

Estimation of Currency Risks in the Process of Enterprise Foreign Economic Activity on the example of Antonov State Company

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Abstract. The problem of risk analysis during foreign economic activity is now becoming ever more relevant especially for Ukrainian economy. In this paper, we had analyzed the environment of currency risk formation and evaluated them based on the example of Antonov State Company which is the leader of the domestic aviation industry as the leading exporter of high-technology products with a high degree of added value. The currency risk estimation of Antonov State Company was done through assessment of the foreign exchange position, matching model, Value at Risk method (VaR) and statistical analysis. In order to analyze the all range of Ukraine's economy threats, which is open economy, we have proposed a methodology for an integrated valuation of currency risk.

Keywords: risk, currency risk, Value at Risk, currency matching, statistical analysis.

1 Introduction

In the conditions of rapid changes in the world market situation and the permanent economic processes transformation, stochasticity and uncertainty are becoming important factors of perspective growth of business entities. The inherent consequence of uncertainty is an increase in the risk level, which is significantly intensified in the conditions of economic activity internationalization and entering new foreign markets. Particular importance of these trends accrues during the analysis of the current realities of the Ukrainian economy, which is operating in coordinates of regulation changeability, volatility of the exchange rate, structural and territorial imbalances of the economic system, radical changes in export policy, etc [1]. However, in the conditions of active devaluation processes in domestic economy, one of the key types of risks during foreign economic activity is currency risk. For instance, I.I. Verbitskaya asserts that currency risk is one of the main barriers hindering the development of domestic exports [2], since the amplitude of exchange rate fluctuations is so devastating and unpredictable that one-off situational measures can not offset negative exchange differences.

The currency risk analysis is on the agenda among domestic and foreign scientists. For example, the essence of currency risk was investigated by A. Volitskaya [3], G. Verbitskaya [2], V. Vitlinsky [4], M. Rebruk [5], A. Zorina [6], and others. The classification of currency risks was studied by A. Gassem [7], J. James [8], J. Daniels [9], N. Vnukova [10], O. Ukrainiska [11], and others. The role of currency risks in the economic system and currency risk management were investigated by A. Rummyantsev [12], S. R. Goldberg et al [13], H. Backlund [14], P. Collier et al [15], and others.

The goal of the paper is to analyze the environment of currency risk formation and to evaluate it based on the example of foreign economic activity of Antonov State Company.

The paper has following structure: section 2 is devoted to related works, section 3 demonstrates the environment of currency risk emergence and evaluates the currency risk of Antonov State Company and section 4 concludes.

2 Related Work

In the conditions of high turbulence of changes in the global market situation and dynamic economic transformations, "risk as a quantitative measure of uncertainty" [16], acquires the status of inherent characteristic of economic activity, which covers all life spheres and serves as "a pervasive phenomenon inherent to all market actors" [17]. The problem of risk analysis during foreign economic activity is now becoming ever more relevant whereby according to global management practices, inadequate analysis or ignoring risk control leads to failure 40% of commercial transactions [12].

Similar to the risk definition, currency risks are identified with probability of losses or damage. For instance, experts of the National Bank of Ukraine identify currency risks as an existing or potential risk for revenues and capital arising from unfavorable fluctuations in foreign exchange rates and prices for bank metals [18]. Nevertheless, currency risk is the best example of dualism, meaning the possibility of getting both negative and positive effects, in the form of positive and negative exchange differences, which requires a dialectical analysis of the etymological nature of the "currency risk" category (Table 1).

Table 1. Dialectical analysis of the etymological essence of the "currency risk" category

The laws of dialectics	Explanation	Economic content
I law Transformation of Quantitative Into Qualitative Changes	qualitative changes in the objective world, are carried out only on the basis of quantitative changes	only a big open foreign exchange position and a significant amplitude of currency fluctuations lead to the emergence of currency risks
II law Unity and Struggle of Opposites	Identity and difference are opposites, which interact, determine each other; is a source and driving force of development	dichotomy of the currency risk effects: the likelihood of receiving both losses (loss of income) and profits (benefits)
III law Negation of the negation	in "new" there is "old", but in a transformed form	the latest risk management tools are based on 3 main approaches: avoidance, minimization of losses, maximization of benefits

The economic nature of currency risk is formed by three interrelated parameters: the volatility of the exchange rate, foreign exchange position, which is defined as the difference in revenues (incoming cash flow) and payments of the entity (outflow) in foreign currency [11] and foreign exchange exposure (the sensitivity of the subject to obtaining costs or income). If we will analyze only one of these three parameters, we can receive distorted management decisions, since currency risk is possible only if there is an open foreign exchange position, while its closed form mitigates the sensitivity to any exchange rate changes. In this case, the unpredictable volatility of the exchange rate can be identified only as an additional catalyst for currency risk while the real reason is an open foreign exchange position or cash flows in a foreign currency. That is why, the currency position is the main object of currency risk management. According to A. Volitska, "specialists of the banking business conduct currency risk management through the currency position management" [3].

Overall, currency risk, as a scientific category, is characterized by a complex dichotomous nature, combining negative and positive results. In this case, currency risk can be identified as a situational set of probability events with subjective-objective nature triggered off open foreign exchange position and unpredictable changes in the exchange rate as a result of information asymmetries, the effect of which is to obtain both negative and positive exchange rate differences.

3. Evaluation of Currency Risk in the Process of Foreign Economic Activity

3.1 Analysis of the Environment of Currency Risk Formation

Despite the significant pressure on the national currency at the beginning of 2017, the volatility of the hryvnia during this year was moderate, which is primarily due to positive trends in the international economic development (fig. 1).

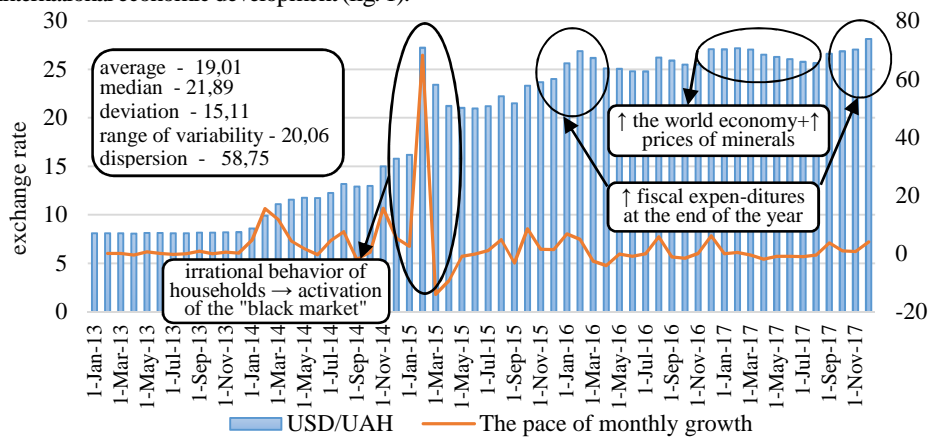


Fig. 1. Dynamics of UAH / USD exchange rate in 2013-2017 [19]

First of all, there was slight increase in the international economics; secondly, there was the restoration of world financial stability as a result of the rising dynamics of financial markets, the introduction of new macro-prudential requirements and the restoration of profitability of systemic

financial institutions; and thirdly, there was a favorable market situation on the world mineral markets (steel, iron ore, energy commodities) [20].

The forecast, built on monthly average weighted exchange rate data of the inter-bank market during 01.2014-01.2018, has shown the average hryvnia exchange rate for 2018 will not exceed the rate of 3071.02 UAH / USD, and by the beginning of 2019 it is likely to be 3299.09 UAH / USD. (fig. 2). The reliability of this forecast is evidenced by the symmetric mean absolute percentage error (SMAPE), which indicates the existence of 1% error prediction. However, Mean Absolute Error (MAE) and Root mean squared error (RMSE) (39 and 45 respectively) confirm, that the volatility of the hryvnia will be maintained which can be explained by the dominant influence of non-economic factors (political, informational, behavioral) on the exchange rate dynamics.

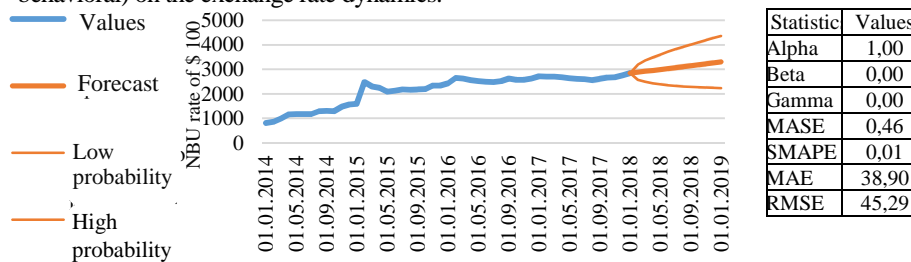


Fig. 2. Forecast dynamics of USD / UAH exchange rate change in 2018 [19]

The transformational nature of the domestic economy determines the priority of the export-oriented development strategy, which provides for macroeconomic equilibrium in the condition of the immature of financial markets. However, the current trends in commodity and mineral markets necessitate a qualitative modernization of the national production system, which should be driven by high-tech industries with a high degree of added value, the best example of which is aircraft construction. That is why the object of this study is the leader of the domestic aviation industry - Antonov State Company as the leading exporter of high-technology products with a high degree of added value.

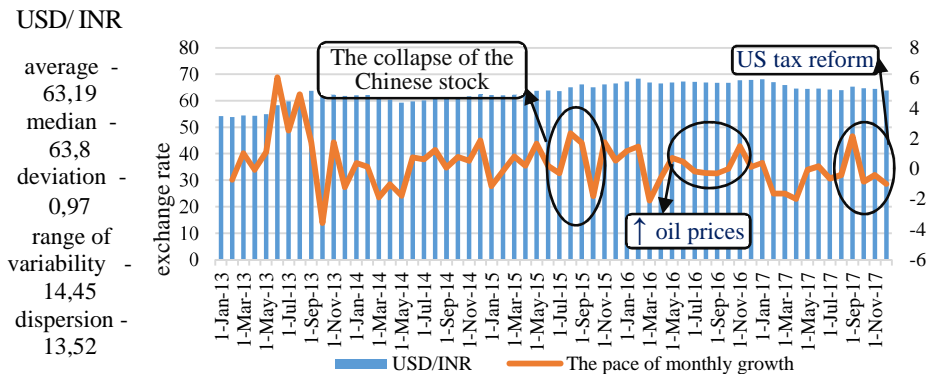
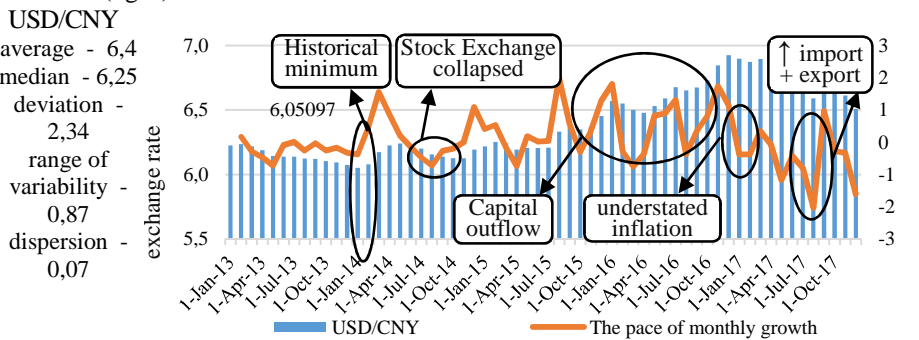
Antonov's particular expertise is in the fields of very large airplanes and airplanes using unprepared runways. Antonov has built a total of approximately 22,000 aircraft, and thousands of its planes are currently operating in the former Soviet Union and in developing countries. In addition to aircraft construction divisions, Antonov founded Antonov Airlines which operates international charter services in the world of oversized cargo market and accounted for about 70% of Antonov's total revenue. On 12 May 2015 the Ministry of Economic Development and Trade transferred it to the Ukroboronprom (Ukrainian Defense Industry) [21].

In order to overcome the limited capacity of the domestic market due to low demand and to increase the efficiency of activity based on economy of scale, Antonov State Company promotes for active participation in the international division of labor, reorientates centers of strategic interests, activates expansion into foreign markets of Azerbaijan (Silk Way Airlines), Saudi Arabia (Taqnia Aeronautics), Turkey (Turkish Aerospace Industries), India (Reliance Defense) and China (Beijing A-Star Space and Technology) (fig. 3). Nevertheless, this strategy is progressive, it is characterized by high risk since these countries are characterized by political instability, high costs of opportunism, volatility of exchange rates, etc.



Fig. 3. Area activities of Antonov State Company [22]

What is interesting, the current foreign-economic contracts of Antonov State Company are not limited by export supplies, but provide for joint research, personnel exchange and joint production of airplanes. As a result, the production process in the territory of customers will be accompanied by costs in the national currency of the partner country. That is why we will analyze the environment of currency risk formation in the economic systems of these countries (fig. 4).



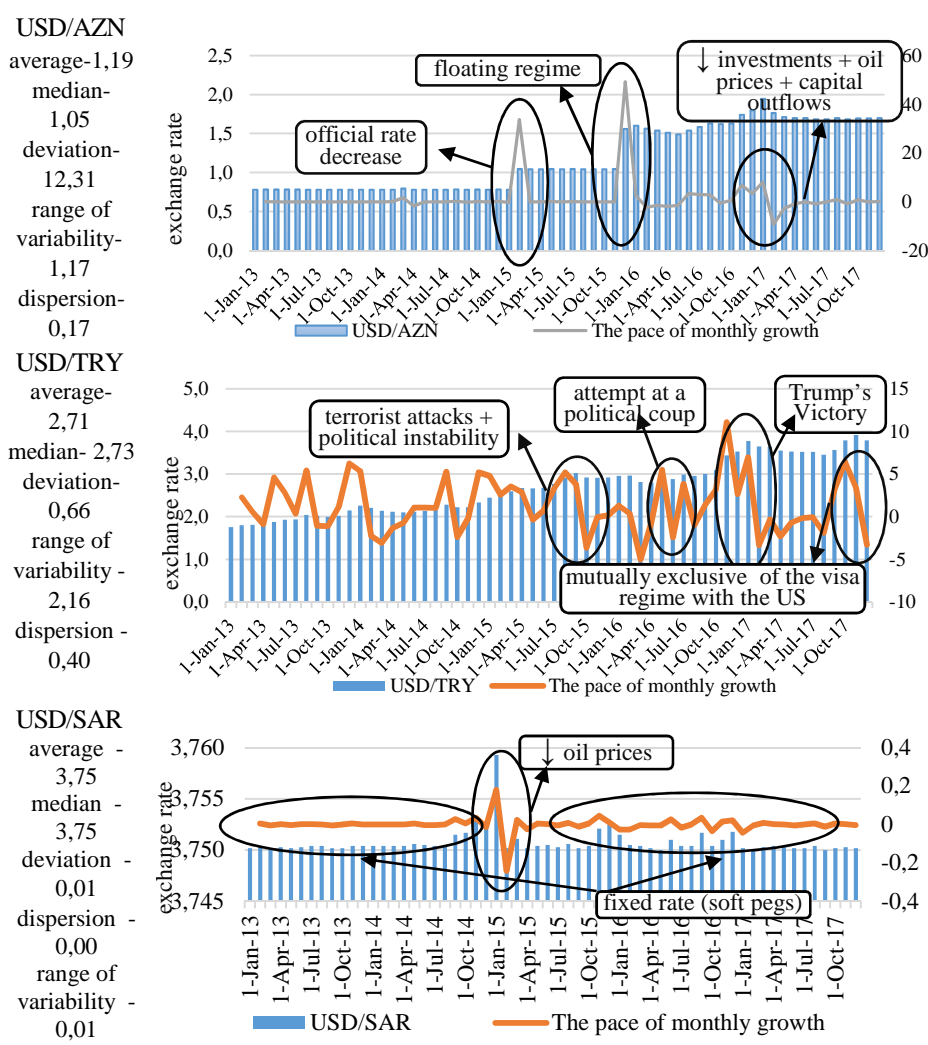


Fig. 4. Dynamics of exchange rate changes in 2013-2017 [19]

In order to study the nature of currency risks, we have done a correlation analysis of macroeconomic indicators (foreign direct investments, gross national income, exports, added value of industry, inflation and interest rates) and the exchange rate of these countries during 2001-2016 (Table 2). Based on the experience of emerging markets, it is logical to assume that one of the key determinants of the successful export of these countries is the price competitiveness of goods and services, which is directly dependent on the exchange rate. However, this hypothesis has been empirically confirmed only for the Chinese economy: the correlation between exports and the Chinese Yuan Renminbi rate is characterized by an ideal negative correlation at 0.969. The results of the correlation analysis for Turkey and India have shown a high level of positive correlation, indicating unidirectional changes in exports and the national currency rates, which can be explained by its closed economies and receptive internal

markets. The low correlation coefficients of Azerbaijan has shown the dominant influence of structural, non-economic factors on the exchange rate formation and dynamics. What is more, Saudi Arabia has demonstrated the absence of a correlation between macroeconomic indicators and exchange rate due to soft peg of Saudi Arabia Riyal to United States Dollar.

Table 2. Correlation matrix of macrofactors and exchange rate of partners of Antonov State Company [24]

Partner countries	Added value, %	FDI, USD	Inflation, %	Loan interest rate, %	Export, USD	GNI, USD
1	2	3	4	5	6	7
China	-0,435	0,969	-0,049	0,004	-0,966 *	0,984
India	-0,821	0,516	-0,486	-0,505	0,638**	0,834
Azerbaijan	-0,517	0,091	0,087	-0,538	-0,360	0,005
Turkey	0,728	0,191	-0,323	-	0,580	0,831
Saudi Arabia	-0,385	-0,157	-0,363	-	0,058	0,240

* correlation coefficients more than 0.75 indicate high correlation level [23]

** for 15 observations with 95% significance level the valid correlation is 0.51 [23]

It is logical to assume, that for the export-oriented economy of Ukraine, the level and dynamics of the exchange rate should be the key factor of economic development. However, the correlation analysis based on statistics of 2001-2016 has shown a low level of correlation between export and exchange rate - 0.078 (Table 3).

Table 3. Correlation matrix of macrofactors and exchange rate of Ukraine [24]

2001-2016							
Macro indicators	Added value	FDI	Inflation	Loan interest rate	Exchange rate	GNI	Exports
Value Added	1						
FDI	0,085	1					
Inflation	-0,087	0,349	1				
Loan interest rate	0,060	-0,582	-0,173	1			
Exchange rate	-0,674	-0,222	0,395	0,080	1		
GNI	-0,533	0,647	0,293	-0,692	0,270	1	
Export	-0,515	0,685	0,123	-0,588	0,078	0,939	1

❖ qualitative restart of the domestic economy;
❖ activation of market regulation mechanisms;
❖ structural modernization of market relations.

2013-2016							
Macro indicators	Added value	FDI	Inflation	Loan interest rate	Exchange rate	GNI	Exports
Value Added	1						
FDI	-0,089	1					
Inflation	-0,213	-0,229	1				
Loan interest rate	-0,067	-0,054	0,970	1			
Exchange rate	0,556	0,037	0,641	0,781	1		
GNI	-0,186	0,143	-0,912	-0,965	-0,898	1	
Export	-0,422	0,210	-0,794	-0,868	-0,955	0,968	1

This can be explained by the underdevelopment of market regulation instruments, the dominance of political factors on hryvnia exchange rate, raw material specialization and structural imbalances, the inertia of changes in the world mineral trade, and, as a result, the insensitivity of domestic exporters to changes in exchange rates and inflation. To the contrary, the economic reforms carried out in 2013-2017 led to a qualitative restart of the domestic economy by intensifying market-based regulatory mechanisms. Consequently, this leads to the ideal negative correlation between hryvnia and Ukrainian exports (-0.955), confirming the structural modernization of market relations, in particular currency ones.

Based on the obtained correlation matrices, we have performed regression modeling of the exchange rate in conditions of economic instability of Ukraine in the EViews 7 where regressand is hryvnia exchange rate (ER) while independent variables include gross domestic product (GDP), inflation rate (IFL), current and financial account (CA and CFA), and official reserves (OR01) (fig. 5). Using least square method we have obtained the following model specification (1).

$$ER = -6170.97 + 0.08252CA - 0.0516CFA + 0.00416GDP + 60.3724IFL - 0.03853ORC \quad (1)$$

According to the results, current account, GDP and inflation directly effect on the hryvnia exchange rate while the financial account and official reserves have a reverse effect on the regressand.

Estimation Command:
LS ER C GDP CA CFA IFL OR01

Estimation Equation:

 $ER = C(1) + C(2)*GDP + C(3)*CA + C(4)*CFA + C(5)*IFL + C(6)*OR01$

Substituted Coefficients:

 $ER = -6170.97158681 + 0.00416486435665*GDP + 0.0825222552424*CA - 0.0516160739704*CFA + 60.3724034098*IFL - 0.0385302200352*OR01$

Hypothesis:
 The formation and dynamics of the exchange rate (ER) are influenced by such determinants as the balance of the current account (CA), the balance of operations with capital and financial operations (CFA), inflation (ifl), GDP (GDP) and the official reserves (OR) .

Model specification

Fig. 5. Representations -of the model in the EViews 7 [24]

The most significant factor of the hryvnia exchange rate is GDP (probability <0.05 i <0.01); among others essential determinants we can note the balance of current and financial accounts while official reserves and inflation are secondary factors (table 4).

Since the model is adequate for Fisher's criterion and has a high explanatory capability with an adjusted determination coefficient of 81.7%, the model comprehensibly represents the link between exchange rate and the analyzed determinants. In order to analyze and control the exchange rate differences of national currencies, based on constructed regression models, lets consider the effect of macro determinants changes on the exchange rates of countries in value terms using elasticity coefficients (Table 5).

Thus, with the help of econometric models, a hierarchy of the most significant determinants of the probability criterion is determined which will allow to assess the effect of the macrofactors changes on the level and dynamics of exchange rates in value terms based on the elasticity coefficients. This is an effective tool for financial management in forecasting and

managing exchange rate differences and costs from joint ventures on the territory of partner countries of Antonov State Company.

Table 4. Estimation output [19; 24]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6170.972	4794.790	-1.287016	0.2055
GDP	0.004165	0.000318	13.08586	0.0000
CA	0.082522	0.038222	2.159015	0.0369
CFA	-0.051616	0.025230	-2.045788	0.0474
IFL	60.37240	47.37216	1.274428	0.2099
OR01	-0.038530	0.027850	-1.383515	0.1742
R-squared	0.838014	Mean dependent var	944.8000	
Adjusted R-squared	0.817765	S.D. dependent var	596.2080	
S.E. of regression	254.5150	Akaike info criterion	14.03770	
Sum squared resid	2591115.	Schwarz criterion	14.27622	
Log likelihood	-316.8672	Hannan-Quinn criter.	14.12705	
F-statistic c	41.38685	Durbin-Watson stat	1.359757	
Prob(F-statistic)	0.000000			

r-squared = 81,8 ≥ 0.75 → high explanatory ability

Prob < 0.01 and 0.05 → significant determinants
Prob > 0.1 and 0.05 → insignificant determinants

Prob (F-statistic) < 0.01 | 0.05 → model is adequate

Table 5. Analysis of the macrofactors of the exchange rates of the partner countries of Antonov State Company [19; 24]

Country	Specification	Significance	Impact	Elasticity
Ukraine	ER = -6170,972+ CA* -0,083CFA* 0,052+ GDP* 0,004+ IFL * 60,372- OR*0,039	Significant: CA, CFA, GDP Insignificant: IFL, OR	Direct: CA, GDP, IFL Indirect: CFA, OR	1% changes in factors leading to changes in exchange rate CA -0,13; CFA -0,069%; GDP 1,28%; IFL 6,446%; OR 0,003 %.
The models constructed for the national currencies of Saudi Arabia and China inadequately reflect the interconnection of macro-factors and the dynamics of exchange rate changes				
Azerbaijan	ER = -0,829 CA* 1,32E-11+CFA* 2,01E-11+ GDP*4,20E-12 +IFL*8,23E-05 -OR*1,82E-11	Significant: CA, CFA Insignificant: GDP, IFL, OR	Direct: CA, GDP, IFL, OR Indirect: CFA	1% changes in factors leading to changes in exchange rate CA 0,072%; CFA 0,066%; GDP 0,139%; IFL 0,002 %; OR -0,092%.
India	ER = 36,281+CA* 1,05E-10-CFA* 8,46E-11+GDP* 2,33E-11- IFL* 1,134- OR*2,08E-11	Significant: GDP, IFL Insignificant: CA, CFA, OR	Direct: CA Indirect: CFA, GDP, IFL, OR	1% changes in factors leading to changes in exchange rate CA - 0,04%; CFA -0,028%; GDP 0,491%; IFL - 0,211%; OR -0,068%.
Turkey	ER = 1,632 +CA* 9,08E-12+CFA* 3,73E-12-GDP* 2,15E-12-IFL* 0,017+OR*2,25E-11	Significant: IFL, OR Insignificant: CA, CFA, GDP	Direct: CA, OR Indirect: CFA, GDP, IFL,	1% changes in factors leading to changes in exchange rate CA - 0,17%; CFA 0,026 %; GDP - 0,9%; IFL - 0,697%; OR 1,111 %.

3.2 An Estimation of Currency Risks of Antonov State Company

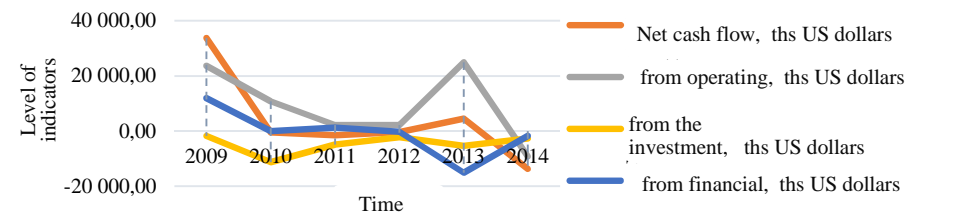
The classical and the most simple method for analyzing the sensitivity of currency risk (as follows, operational currency risk) is the assessment of the value of foreign exchange position

which is defined as the difference between the amount of revenue (incoming cash flow) and enterprise payments (outflow) in foreign currency [11]. In order to ensure exchange market stability and limit the risk associated with conducting currency transactions which can lead to significant losses the National Bank of Ukraine sets limits on the open foreign exchange position [18].

Empirical calculations have shown that the foreign exchange position of Antonov State Company is mostly short open, as 2010-2012 and 2014 were characterized by a negative net cash flow in foreign currency, while a long open foreign exchange position was inherent in 2009 and 2013 (table 6). Analysis of the foreign exchange position of Antonov State Company also allows us to identify "bottlenecks" of its activity. For instance, investment activity is characterized by stable negative result. The key feature of Antonov State Company is the innovative activity and the focus on the high technology development. This characteristic can explain obtaining unexpected financial gains due to foreign exchange rate differences in 2009 and 2013, since, according to Marshall-Lerner theory, a significant fluctuation of the national currency leads to positive financial and economic effects for representatives of industries with a high added value, the best example of which is aviation.

Table 6. Dynamics of changes in net cash flow in foreign currency, 2009-2014 [11, 25]

Indicator	2009	2010	2011	2012	2013	2014
from operating, ths US dollars	23669,1	10814,65	2211,597	2210,819	24949,82	-9233,81
from the investment, ths US dollars	-1742,24	-11284,1	-4962,48	-2246,94	-5403,8	-2706,61
from financial, ths US dollars	11898,94	-6,21727	1265,285	-298,166	-15082,3	-1807,13
Net cash flow, ths US dollars	33825,8	-475,715	-1485,6	-334,29	4463,743	-13747,5



The next stage of this analysis is the currency matching model (Table 7), which is the method of accounting for and estimation of currency risk through mutual calculation of risks on liabilities and assets. It describes the relationship between profits (losses), generated by open foreign exchange position, and foreign exchange differences and helps to choose the an appropriate strategy for managing currency risks [26] (2).

$$\Delta P_v = VP(s_p - s) \quad (2)$$

where ΔP_v - profit (loss) of foreign currency revaluation due to changes in the exchange rate;

VP - foreign exchange position ;

s_p та s - predictable and current exchange rates.

If we choose, between two alternatives: the strategy of currency matching which aims to eliminating currency risk by keeping foreign exchange position closed, and a strategy of maximizing profits, which involves receiving speculative profits by open foreign exchange position, for Antonov State Company it is expedient to choose a strategy for maximizing profits. Since in the conditions of unpredictable currency volatility, currency matching

strategy is unsuitable, because a wide range of hedging instruments opens the possibility of realizing currency speculations in order to generate financial benefits.

Table 6. Estimation of currency risks of Antonov State Company by currency matching [10, 25, 27]

Indicator	2009	2010	2011	2012	2013	2014
Net cash flow, ths US dollars	33 825,8	-475,715	-1 485,6	-334,29	4 463,743	-13 747,5
Actual exchange rate, UAH/USD	7,985	7,9617	7,9897	8,097	8,295	15,875
Expected exchange rate, UAH/USD	7,9	9,023	8,82	9,3	8,2	11,7
Expected exchange rate, ths US dollars	-2 875,19	-504,876	-1 233,49	-402,151	-424,056	57 395,81
Profit / loss from revaluation, ths US dollars	1 897,433	-1 119,36	-732,693	-385,328	-224,834	11 150,36

The currency risk estimation based on an open foreign exchange position only can lead to incorrect strategic decisions, since the level of currency risk is determined by the exchange rates volatility, which is nothing more than a standard deviation. Therefore, during risks estimation we should take into account not only parameter of value, but also parameter of stability [10; 26], which is determined by Value at Risk method (VaR) proposed by J.P. Morgan. The reason of its popularity is analyzing of three elements: a relatively high level of confidence (typically either 95% or 99%), a time period (a day, a month or a year) and an estimate of loss (expressed either in currency or percentage terms). VaR method characterizes the maximum possible size of losses on an open foreign exchange position of a company for a certain time with a certain degree of probability (usually 95% or 99%) [10; 26].

Let us analyze risks for the US dollar and the national currencies of the key partner countries of Antonov State Company as alternative currencies for conducting internal settlements using the VAR method from 01.01.15 to 31.03.15. [19] (Table 8).

Table 8. Currency risk estimation of Antonov State Company by VaR [25, 28-32]

Indicators	USD	IDR	TRY	CNY	AZN	SAR	Sum
Influence of exchange rate changes on the balance of funds, ths UAH	177 012	177 012	177 012	177 012	177 012	177 012	177 012
Probability of tolerated risk,%	99						-
Quantum of normal distribution for 99%probability	2,33	2,33	2,33	2,33	2,33	2,33	-
The exchange rate at the date of balance sheet, 31.12.14*	15,7689	0,2419	6,793	2,5333	20,1027	3,9891	-
Average exchange rate increase (mathematical expectation)	0,134633	0,001416	0,020896	0,02098	0,13491	0,036378	-
The standard deviation of the daily rate of growth	0,046374	0,07825	0,059973	0,04527	0,119216	0,076932	-
Time horizon, days	10						-
VaR for 10 days	4 705,25	-32 022,6	21 036,3	-15 103,5	-25 288,5	-25 290,3	- 114 036
The share of losses from the foreign exchange position for 10 days,%	2,7	-18,1	-11,9	-8,5	-14,3	-14,3	-64,4

The obtained results indicate that with 99% probability of tolerated risk during the first 10 days of the Q2 2015 (01.04.15-10.04.15), losses from the exchange rate fluctuations of alternatives to the US dollar currencies would not exceed 114 036 ths UAH. In the result, there will be 67,1% change in the balance of cash due to changes in foreign exchange rates. The biggest part of expected losses, 32,022.6 ths UAH, Antonov State Company would

receive due to the volatility of the Indian Rupee. While fluctuations of others exchange rates, would also lead to negative effects totaling 118,741 ths UAH where the biggest shares would be created by Indian Rupee, the Azerbaijani Manat and Saudi Arabia Riyal fluctuations. At the same time, the volatility of the US dollar would generate positive effects in the amount of 4,705, 259 ths UAH, which is a 2.7% change in the cash balance.

In order to make insightful analysis of currency risks of partner countries of Antonov State Company followed by joint production of aircraft in the territory of customers, we will perform a statistical analysis of the exchange rate variability (Table 9).

Table 9. Statistical estimations of the exchange rates volatility of the partner countries of Antonov State Company from 01.01.2017 to 31.12.2017 [19, 28-32]

Group	Coefficients	USD	CNY	TRY	AZN	IDR	SAR	
Center metrics	Mathematical expectation	26,59	3,9	7,29	14,63	0,4	7,19	
	Median	26,58	3,92	7,32	14,81	0,4	7,18	
	Mode	25,9	0,00	7,37	14,00	0,38	7,18	
	Deviation between expectation from the median%	0,06	0,49	0,48	1,23	0,37	0,15	
	Average reliability *	reliable						
Variation	Range of deviation	2,6267	4,294	0,9473	2,515	0,1483	0,815	
	bigger quartile, Q_3	26,7997	4,006	7,4687	14,073	0,4067	7,183	
	smaller quartile, Q_1	27,0217	3,923	7,4276	15,225	0,3967	7,25	
	Interquartile range ($Q_3 - Q_1$)	-0,222	0,083	0,0411	-1,153	0,01	-0,067	
	Mean deviation	0,478	0,114	0,146	0,45	0,013	0,05	
	Dispersion	0,327	0,135	0,036	0,283	0,0	0,006	
Others	Standard dispersion	0,571	0,367	0,191	0,532	0,02	0,079	
	Coefficient of variation	Linear	1,797	2,920	2,004	3,077	3,264	0,699
		Quadratic	2,149	9,408	2,617	3,638	4,953	1,099
Oscillations		9,877	109,973	12,996	17,193	37,245	11,329	
Asymmetry and excess	Asymmetry	0,108	-9,762	-0,974	0,251	-2,7	-0,252	
	Type of asymmetry	(+) right	(-) left		(+) right	(-) left right		
	Excess	-0,492	102,909	-0,24119	-0,201	11,404	9,655	
	Distribution type	flat-topped	leptokurtic	flat-topped		leptokurtic		
Trend	Dynamics	-	+	-	+	+	+	
	Approximation coefficient	2,6	27,9	12	59,9	1,4	3,2	
	Reliability trend	unreliable			credible	unreliable		
	Qualitative homogeneity	Homogeneous	extremely heterogeneous	Relatively homogeneous		Heterogeneous	relatively homogeneous	
	Fluctuation	Insignificant	Significant	relatively		little significant	relatively insignificant	

An average is considered to be the most important statistical indicator that displays a typical or "central" but not always adequate meaning, in the range of the variative dynamics. That is why the simplest indicator of the statistical series reliability is the deviation between median and average, which ensures the adequacy of the forecast data and should be less than 5%. The US dollar is characterized by the smallest variation among the alternatives (0.06%), which indicates a high degree of reliability of the center as an indicator in order to make management decisions.

The standard error of the mean (standard dispersion) and interquartile range reflect the

degree of drilling property. The whole range of the currencies demonstrates a relatively low level of volatility that indicates that the fluctuations of these currencies are around mathematical expectations. Similar results reflect the interquartile range, which is as a refining indicator for exchange rate fluctuations.

The level of statistical homogeneity will be analyzed using the variation indices. The biggest quadratic variation has Chinese Yuan Renminbi, which reflects the qualitative heterogeneity of the set of statistical data. Using oscillation coefficient, we can note that the statistical mass of the Chinese Yuan Renminbi is extremely heterogeneous, which substantially deforms the forecast of the probable exchange rate. Significant heterogeneity is also typical for Indian Rupee, whereas United States Dollar has insignificant fluctuations, which indicates a high level of forecasts objectivity based on the average and its qualitative homogeneity. The dynamics of the dollar, as well as the Azerbaijani Manat and the Saudi Arabia Riyal are closely related to the symmetric distribution, reflecting the regular trends in currency fluctuations facilitating the process of perspective forecasting.

Thus, the statistical analysis of currency risks has shown the priority of cooperation between Antonov State Company and Saudi Arabia due to the qualitative homogeneity of the time series because of the result Saudi Arabia Riyal had been pegged to the United States Dollar. The low level of currency risk is also typical for the Indian Rupee and Turkish Lira, but the political component still remains as the key determinant of its fluctuation. In contrast, the relatively high level of currency risk is inherent to the United States Dollar and Azerbaijani Manat as a result of floating exchange rate regime, which essentially depends on the oil prices volatility.

However, in the domestic economic system, currency risk is complex and complicated due to the export-oriented strategy. In this case, the effectiveness of economy depends on stable flow of foreign exchange earnings generated by exporters as a key source of foreign currency and the factor of hryvnia stabilization. As the result, Ukrainian economy significantly depends on the level of domestic demand, indicators of development of foreign states. In order to analyse the all range of Ukrainian economic threats, which is an open economy, we will propose a methodology for an integrated valuation of currency risk (3).

$$R_{ex} = \alpha * R_{natex} - \beta * R_{ecgrowt} + \gamma * R_{exex} + \delta * R_{infex} \quad (3)$$

*de R_{ex} – integral indicator of currency risk of a trading partner,
R_{nat ex} та R_{ex ex} – currency risk of Ukraine and partner countries,
R_{ec growt} – the risk of economic slowdown in partner countries;
R_{inf ex} – inflation risk of the partner countries;
 α, β, γ та δ – weight coefficients.*

The three components of the integrated level reflect the external threats generated by the economic systems of partner countries, which include statistical estimates of currency and inflation risks, as well as the economic slowdown. The third parameter characterizes the volatility of the hryvnia exchange rate. Overall, the integral assessment of currency risk is based on real effective exchange rate, the economic content of which is to reflect the exchange rate change, adjusted for inflation in Ukraine and in countries - major trading partners of Ukraine [18]. However, the proposed methodology includes the risk of economic slowdown of partner countries, which is the main threat of Ukrainian economy in the medium term [20].



According to the integral level of the currency risk, Turkish Lira and Saudi Arabia Riyal, despite the stability of the exchange rate based on soft peg, are characterized by the highest risks due to inflation risks (Table 10).

Table 10. Statistical analysis of currency risks of Antonov State Company partners [24, 28-32]

Partner currency	Currency risk	β	Inflation risk	γ	Risk of economic slowdown	δ	Integral indicator
TRY	0,32	0,5	254,07	0,3	20,43	0,2	842,96
CNY	0,78	0,5	8,74	0,3	3,86	0,2	28,74
IDR	61,12	0,5	5,07	0,3	4,37	0,2	46,59
SAR	0,00	0,5	123,87	0,3	8,75	0,2	411,15
AZN	139,21	0,5	69,00	0,3	20,56	0,2	295,49

Based on the assessment of the exchange rates fluctuations of the trading partners of Antonov State Company we summarize the optimal market strategies and traded positions in the foreign exchange market during February 2018 (Table 11).

Table 11. Analysis of exchange rates volatility of the key partner countries of Antonov State Company [19]

Pair	Rate	Annual change	Parameters		Annual range	Forecast for 1 month	Trader position	5 year old dynamics
			bid	ask				
USD/UAH	27,7719	2,1%	27,521	28,0219	24,415-28,9125	Bulls (77%) / Bears (23%)	Buy	
USD/INR	64,23	-4,4%	64,22	64,24	63,245-67,465	Bulls (45%) / Bears (55%)	Actively sell	
USD/TRY	3,7691	1,93%	3,7652	3,773	3,3845-3,9825	Bulls (64%) / Bears (36%)	Actively buy	
USD/SAR	3,7508	0,01%	3,7468	3,7548	3,7487-3,7525	Bulls (100%)	Sell	
USD/CNY	3,3034	-8,24%	6,3024	6,3044	6,2707-6,9226	Bulls (30%) / Bears (70%)	Actively sell	
USD/AZN	1,689	-12,79%	1,675	1,7030	1,665-1,9397	Bulls (100%)	Neutral	

The final choice of country, nature and depth of cooperation depends on the purpose of the activity, the risk appetite level and the financial capacity of the aircraft producer to accept a certain level of risk [1].

4 Conclusions

The paper presents a theoretical general conclusion and a new solution to the scientific problem, which is to systematize theoretical basis and develop practical recommendations for optimizing the currency risk management of the company by the

example of Antonov State Company. The obtained results indicate the achievement of the goal and give an opportunity to make the following conclusions and make suggestions:

❖ the nature of the independent macroeconomic factors influence on the exchange rate of the partner countries of Antonov State Company was determined and degree of its impact were studied using the elasticity coefficients based on external environment modeling of the exchange rates formation and volatility in EViews 7;

❖ the statistical analysis of currency risks has shown the priority of cooperation of Antonov State Company with Saudi Arabia due to the quality homogeneity of the time series because of the result Saudi Arabia Riyal had been pegged to the United States Dollar. The low level of currency risk is also typical for the Indian Rupee and the Turkish Lira, but the political component still remains as the key determinant of its fluctuation. In contrast, the relatively high level of currency risk is inherent to the United States Dollar and Azerbaijani Manat as a result of floating exchange rate regime, which essentially depends on the oil prices volatility. According to an alternative method of currency risk analysis - VaR, the positive foreign exchange differences of Antonov State Company are received due to US dollar volatility in the amount of 4,705,259 ths USD in Q1 2015; analysis of the company currency position indicates the necessity of choosing a maximizing profits strategy, in contrast to the strategy of currency matching;

❖ In order to analyze the all range of Ukraine's economy threats, which is open economy, we have proposed a methodology for an integrated valuation of currency risk. As the result, Turkish Lira and Saudi Arabia Riyal, despite the stability of the exchange rate based on soft peg, are characterized by the highest risks due to inflation risk;

❖ Analysis of currency risks of Antonov State Company proves that the choice of management methods depends on the scale and nature of the risks impact. In this case, in our opinion, it should be used scenario approach to manage currency risk: to take a certain level of risk within the risk appetite, if it does not exceed acceptable level of losses, hedge risks - without exceeding the critical level of losses by using such tools as forwards and swap agreements, leads & lags strategy; avoid and eliminate risks in case of a catastrophic losses level.

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