

FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN

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Abstract: *International foreign exchange reserves are widely acknowledged as a global medium of exchange that possesses a readily available characteristic. Official public assets, which are foreign assets kept and organized by the monetary authorities of countries, serve as a complement to foreign exchange reserves. Adequate levels of foreign exchange reserves are necessary for nations to meet their payment commitments and sustain the stability of their currency. The primary rationale for the Central Bank's decision to maintain liquid foreign exchange reserves is to establish a safeguard against any speculative assaults or fluctuations in the trade balance. The primary objective of this research was to ascertain the many elements that influence the sufficiency of the aggregate foreign exchange reserves in Azerbaijan and Turkey. The article examined the sufficiency of the gross foreign exchange reserves of the Central Bank of the Republic of Azerbaijan (CBAR) and the Central Bank of the Republic of Turkey (CBRT) based on the ideal reserve ratios recommended by the IMF. Following an extensive examination of theoretical and conceptual literature, this study aims to assess the sufficiency of the Gross Foreign Exchange Reserves held by the CBAR and CBRT. The proposed optimal reserve ratios are utilized to elucidate the reserve adequacy of these countries, while considering the theoretical relationship between the variables. To achieve this objective, a logit regression analysis was conducted using the data spanning from 2012 to 2022. The results indicate that there is a positive and statistically significant relationship between interest rates and the overall adequacy of foreign exchange reserves. Considering the influence of interest rates on economic stability and financial performance, this outcome is anticipated. Furthermore, it was shown that the exchange rate variable exhibited a statistically significant negative impact on the preceding period. The present empirical study offers an overview of the various elements that influence the sufficiency of the aggregate foreign exchange reserves of Azerbaijan and Turkey. The findings of this study offer crucial insights to decision makers regarding the variables that must be considered when overseeing foreign exchange reserves.*

Keywords: *Logit Model, Macroeconomic Indicators, Optimum Foreign Exchange Reserves*

INTRODUCTION

Foreign exchange reserves are often regarded as a reliable sign of a nation's robust economic and financial framework, therefore playing a crucial role in safeguarding economic stability. The assessment of a country's foreign exchange reserves and the examination of the causes influencing these reserves are significant indicators that provide insights into the economic and political conditions of nations.

Based on the criteria established by the International Monetary Fund (IMF), it is required that a nation's central bank maintains foreign exchange reserves that surpass the import index of said nation within a timeframe of three to six months (Wijnholds and Kapteyn, 2001). According to Mulder and Bussiere (1999), an alternative perspective posits that it is advantageous for a nation's foreign exchange reserves to exceed its short-term external debt. Alternatively, if the central bank's reserves are insufficient to cover short-term external debt, it will face a disadvantageous situation (Irefin and Yaaba, 2011; Cinel and Yamak, 2014; Lehto, 1994). The Central Bank of the Republic of Azerbaijan (CBRT) has experienced a rise in its foreign exchange reserves compared to 2022, primarily attributed to the growth in natural resources. The decrease in the foreign exchange reserves of the Central Bank of the Republic of Turkey (CBRT) in recent years, as compared to the year 2022, has elicited significant public responses. One of the primary factors contributing to the decrease in foreign exchange reserves is the utilization of foreign currency sales, given the inherent volatility of the exchange rate. Given the aforementioned concerns, it is evident that doing research on the gross foreign exchange reserves maintained by central banks holds significant significance.

The logistic regression model is a widely employed regression technique in the field of statistical analysis. The aforementioned model is employed for the purpose of quantifying the impact of independent variables and estimating the probability values associated with the dependent variable. The logit model is employed to quantify the impact of individual factors on the sufficiency of foreign currency reserves, while also providing probability values for the purpose of interpreting this impact. Upon the conclusion of the study, an analysis will be conducted on the elements that influence the foreign exchange adequacy of Turkey and the Republic of Azerbaijan, utilizing the framework of this particular model. Subsequently, the obtained results will be interpreted.

Foreign exchange reserves and their adequacy

Definition and Composition of Foreign Exchange Reserves

Reserves refer to foreign exchange assets that are held by a nation's monetary institutions. These reserves function as an insurance mechanism, ensuring the protection of the country during periods of international capital shortages (Park and Estrada, 2014). Previous research conducted by Elhiraika and Ndikumana (2007) has posited that the primary objective of central bank reserve accumulation is to address unforeseen imbalances in the balance of payments. However, more recent studies conducted by Cinel (2015) and Eren (2017) have attributed the preference for reserve levels to the reduction of costs incurred by countries during crises and as a preventive measure against potential crises (Jeanne and Rancière, 2011, pp. 905–930). Reserves can be conceptualized as the aggregate value of international securities and gold that are kept by the central banks of republics, in addition to the aggregate value of assets that possess the potential for convenient conversion into foreign exchange reserves.

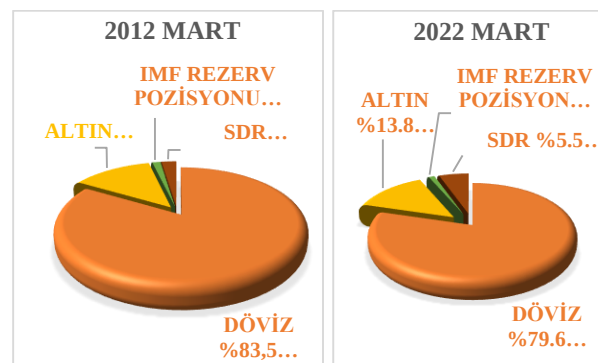
*FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY
OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN*

Reserves are a component of the balance sheet that is subject to careful scrutiny by central banks due to its significant role in promoting stability during periods of financial imbalances. Reserve adequacy can be seen as a significant metric for assessing the vulnerability of financial and economic systems.

Reserves refer to assets that are within the authority of a country's monetary institutions. These assets serve as political tools during periods of economic recession and downturn, and can be easily exchanged and utilized as international external payment instruments (Memiş et al., 2014). According to the International Monetary Fund (IMF), reserves refer to external assets that serve as a safeguard against potential adverse risks. These reserves are managed by monetary policy-making authorities as necessary, aiming to mitigate risks in the balance of payments and reduce instability in the foreign exchange market of a country (IMF, 2015, p. 424). Based on widely accepted definitions, it may be inferred that reserves encompass the aggregate value of many assets held by a nation's central bank, including foreign currency equivalents and gold.

The official reserves that are widely acknowledged in academic research and are incorporated into the balance sheet of central banks as reserves, are worldwide recognized based on the information accepted by the International Monetary Fund (IMF). These reserves comprise the following subcomponents: Convertible foreign exchange assets cover a variety of instruments such as International Standard gold, IMF Reserve Position, Special Drawing Rights (SDR) and other reserve items. The distribution of reserve components in the global reserve total as of March 2012 and 2022 is depicted in Chart 1.1. Upon comparing the eras, it becomes evident that the weights assigned to reserve components, with the exception of the IMF reserve position, underwent alterations towards the conclusion of the 10-year period. According to the data presented in Chart 1.1, it can be observed that foreign exchange reserves occupy a prominent position within the reserve composition, amounting to SDR 9077.3 million as of March 2022. In comparison to the year 2012, there was an increase in the proportion of SDRs and gold, whilst the share of foreign currencies experienced a gain in quantity but a fall in proportion. The aforementioned advancements exemplify the fluidity inherent in reserve components.

Graph 1.1 2012 and March 2022 Official World Reserve Components



Source: IMF 2022 Annual Report, Appendix, International Reserves¹

¹ Source: <https://www.imf.org/external/pubs/ft/ar/2022/downloads/appendix.pdf>.

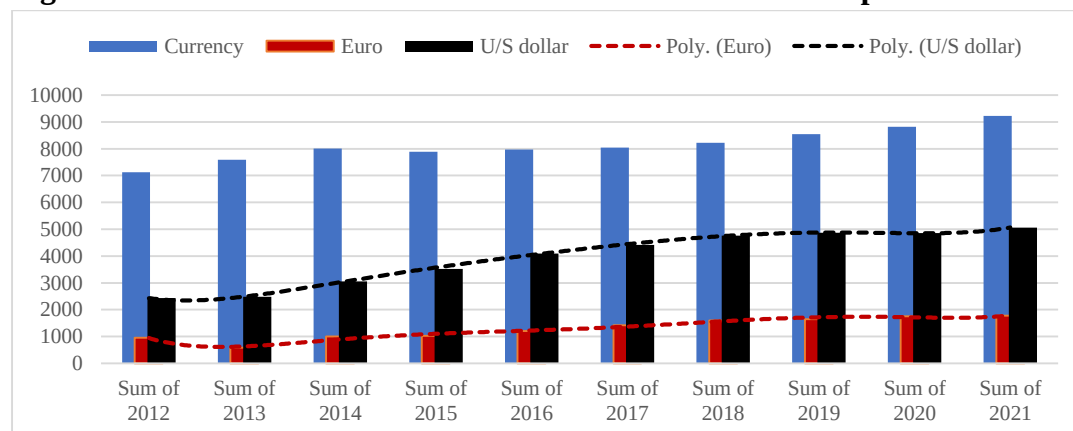
Foreign currency assets that can be converted have the greatest level of liquidity and make up the largest portion of reserves. In contemporary circumstances, there are numerous justifications for nations to maintain a substantial proportion of their reserves in foreign currency. The primary factors contributing to this phenomenon are the limited profitability of gold in global markets, as well as the lack of substantial income generated by SDR and IMF reserve positions. Consequently, central banks maintain a substantial proportion of their international reserves, which are characterized as assets that are readily available for use in overseas markets. These reserves are denominated in foreign currency and are allocated to foreign markets subsequent to a thorough assessment of various investment vehicles, taking into consideration factors such as liquidity and return (IMF, 2014).

Numerous nations accumulate their domestic currency as reserves for foreign exchange, however they exhibit a preference for foreign currencies such as the US dollar, euros, Japanese yen, Swiss francs, and British pounds (Eren, 2017). The primary rationale for assessing the reserves of these nations individually is their utilization as a reserve element within the global market system, thereby augmenting the influence of these countries over the market system.

The US dollar has a substantial share of foreign exchange reserves due to many factors. One crucial aspect is that, although the disintegration of the Bretton Woods System, nations persisted in maintaining the US dollar as a reserve asset owing to their unwavering faith in the American economy. An further significant factor contributing to this phenomenon is the influence exerted by the US dollar on the global economy, stemming from its status as the exclusive superpower following the disintegration of the Soviet Union (Yaman, 2003, p. 13). Even nations that engage in the production of raw resources are compelled to establish their exchange rate policies in relation to the United States dollar, as this has a direct impact on their domestic markets. Simultaneously, a substantial proportion of manufacturing industry items are priced in dollars and sold in global marketplaces.

The data presented in Figure 1.1 illustrates the progression of government foreign exchange reserves, as well as the utilization of the US dollar and the euro as reserves, from 2012 to 2021, measured in billions of SDR.

Figure 1.1. 2012 and March 2021 Official World Reserve Components



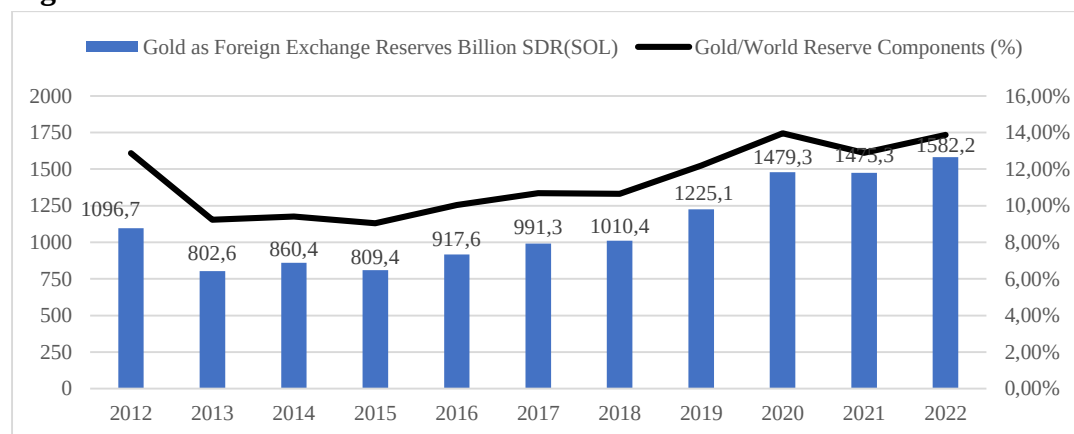
Source: IMF Annual Report, 2012, 2022

FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN

It is evident that the value of the US dollar as a foreign exchange reserve will exceed \$5 trillion by the conclusion of 2021. According to the provided data, the United States dollar constitutes 54.9 percent of the aggregate 9.2 trillion foreign exchange reserves, or over half of the total value of such reserves. The primary indicator of the significance of the US dollar in reserves is its representation of around 44 percent of total international reserves during the specified time. The euro, currently the second most prominent currency in foreign exchange reserves after the US dollar, has had a marginal gain in its exchange rate value relative to the US dollar during certain time periods (Figure 1.1). The dollar's devaluation during certain time periods and the rise in the euro's proportion of total reserves can be ascribed to the policy actions enacted by the United States in reaction to the ongoing global crisis.

Gold, classified as a valuable metal, holds the distinction of being the oldest reserve element kept by nations according to global benchmarks. The inclusion of standard gold in a nation's reserve components may be attributed to several key factors. These include its capacity to serve as collateral, its low risk factor index, its function as a safeguard against crises, and the intention to enhance reserve diversification (Sümmeoğlu, 2010).

Figure 1.2. March 2012 and 2022 International Standardized Gold and Share in Reserves



Source: IMF Annual Report, 2012, 2022

According to the data presented in Figure 1.2, the aggregate quantity of gold reserves maintained by the central banks of various nations falls within the approximate range of SDR 1100–1500 billion in international reserves from 2012 to 2022. This range exhibits intermittent fluctuations, with certain periods seeing a temporary decrease, succeeded by subsequent periods of expansion. Consequently, the limited or nonexistent utilization of gold in the financial systems of nations leads to its displacement from the focal point of the monetary system (Yaman, 2003, p. 11). Conversely, in the present era, financial instruments like electronic money have gained significance and are increasingly utilized for cross-border and inter-individual transactions. Upon comparing the expenses associated with this approach to the expenditures incurred by gold, including storage and transportation, it becomes evident that the overall costs of gold are considerably elevated. Consequently, gold is regarded as a less favored financial instrument.

The reserve position is a reserve resource established by the International Monetary Fund (IMF) in 1969. Every member country of the IMF is required to maintain a predetermined allocation of Special Drawing Rights (SDRs). The predetermined quota serves as a determinant of the financial contribution a member country must make to the International Monetary Fund (IMF), its allocation of financial resources, and its impact on the IMF's decision-making processes. Additionally, it serves as an indicator of the country's voting power and its economic standing relative to other nations. The significance of IMF quotas for countries is evident (Pnar & Erdal, 2011: 544-545). The determination of these quotas is based on Special Drawing Rights (SDRs), which serve as the International Monetary Fund's unit of account. As of March 2021, Turkey's International Monetary Fund (IMF) quota stands at about SDR 4.659 million (1 SDR = 1.4247 in October 2022), equivalent to USD 6.637 million. In contrast, Azerbaijan's allocated quota amounts to SDR 391.7 million, equivalent to around \$559 million.

Special Drawing Rights (SDRs) refer to a collection of currencies that are generated and made available by the International Monetary Fund (IMF) on the market as a distinct currency element. The money in question does not derive its value from any specific tangible resource or nation. The International Monetary Fund allocates reserve resources to all its members based on their quotas, with the aim of diversifying countries' reserves (Kester, 2001, p. 18). In a concise manner, this currency serves solely as a reserve element in transactions conducted between the International Monetary Fund (IMF) and the member nations of this union. Foreign Exchange Reserves Adequacy Indicators

It can be argued that nations maintain reserves to mitigate potential expenses for diverse purposes, and the magnitude of these reserves is subject to variation according to the distinct structures of each country. Measuring the adequacy indicators of reserves is crucial for a country as it serves as a safeguard against potential national and international risks, mitigates the cost of a prospective crisis, and serves as an indicator of financial profitability. The measurement of reserve adequacy and the factors influencing reserve adequacy have been a subject of ongoing debate in numerous research due to advancements in international trade and the monetary system. This study aims to assess the reserve adequacy of two countries by employing widely recognized methodologies.

Measuring the optimal adequacy of foreign exchange reserves : Turkey-Azerbaijan

Nations that maintain high levels of reserves generally exhibit a more rapid recovery from the adverse consequences of financial crises compared to nations with lower levels of reserves. The reserve adequacy level, as defined by Heller (1966, p. 317), refers to the point at which the marginal benefit is equal to the marginal cost. Conversely, Bird and Rajan (2002, p. 7) contend that there is no upper limit to the reserve adequacy level. Instead, they argue that the monetary authority consistently endeavors to augment the level of reserves.

Various methodologies have been devised in academic literature to evaluate the sufficiency of reserves. The approach suggested by the IMF, which is universally applicable, involves calculating the ratios of reserves to imported goods and services, short-term external debt, and broad money supply (CBRT, 2011a).

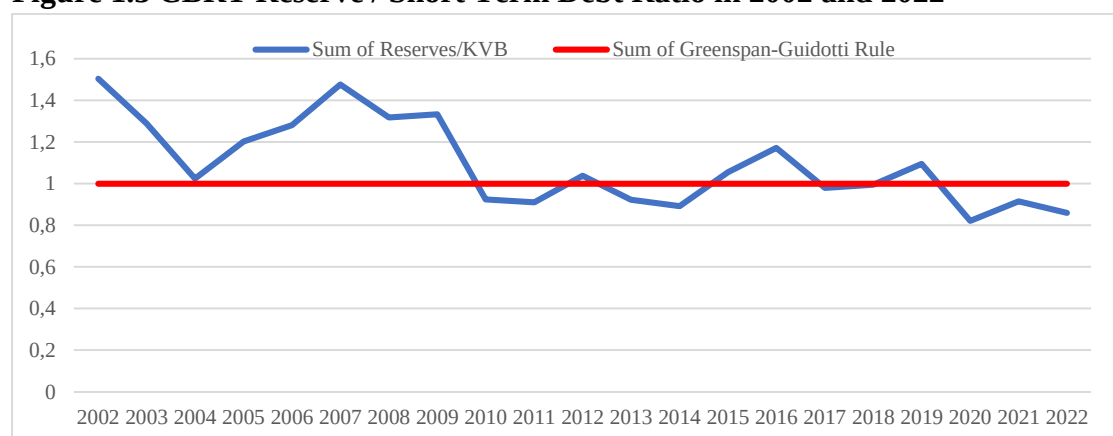
FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN

Ratio of short-term debt to international reserves

The Short-Term External Debt (STED) method is employed by the monetary authority of a nation with the objective of maintaining adequate reserves to meet both domestic and foreign obligations that are scheduled to mature within a one-year timeframe. This demonstrates the government's capacity to meet its debt obligations (Wijnholds & Kapteyn, 2001, p. 9).

In terms of external debt stock, the Republic of Turkey occasionally attains the top position among emerging market economies (EMEs). In comparison to alternative alternatives, it is crucial to evaluate the short-term foreign debt approach with the reserves of these countries. According to the data presented in Figure 1.3, it can be observed that the utilization of all reserves in the years 2010, 2011, 2013, 2014, 2014, 2017, 2018, and 2020-2022 would not be adequate to meet the short-term debt obligations of the nation, as depicted in Figure 2.10. Turkey's creditworthiness in the foreign market and its CDS (Credit Risk Premium) are deemed to be very deficient and insufficient due to a gradual decrease in this ratio.

Figure 1.3 CBRT Reserve / Short Term Debt Ratio in 2002 and 2022



Source: CBRT 2023, (Access date: January 1, 2023)

The values of the link between Azerbaijan's total reserves and short-term external debt up to one year for the periods 2004-2021 are presented in Table 1.1. This analysis was conducted using the CVD model to assess the reserve adequacy of Azerbaijan. During these time intervals, the mean value of the ratio between reserves and short-term debt exceeds 36. This substantial ratio can be attributed to the country's strategic emphasis on long-term borrowing rather than short-term borrowing.

Table 1.1 Reserves / Short-Term Debt Ratio (Million USD)²

History	TP RESPARPD K1	(CVB)	Reserve/CVB
2004	3064,73	198,00	15,48
2005	2872,77	290,00	9,91
2006	4096,31	198,00	20,69

² Source: <https://www.cbar.az/page-40/statistical-bulletin>

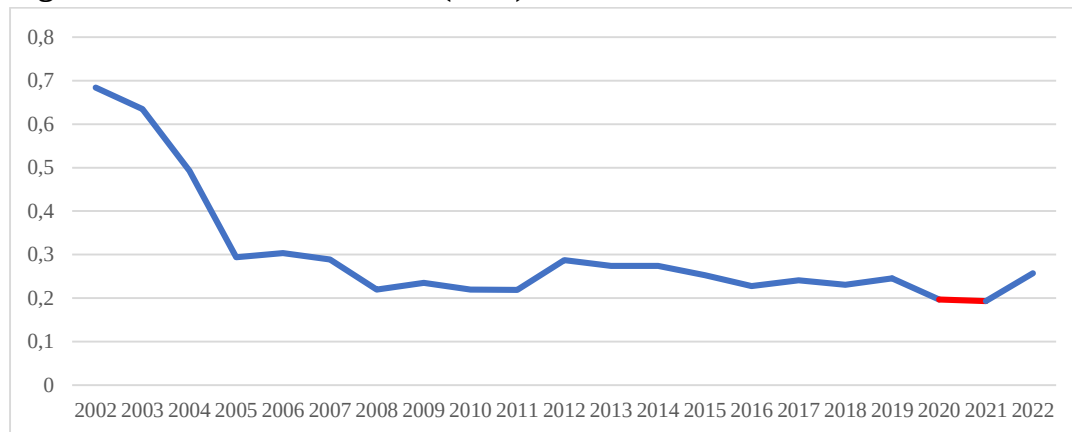
2007	6265,85	202,00	31,02
2008	16812,27	356,00	47,23
2009	20551,32	502,00	40,94
2010	29661,35	422,00	70,29
2011	40762,92	484,00	84,22
2012	47110,02	572,00	82,36
2013	51884,98	700,00	74,12
2014	52542,41	1 900,00	27,65
2015	40390,59	1 700,00	23,76
2016	39142,98	2 200,00	17,79
2017	43128,85	1 500,00	28,75
2018	46975,79	2 100,00	22,37
2019	54869,28	1 700,00	32,28
2020	56510,45	1 600,00	35,32
2021	59321,54	1 200,00	49,43

Ratio of monetary aggregates to international reserves

The approach referred to as the broad money supply or monetary base approach, as described in the literature, involves comparing the amount of reserves with monetary aggregates to assess reserve sufficiency (Reedy, 2003, pp. 104–105). In the event of a financial crisis within a nation, it is not uncommon for residents to redirect their investment choices away from the domestic currency and towards assets denominated in other currencies. The literature does not reach a consensus on the specific ratio due to the significance of this relationship. However, it is widely acknowledged that the recommended range for a country's reserves is between 10 and 20% of its M2 (Cinel, 2015, p. 135).

The declining trend of this ratio in Turkey since 2007 can be attributed to the consistent growth of the country's M2-defined money supply. Considering this methodology, Turkey has consistently maintained a ratio above 20% in all years except for 2020-2021, with an average of 30% from 2002 to 2022 (Figure 1.4).

Figure 1.4 CBRT Reserve / M2 (USD) Ratio in 2002 and 2022

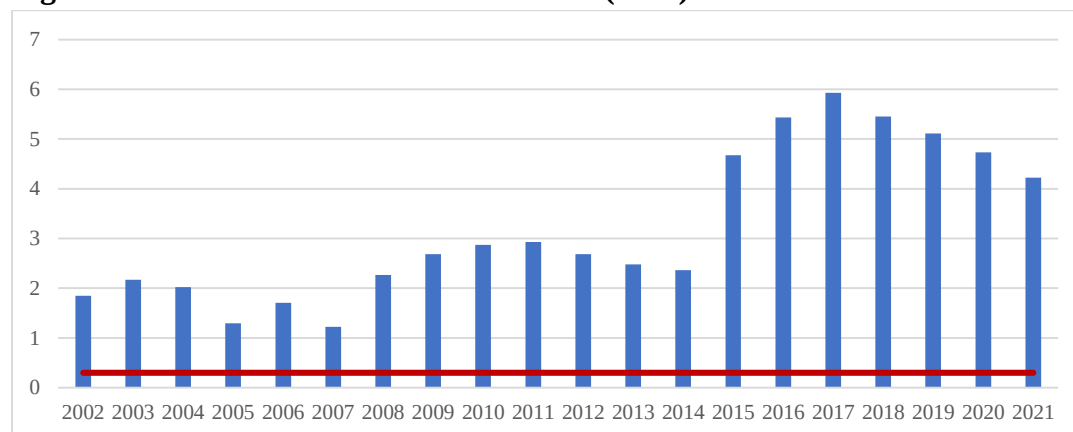


Source: EVDS 2023, (Date of access: January 1, 2023)

FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN

The analysis of the country's reserve adequacy is conducted using the monetary base approach. This involves calculating the ratio of the total reserves held by the Central Bank of the Republic of Azerbaijan and the State Oil Fund to the M2 dollar values for the period spanning from 2002 to 2021. Each of the aforementioned ratios exceeds the commonly acknowledged ratio within the method (10–20%) and has consistently surpassed the arithmetic mean of 4 from 2002 to 2021 (see Figure 1.5).

Figure 1.5 2002 and 2021 AC Reserve / M2 (USD) Ratio



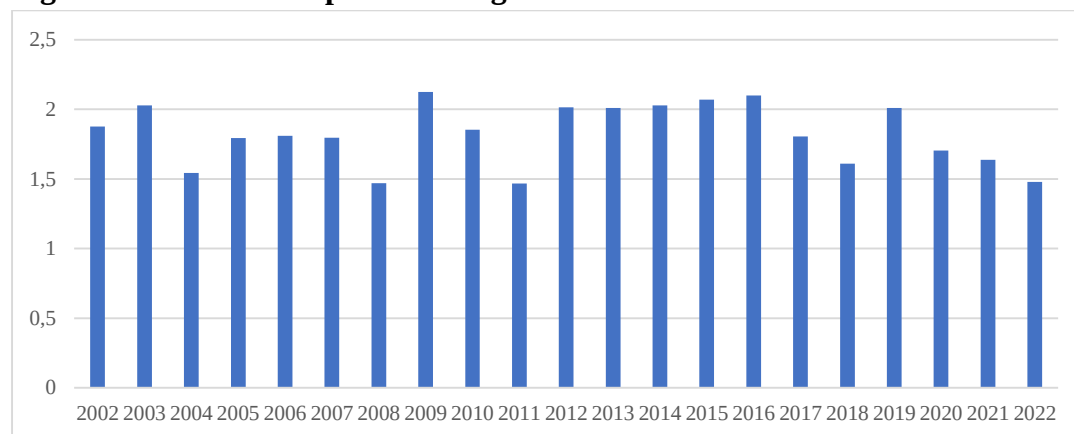
Source: ACMB 2023, (Accessed February 16, 2023)

Adequacy of international reserves to cover country imports

The methodology employed in assessing the sufficiency of foreign exchange reserves relies on the evaluation of international reserves in relation to the yearly import volume. The conventional methodology for assessing reserve adequacy posits that a nation ought to maintain sufficient reserves to meet its import requirements, under the assumption of no capital inflows or outflows. Despite the commonly acknowledged guideline of 3 months, the existing reserves of numerous developing nations have been sufficient to meet imports for a much longer duration (IMF, 2000; Wijnholds and Kapteyn, 2001).

The utilization of this methodology in the context of Turkey demonstrates that the overall reserves are enough. However, during the period from 2017 to 2022, there has been a noticeable decrease in the nation's international reserves, which has hindered its ability to cover its import expenditures. The decrease in the 3-month import payment ratio, which serves as an indicator of adequacy, particularly when it drops below 2%, exhibits similarities to the global crisis experienced between 2004 and 2008, hence suggesting the potential occurrence of a future catastrophe (see Figure 1.6). The fall in question can be ascribed to various variables, encompassing global health concerns, conflicts in nations with which the country has close ties, and recent variations in exchange rates. Furthermore, the economic position was exacerbated by the earthquake disasters that occurred in the country in 2023. Collectively, these elements give rise to a concerning predicament for the nation's economic prospects.

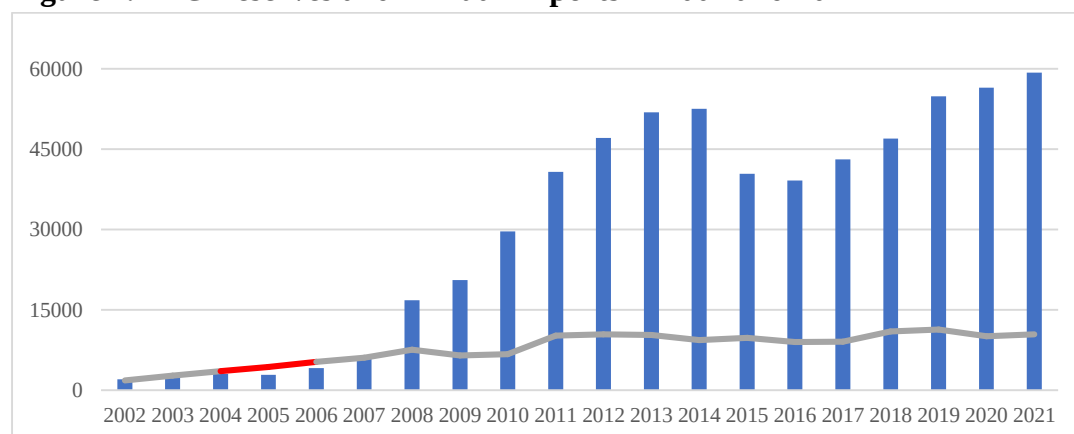
Figure 1.6 3-Month Import Coverage Ratio of CBRT Reserves in 2002 and 2022



Source: TurkStat 2023, (Date of access: January 3, 2023)

The Republic of Azerbaijan has experienced a notable growth in the ratio of reserves to quarterly imports since 2009. Furthermore, the reserves held by the Republic of Azerbaijan are deemed adequate to meet its yearly import requirements for an extended period, as depicted in Figure 1.7. Azerbaijan possesses ample resources to fund its imports, encounters no difficulties in financing imports, and maintains financial stability.

Figure 1.7 AC Reserves and Annual Imports in 2002 and 2021



Source: ACMB and SOFAZ 2023, (Accessed February 16, 2023)

Taking into account all the aforementioned methods for assessing the amount and sufficiency of the CBRT reserves, it can be concluded that reserves are sufficient for all specified years according to the import approach. However, other ways exhibit variations on a year-by-year basis, and in the majority of cases, reserves are insufficient for the period of 2020-2021. Based on the aforementioned methodologies employed to assess the level and sufficiency of the reserves of the Republic of Azerbaijan, it is evident that the reserves are deemed insufficient for some years (2005-2006) as indicated by the import approach, although they are deemed sufficient for all years according to alternative techniques.

*FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY
OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN*

Factors Affecting the Adequacy of Foreign Exchange Reserves: Turkey-Azerbaijan

The evolution and patterns of global foreign exchange reserves are contingent upon various criteria. The size and structure of foreign exchange reserves can be influenced by various factors, including a nation's economic growth, levels of exports and imports, policies implemented by central banks, and volatility observed in international financial markets.

The phenomenon of international investment flows entails the influx of foreign investment into a nation, which contributes to the augmentation of foreign currency reserves, whilst the outflow of foreign investment from a nation leads to a reduction in foreign exchange reserves. Nevertheless, elevated interest rates have the potential to augment foreign exchange inflows by enhancing the appeal of a nation's currency, so bolstering its foreign exchange reserves. Simultaneously, an expansion in the money supply heightens the likelihood of inflation within the nation, potentially leading to investor withdrawal and subsequently reducing the country's foreign exchange reserve (Kaya, 2012).

The escalation of external debt of Turkey throughout the year 2022 resulted in a reduction of foreign exchange reserves. The primary determinant of Azerbaijan's reserve stock is the volatility of oil prices and the magnitude of oil sales inside the nation. There exists a consistent linear correlation between fluctuations in oil prices and the aggregate reserves of the Republic of Azerbaijan over many time periods. Notably, the escalation in oil prices emerges as the primary factor contributing to the expansion of these reserves.

Elevated interest rates enhance the appeal of a nation's currency and augment its foreign exchange reserves. As of March 19, 2021, the Central Bank of the Republic of Turkey initiated a reduction in the interest rate from 20.50%. By the initial quarter of 2023, the percentage had attained 8.50%. Azerbaijan has a low interest rate of 8.75%. The presence of low interest rates restricts the degree of interest from foreign investors in the country, hence posing challenges in augmenting foreign exchange reserves. The inflation rates in Turkey have exhibited significant volatility throughout the past two decades. Simultaneously, the presence of elevated inflation rates and the expansion of the money supply in Turkey exert a mitigating influence on the level of foreign exchange reserves. An examination of the inflationary trends in the Azerbaijani economy from 1996 to 2001 indicates that the devaluation of the manat currency resulted in a rise in inflationary pressures.

The presence of domestic political problems and uncertainties has the potential to diminish the confidence of foreign investors in a nation, thus resulting in a decrease in foreign exchange reserves. Countries' foreign exchange reserves are impacted by foreign policy tensions. The challenges encountered by nations in their interactions with trading partners result in a reduction of foreign exchange reserves. The imposition of sanctions in the global sphere also has an impact on the foreign exchange reserves of nations. Investments in nations result in a reduction of foreign exchange reserves through the imposition of trade volume restrictions on countries. An instance of this is the Nagorno-Karabakh conflict, which has had an impact on Azerbaijan's foreign exchange reserves. Another instance is to the strained relationship between Turkey and the United States around the S-400 missile system. The imposition of sanctions by the United States results in a decline in trade volume and a drop in foreign exchange reserves (Demir 2020).

Logit Method

The current stage of the study involved an examination of the logit technique, which is represented by quantitative preference models. The literature encompasses a regression method that is constructed upon two dependent variables and exhibits linearity through the application of transformations. Statistical approaches are employed to elucidate the likelihood of a phenomenon. The validity of the logit technique is contingent upon the binary nature of the dependent variable. The fundamental concept underlying the logit technique entails applying a logarithmic transformation to the probability of the dependent variable's occurrence, followed by conducting regression analysis to ascertain the association between the independent variables (óakmakyapan, 2011). The logit approach reveals the link between the dependent variable and the independent variable when the dependent variable is binary, meaning it can take two distinct values. This model is typically employed when the value to be estimated occurs in two distinct states.

$$P_i = E(Y = 1(X_i)) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_i)}}$$

Pi = Independent Variable

Xi=Data

i=Probability of making a choice

e=2.72

Analysis of Factors Affecting the Total Foreign Exchange Reserve Adequacy of the Central Bank of Azerbaijan-Turkey : Logit Method

The objective of employing the logit approach in the empirical investigation is to assess the impact of the identified macroeconomic indicators on the magnitude of foreign exchange reserves, hence leading to the emergence of two distinct values for the dependent variable. The data utilized in this study were acquired from many reputable sources, including the Central Bank of the Republic of Turkey (CBRT), the Data Distribution Site (DDS), the Central Bank of the Republic of Azerbaijan (CBRT), the Turkish Statistical Institute (TurkStat), the World Bank, and the OECD. The analysis utilizes data spanning from 2012 to 2022. The study considers several aspects to analyze changes in foreign exchange reserves at the factor scale. However, certain components are disregarded due to the study's multilinear nature. In this study, the explanatory variables used to assess the impact of macroeconomic indicators on the level of foreign currency reserves are X_1 (interest rates), X_2 (inflation rates), X_3 (gross national product), X_4 (real exchange rate), and X_5 (unemployment rates). The selection of the logit regression model for the explanatory variables is determined in the following manner: $\text{Logit}(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$. In the given regression equation, the dependent variable, denoted as Y, represents the total foreign exchange reserve adequacy. The coefficients of the constant term and the explanatory variables are denoted as β_0 , β_1 , β_2 , β_3 , β_4 and β_5 respectively. The model's coefficients represent the impact of each explanatory variable on the overall adequacy of foreign exchange reserves. A categorical variable, known as an indicator variable, typically has two distinct values, typically 0 and 1. In this scenario, we can employ the numerical value "1" to denote that the overall foreign exchange reserve is sufficient, whereas "0" can be used to indicate that it is insufficient. For our study, we will utilize the dependent variable as follows: The variable Y is equal to 1, indicating the presence of factors that influence the adequacy of the total foreign exchange reserves of Azerbaijan and Turkey.

*FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY
OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN*

Conversely, the variable Y is equal to 0, suggesting the absence of factors that affect the adequacy of the total foreign exchange reserves of Azerbaijan and Turkey.

Table 1.2 Logit Model Analysis Results of the Established Model

<i>Variable</i>	<i>Estimated Parameter</i>	<i>Standard Error of Parameters</i>	<i>Wald Statistics</i>	<i>Significant(p)</i>	<i>Odds Ratio</i>
Fixed Term	55,365	71,650	0,597	0,440	-
X ₁	3,177	0,177	17,454	0,000	24,070
X ₂	-0,230	0,193	1,424	0,233	0,795
X ₃	0,000	0,000	2,645	0,104	1,000
X ₄	-51,894	34,225	2,299	0,129	0,000
X ₅	-0,019	0,017	1,233	0,267	0,981

$$\text{logit}(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$$

Here, p represents the probability value and ranges from 0 to 1. The formula includes the constant term, denoted as β_0 , β_1 , β_2 , β_3 , β_4 , and β_5 , as well as the coefficients X₁, X₂, X₃, X₄, and X₅, correspondingly.

$$\text{Logit}(p) = 55,365 + (-3,177 \times X_1) + (-1,232 \times X_2) + (0,446 \times X_3) + (-0,454 \times X_4) + (0,139 \times X_5)$$

The model's performance was assessed using the log-likelihood approach. The adequacy of the model was assessed. A model's fit to the data improves as the log-likelihood value increases. The calculation of the log-likelihood value involves taking the logarithm of the probability values that have been determined. The value has the potential to be negative. In order to evaluate the adequacy of the model, it is crucial to compare the log-likelihood values of many models and choose the model with the highest value. It was determined that the log-likelihood value of the model is -53.68. This finding suggests that the model possesses a satisfactory level of fit to the data.

The logit regression model coefficients utilized for evaluating the impact on foreign exchange reserve sufficiency are displayed in the table. Furthermore, in order to assess the statistical significance of each variable, the Wald statistic and p-value are provided. In hypothesis testing, the Wald statistic is computed by dividing the coefficient by the standard error. The P value is a statistical measure derived from the hypothesis test of each coefficient, ranging from 0 to 1. A decrease in the P value indicates a higher level of statistical significance in the impact of the independent variable on the dependent variable. The odds ratio quantifies the ratio at which a one-unit increase in an independent variable results in a corresponding change in the probability of the dependent variable. The study revealed that the coefficient of the fixed variable was 55.365. The baseline value for foreign exchange reserve sufficiency is determined by holding other factors constant. The variable of interest rate (X₁) exhibits the most significant impact on the adequacy of foreign exchange reserves. The coefficient of the variable is evaluated to be 3.177, with a p-value of 0.000, indicating its statistical significance inside the model. This finding suggests that, while controlling for other variables, a one-unit rise in interest rates would result in a 24.070-fold increase in foreign exchange reserve

adequacy. The coefficient associated with the inflation rate variable (X2) is -0.230, and the corresponding p-value is 0.233. These results indicate that the coefficient lacks statistical significance inside the model. Consequently, if all other factors remain same, a one-unit rise in inflation rates would result in a 0.795-fold reduction in FX reserve adequacy. However, this impact does not have statistical significance. The coefficient for the GDP variable (X3) is 0.000, and the p-value is 0.104, indicating that it lacks statistical significance in the model. Consequently, when all other factors remain unchanged, a one-unit rise in GDP does not impact the sufficiency of foreign exchange reserves. The coefficient for the exchange rate variable (X4) is -51.894, and the p-value is 0.129, indicating that there is no statistically significant relationship in the model. This suggests that, while controlling for other variables, a one-unit increase in the exchange rate during the preceding period does not impact the adequacy of foreign exchange reserves. The empirical analysis reveals that the coefficient associated with the unemployment rate variable (X5) is -0.019, while the p-value is 0.267, indicating a lack of statistical significance within the model. Consequently, while keeping other factors unchanged, a one-unit rise in unemployment rates is associated with a 0.981-fold reduction in foreign exchange reserve adequacy, but this impact is not statistically significant.

CONCLUSIONS

Based on the findings of our literature review, it is suggested that in order to enhance reserve adequacy in Turkey, it would be advisable to augment the central bank policies pertaining to the diversification and expansion of rediscount credits. These credits are primarily utilized by exporting firms and are converted into US dollars. Additionally, it is recommended to incorporate under-pillow scrap gold within the country's central bank reserves and the financial system. In order to mitigate the potential risks associated with currency rates and decrease reliance on natural resource revenues, Azerbaijan aims to diversify its investments across other sectors.

The data indicate that interest rates have a substantial impact on the overall adequacy of foreign exchange reserves ($p < 0.05$), whilst other variables do not show statistical significance. The odds ratio for total FX reserve adequacy improves by 24.070 when the "Interest Rates" variable increases by one unit. However, the impact of other factors on total FX reserve adequacy is not statistically significant.

The analysis demonstrates that interest rates exert a substantial impact on the overall adequacy of foreign exchange reserves. This finding suggests that the implementation of interest rate policies can serve as a viable strategy for enhancing the sufficiency of the foreign exchange reserves in Azerbaijan and Turkey. The impact of other variables on the overall adequacy of foreign exchange reserves is not statistically significant. Nevertheless, the p-value associated with the exchange rate variable exhibits statistical significance, hence necessitating a more comprehensive examination of its impact through the inclusion of a longer temporal scope.

REFERENCES

1. ACMB. 2001- Monetary Policy Review. October, 17 on 2022: <https://www.cbar.az/page-13/monetary-policy-review>
Retrieved from

*FACTORS AFFECTING THE TOTAL FOREIGN EXCHANGE RESERVE ADEQUACY
OF THE CENTRAL BANK: TURKEY AND AZERBAIJAN*

2. Cinel, E.
2015: Are Foreign Exchange Reserves Adequate in Turkey? Mehmet Akif Ersoy University Journal of Institute of Social Sciences, 12, 131-144. Retrieved from: <http://dergipark.ulakbim.gov.tr/makusobed/article/view/109800117/0> on June 2022.
3. Demir, Y.
2020: Evaluation of Foreign Exchange Reserve Adequacy Indicators for Turkey. Journal of Ömer Halisdemir University Faculty of Economics and Administrative Sciences, 13(3), 413-425.
4. Eren, B.
2017: Factors Affecting Reserve Demand and Reserve Adequacy in Developing Countries (Expertise Qualification Thesis). Ankara: Central Bank General Directorate of Banking and Financial Institutions.
5. IMF. 2011a: "Assessing Reserve Adequacy." Retrieved on January 2022 from: <https://www.imf.org/external/np/pp/eng/2011/021411b.pdf>.
6. IMF. 2000: Annual Report of the Executive Board. Retrieved on April 2023 from: <http://www.imf.org/external/pubs/ft/ar/2000/eng/index.htm>.
7. IMF. 2012-
2022: Appendix I. International Reserves, 2012-2022. Retrieved April 2023 from: <https://www.imf.org/external/pubs/ft/ar/2022/downloads/appendix.pdf>.
8. IMF. 2019-
2022: IMF Quotas and Quota Reviews fact sheet. Retrieved April 2023 from: <https://www.imf.org/-/media/Files/Factsheets/English/quotas.ashx>.
9. IMF. 2022: Annual Report of the Executive Board. January 2023: Retrieved from <https://www.imf.org/external/pubs/ft/ar/2022/downloads/imf-annual-report-2022-english.pdf>
10. Irefin, D., &
Yaaba, B. N.
2011: "Determinants of Foreign Reserves in Nigeria: An Autoregressive Distributed Lag Approach", CBN Journal of Applied Statistics, 2(2), pp. 63-82.
11. Jeanne, O.,
& Rancière, R.
2011: "The Optimal Level of International Reserves for Emerging Market Countries: A New Formula and Some Applications", The Economic Journal, 121(555): 905-930.
12. Kaya, V.
2012: The Relationship between Exchange Rate Volatility and Foreign Trade in Developing Countries and the Case of Turkey. PhD Thesis, Istanbul University, Istanbul.
13. Kester, A.
2001: "International Reserves and Foreign Currency Liquidity Guidelines for a Data Template." Retrieved on April 2023 from: <http://dsbb.imf.org/images/pdfs/opguide.pdf>.
14. Memiş, H.,
Paksoy, S., &
Yöntem T.
2014: The Relationship Between Central Bank Reserves and Macroeconomic Variables: An Application on the Period 1989-2013. Journal of Süleyman Demirel University Faculty of Economics and Administrative Sciences, 19, 4, 93-108.
15. Park, D., &
Estrada, G.
2014: "The Emergence of Sovereign Wealth Funds in Asia", in D. Lee and G.N. Gregoriou (eds.), Handbook of Asian Finance: Financial Markets and Sovereign Wealth Funds, 299-313.
16. Pinar, A., &
B. Erdal. 2011: Money-bank financial institutions and international financial system (2bs). Ankara: Turhan Kitabevi.
- Reedy, Y. V.
2003: Reserve Managment at the Reserve Bank of India, How Countries Manage Reserve Assets. The Royal Bank of Scotland, 97-119.

17. Sümmeoğlu, O. E. 2010: International Reserves, Reserve Management in Turkey and Reserve Management Policies Implemented by the Central Bank of the Republic of Turkey in the 1990-2009 Period. Master's Thesis, Gazi University, Ankara.
18. CBRT. 2011a: Reserve and Risk Management in Central Banks. Retrieved on October 2022 from: http://www.tcmb.gov.tr/wps/wcm/connect/622a2955-8ab3-430a-b01e-acc2fb087033/11_7.pdf?MOD=AJPERES&CACHEID=622a2955-8ab3-430a_b01e-acc2fb087033.
19. Wijnholds, J. O. D. B., & Kapteyn, A. 2001: "Reserve Adequacy in Emerging Market Economies", IMF Working Paper, 2001, pp. 1-49. IMF Working Paper, 143: Retrieved from <http://www.imf.org/external/pubs/ft/wp/2001/wp01143.pdf>
20. Yaman, B. 2003: International reserves, reserve adequacy and optimum reserve level application for Turkey. (Expertise Qualification Thesis). Ankara: Central Bank General Directorate of Statistics.