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**Yatsenko Valeria**

PhD student,

Department of International Economics and Marketing,

Taras Shevchenko National University of Kyiv

ORCID: <https://orcid.org/0000-0002-2925-7470>E-mail: [valeriayatsenko5@gmail.com](mailto:valeriayatsenko5@gmail.com)

## DATA MANAGEMENT AS A TOOL FOR ECONOMIC SUSTAINABILITY: APPLICATION TO CURRENCY RISKS OF TECHNOLOGY ENTERPRISE

The global economy is entering into recession and markets excessive volatility. Market disruptions implications would be liquidity loose of enterprises' balances, eroding assets and turning to losses, supply chains, and operational instability, outplacements, etc. Moreover, exchange rates will fluctuate unpredictable and currency risks will rise. Consequently, these tendencies will lead to the volatility of the currency market as one of the most sensitive parts of the modern economic system. Therefore, it drives a need for looking at the possibilities to apply data management to constant and frequent analysis of distress factors for enterprise economies, such as currency risks, to ensure their sustainability.

**Keywords:** risk, currency risk, currency risk management, data management, foreign economic operation.

### Яценко В.О. УПРАВЛІННЯ ДАНИМИ ЯК ІНСТРУМЕНТ ЕКОНОМІЧНОЇ СТІЙКОСТІ: ЗАСТОСУВАННЯ ДО ВАЛЮТНИХ РИЗИКІВ ТЕХНОЛОГІЧНОГО ПІДПРИЄМСТВА

Зменшення обсягів світової торгівлі, порушення глобальної фінансової стійкості, від'ємні темпи економічного зростання більшості країн світу, загострення боргової кризи, а також пандемія COVID-19 безсумнівно вказують на перехід сучасної міжнародної економіки у фазу рецесії, що вже відображається надмірною нестабільністю та непередбачуваністю товарних та фінансових ринків. Наслідками зазначених процесів на мікрорівні можуть стати втрата ліквідності балансів підприємств, розмивання активів та перетворення на збитки, розрив ланцюгів поставок, настання операційної нестабільності тощо. Логічно, що ці тенденції призведуть до нестабільності валютного ринку загалом та непрогнозованого коливання валютного курсу зокрема, як однієї з найбільш чутливих складових сучасної економічної системи, що, в свою чергу, неодмінно призведе до підвищення валютних ризиків. В даному контексті, особливого значення набувають ідентифікація, аналіз та управління валютними ризиками, що виступає невід'ємним елементом здійснення зовнішньоекономічної діяльності. Світовою практикою доведено, що ігнорування валютних ризиків призводить до невдач значної частки зовнішньоекономічних операцій та, як наслідок, зниження рентабельності, що особливо актуально для вітчизняних підприємств. Однак, реалізація ризик-менеджменту суттєво ускладнюється внаслідок непередбачуваної і швидкої волатильності валютного курсу, а у випадку здійснення довгострокової співпраці – неможливістю побудови точного прогнозу для визначеного часового горизонту, зумовлюючи необхідність використання автоматизованих методів управління. Об'єктом дослідження було обрано державне підприємство «Антонов» як один із провідних виробників високотехнологічної продукції в Україні, яке нині активно працює над спільним українсько-турецьким проектом з розробки та виробництва літака Ан-188. В статті досліджуються можливість та напрями застосування інструментів аналізу даних (Data Science) для управління валютними ризиками високотехнологічних підприємств із складними зовнішньоекономічними операціями.

**Ключові слова:** ризик, валютний ризик, управління валютним ризиком, управління даними, зовнішньоекономічна діяльність.

### Яценко В.А. УПРАВЛЕНИЕ ДАННЫМИ КАК ИНСТРУМЕНТ ЭКОНОМИЧЕСКОЙ УСТОЙЧИВОСТИ: ПРИМЕНЕНИЕ К ВАЛЮТНЫМ РИСКАМ ТЕХНОЛОГИЧЕСКОГО ПРЕДПРИЯТИЯ

Мировая экономика вступает в рецессию и рынок становится чрезмерно неустойчивым. Последствиями провалов рынка могут быть снижение ликвидности баланса предприятий, обесценивание активов, убытки, разрушение цепочек поставок, возникновение операционная нестабильность и т.д. Более того, обменные курсы будут непредсказуемо колебаться, а валютные риски возрастут. Следовательно, подобные тенденции приведут к нестабильности валютного рынка как одной из наиболее чувствительных частей современной экономической системы. Таким образом, появляется необходимость в анализе возможности применения управления данными для постоянного и частого анализа факторов упадка предприятий, таких как валютные риски, для обеспечения их устойчивости.

**Ключевые слова:** РИСК, валютный риск, управление валютным риском, управление данными, внешнеэкономическая деятельность.

**Problem statement.** The decline of world trade and global economic growth, financial stability shocks, and the COVID-19 pandemic undoubtedly indicate the recession of the modern international economy. Obviously, it will lead to financial market instability and consequently unpredictable exchange rate fluctuations and rise of currency risks. In this context, the identification, analysis, and management of currency risks, as an integral part of foreign economic activity, are of particular importance. However, current currency risks are hard to analyze and manage, that is why risk management requires new approaches and tools for instance Data Science.

**Analysis of recent research and publications.** Demand for Data Science services, tools and applications are growing across most of economic and social

sectors, it will be increasing in the course of Fourth industrial revolution, as envisaging by experts of the World Economic Forum [1]. One of the major approaches to the successful Data Science applications are multiple collaboration of entities of common interest – public private, domestic, foreign, international – in sourcing, verifying, exchange, processing and application of data [2]. The purposes of such complex collaborative approach are to increase data sustainability, value and reduce risks of various applications [3].

Sustainability of data processing and its implications is essential for positive economic effect on macro and micro levels: "A sustainable solution is one which allows for the robust, repeatable and replicable use of data occurs in different geographical and user-cases, underpinned by a secure source of funding enabling

continuity in the supply and analysis of data, to generate actionable insights” [3].

The data processing continuity close to real-time comes as a need in a cases of currency risks in high technology production with mixed (domestic and foreign) suppliers affecting by cross-influence of exchange rates fluctuation. For example, Ukrainian enterprises should react on risks of substantial UAH revaluation for 16 per cent during 6 months at the end of 2019, which has changed to rapid devaluation at similar level during one month in 2020 [4]. One of the samples of such need for real-time data management of currency risks adjustments with respect of high tech and complex supply is cargo and passenger planes production.

The purpose of the study is to present a way of implementation Data Science tools to currency risk management in high technology production with complex foreign economic operations.

**Presentation of the main research results.**

**I. Currency Risks of Antonov Company**

One of the main strategic goals of the Ukrainian planes producing Antonov Company for 2020–2024 is to renew aircraft mass production of the An-1X8 family (passenger (An-148 and An-158) and cargo planes (An-178 and An-188)) including set up of international joint production with highest priority of the Ukrainian-Turkish project An-188 [5]. Implementation of this project will go along with currency risk since the joint development and production of the aircraft involves transactions in three currencies:

- UAH – the value of majority home-produced components and assemblies, salaries and emoluments, the main part of development and design costs;
- USD – most of the cash flows namely the price of finished goods, aftersales service, currency loan servicing;
- TRY – partially joint R&D costs, Turkish staff training.

The Antonov Company is well-known for its fully integrated production and cargo aircrafts export. However, the company traditionally imports the most complex components. For instance, the An-188 aircraft will be equipped with Turkish avionics ASELSAN, and the third model An-188-120 will contain 4 turbo propeller engines LEAP of the American company CFM International (CFMI) (table 1).

Table 1

**Foreign economic operations of An-188-120 production process**

	Credit (Export)	Debit (Import)
Engines LEAP	Currency payment risk: USD/UAH ↓	Goods
Avionics ASELSAN	Staff trainings and R&D research	Goods risk: USD/TRY ↑
Aircraft An-188-120	Goods	Avionics and Payments risk: USD/UAH ↑, USD/TRY ↓
Repair and maintenance	Services	Payments risk: USD/UAH ↑

Consequently, this project will create currency risks influenced by two groups of factors: specifics of foreign economic operations (import-export operations, joint R&D, staff training, operating cycle more than a year) and volatility of currencies.

The analysis of currency volatility was based on daily exchange rate data from January 1, 2019, to March 20, 2020 (320 observations) [9]. Statistical analysis showed the following results: that average is typical, the currency risk is low and statistical data is homogeneous since standard deviation close to 1, and the coefficient of variation as the main quantitative measure of risk, does not exceed 10%. Nevertheless, the TRY/UAH pair has relatively higher risk level since the coefficient of variation is 8.32% (table 2).

**Currency Operations of Transport Aircraft: An-188**

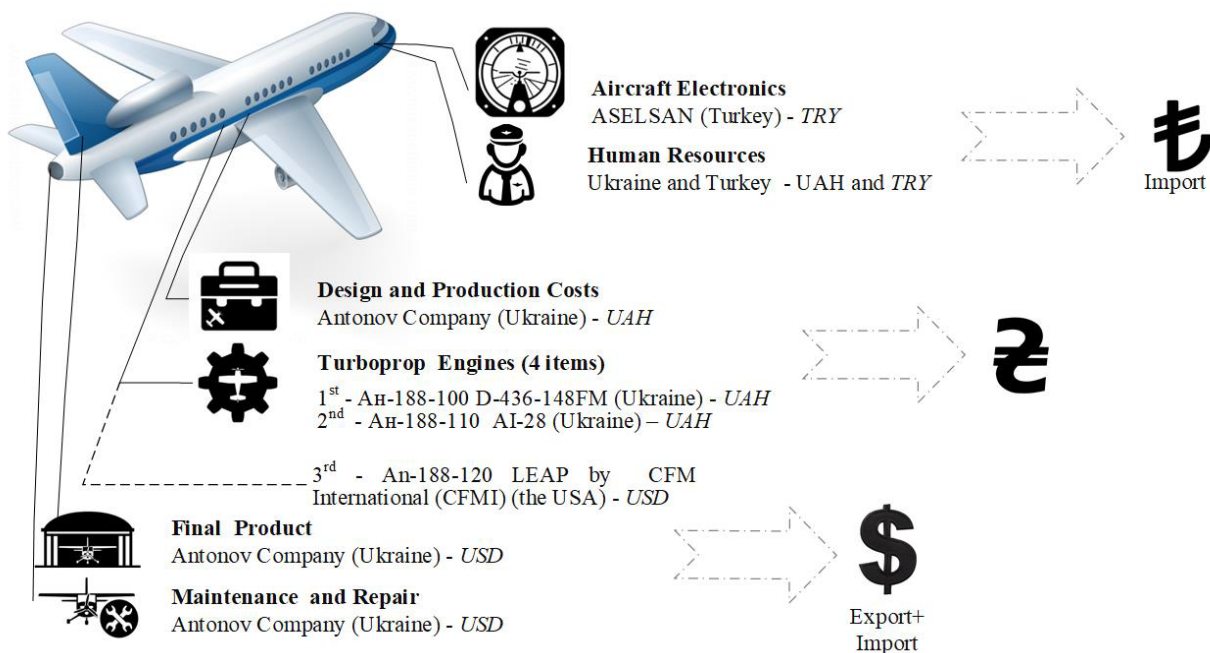




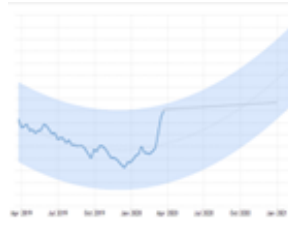


Figure 1. Whence currency risk of An-188 project appears [6–8]

Table 2

Statistical analysis and Value at Risk (using the Historical Simulation approach) of currencies used in An-188 project [10]

	USD/TRY	TRY/UAH	USD/UAH
<i>Statistical analysis</i>			
Average	5,7523	4,4667	25,6316
Range of deviation	1,3972	1,4262	4,9862
Mean deviation	0,26	0,37	1,29
Coefficient of variation (quadratic), %	4,59	8,32	5,02
<i>Value at Risk (using the Historical Simulation approach)</i>			
Maximum losses (long), %	-4,09	-6,05	-1,68
Maximum losses (short), %	4,75	3,29	1,58
Most probable losses, %	0,33%	0,17%	0,16%
<i>Trend</i>			
Dynamics			
Forecast for 2020 – the beginning of 2021		NA	
Trend equation	$y = 2E-07x^3 - 9E-05x^2 + 0,014x + 5,094$	$y = -0,003x + 5,0511$	$y = 6E-07x^3 - 0,0003x^2 + 0,0104x + 27,349$
Confidence coefficient, RI	0,7295	0,8226	0,8732
Risk	Devaluation	Revaluation	Devaluation

Value at Risk method using the Historical Simulation approach, on worst-case scenario, shows higher losses of TRY/UAH pair in case of long position (bought) and USD/TRY in case of short (sold) position TRY versus the US dollar. However, the probability of losses does not exceed even 1%, representing 0.33% (risk of revaluation TRY/UAH), 0.17% (devaluation of USD/TRY) and 0.16% (devaluation of USD/UAH).

However, the World Bank estimated that global economic growth was 2.4% in 2019. It is the lowest indicator since the financial crisis due to a decrease in world trade and investment activity. According to tentative forecast, global economic growth would slightly increase by 2.5% in 2020 [11]. But obviously, the coronavirus pandemic will significantly reduce global business activity this year. Thus, global value chains have been disrupted due to the partial shutdown of China's industry, while financial markets and international trade (especially oil, steel products, and food markets) have already dramatically suffered in the first months of 2020. As a consequence, the exchange rates of most developing countries after a strong appreciation in 2019, will be under significant pressure in 2020 – the current situation both of Ukrainian hryvnia and Turkish lira.

## II. Currency Risk Management of the Antonov Company

There are three types of money flows: USD/TRY and USD/UAH are likely to devalue, while TRY/UAH is revaluating during March 2020. Nevertheless, both Ukraine and Turkey have immature financial and currency markets, as well as the unstable political situation. That is why to minimize the risks of Turkish avionics purchase it is better to use the counter-procurement namely industrial offset. It is an excellent example when a buyer of the aircraft sells navigation equipment for the manufacturer – Antonov Com-

pany. Moreover, there are two options for the parties. Firstly, Antonov can buy avionics for other aircrafts, in this case there is no need for trade financing or credit insurance [12]. Secondly, in exchange for avionics Antonov can provide staff training for the buyer and/or partially cover expenses for extra R&D research connected with the developments for the Turkish buyer. With the use of industrial offset, some of the currency risks can be neutralized to focus on managing USD/TRY and USD/UAH.

Taking into account specifics of foreign economic operations of Antonov Company and currency management tools, we have created the matrix of optimal management of USD/TRY and USD/UAH volatility (Table 3). Each tool has its own specific which should be considered in currency risk management. Thus, the most widely used tools are forwards and options including zero cost options, as well as cross-currency swaps which are suitable both for import and export operations. However, currency swaps usually have higher costs, that is why they are not suitable for our case. Limit Orders are used when current market rates are less favorable for currency buyers, Stop Loss Orders when negative movements are expected. Foreign Bank Account is a tool for an importer, while Government Exchange Risk Guarantee insurances against export credit risk. Netting is the best tool for an enterprise that provides active foreign economic activity. Pricing Policy (invoicing policy) can be used only in situation of dramatic changes in exchange rate since prices for goods are fixed beforehand, while the Leading and lagging strategy is flexible and easy to use.

However, the constant and unpredictable changes in exchange rates make human management impossible and require a need for an automated system of management with the quick processing of data. In this case an

Table 3

Matrix of currency risk management of Antonov Company

	USD/UAH		USD/TRY	
	Devaluation	Revaluation	Devaluation	Revaluation
Export	Forwards short Put options short	Government Exchange Risk Guarantee Forwards long Put options long	Forwards short Put options short Stop Loss Orders	Forwards long Put options long Government Exchange Risk Guarantee
Import	Foreign Bank Account Limit Orders Stop Loss Orders Debt Forwards short Call options short	Foreign Bank Account Debt Forwards long Call options long	Leading and lagging Forwards short Put options short	Industrial offset Matching Netting Pricing Policy (invoicing policy)

enterprise should create its own application to handle data quickly and in the most convenient way taking into account all relevant factors. The main goal of this application is to identify the best tool of currency risk management for a particular operation based on its specific characteristics and currency volatility.

For Antonov Company this application should be based on the following algorithm:

1. to determine the type of operation – import or export;
2. to choose the currency of the operation – USD/UAH or USD/TRY;
3. to calculate the percentage of a change in the exchange rate over the last week;
4. to identify the best strategy of currency risk management – to ignore risks (if rangeability,  $\Delta$  is less than 5%, to manage risks if  $5\% \leq \Delta \leq 33\%$  and to avoid the risk if  $\Delta \geq 33\%$ ) [13];
5. to draft the most suitable tool within the chosen strategy (Table 3);
6. to calculate the efficiency of the currency risk iteration.

Such an application will increase the overall efficiency of currency risk management and will allow to allocate the economic resources (first of all, time and human resources) for the core business activity.

Conclusions. The data processing is becoming more and more urgent management issue to manage currency risks in high technology production with mixed (domestic and foreign) operations and conditions of unpredictable exchange rates fluctuation effectively. The presented case of Antonov Company proves the necessity of data management implementation into currency risk management due to the cross-influence of three exchange rates on the economic results of the company. The automated system of currency risk management will increase the overall efficiency of currency risk management and will allow allocating the economic resources (first of all, time and human resources) for the core business activity. Future work will aim at creating and testing an application to manage currency risk effectively.

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