article of Aisyah Abu Bakar et al. (2015), written on the basis of the same reports, but published one year earlier, shows the relationship between well-being and sustainability, which is the basis for the concept of sustainable well-being. Handan Turkoglu (2015) also shows the relationship between sustainable development and the quality of life. External, economic, social, physical and health indicators are considered in terms of their contribution to the strategy of sustainable development. The subjective quality of life illustrates the quality of life as a psychological state of life satisfaction, rather than objective conditions (physical, social, economic), although they are interrelated. An attempt to create an index of the macro psychological state of society was also undertaken by Russian scientists (Yurevich et al., 2007). The question “How do Russians assess the situation in their country?” seems relevant, especially in the context of its relationship with economic behaviour.

In this article, we will try to describe how Russians evaluate the socio-psychological and political situation in Russia and how these assessments are related to their personal characteristics and economic behaviour. We focused our attention on the respondents' economic behaviour and investment preferences. This choice is due to the fact that the shift in economic behaviour (from borrowing to saving, for instance) is connected with the way respondents assess their prospects. Uncertainty about future events is associated with individuals with financial risks, and the prospect of not being able to pay off the debts is frightening, up to suicidal attempts. This causes people to develop savings plans and overcome their desire to spend money as soon as they do. The relationship between consumption, savings and debt is as follows: in the case of saving — consumption is delayed, unlike a loan — it can meet the need immediately. Debtors have a shorter time perspective and a number of certain personality traits, according to Nyhus and Webley (2001). Savings behaviour, contrary, implies the ability to connect the present and the future and is the result of the prevalence of the desire for benefit in the long run over the motivation to spend money immediately. Roland-Levy et al. (2010)

suggested that a fear about the financial crisis would provoke a desire to save more and borrow less, but the hypothesis was not confirmed and the attitude to the financial crisis affected neither savings nor borrowing behaviour. The difference between saving and investing is that investing is an active process aimed at multiplying existing assets, and saving is only to preserve them. E.R. Bezsmertnaya (2016) explains the Russians low engagement into investment behaviour by a low level of financial literacy and the lack of an investment culture of citizens, as well as a low level of trust in financial institutions. The readiness to invest also reflects people's trust in Russian authorities (Dejneka & Vartanova, 2012). In addition, the higher socio-psychological and political instability in the country is, the higher the belief in accidental enrichment and gambling.

The psychological state of Russian society, in terms of its social significance, is comparable to its political and economic characteristics. There are different approaches to its measurement as we understood from the beginning of our review. It was even suggested to monitor the psychological state of Russian society in terms of the dynamics of the spread of suicidal mortality, which indicates the degree of adaptation of the population to the existing conditions of life (Ilin & Morev, 2016, p. 925).

In the works of Hashchenko (2012) “subjective economic well-being” (SEW) is analyzed in details and shown on the Russian sample that the amount of income is gaining psychological value in richer people. The level of SEW is minimally dependent for low income, but it increases significantly when its size reaches or exceeds normal (average) prosperity according to respondents' estimates.

According to statistics for 2017, the main factors of concern for Russians remain fears associated with price increases and international conflicts. Yurevich (2009) notes that the feeling of stability for the majority has been replaced by a sense of despair, oppression, and some social rejection, but the conclusion that “the phenomenon of feeling the stability of one's position is not valid for Russia” is unfounded.

The psychological attitude to economic and political stability depends not only on the objective situation and its interpretation by the subject but also on how this subject relates to the

state, as well as on its individual psychological characteristics, particular situation and general mood. One of the most important individual psychological characteristics is life satisfaction, which to some extent reflects the assessment of “stability” at the personal level (Dejneka & Vartanova, 2012, p. 2)

In the article by Proto and Rustichin (2015), personality traits are seen as mediators between income and life satisfaction. The effect of neuroticism, which measures sensitivity to threat and punishment, is strong in both the British Household Panel Survey and the German Socio-economic Panel. It was found that individuals with a higher Neuroticism score enjoy extra income more than those with a lower score if they are poorer, and enjoy extra income less if they are richer. When the interaction between income and Neuroticism is introduced, income does not have a significant effect on its own. To interpret the results, Proto and Rustichini (2015) presented a simple model based on Prospect Theory, where they assumed that: (i) life satisfaction is dependent on the gap between aspired and realized income, and this is modulated by Neuroticism and (ii) income increases in aspirations with a slope less than unity, so that the gap between aspired and realized income increases with aspirations. From the estimation of this model, Proto and Rustichini argued that poorer individuals tend to overshoot in their aspirations, while the rich tend to under-shoot. The estimation of the model also shows a substantial effect of traits on income. A study conducted by Benjamin et al. (2011) showed that overall satisfaction with the lives of respondents with high Neuroticism decreases more quickly for a high-income level.

Bujor and Turliuc (2014) describe personal, family and emotional predictors of subjective well-being. In their paper, well-being is operationalized through positive affects, negative affects, emotional distress, and life satisfaction. This research integrates three concepts (personality (measured by Big 5 inventory), family correlates and emotion regulation) in a predictive model of well-being.

The results showed that emotional stability predicts well-being on all four dimensions: positive affects, negative affects, emotional distress and life satisfaction. Emotion regulation strategies are predictors for (positive and negative)

affects only, and not for emotional distress or life satisfaction

Summing up the theoretical analysis of domestic and foreign literature, we formulated the following hypothesis: there is a connection between the assessments of the political, economic and psychological situation in the country, personal traits and economic behaviour. Following other authors (Bujor & Turliuc, 2014; Kelley & Evans, 2017), we used the taxonomy of the Big Five to determine personality traits. As types of economic behaviour, we considered debt behaviour that we have already analyzed in previous papers (Gagarina & Shantseva, 2017; Smurygina & Gagarina, 2016) and investment behaviour, by sampling individuals investing in securities (stocks and bonds) and those who invest in crypto-currency and mining equipment. The latter was taken by us since this type of activity is characterized by a high degree of risk, as in scientific articles Eng-Tuck Cheah and John Fry (2015) raise the question of the actual cost of bitcoin (fundamental value) and the signs of a bubble in the crypto-currency market. At the same time, the authors prove that the fundamental cost of bitcoin is zero and its growth is largely determined by speculation.

Methodology

To study the representations about the situation in Russia, we used a questionnaire, which included the following blocks of questions: 1) Evaluate, which, in your opinion, is the psychological atmosphere in Russia today; 2) Evaluate, which, in your opinion, is the political situation in Russia today.

Each characteristic was presented in the form of two antonymous adjectives and bipolar scales. On each scale there should be only one estimate, where 3 is a strong expression; 1 — poor quality of expression. When processing the results, the bipolar scale was converted to a unipolar scale (from 1 to 7).

Then followed the assessment of the social and economic situation in the country and assessment of subjective economic well-being.

We assessed personality traits with A short portrait questionnaire of the Big Five; debt behaviour and debt attitudes with Questionnaire of debt behaviour of M. Gagarina and investment behaviour (and preferences) on the experience

Table 1
Descriptive statistics and t-test for representations about the political situation in Russia of male and female respondents

Political situation in Russia	Males, N = 86		Females, N = 130		t	p
	M	SD	M	SD		
Explosive/Calm	3.6	1.62	3.6	1.52	-0.1	0.903
Authoritarian/Democratic	2.9	1.54	3.4	1.62	-2.4	0.016
Contradictory/Consistent	3.1	1.57	3.6	1.71	-1.9	0.057
Irritating/Restful	2.9	1.42	3.4	1.48	-2.0	0.044
Hostile/Friendly	3.2	1.39	3.7	1.43	-2.9	0.004
Tense/Relaxed	3.0	1.38	3.2	1.62	-1.0	0.343
Unstable/Stable	4.2	1.98	4.0	1.82	0.5	0.652
Unpredictable/Predictable	4.5	1.97	4.2	1.83	1.3	0.207
Dependent/Independent	3.1	1.56	3.6	1.57	-1.6	0.116
Economic situation in Russia	2.4	0.97	2.6	0.89	-1.8	0.075
Social situation in Russia	2.6	0.82	2.7	0.81	-0.5	0.610

Source: author's calculations.

of investing in various products of the financial market.

We interviewed 216 people, including 86 males and 130 females.

Results and Discussion

First, we will consider the gender differences in the assessments of the political, psychological and social situation in Russia. The results are presented in Tables 1 and 2.

The political situation in Russia, according to males, is more authoritative, hostile and irritating than to females. Differences in the assessment of the economic situation (living standards, prospects of development, etc.), as well as the social situation (conflicts and contradictions between people, social strata, etc.) and subjective well-being, have not been revealed.

Analyzing the psychological atmosphere in Russia (Table 2), males have significantly more negative assessments than females, considering it more unfree, tense, aggressive and hopeless.

Our sample included respondents from Moscow, the Moscow Region, Saratov, Samara and Cheboksary. However, due to the small representation of the remaining regions, we compared the views of only residents of Moscow and the Moscow Region. There were no significant differences in any of the parameters.

Further, we were interested in how the assessments of the situation in Russia are connected with personality traits and economic behaviour. For this, we calculated the Pearson correlation coefficients and carried out a comparative analysis.

First, we will analyse how the representations of the situation in Russia are related to personality traits (Table 3).

The assessments of the political situation in Russia turned out to be related to personality traits in the following way. Extroversion is inversely related to the assessment of the political situation as consistent ($r = -0.2$; $p < 0.05$). That is, the more a person is active, sociable and aimed at interacting with other people, the more he considers the political situation in the country to be contradictory. The openness to experience is inversely related to the assessment of the political situation as calm ($r = -0.2$, $p < 0.05$). That is, the more a person is inquisitive, open to innovations and creative, the more he is inclined to assess the political situation as unsettled. Consciousness is positively interconnected with the assessment of the political situation as friendly ($r = 0.2$, $p < 0.05$) and the social situation as calm ($r = 0.2$, $p < 0.05$): the more a person expresses responsibility, the propensity to planning and following the rules, the more highly

Table 2

Descriptive statistics and t-test for representations about the psychological atmosphere in Russia of male and female respondents

The psychological atmosphere in Russia	Males, N = 86		Females, N = 130		t	p
	M	SD	M	SD		
Not Free/Free	3.2	1.55	3.7	1.57	-2.5	0.012
Tense/Relaxed	2.6	1.26	3.0	1.26	-2.1	0.036
Aggressive/Benevolent	3.2	1.33	3.7	1.25	-2.5	0.014
Sad/Joyful	3.1	1.44	3.5	1.43	-1.8	0.071
Hopeless/Promising	3.6	1.44	4.2	1.44	-2.9	0.005
Hostile/Friendly	3.6	1.35	4.0	1.36	-1.9	0.057
Fussy/Peaceful	3.3	1.33	3.2	1.54	0.2	0.857
Dull/Cheerful	3.5	1.66	3.7	1.52	-0.8	0.424
Frustrating/Calm	3.4	1.39	3.5	1.31	-0.4	0.665

Source: author's calculations.

Table 3

Pearson's correlation coefficients for assessments of the political, social and economic situation in Russia and the personality traits of the respondents

Political situation in Russia	Extraversion	Neuroticism	Openness to experience	Conscientiousness	Agreeableness
Explosive/Calm	-0.1	-0.1	-0.2*	-0.1	0.1
Authoritarian/Democratic	0.0	0.1	0.0	0.0	0.1
Contradictory/Consistent	-0.2*	0.0	0.0	0.0	0.1
Irritating/Restful	0.0	-0.1	-0.2	0.0	0.2
Hostile/Friendly	0.0	0.0	0.0	0.2*	0.2
Tense/Relaxed	0.1	0.0	0.0	0.1	0.1
Unstable/Stable	-0.2	0.1	-0.1	-0.1	0.0
Unpredictable/Predictable	0.0	0.0	0.0	-0.1	0.0
Dependent/Independent	0.1	-0.1	0.1	0.1	0.1
Economic situation in Russia	0.0	0.1	0.1	0.0	0.1
Social situation in Russia	0.0	0.0	0.1	0.2*	0.0

* Significant at $p < 0.05$.

Source: author's calculations.

he assesses the political situation as a friendly and social situation as calm. For neuroticism and agreeableness, significant interrelations have not been found.

The following significant correlations of assessments of the psychological situation in the country with personality traits were obtained.

Openness to experience is inversely related to the assessment of the situation as peaceful ($r = -0.2$; $p < 0.05$). The conscientiousness is positively correlated with the assessments of the psychological situation as benevolent ($r = 0.2$; $p < 0.05$), promising ($r = 0.2$, $p < 0.05$) and cheerful ($r = 0.2$, $p < 0.05$).

Table 4

Pearson's correlation coefficients for assessments of the psychological situation in the country and the personality traits of the respondents

The psychological atmosphere in Russia	Extraversion	Neuroticism	Openness to experience	Conscientiousness	Agreeableness
Not Free/Free	-0.1	0.0	-0.1	0.0	0.1
Tense/Relaxed	0.0	0.0	-0.1	0.0	0.1
Aggressive/Benevolent	0.0	0.0	0.0	0.2*	0.0
Sad/Joyful	0.1	-0.1	0.1	0.1	0.1
Hopeless/Promising	0.1	-0.1	0.0	0.2*	0.2*
Hostile/Friendly	0.1	-0.1	0.1	0.2	0.1
Fussy/Peaceful	0.0	-0.1	-0.2*	0.0	0.0
Dull/Cheerful	0.1	-0.1	0.0	0.3*	0.1
Frustrating/Calming	-0.1	0.0	0.0	0.1	0.1

* Significant at $p < 0.05$.

Source: author's calculations.

Table 5

Pearson's correlation coefficients for assessments of the political, social and economic situation in Russia and Debt behaviour questionnaire scales, age and subjective well-being (SWB)

The political situation in Russia	Debt avoidance	Rational debt behaviour	Debt attitudes	Internality in debt	Age	SWB
Explosive/Calm	0.0	-0.1	0.0	-0.1	0.2	0.0
Authoritarian/Democratic	-0.1	-0.1	0.1	-0.1	0.1	0.0
Contradictory/Consistent	0.0	0.0	0.1	-0.1	0.2	0.0
Irritating/Restful	0.0	0.0	0.1	0.0	0.0	0.0
Hostile/Friendly	-0.1	-0.1	0.1	-0.1	0.2*	0.0
Tense/Relaxed	-0.1	0.0	0.0	-0.1	0.2	0.2*
Unstable/Stable	0.0	0.0	0.0	0.0	0.2*	0.0
Unpredictable/Predictable	0.0	0.0	-0.1	-0.1	0.1	-0.1
Dependent/Independent	0.0	0.0	0.0	0.0	0.1	0.0
Economic situation in Russia	0.0	0.0	0.2	0.0	0.1	0.1
Social situation in Russia	0.0	0.1	0.0	0.0	0.1	-0.2*

* Significant at $p < 0.05$.

Source: author's calculations.

Next, we looked at how assessments of the political (Table 5) and psychological (Table 6) situation in the country are related to age, subjective economic well-being and debt behaviour.

The more highly respondents assess their subjective economic well-being, the more they

perceive the political situation as relaxed and less positively assess the social situation. Age is positively correlated with the assessment of the political situation as friendly and stable.

Assessments of the political situation in Russia are not related to any scales of debt behaviour questionnaire scales.

Table 6

Pearson's correlation coefficients for assessments of the psychological situation in Russia and Debt behaviour questionnaire scales, age and subjective well-being (SWB)

The psychological atmosphere in Russia	Debt avoidance	Rational debt behaviour	Debt attitudes	Internality in debt	Age	SWB
Not Free/Free	0.2	0.2	0.3*	0.2	0.1	0.1
Tense/Relaxed	0.1	0.1	0.2	0.1	0.0	0.1
Aggressive/Benevolent	0.1	0.1	0.2*	0.1	0.1	0.0
Sad/Joyful	0.0	0.1	0.1	0.0	0.1	0.0
Hopeless/Promising	0.0	0.0	0.1	0.0	0.2	-0.1
Hostile/Friendly	-0.1	-0.1	0.0	-0.1	0.2	-0.1
Fussy/Peaceful	-0.3*	-0.2*	-0.1	-0.2*	0.3*	0.0
Dull/Cheerful	-0.1	0.0	0.0	-0.1	0.1	0.1
Frustrating/Calming	0.0	0.0	0.1	0.0	0.2*	0.0

* Significant at $p < 0.05$.

Source: author's calculations.

Table 7

Descriptive statistics and t-test for representations about the situation in Russia of respondents trading and not trading securities

	Do not trade securities			Trade securities			t	p
	M	SD	N	M	SD	N		
Hostile/Friendly	3.3	1.36	24	4.0	1.35	183	-2.45	0.015
Unstable/Stable	3.1	1.47	24	4.2	1.89	184	-2.75	0.006

Source: author's calculations.

Table 8

Descriptive statistics and t-test for representations about the situation in Russia of respondents investing and not investing in financial pyramids

	Do not ready to invest in financial pyramids			Ready to invest in financial pyramids			t	p
	M	SD	N	M	D	N		
Fussy/Peaceful	3.2	1.49	165	4.5	0.84	16	-2.09	0.038
Dull/Cheerful	3.5	1.66	99	5.2	1.10	15	-2.26	0.026
Tense/Relaxed	3.0	1.55	165	4.3	1.86	16	-2.01	0.046

Source: author's calculations.

Assessments of the psychological situation in the country are not related to assessments of subjective psychological well-being but are related to age. The older the respondents, the more they evaluate the psychological situation as friendly ($r = 0.2$, $p < 0.05$), peaceful ($r = 0.3$; $p < 0.05$) and calming ($r = 0.2$; $p < 0.05$).

Evaluation of the psychological situation in Russia as peaceful is negatively associated with

debt avoidance ($r = -0.3$; $p < 0.05$), rational debt behaviour ($r = -0.2$; $p < 0.05$), negative debt attitudes ($r = -0.2$, $p < 0.05$). That is, the more respondents tend to consider the psychological situation in Russia as fussy, the more they are convinced that they are responsible for their debts alone, avoid borrowing, and if they borrow, they calculate how and when they will pay it back in full. A representation that living with

Table 9

Descriptive statistics and t-test for representations about the situation in Russia of respondents investing and not investing in financial pyramids

	Do not participate in the crypto-currency market			Participate in the crypto-currency market			t	p
	M	SD	N	M	SD	N		
Not Free/Free	3.2	1.57	124	5.2	1.33	11	-4.15	0.000
Tense/Relaxed	2.7	1.27	124	3.5	1.13	11	-2.20	0.030
Aggressive/Benevolent	3.3	1.32	123	4.2	1.33	11	-2.08	0.039
Irritating/Restful	3.3	1.31	124	4.3	1.19	11	-2.29	0.024
Authoritarian/Democratic	2.9	1.56	124	4.0	1.10	11	-2.27	0.025
Frustrating/Calming	3.1	1.47	124	4.3	1.56	11	-2.56	0.012
Tense/Relaxed	2.9	1.47	124	4.0	1.79	11	-2.31	0.022
Economic situation in Russia	2.5	0.96	124	3.1	1.14	11	-2.04	0.044

Source: author's calculations.

debts is not normal is positively associated with the assessment of the psychological situation as benevolent and free.

Then we turned to the economic behaviour of the respondents. We compared the assessments of the situation in Russia of respondents with different investment preferences (t-test): those who invest in securities on the exchange (Table 7, here and below only significant results are presented), ready to invest in financial pyramids (Table 8) and participate on crypto-currency market (Table 9).

Respondents trading securities on the exchange, rate the political situation in Russia as more hostile and the psychological situation as more unstable than respondents who do not trade. There were no differences in the assessments of the economic and social situation.

Respondents who are ready to invest money in financial pyramids assess the psychological situation as peaceful and cheerful compared to those who are not ready to invest. Differences in the assessment of the political situation are detected by the degree of its tension – those participating in the financial pyramids estimate it as less tense; differences in assessing the social and economic situation are not revealed.

Respondents engaged in the crypto-currency market (by mining crypto-currencies, buying crypto-currency and equipment for mining) are more likely to assess the political situation as

free, relaxed, benevolent and calming, and the political situation as democratic, restful, relaxed. They see the economic situation as prosperous. In general, we can say that they are more optimistic, easy-going in their attitudes toward the situation in Russia. In our work (Gagarina & Lopanova, 2018), performed on a sample of 360 people, we found rather contradicting results about their personal traits. We compared the personal profiles of the above-described investors and got that those who are engaged in mining differ from those who invest in traditional financial instruments and from those who invest in financial pyramids by a lower level of extraversion, openness to experience and agreeableness and higher neuroticism. While investors in financial pyramids and investors in traditional financial instruments differ only in terms of the level of consciousness, which is lower in the latter. So we can assume that such a superficial and demonstratively positive assessment of the social, psychological, political and economic situation in Russia by respondents engaged in the crypto-currency market is a manifestation of psychological defence.

Conclusions

Summarizing, we can draw the following conclusions. In our sample, males assess the political and psychological situation in Russia more negatively than females. Personality

traits are also important in shaping the representations of the situation in Russia. The higher the extraversion, the more inconsistent the political situation is assessed. With increasing in openness to experience, the political situation is assessed more restless and fussy. The growth of consciousness is connected with an estimation of a political situation as more friendly, and psychological as more benevolent, promising and cheerful. Debt behaviour is associated only with the assessment of the psychological situation in Russia and is not related to the assessment of political. Investors in financial instruments traded on the exchange have more negative views about the political situation in Russia. Investors in financial pyramids have more positive assessments of the psychological situation in the country. Respondents involved in the crypto-currency market have more positive assessments of the political, psychological and economic situation in the country.

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Роль личностных черт в оценке состояния российского общества лицами с различным экономическим поведением

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Аннотация. В статье анализируются результаты исследования состояния общества в России по следующим показателям: счастье, субъективное экономическое благополучие, удовлетворенность жизнью, субъективное качество жизни и др. Поднимается вопрос о роли личностных черт в оценке ситуации в стране и влияния этой оценки на экономическое поведение граждан. Приведены результаты анкетирования 260 граждан, в которое были включены вопросы о политической, психологической, социальной, экономической ситуации в стране, экономическом поведении, а также психодиагностические тесты. Выявлена взаимосвязь оценок политической и психологической ситуации в стране с личностными чертами и долговым поведением. Экстраверсия и открытость новому опыту взаимосвязаны отрицательно с позитивными оценками состояния российского общества, а сознательность – положительно. Описаны различия в оценках состояния российского общества между респондентами с разными инвестиционными предпочтениями.

Ключевые слова: политическое, социальное и психологическое состояние общества; субъективная оценка состояния общества; субъективное экономическое благополучие; личностные черты; экономическое поведение; инвестиционное поведение; долговое поведение; майнинг криптовалют

Russia's Foreign Trade under the Anti-Russian Sanctions

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Abstract

Development model based on the export of raw materials and high dependence on external economic conditions are among the main strategic threats to the national security of the Russian Federation in the field of economy. So, a number of states, not without reason, are trying to realize these threats in order to achieve their geopolitical goals by imposing different restrictions, various prohibitions and multiple sanctions. Some results of the analysis of the impact of the anti-Russian sanctions on the Russian foreign trade in 2014–2016 I present in this article. For the sphere of foreign trade, it is shown that the negative impact of prohibitions and sanctions, as well as adverse external and unfavourable internal processes and factors, had a greater impact, first of all, on the fuel and energy, petrochemical and machine-building complexes. The subjects of the Russian Federation with a high concentration of export and import, oil and gas extraction and metal-production were affected stronger than other regions. Along with this, the impact of sanctions and the response of the Russian government are stronger on the export of Russian products than on imports.

Keywords: Anti-Russian sanctions, the Russian Federation, import, export, geographical structure of foreign trade
JEL classification: F40, F49, H56

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Reduction of the Russian Federation Imports

The state and dynamics of foreign trade of any country, generally, depends on the three groups of factors: the situation in its economy and the credit and financial system; the conjuncture on the world markets; the geopolitical situation in the world. These factors largely determine the volume, dynamics and structure of foreign trade. In 2014–2016, all three groups of factors were unfavourable for the Russian Federation. The decline in investment activity was followed by an economic downturn (Figure 1), which led to a decline in demand for investment and consumer goods, including imported ones.

At the same time, the world prices for the main Russian exports have fallen, which had the effect of the reduction in the positive balance of exports

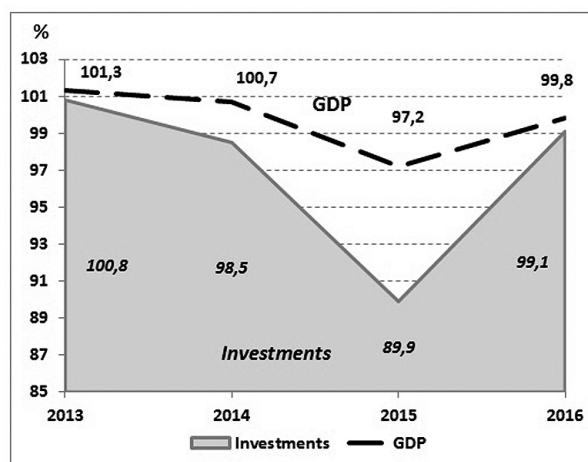


Figure 1. The rate of change of GDP and the investment in fixed assets in 2013–2016 (at comparable prices), %.

Source: the author on the basis of Rosstat's data (Rosstat, 2017).

Table 1
 Volumes of the Russian imports of certain commodity groups in 2001–2016, millions US dollars

Commodity group	2001	2013	2016
Food and raw materials	9,136.7	43,076.1	24,986.4
Production of fuel and energy complex	1,023.5	3,613.6	1,530.0
Petrochemical complex products	7,523.1	50,129.5	33,815.9
Wood and its products	1,307.8	6,641.9	3,379.1
Ferrous and non-ferrous metals	2,677.6	22,017.3	11,410.8
Engineering products	14,144.8	154,370.4	86,033.2
Other product groups	1,464.3	35,436.3	21,011.3
Imports – total	37277.8	315285.1	182166.7

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 2
 Average annual change in volumes of the Russian imports in 2002–2013 and in 2014–2016

Commodity group	Annual average absolute change in volume, mln US dollars		Average annual rate of change, %	
	2002–2013	2014–2016	2002–2013	2014–2016
Food and raw materials	2,828.3	–6,029.9	113.8	83.4
Production of fuel and energy complex	215.8	–694.5	111.1	75.1
Petrochemical complex products	3,550.5	–5,437.9	117.1	87.7
Wood and its products	444.5	–1,087.6	114.5	79.8
Ferrous and non-ferrous metals	1,611.6	–3,535.5	119.2	80.3
Engineering products	11,685.5	–22,779.1	112.0	82.3
Other product groups	2,831.0	–4,808.3	130.4	84.0
Imports – total	23,167.3	–44,372.8	119.5	83.3

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

and imports. In such circumstances, there have been introduced anti-Russian sanctions which were consistently expanded and tightened. The combined effect of these factors contributed to a reduction in the Russian imports both in absolute and relative terms (Tables 1 and 2).

In absolute terms, the volume of imports of machine-building products decreased the most in 2014–2016. In second place were food and raw materials, which was largely the result of Russia's actions in response to the sanctions imposed against it. In the third place — was the decline of petrochemical products. In absolute terms, the volume of import of fuel and energy products decreased the least. However, in the last case, the rate of reduction was higher than that of other commodity groups (see Table 1). As a result, their lowest share in total imports in 2001 and

2013, became even smaller in 2016 (Table 3). The structure of imports by commodity groups under consideration in 2016 differs from the structure in 2013: the coefficient of relative structural changes is equal to 0.0602¹.

In the regional aspect, five regions of the Russian Federation increased import volumes in 2014–2016. These are the Republic of Altay, the Republic of Ingushetia, the Chechen Republic, the Sakhalin Region and Yamal-Nenets Autonomous Area. Their combined share in the total volume

¹ The linear coefficient of relative structural shifts ($k_{s,t}$) is calculated as the sum of the absolute value of differences of shares of elements of these structures (d_i) at the time point $t-1$ and t : $k_{s,t} = \sum_i |d_{i,t} - d_{i,t-1}|$. This coefficient varies in the range from zero to two and allows us to determine the average difference in the specific weights of parts of the whole at the considered points of time. The closer the coefficient is to zero, the less the structure has changed (Kazinets, 1981).

Table 3

Shares of some product groups in the total volume of the Russian's imports in 2001–2016, %

Commodity group	2001	2013	2016
Food and raw materials	24.51	13.66	13.72
Production of fuel and energy complex	2.75	1.15	0.84
Petrochemical complex products	20.18	15.90	18.56
Wood and its products	3.51	2.11	1.86
Ferrous and non-ferrous metals	7.18	6.98	6.26
Engineering products	37.94	48.96	47.23
Other product groups	3.93	11.24	11.53
Imports – total	100.0	100.0	100.0

Source: author's calculations.

Table 4

Ten administrative entities of the Russian Federation with the most significant reduction in imports from non-CIS countries in 2014–2016

Administrative entities of the Russian Federation	Decrease in imports		The coefficient of consensus, in fractions of a unit	The share of the region* in the total volume of the Russian imports in 2016, %
	Bln US dollars	%		
Moscow city	–53,032	–43.5	0.776	43.1
Sankt-Petersburg city	–14,101	–40.5	0.200	12.4
Moscow Region	–11,414	–39.9	0.158	10.6
Primorsky Krai	–5,290	–62.4	0.118	1.9
Kaliningrad Region	–6,121	–52.5	0.106	3.5
Kaluga Region	–3,289	–45.5	0.050	2.4
Bryansk Region	–0,896	–81.9	0.041	0.1
Leningrad Region	–2,340	–47.1	0.037	1.6
Magadan Region	–0,410	–89.5	0.032	0.03
Krasnodar Krai	–1,970	–38.6	0.027	1.9

Source: author's calculations.

* The terms “region”, “administrative entity of the Russian Federation”, and “subject of the Russian Federation” in this work are used as synonyms.

of Russian imports in 2016 was 3.8%. In 43 of 82 subjects of the Russian Federation from the studied imports of at least one of the product groups in 2016 was more than in 2013.

However, the assessment of the significance of the decrease in imports (relative significance) for a particular administrative-territorial entity does not necessarily coincide with the assessment of the significance (relative significance) of such a decrease for the country as a whole. For example, in 2016 the volume of imports of the Kaliningrad Region was less by 52.5%, and Moscow city by 43.5% less than, accord-

ingly, in 2013. It seems that a decrease in the import's volume in the Kaliningrad Region was more significant than in Moscow city. However, in relative terms, the decline in Moscow's imports amounted to 42.4% of the total decrease in the country's imports, and the Kaliningrad region — only 4.6%.

Therefore, for the Russian Federation as a whole, the decrease in Moscow city imports was more significant than the decrease in the Kaliningrad Region. Another example. The shares of the decrease in imports of the Kostroma Region and the Jewish Autonomous Region in the total

Table 5

Ten administrative entities of the Russian Federation, whose imports from non-CIS countries increased in 2014–2016

Administrative entities of the Russian Federation	Increase in imports, mln US dollars	The share of the region in the total volume of the Russian imports in 2016, %
Yamal-Nenets Autonomous Area	4,781.7	3.12
Sakhalin Region	508.5	1.04
Kursk Region	84.7	0.18
Tyumen Region less autonomous areas	80.8	0.32
Vologda Region	25.5	0.31
Chechen Republic	14.7	0.02
Republic of Tuva	4.0	0.00
Republic of Altay	2.9	0.01
Republic of Ingushetia	2.5	0.01
Kamchatka Territory	2.1	0.05

Source: author's calculations.

volume of a decrease in the Russian imports in 2015–2016 coincide and were equal to 0.041%. At the same time, imports of the Kostroma Region fell by 26.5%, and imports of the Jewish Autonomous Region — by 67.7%. Therefore, with the same significance for the country decrease in the Jewish Autonomous Region was more significant than in the Kostroma Region.

For joint accounting and coherence of the significance of reducing the value of some indicator for the country and the region we propose to calculate the coefficient of consensus $k_{i,t}$:

$$k_{i,t} = (d_{i,t} \times v_{i,t-1}) / (d_t \times v_{i,t}). \quad (1)$$

Here, in the general case:

i — index of indicators, $i = 1, 2, \dots, n$;

t — time points, $t = 1, 2, \dots, T$;

$v_{i,t}$ — the value of the index i at the point of time t ;

$d_{i,t} = v_{i,t} - v_{i,t-1}$ — change in the value of indicator i between the time point $t-1$ and the time point t ;

$d_t = \sum_i d_{i,t}$ — total change of values of all indicators i between the time point $t-1$ and the time point t .

In the study of the growth of the values of the indicators, the formula for calculating the consensus coefficient has the form:

$$k_{i,t} = (d_{i,t} \times v_{i,t}) / (d_t \times v_{i,t-1}). \quad (2)$$

The higher the value of the consensus coefficient, the more significant is the change in the studied indicator for the country and for the particular region.

On the basis of the analysis of values of the proposed consensus coefficient, in 2014–2016 the most significant was the decrease in the volume of imports from so-called “far-abroad” countries², of the ten subjects of the Russian Federation presented in Table 4.

In 2016, these ten regions accounted for 77.5% of Russia's total imports from “far-abroad” countries in particular for Moscow city, Sankt-Petersburg city and the Moscow Region — 66%. However, among these three regions, imported goods are “internally exported” by the importing firms and numerous intermediaries to other regions of the country. The exception by virtue of its geographical position is only the Kaliningrad Region.

Despite the overall decrease in the value of imports by the Russian Federation in 2014–2016 as a whole, its value increased in ten administrative entities of the Russian Federation (Table 5). However, their aggregate share in the total volume of imports of the whole country in 2016 was only 5%, and 4% of it concerns both the Yamal-Nenets Autonomous Area and the Sakhalin Region.

² In Russia so-called “far-abroad” countries means all countries (states) except those that came out of the USSR, were they were the Union Republics.

Table 6

Shares of some product groups in the total volume of the Russian exports in 2001–2016, %

Commodity group	2001	2013	2016
Food and raw materials	1.55	3.08	5.97
Production of fuel and energy complex	54.65	70.67	58.18
Petrochemical complex products	7.15	5.84	7.29
Wood and its products	4.47	2.08	3.43
Ferrous and non-ferrous metals	14.35	7.77	10.08
Engineering products	10.09	5.39	8.55
Other product groups	7.74	5.17	6.50
Exports – total	100.0	100.0	100.0

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 7

Volumes of the Russian exports of some commodity groups in 2001–2016, mln US dollars

Commodity group	2001	2013	2016
Food and raw materials	1,472.3	16,196.1	17,057.2
Production of fuel and energy complex	52,074.9	371,792	166,170.3
Petrochemical complex products	6,815.2	30,739.2	20,813.6
Wood and its products	4,255.3	10,965.4	9,804.8
Ferrous and non-ferrous metals	13,673	40,859.1	28,793.3
Engineering products	9,161.4	28,339.1	24,415.1
Other product groups	7,374.5	27,221.4	18,565.5
Exports – total	95281.6	526112.3	285619.8

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 8

Average annual change in volumes of the Russian's export in 2002–2013 and in 2014–2016

Commodity group	Annual average absolute change in volume, mln US dollars		Average annual rate of change, %	
	2002–2013	2014–2016	2002–2013	2014–2016
Food and raw materials	1,227.0	287.0	122.1	101.7
Production of fuel and energy complex	26,643.1	–68,540.6	117.8	76.5
Petrochemical complex products	559.2	–3,308.5	113.4	87.8
Wood and its products	2,265.5	–4,021.9	109.6	89.0
Ferrous and non-ferrous metals	1,560.2	–1,308.0	109.4	95.2
Engineering products	1,653.9	–288.5	111.5	88.0
Other product groups	35,902.6	–80,164.2	115.3	81.6
Exports – total				

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Summing up the interim results, we can say that the systemic effect of the unfavourable geopolitical situation for Russia, anti-Russian sanctions, and the Russian counter-sanctions imposed in response to them, as well as the economic recession in the country in 2015–2016, naturally led to a decrease in the volume of the Russian imports.

Changes in the Volume and Structure of the Russian Exports

By the time of the introduction of anti-Russian sanctions by President Barack Obama, the share of fuel and energy products in the total volume of Russian exports exceeded 70% (Table 6). The sanctions were aimed primarily at the financial, fuel and energy, defence, scientific and technological sectors of the Russian economy³. Therefore, it can be assumed that all other things being equal, the anti-Russian sanctions have contributed to the reduction of exports of Russian fuel and energy products. In 2014–2016 exports of this particular commodity group fell most strongly in both absolute and relative terms (Tables 7 and 8).

In the second place, in absolute and relative terms, decrease concerned the export of petrochemical products, and in the third place — engineering products. Many companies in these sectors of the economy are until now the subjects of the anti-Russian sanctions adopted in March 2014 and consistently expanded. Exports of wood and wood products decreased the least. Russia's response to the sanctions imposed by the group of countries was primarily aimed to support the domestic agricultural producers and a ban on the import of a number of food products from countries that have adopted anti-Russian sanctions. As a result, this contributed to the increase in the volume of Russian exports of food products and raw materials.

The difference in the rate of change in the volume of exports of the main commodity groups led to a change in the commodity structure of the Russian exports (Table 6). Taking into account the value of the linear coefficient of relative structural changes (0.2498), the structure of exports of analysed product groups in 2016 was almost a quarter different from the structure of 2013. The share of exports of fuel and energy products has decreased.

³ From March 2014 to August 2017, the United States introduced restrictive measures against 244 companies, organizations and banks and 172 individuals.

However, the decrease was compensated by the growth of shares of all other product groups.

In the regional context, 16 administrative entities of the Russian Federation (out of 82 studied) increased their exports in 2014–2016. However, it did not have a significant impact on the total volume of exports, since their aggregate share in the Russian exports in 2016 was only 2.5%. The number of regions that increased the volume of exports of at least one of the product groups is much larger (Table 9). In 2014–2016 only ten regions did not increase the volume of exports of any of the commodity groups presented in Tables 7–8. These are the Republic of Bashkortostan, the Republic of Mari El, the Karachay-Cherkess Republic, the Perm region, also the Volgograd, Voronezh, Irkutsk, Leningrad, Novgorod, and Chelyabinsk regions. Their aggregate share in the total volume of exports of the country as a whole was not significant; in 2016 it was equal to 9.7%.

In the regional aspect, in 2014–2016, the volume of exports to “far-abroad” countries decreased by 59 of the 82 subjects of the Russian Federation. The total share of exports of ten of them with the highest values of the consensus coefficient $k_{i,t}$ in the total volume of exports of the Russian Federation to “far-abroad” countries in 2016 was 60.1% (Table 11). It is easy to see that eight of them are oil-producing regions, and Moscow city is an exporter of crude oil and oil products⁴. No doubt, it was a consequence of the above-described fall in revenue from oil sales caused by declining oil prices.

The volume of exports to “far-abroad” countries has decreased in 23 subjects of the Russian Federation. Among them, there are also three oil-producing regions (the Novosibirsk region, the Republic of Dagestan and the Chechen Republic), but their share in total oil production in Russia is not large. The aggregate share of these 23 regions in the total volume of the Russian exports in 2016 was only 2.7%.

Thus, the fall in prices on the world energy markets led not only to a decrease in foreign currency earnings from oil and gas exports received by the Russian Federation in 2014–2016 but also contributed to a reduction in the volume of exports of oil and gas producing regions.

⁴ The Federal Service of State Statistics (Rosstat) provides data on exports and imports of subjects of the Russian Federation in accordance with the place of registration of the owner of the goods, and not the regions of its activities (production of exported goods, consumption of imported goods).

Table 9

Shares of the first three regions of the Russian Federation with the largest increase in the volumes of exports of commodity groups in the total increase in the volume of exports of these commodity groups from Russia in 2014–2016, %

Administrative entities of the Russian Federation	Share, %	Administrative entities of the Russian Federation	Share, %
Food and raw materials		Ferrous and non-ferrous metals	
Rostov Region	27.8	Murmansk Region	33.8
Kaliningrad Region	12.0	Krasnodar Krai	16.9
Murmansk Region	7.3	Kaluga Region	15.8
Total	47.1	Total	66.5
Products of fuel and energy complex		Engineering products	
Stavropol Krai	32.9	Moscow city	44.0
Kaluga Region	19.8	Sverdlovsk Region	17.4
Bryansk Region	19.3	Khabarovsk Krai	10.4
Total	72.0	Total	71.8
Petrochemical complex products		Other products	
Rostov Region	49.0	Arkhangelsk Region	36.0
Novosibirsk Region	14.1	Khabarovsk Krai	8.8
Krasnodar Krai	12.1	Rostov Region	6.9
Total	75.2	Total	51.7
Wood and its products		The total increase in exports	
Sankt-Petersburg city	45.5	Murmansk Region	28.5
Republic of Tatarstan	13.0	Novosibirsk Region	28.2
Smolensk Region	8.4	Republic of Tuva	12.7
Total	66.9	Total	69.4

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 10

Shares of the first three regions of the Russian Federation with the largest decrease in the volumes of exports of commodity groups in the total decrease in the volume of exports of these commodity groups from Russia in 2014–2016, %

Administrative entities of the Russian Federation	Share, %	Administrative entities of the Russian Federation	Share, %
Food and raw materials		Ferrous and non-ferrous metals	
Sankt-Petersburg city	16.4	Krasnoyarsk Krai	19.4
Moscow Region	12.8	Sverdlovsk Region	10.6
Moscow city	9.7	Lipetsk Region	10.2
Total	38.9	Total	40.2
Products of fuel and energy complex		Engineering products	
Moscow city	50.9	Samara Region	13.5
Tyumen Region	9.8	Republic of Tatarstan	12.8
Khanty-Mansi Autonomous Area – Yugra	6.3	Moscow Region	9.9
Total	67.0	Total	36.2
Petrochemical complex products		Other products	
Moscow city	15.0	Moscow city	45.3
Samara Region	12.3	Sankt-Petersburg city	10.7
Republic of Tatarstan	10.3	Belgorod Region	6.8
Total	37.6	Total	62.8
Wood and its products		The total decrease in exports	
Irkutsk Region	24.9	Moscow city	45.6
Republic of Karelia	13.9	Tyumen Region without autonomous areas	8.4
Perm Krai	12.3	Republic of Tatarstan	5.4
Total	51.3	Total	54.4

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 11

Ten administrative entities of the Russian Federation with the largest decrease in the volume of exports in 2014–2016

Administrative entities of the Russian Federation	Decrease		The coefficient of consensus, in fractions of a unit	The share of the region in the Russian export, %
	bln. US dollars	Percentage points		
Tyumen Region	-18,885	-90.7	0.990	0.8
Moscow city	-93,955	-46.9	0.962	42.6
Republic of Tatarstan	-12,097	-59.9	0.147	3.2
Leningrad Region	-8,662	-65.9	0.124	1.8
Khanty-Mansi Autonomous Area – Yugra	-12,097	-51.9	0.123	4.5
Republic of Bashkortostan	-7,706	-61.3	0.097	2.0
Sakhalin Region	-8,010	-47.7	0.075	3.6
Komi Republic	-2,554	-78.5	0.058	0.3
Samara Region	-3,822	-61.1	0.048	1.0
Volgograd Region	-2,137	-73.7	0.040	0.3

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

Table 12

Geographical structure of foreign trade of the Russian Federation in 2000–2016,%

Year	Russia – total	CIS countries	“Far-abroad” countries	
			Which have introduced the anti-Russian sanctions*	Which have not introduced the anti-Russian sanctions
Imports				
2000	100.0	34.3	61.4	4.3
2013	100.0	13.6	55.6	30.8
2016	100.0	10.7	52.4	36.9
Exports				
2000	100.0	13.4	66.4	20.2
2013	100.0	15.0	66.9	18.1
2016	100.0	13.2	56.5	30.3
Trade turnover				
2000	100.0	18.6	65.1	16.3
2013	100.0	14.4	62.4	23.2
2016	100.0	12.3	54.9	32.8

Source: author's calculations on the basis of Rosstat's data (Rosstat, 2017).

* Ukraine is included in this work in the number of “far-abroad” countries that have declared anti-Russian sanctions.

The geographical structure of foreign trade of the Russian Federation in the conditions of anti-Russian sanctions

It is natural to expect that if a country or a group of countries for some reason limits foreign trade relations, scientific, technical, cultural, educational, and other relations with a certain country (let's call it the implementation of hostile poli-

cies), the latter will seek to shift to friendly-oriented states and develop relations with them. At the same time, its trade and other relations with countries engaged in hostile policies will, by virtue of the actions of the latter, weaken.

This is what the economic agents in regions of the Russian Federation have done in the conditions of the anti-Russian sanctions. They have

Table 13

Ten of the countries that have established anti-Russian sanctions, in which in 2014–2016 the volume of exports from the Russian Federation was most severely reduced

Country	Decrease		The coefficient of consensus, in fractions of a unit	Share in Russia's exports to countries that have imposed sanctions, 2016, %
	mln US dollars	percentage points		
The Netherlands	-40,845	-58.3	0.520	18.1
Italy	-26,805	-69.1	0.461	7.4
Ukraine	-17,471	-73.4	0.349	3.9
Germany	-15,797	-42.6	0.146	13.2
United Kingdom	-9,505	-57.8	0.120	4.3
Poland	-10,442	-53.3	0.119	5.7
Japan	-10,307	-52.4	0.115	5.8
Swiss Confederation	-5,711	-65.4	0.088	1.9
Finland	-6,770	-50.9	0.073	4.0
Spain	-4,082	-67.7	0.670	1.2

Source: author's calculations on the basis of 'Sanctions against Russia' (2018) and Rosstat (2017).

Table 14

Ten of the countries that have established anti-Russian sanctions, in which in 2014–2016 the volume of imports from the Russian Federation was the most severely reduced

Country	Decrease		The coefficient of consensus, in fractions of a unit	The share of imports from Russia in 2016, %
	mln US dollars	percentage points		
Ukraine*	-11,902	-75.4	0.513	4.1
Germany	-18,463	-48.7	0.382	20.4
Japan	-6,884	-50.7	0.149	7.0
Italy	-6,716	-46.1	0.133	8.2
United Kingdom	-4,682	-57.7	0.118	3.6
Poland	-4,367	-52.5	0.098	4.1
USA	-5,835	-35.3	0.096	11.2
France	-4,522	-34.8	0.074	8.9
Finland	-2,918	-54.0	0.067	2.6
The Netherlands	-2,835	-48.4	0.058	3.2

Source: author's calculations on the basis of 'Sanctions against Russia' (2018) and Rosstat (2017).

* On March 21, 2018, the Cabinet of Ministers of Ukraine decided to terminate the Program of economic cooperation with Russia. This program "was approved by the parties in 2011 and is designed for the period up to 2020. It provides for cooperation between the two countries in various fields, including trade, transport, resort and recreational area, social and humanitarian matters, border territories, and a number of others" (The Cabinet of Ministers, 2018).

changed the structure of foreign trade in favour of “far-abroad” countries that have not joined the hostile policy of the United States, the European Union and the countries that support them (Table 12). It should be noted that with regard to imports, such a reorientation is due to a number of reasons (in particular, the Jackson-Vanik amendment, the so-called “Magnitsky List”, hostile actions carried out by foreign States after E. J. Snowden’s arrival in the Russian Federation) was held for a long time.

Despite the decrease in the volume of foreign trade turnover with countries which established the anti-Russian sanctions, the country’s structure of exports from the Russian Federation in these countries in 2016 has little changed as compared to 2013. Even less has changed the structure of the Russian imports from these countries (Figure 2). This means that the main partners of Russia in the sphere of foreign trade among the countries that have adopted anti-Russian sanctions remained the same. The top five countries with the greatest turnover in trade with the Russian Federation in 2013 were the Netherlands, Germany, Italy, Ukraine, and Japan (their aggregate share in trade with all countries of the anti-Russian coalition was 51.4%), and in 2016 were Germany, the Netherlands, the USA, Italy, and Japan (50.1% share).

In 2016, the volume of Russian exports to 32 of the 42 states announced in 2014 the anti-Russian sanctions were less than in 2013. For two countries — the Republic of Slovenia and Montenegro exports from Russia remained at the level of 2013. For seven countries (Bulgaria, Luxembourg, Portugal, Romania, Albania, Iceland and Liechtenstein) it increased. Their aggregate share in the total volume of the Russian exports to countries that apply sanctions against Russia was not large in 2016 — only 3.06%. And for one country — the Republic of Moldova — data on the size of foreign trade could not be found.

Table 13 shows a dozen countries with the most significant decrease in the Russian exports. In 2016, the share of exports from the Russian Federation to these ten countries was 65.5% of Russia’s exports to countries that have imposed sanctions.

In 2016, the volume of imports of the Russian Federation from 40 countries, applied the anti-Russian sanctions, was less than in 2013. Imports from the Republic of Albania remained at the same level. For the Republic of Moldova, there is no data. Ten countries, of which Russian imports fell most significantly, are shown in Table 14.

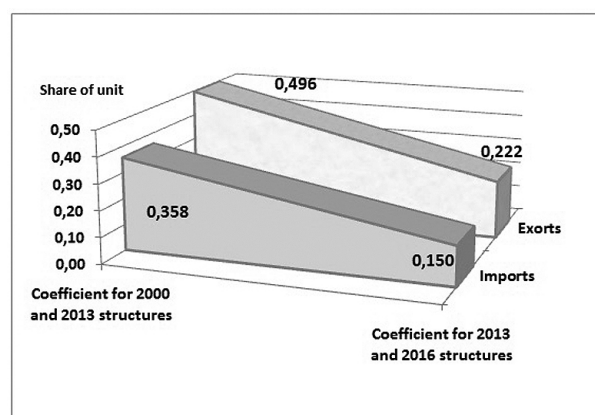


Figure 2. The values of the coefficient of relative structural changes for compared export structures of the Russian Federation to the countries that have established anti-Russian sanctions and for the structures of the Russian imports from these countries in 2000 and 2013, and in 2013 and 2016.

Source: the author.

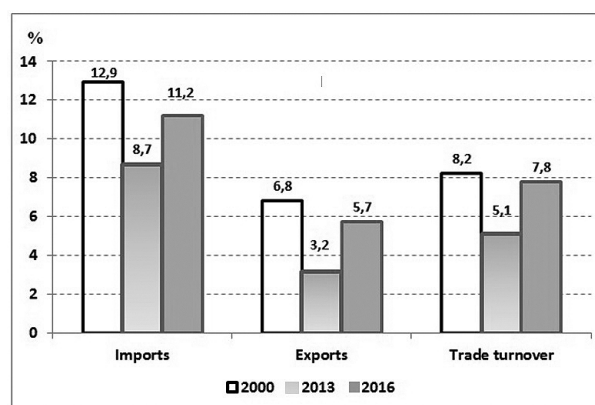


Figure 3. The share of the USA in the total volume of Russia’s foreign trade with the countries of the anti-Russian coalition in 2000–2016, %.

Source: author’s calculations on the basis of Rosstat’s data (Rosstat, 2017).

The share of imports from countries listed in Table 14 in the total volume of imports from the Russian Federation in the states in which anti-Russian sanctions are in force in 2016 was 73.3%⁵.

⁵ In sixth place according to the value of the coefficient of the consensus was the Principality of Liechtenstein. The volume of its imports from Russia fell by 97%. However, the scale of reduction was small (–291 million dollars), and the share of the Principality in the total volume of imports of states that established anti-Russian sanctions in 2016 was only 0.01%. In nine countries, we observed the decrease of the Russian imports less in absolute terms than in Liechtenstein, and the share of import from Russia, compared with that in Liechtenstein, was only in two of them. Hence, the Principality of Liechtenstein was not included in Table 14.

Table 15
Aircraft fleet of the largest airlines in Russia, units

Aircraft	Aeroflot July 2018	S 7 Airlines July 2018	UTair July 2018	Rossiya Airlines July 2018
		Foreign		
Boeing	58	21	53	37
Airbus	138	50	0	31
Embraer	0	17	0	0
ATR	0	0	15	0
		Russian		
	45		9	
	SSJ-100 (Sukhoi SuperJet100)	0	AH-74, AH-74 TK-100, AH-2	0

Source: compiled by the author according to the airline websites.

What about trade between the Russian Federation and the United States, the main initiator of anti-Russian sanctions? In terms of the reduction of the Russian exports to the United States in 2014–2016, they were on the 23rd place out of 32. The Russian export to this country decreased by 1844 million dollars or 16.6%. At the same time, their share in the total volume of the Russian exports to the countries of the anti-Russian coalition increased from 3.2% in 2013 to 5.7% in 2016 (Figure 3).

One of the reasons is that by introducing all sorts of restrictive measures, the government and large US corporations strictly observe their own interests: they do not prohibit or restrict trade with the goods in which they themselves are in dire need or in the export of which they are interested⁶. Here, for example, with what care the Countering America's Adversaries Through Sanctions Act (HR 3364) prescribes an exception to the number of sanctioned goods relating to activities of the National Aeronautics and Space Administration.

"Nothing in this Act or the amendments made by this Act shall be construed to authorize the imposition of any sanction or other condition, limitation, restriction, or prohibition, that directly or indirectly impedes the supply by any entity of the Russian Federation of any product or service, or the procurement of such product or service by any contractor or subcontractor of the United States or any other entity, relating to or in connection with any space launch conducted for (1) the Na-

tional Aeronautics and Space Administration; or (2) any other non-Department of Defense customer" (HR 3364, 2017, Sec. 237, (b)).

There is no ban on goods that are profitable for Western countries to export to the Russian Federation. In addition, on the Russian market successfully operate well-known American companies and their branches: "Procter & Gamble", "Apple", "PepsiCo", "Mars", "Coca-Cola", "McDonald's", "Johnson & Johnson", "Cargill", "International Paper". In 2016, the total revenue of these 10 companies in Russia amounted to 864 billion rubles. It was equal to 6.4% of the revenues of the federal budget of the Russian Federation or to 9.0% of the volume of shipped products made exclusively in enterprises of the Russian form of ownership. Neither the US nor the EU has sanctions against exports to Russia of cars, civil aircraft, medicines and some other goods.

The size of the decrease in the volume of the Russian imports from the United States, the latter is also not the first, but only in seventh place. One of the reasons — they are less than the main European countries affected by the response of the Russian Federation. In addition, it also involves a) the interests of large corporations and b) the desire to keep the Russian Federation in a state of technological dependence⁷.

The acquisition of high-tech products and technologies in the foreign market reduces the incentives of the state and business to conduct their own expensive scientific and technical research, to develop,

⁶ According to the President of the American Chamber of Commerce in Russia Alexis Rodzianko, "American sanctions affect areas in which trade exchange was previously small, for example, military products" (Spigel, 2015).

⁷ "The degree of technological dependence is simply enormous. And it is much more than it follows from the general figures that we buy more than \$ 100 billion a year of machinery and equipment" [Klepach, 2015, p. 7].

test and certify the high-tech and expensive products, such as: software, information technology, modern computer equipment, communications technology and electronic component base (primarily the space-military level), medical equipment and medicines, 3D printing, genetic material, raw materials for the production of vaccines, seeds, etc.

As an example of import dependence, we take the aircraft fleet of the largest airlines of the Russian Federation. It is dominated by foreign-made aeroplanes (Table 15).

However, in the SSJ-100 aircraft (Sukhoi SuperJet-100) 85% assembled components and assemblies come from “Airbus” and “Boeing” (Ivashov, 2017). Moreover, under the terms of the contract with Boeing and the lessors, Aeroflot is entitled to a 30% discount, only in the absence of Russian-made aircraft in its aircraft. Hence, do not blame the “aggressive” policy of “Boeing” or “Airbus” in Russia — they penetrate to the extent that they are allowed.

The use of foreign-made aircraft, as well as any other foreign equipment, entails the need to import the necessary spare parts, repair equipment and software, as well as training of personnel abroad. As a result, the US share in the total volume of the Russian imports from states that have adopted the anti-Russian sanctions increased by 2.5 percentage points (pp), and in a trade with these states — by 2.7 pp.

Therefore, during the period under review, in the field of foreign trade with the Russian Federation, losses of the USA from the anti-Russian restrictions and Russia's response measures were less than many other states that supported sanctions against Russia. In 2016, the USA share in the structure of foreign trade of the Russian Federation with the countries of the anti-Russian coalition practically returned to the level of 2000 (Figure 2).

Conclusions

For many years, the United States and other foes of the USSR and the Russian Federation purposefully formed a group of potentially dangerous for the country's economy external factors (Sanctions against Russia, 2018). These include, in particular, technological, financial and import dependence on the Western countries and the oil and gas orientation of the economy and exports. The development on the basis of foreign technology, knowledge, know-how and technolo-

gies required attracting foreign currency for their purchase. Principally, the currency came from the export of fuel and energy resources and other mineral resources. Imported technologies, machinery and materials were used for their extraction. The result was an emergence of a vicious circle — large-scale import of equipment and technologies required expanding the volume of sales of raw materials. To do this, it was necessary to increase the size of its production. That, in turn, required an increase in imports of equipment and other goods used for the extraction of mineral resources.

Payment for imports in foreign currency received as loans from foreign banks, put business and the state in dependence on the global financial and credit system, largely controlled and managed by the United States of America.

In addition, development of the USSR and Russia, through the import of equipment, technologies, purchase of foreign patents and licenses, contributed to the fact that the country as a whole, large and the largest firms and corporations reduced (up to complete cessation) their own research, development of innovations, the creation of testing laboratories and stands, etc. As a result, they not only found themselves in scientific, technological and financial dependence on the advanced development in science and technology states, public, and private corporations but fixed forever such dependence. At the same time, the scientific and technological gap did not remain at a fixed level but deepened over time.

Vladimir Putin in his message to the Federal Assembly said that “technological lag, dependence mean reduction of security and economic opportunities of the country, and as a result — loss of sovereignty” (President Putin's Message, 2018). At a convenient time, foes of the Russian Federation can use these time bombs.

The system of hostile external factors also includes restrictive financial and economic measures (sanctions), unfavorable conditions of the world energy markets, the use of unfair competition against Russia, the ill-grounded use of legal means, measures of political, cultural, scientific and technological isolation of the Russian Federation, information war organized against the country and its leadership.

Together, these factors have largely contributed to the reduction in the volume of foreign trade

of the Russian Federation. At the same time, the dynamics of the Russian imports were higher than exports. The product and geographical structure of imports have changed less than that of exports. Consequently, the negative impact of the global economic environment, the anti-Russian sanctions and Russia's response measures on the dynamics and volumes of exports from the Russian Federation were stronger than the dynamics of change and the volume of imports.

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Внешняя торговля России в условиях санкций

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Аннотация. Экспортно-сырьевая модель развития и высокая зависимость от внешнеэкономической конъюнктуры входят в число главных стратегических угроз экономической безопасности Российской Федерации. Поэтому не случайно ряд стран пытается реализовать эти угрозы для достижения своих геополитических целей и вводит разного рода ограничения, запреты и санкции. В статье представлены результаты анализа влияния антироссийских санкций на внешнюю торговлю России в 2014–2016 гг. Показано, что в сфере внешней торговли негативное воздействие запретов и санкций, а также неблагоприятных внешних и внутренних процессов и факторов сильнее чем в других секторах экономики отразилось на топливно-энергетическом, нефтехимическом и машиностроительном комплексах. Больше других их почувствовали субъекты Российской Федерации, в которых сосредоточены основные потоки экспорта и импорта, а также некоторые нефтегазодобывающие и металлопроизводящие регионы. При этом воздействие санкций и ответных на них мер Правительства России на экспорт было сильнее, чем на импорт.
Ключевые слова: антироссийские санкции; внешняя торговля; импорт; экспорт; ограничения; запреты; экономическая безопасность

Psychological Factors of Multiple Debt Repayment Strategies

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Abstract

The article presents a review of the literature and the results of an empirical study of strategies for repayment of multiple debts in a laboratory experiment and their connection with the personality traits of the respondents (N = 348). The main strategies of debt repayment are identified – Rational, Semi-rational, Aversive, Distributive, Chaotic and Ignoring of small numbers. The smallest group in the empirical study is the group of respondents with Rational strategy. Respondents of all the groups, except Rational, were compared among themselves on personal characteristics. Respondents with the Semi-rational strategy, in contrast to respondents with other strategies, demonstrate a greater propensity for risk. An Aversive strategy is characterised by a tendency to reduce the number of debts and is demonstrated by respondents when performing various tasks. Respondents with a Chaotic strategy made multiple mistakes in the simulation and, in comparison with all other respondents, are less open to new experience. Respondents with a strategy for paying off debts Ignoring small numbers turned out to be more benevolent than Chaotic respondents and respondents with the Close to rational strategy.

Keywords: debt behaviour; personality traits; willingness to take risks; debt recovery strategies

JEL Classification: C91, D14, D84, G02

The Relevance of the Study

A credit strategy suggests a high level of predictability and consistency of consumption. However, increasing loan availability leads to households plunging into debts, thus damaging their financial wellbeing. Despite its evident burden, the majority of people manage their debt ineffectively trying to play with various types of debts, different terms and interest rates. This debt diversification demands to make decisions on the best ways of allocating limited resources. The most effective method of clearing a debt is to pay more attention to long-term credits with high-interest rates. It is empirically proven that the most part of consumers manages their multiple debts in favour of the shorter ones – paying them first. It is supposed that the strategy – aversive strategy is not just a mistake; it has a systematic character (Amar et al., 2011; Tversky & Kahneman, 1981). The majority of consumers with multiple debts are motivated to reduce a total of a number of debts instead of reducing a total amount of the related expenses.

It is possible to eliminate the tension between rationality and intuition, which is sometimes irrational, by initial payments of the debt with the highest per cent or structuring the environment with a guarantee of optimal allocation. The difficult solution of refinancing or debt integration demands time and efforts and can lead to a failure and inability to make the decision for fear.

In terms of a debt, it means that people who make the decision of using credit cards do it without a full understanding of the total cost of a debt in the future and an opportunity to call the automatic processes of control demanding internal obligations. Standard models in behavioural economy ignore internal mechanisms of obligations (Benhabib & Bisin, 2005). When preferences are inconsistent, decisions are defined not only rationally: making a decision at each stage of their own future decisions is based on various preferences. Such expectations are defined in balance. Dynamic decisions as a consecutive game between various options are limited to Markov balance and balance according to Nash in which people

are implicitly modelled as lacking for any form of internal psychological ability to the obligation or self-checking. Theoretical and experimental literature in psychology studies a problem of the dynamic choice and defines various internal obligations and the strategy of self-control. The dynamic choice of people with inconsistent preferences cannot be well understood without an obvious analysis of the dynamic strategy, including self-control. Thus, it is necessary to simulate the operating process inducing to the implementation of a number of the purposes irrespective of the impulses or temptations connected with a choice problem. A various action of automatic and controlled processes defines what process is responsible for the choice. Neurobiological basis of a postulate of this analysis, in which the internal obligation and self-control in the dynamic choice operate a certain form of informative control, has never been checked.

The environment with great temptations is characterized by the higher probability that the self-control is carried out, and temptations are forbidden. On the other hand, in such an environment, the less ambitious goals of the economy are established. A person with lower abilities to control, or a person whose attention is concentrated on other important tasks, trains self-control less often, and besides, establishes less ambitious goals in an attempt to forbid temptations. Psychologists constantly note that 'complexity' of the purposes reduces efficiency in problems of self-control and self-checking. According to this representation, the task is simpler in implementation if the purposes are simpler.

A simple saving consumption purpose can be more preferable than a complex purpose. More than that, a simple purpose tends to be preferred if a rate of return is rather small, in this case, there is little profit from self-control, and it is the dominating choice for a debtor to consume the most part of his accumulation every period. A simpler purpose will be also preferred if temptations become big. It is caused by the fact that when temptations are quite big both the difficult and simple purposes optimally cause automatic prohibition.

Interest in decision-making models, with violation of the neoclassical behavioural axioms considered and (taking into account) "irrational" behaviour of the beginnings, a search of a "rational" explanation of this phenomenon, increases.

A complete model (Opaluch & Segerson, 1989) has to provide communication between three components of the choice: motivation, decision rules for making a choice and potentially observed behaviour.

One of the difficulties of the classical approach to behaviour modelling is that the resultant structure is incapable of describing a full range of the actual behaviour. Instead, the approach to modelling defines critical motivation for decision-making and traces logics of the resultant model. In cases of lack of information, a less effective approach based on the general observations of behaviour can be useful as emphasizes. Moreover, there is usually no convincing way of checking the validity of hypothetical motivation of observed behaviour as there is no unambiguous compliance between the cornerstone motives and rules of decision-making or observed behaviour. Nevertheless, partial validation can be carried out when certain types of behaviour, which will be coordinated with some main motivation, are identified. Thus, though the peculiar hypothetical motivation cannot be usually checked, it can be recognized invalid as incompatible with peculiar observed behaviour.

The second approach to behavioural modelling begins with the indication of a certain set of rules of decision-making, such as optimization of rules, implementation of rules, empirical rules or lexicographic rules. Further sets of observed behaviour which is meant by such a rule of decision-making are defined. Rules of decision-making are not either motive of behaviour, or behaviour itself, but rather a means of transforming motivations into behaviour. Rules of decision-making can be exact, formal implementers of these motives or just convenient "philosophy" for the choice. Besides, the rule of acceptance can be the actual rule used by an individual making the choice or can be the rule "as if" where potentially observed behaviour corresponding to fundamental motives is considered as "decision". It is useful to be based on behavioural modelling for decision-making forecasting of observed behaviour, but it can also result in difficulties for welfare measurement and the analysis of social policy.

The third approach consists of defined rules of observed behaviour. This approach is useful for behaviour forecasting as it is capable of integrating broad observations concerning the real choice

and will lead to estimates which will probably correspond and, perhaps, will be a good predictor of observed behaviour. Tracking observed behaviour may be a useful method for the initial specification of hypothetical motives.

Introducing psychological approach into the analysis of a consumer debt has shown the importance of psychological factors when modelling consumers' debt by matching a number of personal qualities, relations, beliefs and behaviour to a consumer debt. A consumer debt is considered to be a phenomenon with distinct aspects, which are influenced by several psychological factors, and involves social and economic consequences (Ladas et al., 2015).

The most research is carried out on the limited number of observations that complicates consideration of the received results as the representative ones. Use of the Data mining methods with careful preliminary data processing, the powerful models and reliable methods of assessment containing full and difficult tools for the analysis of difficult data of the real world can guarantee representative and substantial discovery of knowledge. Data mining models from different families of intellectual modelling, namely logistic regression, the casual woods and neural networks, for assessment of a contribution of psychological factors to the analysis of a debt burden in a large number of experiments are used. The research for the debt obligations analysis generally focuses on the answer to three fundamental questions: 1) What factors separate debtors from not debtors? 2) What factors influence the amount of debt? 3) What factors influence repayment of a debt?

The answer to these questions leads to the detection of a number of the factors connected with a consumer debt. Amongst them: personal characteristics such as debt attitudes (Harrison N., et al., 2015); self-control and impulsiveness (Achtziger et al., 2015), other psychological factors, such as personal traits (Brown & Taylor, 2014) and locus of control (level of internality) according to Mewse et al. (2010). Framing effect is also considered: risk-taking in decisions depends on how the situation is presented; e.g. as a loss or as a gain (Tversky & Kahneman, 1981). By analogy with loss aversion, debts (losses) are perceived as the most stressful when accumulated. Several debts are more painful than a single one equal in

the amount. The wide list of the factors presented in the literature is supplemented by well-studied socio-economic factors which are traditionally used in economic models for an explanation of a consumer debt, for example, of the status of work, pure wealth and the number of children in family, income, a floor, education, etc. Impulsiveness and self-control appeared to be significantly connected consumer debts, especially in case of credit cards and catalogues of post orders. The impulsiveness is recognized as a strong predictor of unsecured debts, compared with mortgages and car loans. The rationale for this that secured debt influences decisions that last a long time and are therefore related to the life-cycle theory, according to which the consumer enters into debts on rational grounds in order to maximize utility and, therefore, is not associated with impulsive behaviour that favours short-term benefits.

Method or Instruments

To study the strategies of debt repayment in the situation of the multiple debts and the factors influencing decisions the following situation has been simulated. Participants had to distribute a certain sum of money to pay off six credit card debts. The game lasts 25 rounds; each round is equal to one year. Every year the player receives a certain sum, which he has to use completely for debt repayment. During the game, additional bonuses, which also have to be used for payment of the credits, are provided to participants. The winner will be the player with the positive balance (or with the smallest debt) at the end of the game.

To assess the role of psychological factors in the choice of debt repayment strategy, we used the following psycho-diagnostic techniques.

The "Big Five" personality traits, the questionnaire by which the literature already presents the results that confirm the reliability of this tool and indicate the time invariance of personality traits (Caspi et al., 2005), as well as the role of personality traits diagnosed with the help of this tool in economic behaviour (Brown & Taylor, 2014). "Personal factors of decision-making of T. V. Kornilova" aimed at assessing risk-taking (risk readiness) as a readiness for self-control of actions in uncertainty and incompleteness of information, as well as a willingness to rely on its own potential.

The basic methods in our study were a game aimed at determining debt repayment strategies and a questionnaire of debt behaviour — they were performed by all 350 respondents. The remaining methods were connected at different stages: “Big Five” (N = 290 people), “Personal factors of decision-making, T.V. Kornilova” (N = 137 people). For all respondents, socio-demographic characteristics were collected: gender, age, education.

Hypotheses: We supposed that strategy of debt repayment is determined by psychological traits and attitudes to risk.

Procedure: The participants were informed about the research, about their rights and their responsibilities. The examination procedure was objectively explained.

Results

Analysis of Debt Repayment Strategies in the Simulation

Based on the actions taken by respondents for repayment of debts we identified following strategies: rational, semi-rational, aversive, distributive, chaotic and ignorance of small numbers. By “the strategy of debt repayment” we mean the system of actions for distribution of the resources which are available in the “Game” leading to the change of the total amount of debt.

Rational strategy is a repayment of debt taking into account the interest rates for the credit and directed to the reduction of total amount of debt. Only this strategy allows completing a game with a positive balance in our experiment.

Semi-rational strategy directed to reduction of total amount of debt — is aimed at reducing the total amount of debt, is characterized by the procedure for repaying debts from the larger with the highest interest rate to a smaller one, but with small deviations (for example, in one or two rounds, the respondent distributes money between two large accounts or repays a small debt in full). As a result, the respondent ends the game with a small, in comparison with other strategies, debt.

The aversive strategy is the strategy directed to the reduction of a number of debts, but not the total amount of debt. The respondent pays off small debts completely, proceeding from the sum available to placement and finishes a game with outstanding big debts.

Distributive strategy — the respondent deposits funds to pay off all or several debts (three

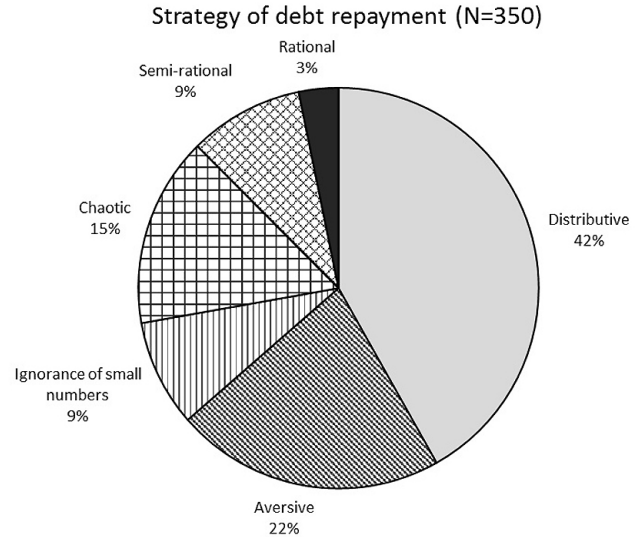


Fig. 1. Representativeness of strategies.

or more) simultaneously, without closing them completely.

The chaotic strategy is characterized by the existence of mathematical and logical mistakes — the respondent does not use all available funds for repayment of debt, places more means on account of repayment of debt than it is required or continues to pay a debt after his full repayment. Representativeness of strategies in our group you can see in Figure 1.

The most common strategy is “Distributive” (42%) — it means respondents consider repayment of debts as a task for asset allocation, which is similar to the results obtained by other authors. Next, on popularity is “Aversive” strategy (22%) — aimed at reducing the number of debts, while the amount of debt continues to grow.

A “Rational” strategy (3%) is the least common, probably because the situation of having six simultaneous debts is quite complex and atypical for our respondents, although before the beginning of the experiment they were asked whether they understand what the interest rate is credit, how the interest accumulates, etc., however, for most, such knowledge was insufficient to solve the task. Group “Chaotic” (15%): although the assignment was accompanied by verbal and written instructions, an explanation of the progress of work, nevertheless some respondents made mistakes indicating a complete lack of understanding of the task. We assume that this is due to the motivation to perform the task and personal characteristics. The strategy “Semi-rational” meets with the same frequency as “Ignorance of small numbers” (9%).

Table 1
Comparison of the mean value of scales of the Big Five among respondents with different debt repayment strategies

Big Five questionnaire							
Strategy/scale	Semi-rational (N=18)		Chaotic (N=31)		t	df	p
	M	SD	M	SD			
Openness to experience	11.44	1.98	9.45	2.69	-2.74	47	0.01
	Semi-rational (N=18)		Ignorance of small numbers (N=21)		t	df	p
	M	SD	M	SD			
Agreeableness	9.17	2.66	11.48	4.15	2.03	37	0.05
	Aversive (N=49)		Chaotic (N=31)		t	df	p
	M	SD	M	SD			
Openness to experience	11.14	2.28	9.45	2.69	3.01	78	0.00
Agreeableness	10.65	2.88	9.32	3.20	1.92	78	0.06
	Distributive (N=87)		Chaotic (N=31)		t	df	p
	M	SD	M	SD			
Openness to experience	10.63	2.43	9.45	2.69	2.26	116	0.03
	Ignorance of small numbers (N=21)		Chaotic (N=31)		t	df	p
	M	SD	M	SD			
Agreeableness	11.48	4.15	9.32	3.21	2.11	50	0.04

Source: authors' calculations.

Table 2
Comparison of mean values of the scales of the methodology "Personal factors of decision-making, T.V. Kornilova" among the respondents with different strategies for debt repayment

Personal factors of decision-making							
	Semi-rational (N=11)		Aversive (N=23)		t	df	p
	M	SD	M	SD			
Risk readiness	5.09	3.53	2.09	3.67	-2.26	32	0.03
	Semi-rational (N=11)		Chaotic (N=21)		t	df	p
	M	SD	M	SD			
Risk readiness	5.09	3.53	1.95	3.61	-2.35	30	0.03
	Semi-rational (N=11)		Ignorance of small numbers (N=11)		t	df	p
	M	SD	M	SD			
Risk readiness	5.09	3.53	2.00	3.13	-2.17	20	0.04

Source: authors' calculations.

After that, we compared in pairs the respondents with different debt-repayment strategies on their personal characteristics. The Tables only reflect the scales for which significant differences were found.

Respondents from "Chaotic" debt repayment strategy significantly differ from those with "Semi-rational", "Aversive" and "Distributive" strategies with lower values on the "Openness to experience" scale.

Table 3

Comparison of mean sums of money placed on the indebted accounts in the tasks “3,000 roubles task” and “30,000 roubles task” for respondents with different debt repayment strategies

“3,000 roubles task”							
Strategy/Indebted account	Aversive (N = 64)		Rational (N = 10)		t	df	p
	M	SD	M	SD			
3,000 roubles; 19% APR	2,146.4	1,264.99	850.0	1,375.38	2.98	72	0.004
30,000 roubles; 24% APR	853.6	1,264.99	2,150.0	1,375.38	-2.98	72	0.004
“30,000 roubles task”							
Strategy/Indebted account	Aversive (N = 64)		Semi-rational (N = 28)		t	df	p
	M	SD	M	SD			
3,000 roubles; 19% APR	2,146.4	1,264.99	1,321.4	1,492.04	2.72	90	0.008
30,000 roubles; 24% APR	853.6	1,264.99	1,678.6	1,492.04	-2.72	90	0.008
“30,000 roubles task”							
Strategy/Indebted account	Ignorance of small numbers (N = 26)		Semi-rational (N = 28)		t	df	p
	M	SD	M	SD			
3,000 roubles; 19% APR	1,335.0	1,598.71	428.6	1,069.04	2.47	52	0.017
“30,000 roubles task”							
Strategy/Indebted account	Aversive (N = 64)		Chaotic (N = 45)		t	df	p
	M	SD	M	SD			
30,000 roubles; 24% APR	2,9044.7	1,431.41	2,6851.2	8,102.23	2.12	107	0.036

Source: authors’ calculations.

Respondents with a strategy for paying off debts “Ignoring small numbers” differ significantly from respondents with strategies “Semi-rational” and “Chaotic”, and respondents with the “Aversive” strategy from respondents with the strategy “Chaotic” higher values on the scale of “Agreeableness”.

As a result, questionnaires “Personal factors of decision-making” respondents with the “Semi-rational” strategy are characterized by higher risk readiness than respondents with “Aversive”, “Chaotic” strategies and the strategy “Ignorance of small numbers”.

Based on the results of “3,000 roubles task”, we figured out that the respondents with “Aversive” were significantly different from the respondents with “Rational” and “Semi-rational” strategies. They allocated a significantly higher sum of money to repay debts of 3,000 roubles, 19% than repay debts of 30,000 roubles, 24%. It reflects the tendency to close the small account in full.

In result of “30,000 roubles task” we received reliable differences between respondents with the strategy “Semi-rational” from respondents with the strategy “Ignorance of small numbers”, who significantly more often closed the account of 3000 roubles. When comparing respondents with the strategy “Aversive” and “Chaotic” — the latter significantly fewer pay off debt account 30 000 roubles with 24%.

Discussion

The results obtained in the study show that when solving problems for repayment of multiple debts respondents use different strategies and those strategies differ from rational ones.

For respondents with the “Rational” strategy, only one difference was found — from respondents with the “Aversive” strategy for solving the “3,000 roubles task” and these results confirm the content of both strategies. “Rational” respondents behave “more rational” and “Aversive” behave “more aversive”.

The strategy “Semi-rational” is characterized by the desire of respondents to reduce the total amount of debt, the actions are considered as analytical, but some inaccuracies do not allow characterizing them as fully rational. These respondents, in contrast to respondents with other strategies (except “Rational”), demonstrate a greater propensity for risk. It is important to dwell on the content we mean under “risk readiness”: it is a readiness for self-control of actions with deliberate incompleteness or inaccessibility of necessary benchmarks, and also a willingness to rely on one’s own potential. This definition of readiness for risk is in good agreement with our understanding of the experiences that accompany the passage of the “Game”. Because if the respondent chooses a rational or semi-rational debt repayment strategy (starting with large debts that have a high-interest rate), then he does not see a positive result of his actions long enough. The earliest when he sees a full repayment of Debt 6 is the fifth round, and then he starts paying off Debt 5 and repays it not earlier than the fifteenth round. All this time he must overcome the doubts caused by the uncertainty of the result: money is spent, and the debt does not decrease and it is necessary to have self-confidence and self-control in order to realize this strategy to the end.

As for personality traits, respondents with the “Semi-rational” strategy, they demonstrate higher curiosity, flexibility and readiness for change, compared with “Chaotic” respondents and tend to perceive others as competitors, in comparison

with respondents with the strategy “Ignorance of small numbers”.

The “Aversive” strategy is aimed at reducing the total number of arrears, more typical for women than for men. Respondents with this strategy make similar mistakes in a similar task with two debts: reducing the amount of arrears based on the number of funds available for placement.

Respondents with a “Chaotic” strategy allow multiple errors in the fulfilment of the task of paying off multiple debts. They miss payments, place more money on their accounts to repay the debt than they have, continue to put money into the account when the debt is already paid off, etc. In comparison with other respondents (Strategies: “Close to rational”, “Distribution” and “Aversive”), they are less open to new experience, not curious and flexible. In our opinion, they are not very interested in obtaining new knowledge and are not ready to make efforts to solve the set tasks.

Respondents with a strategy for paying off debts “Ignorance of small numbers” turned out to be more benevolent than “Chaotic” respondents and respondents with the “Close to rational” strategy.

In conclusion, we would like to say that our hypotheses that strategy of debt repayment is determined by psychological traits and attitudes to risk were proved. There are significant differences in personality traits and readiness to risk between respondents with different debt repayment strategies.

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Психологические факторы стратегий погашения множественных задолженностей

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Аннотация. В статье представлены результаты эмпирического исследования стратегий погашения множественных задолженностей в условиях лабораторного эксперимента и их связь с личностными чертами респондентов ($N = 348$). Выделены основные стратегии погашения задолженностей – рациональная, близкая к рациональной, аверсивная, распределение, хаотичная и игнорирование малых чисел. Самая малочисленная группа – респонденты с рациональной стратегией. Все остальные группы сравнивались между собой по личностным характеристикам. Респонденты со стратегией «Близкая к рациональной», в отличие от респондентов с другими стратегиями, демонстрировали большую склонность к риску. Стратегия «Аверсивная» направлена на уменьшение общего количества задолженностей и свойственна этим респондентам при выполнении разных задач. Респонденты с «Хаотичной» стратегией допускают множественные ошибки при выполнении задачи на погашение множественных задолженностей и, по сравнению со всеми другими респондентами, в меньшей степени открыты новому опыту. Респонденты со стратегией погашения задолженностей «Игнорирование малых чисел» оказались более доброжелательны, чем «Хаотичные» респонденты и респонденты со стратегией «Близкая к рациональной».

Ключевые слова: долговое поведение; личностные черты; готовность к риску; стратегии погашения множественных задолженностей

JEL Classification: C91, D14, D84, G02

Analysis of Cryptocurrency Risks and Methods of their Mitigation in Contemporary Market Conditions

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Abstract

In the course of the research, we identified seven risk groups, analyzed their influence, and formulated possible measures of the risk mitigation. For initial coin offerings projects, we formulated a special risk-assessment scoring system based on a 100-point scale. Investment risks (volatility) were one of the main issues. The only effective option of risk-management here is risk aversion – the refusal of any interaction with the cryptocurrency market. On the other hand, traditional risk management method of diversification has proved its worth and viability on empirical studies of portfolio investments. The portfolio should not be mostly “crypto” but rather it should also consist of traditional assets. It is necessary to consider the opportunity to quit the cryptocurrency market for a short period of time, to prevent the harmful consequences of dramatic price shifts.

Keywords: cryptocurrency; cryptocurrency market; Bitcoin; risk-management; diversification; investment portfolio
JEL Classification: G02, G11, G29

The Blockchain technology and cryptocurrency market can truly be considered revolutionary and innovative. Generally, all the ideas incorporated in the system were known earlier but only in 2009, the Bitcoin authors managed to put all together and make them work.

In the pursuit of revolutionism, many concentrate on the advantages and often forget to assess the real state of the system. So, what are the risks if cryptocurrency is used for legitimate purposes?

Considered as an asset or a currency, risks associated with both classes may be typical for the cryptocurrency. However, specific principles sometimes make the probability of the problems higher and consequences – more unpleasant. In addition, they may define a number of risks that are unique for cryptocurrencies as a separate class.

Since its existence, the cryptosystem has demonstrated security and reliability. But various third-party online services that operate within this system – exchanges, wallets, etc. –

can become the target of hacker attacks. Security risks of using the system are the following: substitution of payment details and phishing, loss or theft of private keys, platform hacking, closing exchanges, etc.

Operating without licenses or being hacked, any exchange may close overnight. To reduce the potential risk of losing funds one may store cryptocurrencies in the wallet. But on the other hand, money may be stolen by malware or disappear because of hard disk failure. Therefore, the most advanced users record a copy of the secret key on an ordinary piece of paper and have hardware USB-wallets. Notably, the hackers' community is also developing. It uses innovative technologies and sophisticated hacking tools as Blockchain does. That is why there are no methods or mechanisms that would completely exclude security risks. But advanced users can take the following measures to limit and mitigate them: to check and recheck addresses and all the transaction information, not to follow suspicious links; to use the hardware wallets for cryptocurrency; to use high-quality anti-virus protection, etc.

Table 1
Output data

Characteristics	Symbol	Value
Hashing power	h	14 TH/s
Power consumption	p	1475 W
Cost of the miner	c	2400 USD
Exchange rate (Bitstamp)	ER	7720 USD/BTC
Block reward	R	12.5 BTC for a block
Difficulty	D	3.51e+12
Time accounted	t	1 day = 86400 s
Electricity cost per kWh (USA)	E	0.12 USD

Source: <https://www.bitstamp.net/>, <https://www.eia.gov/electricity/>, <https://shop.bitmain.com>.

Table 2
Sensitivity analysis of daily net income and payback period

Change in cost	Electricity cost	Daily net income (Incomei-OPEXi)	Change in net income	Payback period (years)	Change in a payback period
-50%	0.06	5.62	61%	1y 3m	-38%
-40%	0.072	5.19	49%	1y 4m	-33%
-30%	0.084	4.77	36%	1y 5m	-27%
-20%	0.096	4.34	24%	1y 7m	-20%
-10%	0.108	3.92	12%	1y 9m	-11%
0%	0.12	3.49	0.0%	1y 11m	0%
10%	0.132	3.07	-12%	2y 2m	14%
20%	0.144	2.64	-24%	2y 6m	32%
30%	0.156	2.22	-36%	3y	57%
40%	0.168	1.79	-49%	3y 8m	95%
50%	0.18	1.37	-61%	4y 10m	155%

Source: author's calculations.

Technical risks are not fully disclosed within this work since it is a separate topic for the study but some risks associated with mining equipment should be mentioned.

On average, mining consumes 20,000 GWh per year or 0.1% of the world electricity production. This is almost equal to the energy consumption of a country like Ireland. Therefore, the issue of electricity prices is very acute for cryptocurrency

(Cocco et al., 2016). Let us simulate the mining process with the following data (Table 1).

Considering mining is a classical project where you invest capital and expect to have some income during the life of the asset (n), and omitting the time value of money concept, depreciation and power supply unit (150–200 USD), the mining profit formulas are the following:

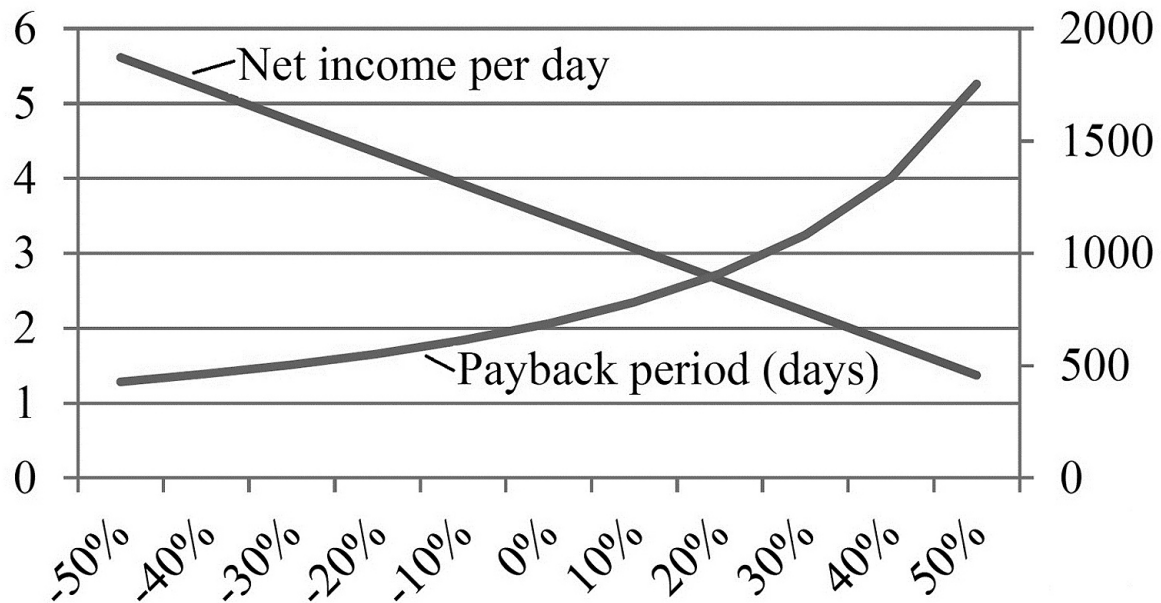


Figure 1. Sensitivity analysis.

Source: the author's calculations.

$$NPV = -CAPEX - \sum_{i=1}^n OPEX_i + \sum_{i=1}^n Income_i,$$

where: $CAPEX$ (cost of the miner) = c ,

$$OPEX \text{ (daily electricity cost)} = 24 * \frac{P}{1000} * ER,$$

$$Income \text{ (daily mining income)} = \frac{h * t * R}{2^{32} * D} * ER.$$

$$\text{Payback Period in days} = \frac{CAPEX}{Income_i - OPEX_i}$$

In Table 2 is the result of sensitivity analysis in case of electricity cost fluctuations. Interestingly, the initial electricity value prices were based on US experience. If Russia or China was taken for example where electricity cost is much smaller – 9.1 cents/kWh, mining procedure would be more profitable.

Such result as a 2-year payback period implies that all the factors, especially bitcoin exchange rate, would be stable and remain the same that is extremely unlikely in the rapidly changing world of cryptocurrency (Hassani, 2016). According to the Goldman Sachs valuations, reaching the price of 5,900\$ makes mining almost unprofitable even in comparison with bank deposits.

Figure 1 provides sensitivity analysis graphs of electricity cost dependent on the change of net income per day and payback period in days.

All in all, utility prices raised by 10% will lead to a 12% decrease in net income per day and 14% increase in overall payback period. It should be taken into account that the mining difficulty changes over time. With expanding equipment processing power, the difficulty also increases but the income of each individual miner falls proportionally. Assuming 10% rise in electricity cost and 5% difficulty growth rate every 15 days, all other things being equal, mining will cease to be profitable in 5 months.

If it goes to the industrial level, the situation will dramatically change. Unfortunately, this is the only way how to mitigate the risk connected with electricity costs while mining cryptocurrency and it requires significant funds. Even if an operator changes a country to the one with lower tariffs, increasing mining difficulty will still make it unprofitable after a while. In this sphere, the main thing is to keep up with technical trends and technology.

Risks associated with ICO. Raising money through ICO picks up speed and exceeds the amount of venture investment in blockchain projects. In 2016 about \$ 600 million of venture capital (VC) was invested in start-ups at cryptocurrency markets against one-third of this amount – \$ 256 million – totalled by ini-

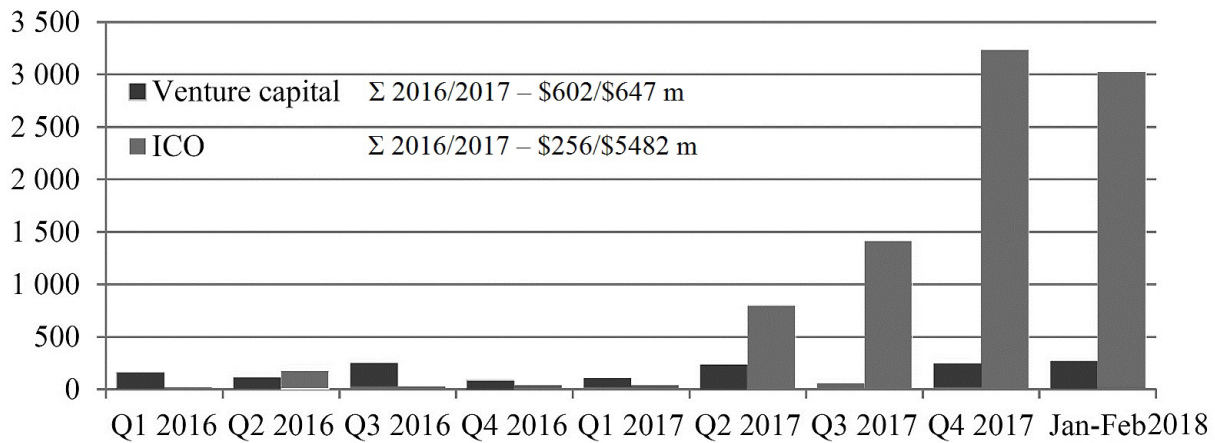


Figure 2. Investment in Blockchain by a quarter of 2016-2018, \$ million.

Source: <https://www.coindesk.com>.

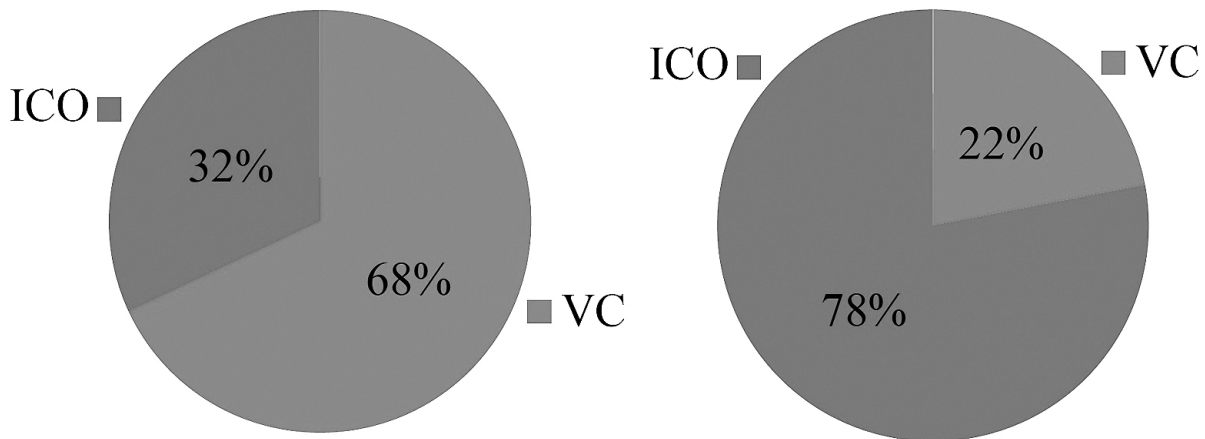


Figure 3. Blockchain deal (left) and dollar (right) volume by funding, 2017-February 2018.

Source: <https://www.crunchbase.com>.

tial coin offers (Figure 2). In 2017 an opposite trend was observed: entrepreneurs raised about \$ 5.5 billion leaving venture capital funding far behind – \$ 647 million. The largest deal was the first regulated ICO – Filecoin – that set a new record for the cryptocurrency industry and collected \$ 257 million. Another one – Tezos – raised about \$ 230 million.

The number of ICOs from January 2016 to February 2017 is smaller – 32% and 68% for VC respectively (Figure 3). But the dollar volume raised through ICO exceeds the greatest expectations in comparison to venture – by a factor of 4.

The low entry barriers attract investors. The price of the token can start from a few cents. In case of successful projects investing would be a big deal. According to Table 3, the highest

yields relate to tokens of NXT (an increase of 1 million per cent since the ICO), IOTA (334 thousand per cent) and Neo (214 thousand per cent) projects.

But at ICO it is quite probable both to earn and lose money. A potential investor can make a comprehensive examination of the project but the success of the ICO will depend on a number of factors beyond the control of the project creators. There is a high probability that the ICO will go wrong as it was not expected. Last year, only 41% of the projects really succeeded (Token Sales & ICOs List). Although there is no much news about them, investors are not losing optimism and continue to invest.

In some countries, ICOs are generally prohibited considered fraudulent (China). So, there is a risk of change in regulation (legal and regulatory

risks) that can lead, for example, to inability to monetize tokens. In the end, ICO initiators can simply disappear with money because it is not so easy to track down and de-anonymize the payee. Moreover, during the ICO, hackers can get access to the project site and change the address at the very moment of its opening (security risks).

The problem is that the cryptocurrency market is not regulated, there are no risk assessment mechanisms, and the return on investment is not guaranteed. The project is assessed by the public excitement around ICO that leads to extreme volatility in the subsequent trading.

It is important to note that most ICOs are realized when the project is at its “idea” (84%) or “prototype” (11% of projects 2017) stages. Therefore, there is a low probability to have any historical data and financial indicators in general to apply typical valuation frameworks and quantitative analysis. The only way to evaluate projects and their risks is to turn to the experience of venture capitalists and apply fundamental and qualitative analysis. Some help can be provided by rating agencies involved in the ICO analysis: ICO Rating, ICO Bench, etc.

For ICO projects the special scoring system was formulated. It is based on the following criteria those are assessed on a 100-point scale:

Team — 30 points. Preferably, a project should be founded by entrepreneurs who already have successful work experience and good reputation. Presence of credible advisors and participation of financial institutions are also advantages. It is necessary to try to analyse the environment inside the project, the background of each participant, their location (whether the team is able to cooperate with each other quickly) and age. The team should be open and highly engaged in communication with potential investors to be able to clear doubts and questions about oncoming ICO.

Overall concept — 20 points. The idea of a project should be simple and realistic. The team must set big but achievable goals, have a clear understanding of how the project will develop after raising investment over the time (development roadmap) and not overflow the whitepaper with marketing terms. Another important aspect is the scalability of an idea. The project audience should not be limited by regional bounds

Table 3
Changes of tokens ROI since ICO

Token	Value
NXT	+1,019,715%
IOTA	+334,073%
Neo	+214,059%
Ethereum	+168,728%
Stratis	+67,056%

Source: <https://icostats.com>.

or very narrow activities or interests to support substantial growth.

Token analysis — 40 points. At the ICO stage, it is impossible to calculate liquidity but it can be predicted by analysing the following factors:

Inflationary/deflationary economic model of the token — whether the supply is limited. For future growth deflationary model, like bitcoin, represents higher interest.

Sales policy: capped/uncapped, (crypto-) currency of investment, discounts for earlier investors, extra issue/withdrawal.

Bonuses: Large bonuses negatively affect investments.

Use in the ecosystem: to what extent it is a clone of existing cryptocurrencies and what distinctive features give value. The higher its need the greater is the demand.

Token capitalization, distribution through ICO/pre-ICO and its share allocated to the issuer: Probably, one-third of the total is a good indicator. It means that the founders have an incentive to develop and maintain liquidity.

Platform choice and legal barriers: The most common option is to use Ethereum. If an idea behind the project is more complicated, another platform can be used. It is crucial to analyse the code of the smart contract, platform code and statistics on the subject of errors. An additional measure may be a code audit.

Social popularity — 10 points. The analysis is based on activity in social networks, messengers, forums, and mass-media. If the activity is low, the even good project may fail.

Interpretation of the data obtained is carried out with the use of expert judgement. Providing

the highest evaluation results of most factors, some group may lag behind. Then it becomes important to give this group special attention and, perhaps, to abandon the project in view of the increased risks. The indicators obtained in the analysis process will help assess risks and better understand the economics of the ICO project. The best way is to look for quality projects with strong teams. They are the ones most likely to be successful in the long run.

Legal and regulatory risks are related to actions of state authorities that seek to establish legal status for cryptocurrencies and rules for its use. Since Bitcoin is a completely decentralized peer-to-peer system that does not have a single control centre, states do not have a direct mechanism to influence its performance. But the state can do the following: send negative signals to the financial market; regulate the interconnected sphere of fiat money (Kozina, 2017); introduce criminal liability for crypto-operations, etc. It can go the other way – to make a competitor and create its own cryptocurrency. Likelihood and impacts of these risks depend on the economic market and state policies in a country. The key to overcoming legal challenges may be open communication with law enforcement and regulators in order to reach a common agreement and elaborate the universal approach to the legal status of cryptocurrencies and tax issues.

Social risks or risks of acceptance come from the public. It is the risk of trust – how far the public trust in a new phenomenon will go. In comparison to fiat money, Bitcoin is voluntary. If individuals and institutions decide no longer to accept it, this cryptocurrency will become useless and worthless. The very idea of cryptocurrency will fail. To a large extent, it depends on activities of mass media.

Obviously, the acceptance of cryptocurrency by population will be more common in countries where confidence in local currency falls, inflation is high and the government does not cope well with financial crises (crisis of trust). For example, it is already happening in Venezuela that was the first in the world to launch the national currency El Petro backed by oil.

Thus, social risks are inevitable and may have positive impacts as global recognition and adoption of Bitcoin grow. They are also in-

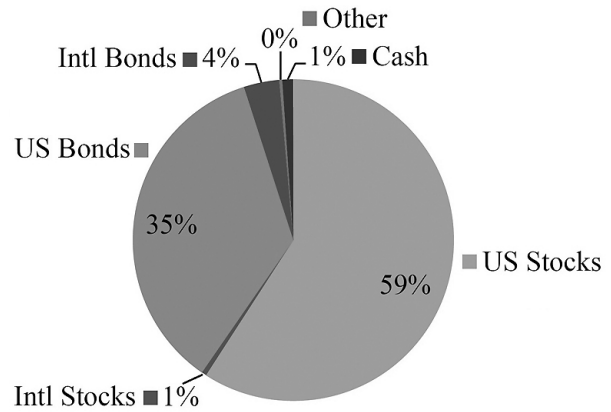


Figure 4. The asset allocation of indices.

Source: <https://investor.vanguard.com>.

terconnected with technological and especially legal challenges. Any technological problem will increase social risks too, as well as various prohibitions and restrictions in the cryptocurrency market introduced by the legislative authorities.

Investment risks are one of the key issues because they are connected with volatility. It acts as a keystone of the bitcoin investment potential and a serious risk. In certain periods of time, the price of cryptocurrency has an exponential growth and after it blows up like a bubble. Because cryptocurrency has neither an intrinsic value nor is capable of being valued according to fundamental analysis, the institutional investors are largely staying away. Crypto-currencies instead rely on individual investors worldwide. The downside is that individual investors are rarely buy-and-hold investors or have a long-term investment horizon, whereas institutional investors take the long view of their assets and may be content to hold particular assets for years before they pan out. The lack of institutional investors, with their buy-and-hold views, is one of the biggest reasons for the extreme volatility of cryptocurrencies.

Now, lots of ways of risk mitigation exist: starting with insurance, otherwise called hedging, following the rule to invest not in altcoins but in the ideas embodied, and ending with the simple advice “not to put all the eggs in one basket” (Kanuri et al., 2018). Anyway, they cannot guarantee complete elimination of risks – unless not to participate in transactions at this market at all (risk aversion). But there is still a risk of losing fiat capital as a result of inflationary processes and economic crises that,

Table 4
Portfolio analysis

Metric	Provided Portfolio	Max Return at 4% Volatility	Min Volatility at 20% Return
	1	2	3
VTSMX	60%	32.59%	65.05%
VBMFX	40%	66.35%	31.4%
BTC	0%	1.06%	3.55%
Start Balance	\$ 10,000	\$ 10,000	\$ 10,000
End Balance	\$ 11,270	\$ 11,090	\$ 12,526
End Balance (inflation adjusted)	\$ 10,903	\$ 10,729	\$ 12,118
CAGR	10.03%	8.63%	19.74%
CAGR (inflation adjusted)	7.16%	5.79%	16.61%
Expected Return	10.14%	8.68%	20.00%
Stdev	4.40%	3.23%	6.63%
Sharpe Ratio	1.92	2.21	2.54
US Stock Market Correlation	0.98	0.73	0.75
Mean Return (annualized)	10.14%	8.68%	20.00%
Compound Return (annualized)	10.03%	8.63%	19.74%
Volatility (annualized)	4.56%	3.35%	6.87%
Market Correlation	0.98	0.73	0.75
Beta	0.59	0.32	0.68
Historical Value-at-Risk (5%)	-2.64%	-1.83%	-2.54%
Positive Periods	13 / 15 (87%)	12 / 15 (80%)	12 / 15 (80%)
Gain/Loss Ratio	0.67	1.25	1.33

Source: author's calculations.

according to Karl Marx, inevitably occur under capitalism.

The optimal way to distribute risks is to diversify and create a well-balanced investment portfolio (Anyfantaki et al., 2018). In order to predict the value of the cryptocurrency and its prospects, it is necessary to consider the following factors: market share, the practical value of the altcoin, the volume of transactions, liquidity, technology development and market news. Cryptocurrency indices help to understand general dynamics and investors' attitude.

The difficulty is that investing within the same crypto-sphere does not always hedge against volatility risk. The bulk of altcoins follows BTC, and therefore such investments can-

not solve the issue. In order to, at least, partially secure savings, crypto-investments should be combined with time-proven traditional funding placed in real estate, precious metals, the stock of developing companies, etc.

To identify the optimal rebalancing method, two types were studied: timing-rebalancing (after a certain period of time) and percent-balancing (in the case when the deviation is specified within the portfolio). Both work better than the portfolio "un-rebalanced" at all. There is also an opinion that in the crypto-market rebalances must be conducted every day because of high volatility. The researches performed show that frequent rebalancing is useless taking into account no commission.

Table 5
Portfolio Risk Decomposition

Ticker	Provided Portfolio, %	Maximum Return at 4% Volatility, %	Min Volatility at 20% Return, %
VTSMX	97.93	53.76	53.82
VBMFX	2.07	23.01	3.19
BTC		23.23	42.99

Source: author's calculations.

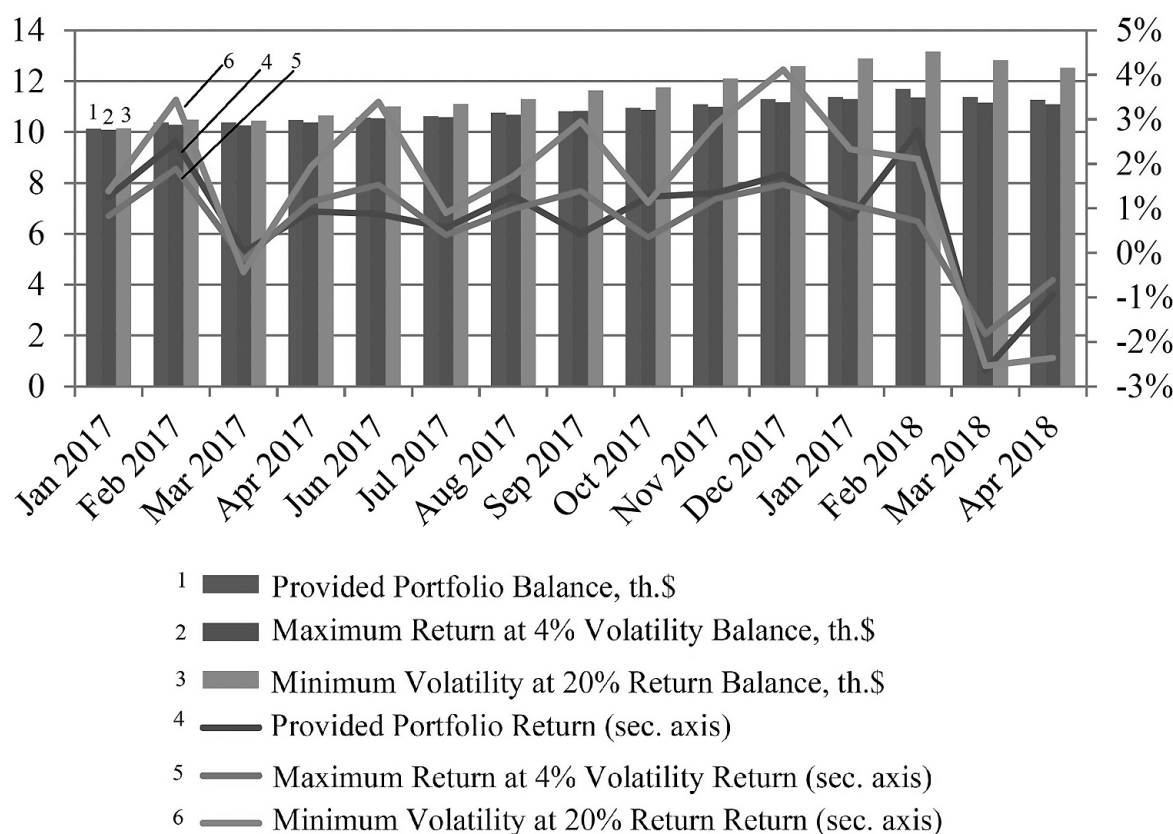


Figure 5. Portfolios growth.

Source: author's calculations.

With the fee, frequent rebalancing will worsen portfolio even more.

Let us focus on timing-rebalancing with an optimal period of 31 days, that is, change in portfolio structure every month. As the market matures (decrease in the standard deviation of daily return), it is necessary extending the rebalancing period. At the fiat markets, it may be enough to rebalance once in six months/year.

To test the efficiency of diversification method, the investment portfolio is created. Traditional asset allocation — 60% shares and 40% bonds — is considered. A simple strategy presented in Figure 4 will be to use 60% Vanguard

Total Stock Mkt Idx Inv (VTSMX, large blend category) and 40% Vanguard Total Bond Market Index Inv (VBMFX, intermediate-term bond).

The expected return of this portfolio is about 10%, annualized volatility — 4.6%. Start year — 2017, the month-to-month time period from January 2017 to March 2018, initial balance — 10,000 USD.

Having chosen this strategy as a basis, the aim is to form a better portfolio with the help of Bitcoin. The original allocation will be modified with the new asset class. Optimization goals — to maximize return subject to 4% annual volatility and to minimize volatility subject to 20% annual return.

Table 6
Correlation of assets

Ticker	VTSMX	VBMFX	BTC	NFLX	BA	PYPL	AMZN	MSFT
VTSMX	–	–0.27	0.13	0.51	0.55	0.52	0.48	0.75
VBMFX	–0.27	–	–0.02	–0.07	–0.18	–0.03	–0.07	–0.09
BTC	0.13	–0.02	–	0.18	0.05	0.18	0.04	0.11
NFLX	0.51	–0.07	0.18	–	0.26	0.40	0.52	0.50
BA	0.55	–0.18	0.05	0.26	–	0.32	0.25	0.40
PYPL	0.52	–0.03	0.18	0.40	0.32	–	0.43	0.52
AMZN	0.48	–0.07	0.04	0.52	0.25	0.43	–	0.62
MSFT	0.75	–0.09	0.11	0.50	0.40	0.52	0.62	–

Source: author's calculations.

Table 7
Portfolio analysis

Metric	Provided Portfolio	Min Volatility at same return
NFLX	12.65%	1.16%
BA	28.21%	26.31%
PYPL	27.58%	0%
MSFT	31.56%	66.49%
BTC	0%	6.04%
Start Balance	\$ 10,000	\$ 10,000
End Balance	\$ 19,212	\$ 19,312
End Balance (inflation adjusted)	\$ 18,587	\$ 18,684
CAGR	68.60%	69.30%
CAGR (inflation adjusted)	64.20%	64.88%
Expected Return	71.29%	71.29%
Stdev	18.90%	15.83%
Sharpe Ratio	2.77	3.3
US Stock Market Correlation	0.73	0.65
Mean Return (annualized)	71.29%	71.29%
Compound Return (annualized)	68.60%	69.30%
Volatility (annualized)	19.57%	16.38%
Market Correlation	0.73	0.65
Beta	1.88	1.4
Historical Value-at-Risk (5%)	–4.57%	–6.40%
Positive Periods	13 / 15 (86.67%)	14 / 15 (93.33%)
Gain/Loss Ratio	2.28	0.84

Source: author's calculations.

Table 8
Asset analysis

Ticker	Expected Return	Standard Deviation	Sharpe Ratio*	Min. Weight	Max. Weight
NFLX	113.83%	41.51%	2.721	0%	100%
BA	92.29%	27.75%	3.294	0%	100%
PYPL	72.32%	22.32%	3.200	0%	100%
MSFT	40.18%	14.36%	2.735	0%	100%
BTC	696.48%	118.13%	5.888	0%	100%

* Ex-ante Sharpe Ratio calculated using historical 1-month Treasury bill returns as the risk-free rate (0.90% annualized).

Source: author's calculations.

Table 9
Portfolio Risk Decomposition

Ticker	Name	Minimum Volatility at 71.29% Return
NFLX	Netflix, Inc.	1.52%
BA	Boeing Company	30.54%
MSFT	Microsoft Corporation	48.20%
BTC	Bitcoin Market Price	19.73%

Source: author's calculations.

It turned out that in order to reduce the portfolio volatility to 4% it is enough to have 1% Bitcoin. The result is shown in Table 4. Beta and market correlation was calculated against the US stock market. Value-at-risk metrics are based on monthly returns.

By the way, adding 4% bitcoins increases portfolio return by 2 times with minimum annualized volatility of 7%. In Table 5, risk factor analysis by the asset is given.

The general trend is the drawdown of all portfolios in 2018 due to a decrease in the return on assets:

Vanguard Total Stock Mkt Idx Inv — about 4% in February and 2% March;

Vanguard Total Bond Market Index Inv — 1% in January and February each;

Bitcoin Market Price USD — 28% in January and 36% in March.

Having the same asset allocation “unrebalanced”, an investor could get accumulated funds

of \$ 11,294 (4.81% volatility and 10.34% return), \$ 11,454 (8.13% volatility and 11.81% return) and \$ 13,611 (20.67% volatility and 30.47% return) for respective Portfolios in the end (Figure 5).

Considering long-term investments in the same assets since 2009 (appearance of Bitcoin), the original “60/40” portfolio without BTC will have 6.84% volatility, 10.34% return and \$ 20,733 final balance. Reducing the volatility to 6% by adding 1.5% BTC, we obtain \$ 22,790 in March 2018 (11.67% expected return). No rebalancing will lead to the final result of \$ 19,182 for Portfolio 1 and the phenomenal sum of \$ 3,460,733 for Portfolio 2! But volatility will also be enormous — 169%.

Let us compose aggressive growth stock portfolio maximizing diversification ratio. Leaders by stock growth over the past 12 months were Netflix (NFLX), The Boeing Company (BA), PayPal Holdings, Inc. (PYPL), Amazon.com, Inc. (AMZN) and Microsoft Corporation (MSFT). Ac-

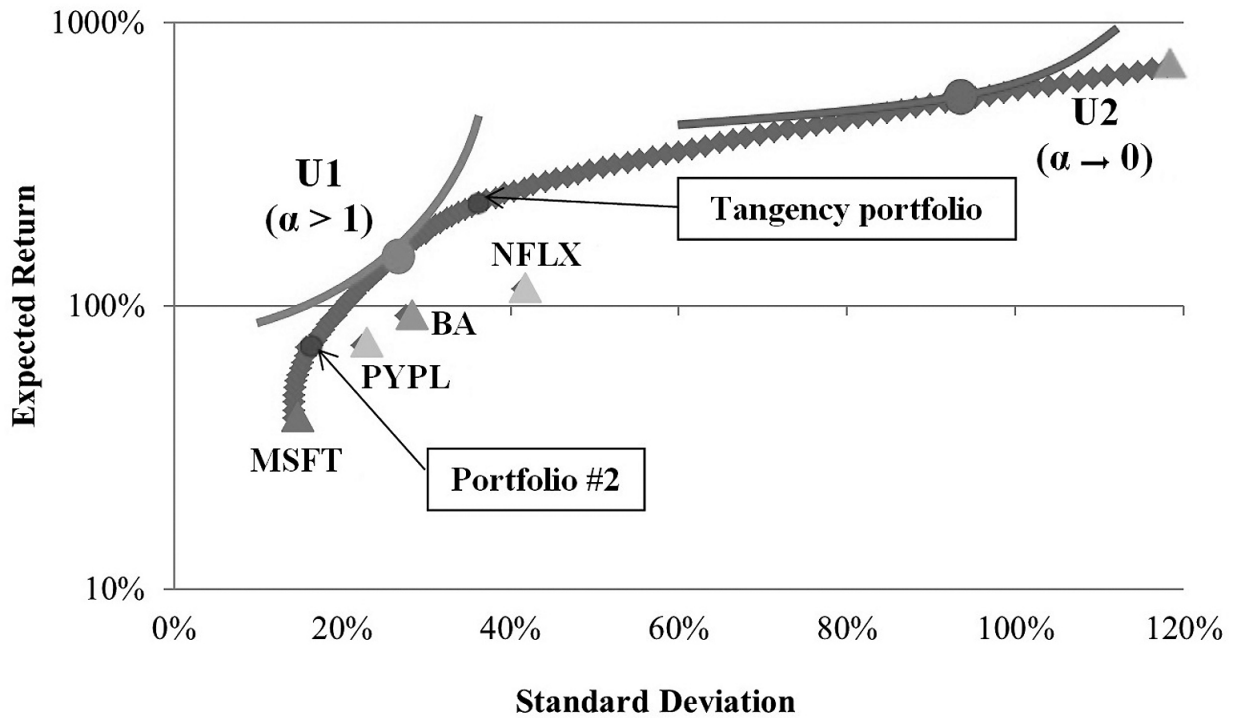


Figure 6. Efficient frontier for Portfolio No. 2.

Source: author's calculations.

Table 10
Portfolio analysis

	Aggressive crypto-portfolio No. 1	Diversified portfolio No. 2
Asset allocation	BTC – 50%, ETC – 30%, XRP – 20%	Cryptocurrencies – 30%: BTC – 10%, ETC – 10%, XRP – 10% Stock: Apple – 10%, NFLX – 20% Commodities & energy: Brent – 20%, Gold – 20%
Start Balance	10,000.00	10,000.00
End Balance	5,299.57	10,018.85
Earnings/losses	-4,700.43	18.8
Exp. return	-17.6%	12.5%
St. deviation	75.5%	4.3%
Dispersion	57%	0.18

Source: author's calculations.

According to main diversification rule, the stock of companies within different industries should be included. At table 6, it is a correlation of the above-mentioned assets for time period 01/01/2017–31/03/2018 based on daily returns. No high correlation is observed.

For the second portfolio, the goal is to reduce volatility by adding BTC and save return at the same time. Cryptocurrency successfully deals with this task – 3% BTC volume decreases the volatility of the entire portfolio by 3% but with the elimination of PayPal stocks (Table 7).

The possible range of expected annual portfolio returns (for portfolio No. 2) for the given period taking into account the specified constraints is 40.18% to 696.48% (Table 8).

Contribution to the risk of each asset is given in table 9.

Figure 6 shows the effective frontier for assets NFLX, BA, PYPL, MSFT and BTC. The portfolios below it are ineffective. Respectively, it makes no sense to invest 100% of funds only in PYPL, BA or NFLX. The best ratio of risk and return is at the efficient frontier. Thus, effective

Table 11
Risk assessment results

	Risks	Likelihood	Risk level
1	Security risks	Medium	High
2	Technical risks (not considered)		
3	Economic risks associated with mining	Medium	High
4	Risks associated with ICO	High	High
5	Legal and regulatory risks	High	High
6	Social risks /risks of acceptance	Medium	Medium
7	Investment risks (volatility)	High	High

Source: author's calculations.

tive is the portfolio consisting only of bitcoins with an expected return of about 700% and a standard deviation of 120%. Not every investor agrees with this asset allocation.

So, we cannot claim that a portfolio at the effective frontier is the best/optimal for an investor. To choose, it is necessary to know his preferences that are expressed in a risk and return ratio. It is generally described by the utility function.

On the graph, this function is represented by a number of curves, of each consists of points that have equal value and utility increases when the curves shift to the top-left. The most common is the quadratic (classical) utility function:

$$U = r - \alpha * \sigma^2,$$

where α is risk aversion coefficient.

The smaller the coefficient, the more investor is prone to risk: the less reward in units of expected return he requires. Then the utility function is flat (U 2). If an investor is not risk-tolerant, then the line goes up steeply (U 1). The simplest way to assess the investor's attitude to risk is by interviewing or analyzing his actual market behaviour.

Therefore, the optimal portfolio is at the tangency point of the utility curve and effective frontier. At this point, the angle of the effective frontier is equal to the tangent of the utility curve angle. Graphically, the risk aversion coefficient is the angle of the utility curve at the tangency point of its effective frontier.

In our case, only a very narrow group of investors can afford to invest 82% of funds in bitcoins and the remaining 18% — in NFLX because then, the Expected Return will be 532%, and Standard Deviation — 93%.

Another approach is to modify crypto-portfolio with traditional financial assets. Then, the first stage is to identify cryptocurrencies with low correlation. Assuming that Bitcoin, as the most capitalized and popular cryptocurrency, will be the first asset in the portfolio, it is necessary to add altcoins with the lowest possible correlation. Over the past six months, it was Ethereum and Ripple (0.42 and 0.47 respectively). All other coins have a correlation with BTC above 0.7.

Obviously, having started investing money in 2017, a market participant would make a huge profit due to a jump in the cryptocurrency exchange rate in December 2017: the volatility risk would be levelled by investment return (105% variance and end balance increased by 41 times). So, it makes sense to test crypto-portfolio from the beginning of the year to analyze diversification opportunities (Table 10). Rebalancing is not used.

It can be seen that a decrease in the cryptocurrency share from 100% to 30% in the portfolio significantly improved risk and return indicators. A conservative approach was about investing 10% in stock of a popular company — Apple, 20% — in the market leader by stock growth — Netflix, and 20% each in traditional investment assets — oil and gold. Taking into account changes, it became possible to reduce

the standard deviation from 75.5% to 4.3% making the return of the new portfolio positive.

The research on different portfolios has shown the following.

Monthly rebalancing is not always profitable, especially in a short term. But at the same time, this measure reduces the volatility of the portfolio.

It is necessary to consider the opportunity to quit cryptocurrency market for a short period of time to prevent harmful consequences of dramatic price shifts.

The portfolio should not be mostly “crypto” but rather it should consist of traditional assets, for example, gold, oil (Antonakakis et al., 2018), stocks or bonds in order to capture return from the growth (Uddin et al., 2018). Otherwise, it will remain a virtual profit. Plus, the presence of fiat assets gives an opportunity for a profitable purchase on corrections when the entire cryptocurrency market falls.

Thus, the diversification method has proved its worth and viability on empirical studies of portfolio investments. Probably, it is reasonable to split all the cryptocurrencies into segments and build a strategy based on this knowledge. For example:

Basic investments — Bitcoin, Ethereum, Litecoin, etc.

Platforms — Ethereum, NEO, Ark, etc.

Anonymous cryptocurrencies — Monero, Zcash, PivX, etc.

Banking/accounting solutions — Ripple, Stellar, etc.

Corporate solutions — VeChain, Walton, WABI, etc.

Innovative solutions — Raiblocks, IOTA, Cardano, etc.

Since the market is unstable at the current stage, most of the assets should be associated with “basic investments”. Possible conditions for the formation of a high-return cryptocurrency portfolio may be thousand dollars of initial capital and priority for top-level coins.

In Table 11, the assessment of risks associated with cryptocurrencies is given.

Thus, it can be said that in view of novelty and innovativeness of the cryptocurrency market phenomenon, no 100% effective risk-management method exists. The only possible way is risk aversion — the refusal of any interaction with the cryptocurrency market. On the other hand, to reduce volatility risk, one of the most significant one that bothers investors all over the world, crypto-community should turn to traditional risk management methods of diversification that may acquire new opportunities. As cryptocurrencies are maturing and evolving into the significant asset class, we are going to witness in near future to what extent.

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Анализ рисков криптовалют и способы их минимизации в современных рыночных условиях

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Аннотация. В ходе исследования автором статьи были идентифицированы семь групп рисков, проанализировано их влияние, сформулированы возможные меры по снижению всех видов рисков. Для проектов первичных размещений криптоактивов сформулирована специальная система оценки рисков, основанная на 100-балльной шкале. Инвестиционный риск (волатильность) был одним из основных объектов исследования. Единственным эффективным вариантом управления данным видом риска является отказ от любого взаимодействия с криптовалютным рынком. С другой стороны, традиционный метод управления рисками – диверсификация портфельных инвестиций – доказал свою ценность и жизнеспособность. Портфель не должен ограничиваться только криптовалютой, а обязательно должен включать в себя и традиционные виды активов. Необходимо также рассматривать возможность выхода с криптовалютного рынка на некоторый период времени, чтобы иметь возможность предотвратить опасные последствия резких скачков цен.

Ключевые слова: криптовалюта; криптовалютный рынок; биткоин; риск-менеджмент; диверсификация; инвестиционный портфель; криптоактивы; оценка инвестиционных рисков

JEL Classification: G02, G11, G29