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MODERN INTERNATIONAL PAYMENT SYSTEMS AND THEIR LIMITATIONS: THE CASE OF INTERNATIONAL STUDENTS AND SANCTIONED ECONOMIES

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EXECUTIVE SUMMARY

This study examines the current structure of international payment systems and the challenges they pose for international students, especially those from sanctioned or economically isolated countries. As globalization accelerates and educational migration increases, the necessity for fast, secure, and affordable cross-border financial transfers becomes more pressing. However, many students encounter significant financial constraints due to limited access to traditional banking systems, blocked transactions, and regulatory restrictions associated with international sanctions.

The research explores the evolution of institutional systems such as SWIFT, SEPA, and Instant Payment Systems (IPS), highlighting their advantages and structural limitations. While these systems act as the backbone of global financial communication, they often exclude users in countries like Russia, Iran, and Venezuela due to compliance barriers or political decisions. In such situations, international students frequently struggle to receive remittances or cover tuition and living expenses abroad. This exclusion from mainstream financial infrastructure has led to the emergence of alternative methods — most notably, the use of decentralized digital currencies.

In particular, stablecoins such as Tether (USDT) have emerged as a workaround for students who cannot depend on traditional bank transfers. These blockchain-based tokens provide near-instant transactions and are pegged to the US dollar, ensuring minimal volatility and easier exchange. The research highlights that since 2020, both the volume and frequency of stablecoin transactions have increased significantly, indicating growing adoption and practical use in international remittance contexts.

To analyze market dynamics, the study employs ARIMA time series modeling with R. It examines stablecoin transaction volumes from 2018 to 2025, removing seasonality and trend components to ensure forecast accuracy. The results indicate a steady increase in usage, followed by a projected stabilization around 2026. Although this suggests a maturing technology, the sector continues to face regulatory uncertainty, potential fraud risks, and accessibility challenges in certain regions.

The paper concludes by emphasizing the need for a more inclusive and resilient global payments infrastructure. Policymakers and financial institutions must strike a balance between regulatory oversight and accessibility, particularly for vulnerable populations like international

students. While stablecoins are not a panacea, they represent an essential development in modern finance and offer a financial lifeline to individuals who are otherwise disconnected from the global banking network.

BACKGROUND

This research addresses a pressing and increasingly relevant issue affecting many individuals: the challenges of cross-border payments, particularly for international students who must finance tuition and living expenses while studying abroad.

The frequency and severity of these difficulties — including blocked transactions, sanctions, and limited financial access — prompted a deeper investigation into the mechanisms of international transfers. This study aims to analyze existing systems, explore viable alternatives such as stablecoins, and propose potential solutions for improving cross-border financial accessibility.

LITERATURE REVIEW

The crucial part of a modern payment institution is the Instant Payment Systems, alternatively IPS. Dr. Viktor Dostov et al. (2022) determine IPS as a set of technical solutions and contractual relationships between various banks that allow individuals to initiate almost instant transactions to each other and legal entities.

Ranjan (2024) investigates the fact that the first IPS was introduced in Japan in 1972. The world's instant payment systems can be divided into government-supported (such as the Faster Payments in the UK and Russia's SBP) and business-supported (examples include Sweden's Swish and Switzerland's TWINT).

The study describes the importance of developing IPS, showing different approaches and stably spreading.

The ability to pay immediately and send money almost to everyone, no matter which bank's recipient is, and their current location is an inalienable part of the world nowadays. Today, banks are mainly digital. First steps on the way to the banks' digitalisation were done by introducing and developing ATMs, which follows from Ritesh Ranjan (2024), the business director of the US bank Capital One. Electronic systems, ATMs, telephone banking, online banking, and even artificial intelligence - were stages of banking development since the 1960s.

The digitalization process, which has been observed for the last several decades, greatly impacted the banking and payment industry. It was also another reason for the development of Instant Payments Systems and international transfers in particular. Technologies provide a basis for the creation of powerful networks between different banks, businesses, and individuals.

The industry had been improved by not only these internal components, such as technologies, but also the ability to make one's own and customers' communication better and more rational. Due to the trends of globalization and the trend of blurring boundaries. In other words, the process of globalization, the multifaceted process characterized by the increasing interconnectedness and interdependence of the world's economies, cultures, and populations. This phenomenon is driven by cross-border trade, investment, technology, and information flows, which forced the banking industry to establish technologies and methods of economic communication between banks to provide the wider range of its services for a greater number of customers. Concerning Dr. Manuel Castells (2005) and his concept of the network society,

nowadays the economy is not limited by the borders of countries. International companies, students' mobility, social media, and technologies are the purpose and the outcome of the banking industry and international transfers development.

Furthermore, the SWISH and SBP should be noticed. These systems work similarly. Both of them provide the ability for businesses and individuals to pay immediately across different banks. For individuals, payments are free and no fee is charged, while businesses pay them. Such systems provide a wide range of ways to make a transfer: QR codes, applications for smartphones using the NFC, and mobile numbers as well. However, it works only in a particular country. Nevertheless, the recent study (Dostov, et al., 2022) illustrates the high level of market saturation of such local IPSs. For instance, SWISH transactions demonstrate a growing cooperative behavior, and the market saturation grows steadily. Such payment systems show the significant meaning for domestic markets, but in the case of international transfers, they do not cover all of the needs.

Clearly, one of the main principles of the European Union is a single market. Due to cross-border transfers being halted at national borders, a bank cannot create a system that allows individuals and businesses to send and receive payments quickly. As a result, the EPC introduced rulebooks and schemas that became operational, leading to the introduction of SEPA Instant Credit Transfer. Currently, thirty-four countries utilize SEPA for cross-border transactions in Europe. According to the European Payment Council (2025), 2,733 payment service providers have already joined the scheme, representing 77 percent of European PSPs and 89 percent of PSPs in the euro area. SEPA transactions are mainly commission- free; however, some payments may incur fees. In such cases, the fees are shared between senders and beneficiaries.

Another benefit of technologies in the payment sector is a cryptocurrency. The first time cryptocurrency was introduced was by mathematician David Chaum in 1982, and later, it was explained by Victor Dostov (2014). This invention should solve such disadvantages for individuals as the determination of the payment information, including the payee. The 'coins' were centrally issued, however, they changed their number after each transaction. Bitcoin (another cryptocurrency), on the other hand, can be issued by anyone, coins have their own number and their amount is limited. However, Bitcoin is traceable despite being much less traceable compared to bank transactions. However, its price fluctuation, difficulty to calculate (or mine), and free issuance by everyone make bitcoin unacceptable for day-to-day payments. Unfortunately, the research of Dr. Dostov (2014) has more theoretical than empirical survey,

and might be outdated due to an old publication date and the growing role of cryptocurrency nowadays.

Moreover, some cryptocurrencies have approximately the same value as the currency to which it is pegged. It makes them more convenient to make payments and hold money. Also, they are not private, so it is harder to trace transactions. Stablecoins, for instance, USDT, which is pegged to the US dollar, are usually used as the method of cross-border transactions, money laundering, and the drug market. However, bitcoin is still much more popular for out-of-law transactions because it remains the most popular payment or even the only one in criminal marketplaces, which can still stay anonymous using bitcoin mixers or multiple transactions.

Nevertheless, cryptocurrency cannot be used as an official and main tool for international transfers. Despite the popularity of the crypto market, it is still difficult to buy cryptocurrencies immediately. They are beyond the states' control, which makes them unpredictable and uncontrollable, as much as usual money, and hardly traceable.

Another trend is digital currencies. Junie Joseph (2023) defines a digital currency as a digital form of a country's currency issued by its central bank. The main difference between the CBDC and the cryptocurrency is the existence of the centralized issuer - the central bank.

Hence, the ownership and use of CBDC is protected by a state government. Its price is equal to the domestic currency price. In other words, digital currency just is another form of currency like cash or e-money. More than 100 countries have already issued their own CBDC, and a large number of countries are piloting or planning its issue (Joseph, 2023). The main goal of the CBDC issuing is a simplified method to make cross-border transfers between countries, businesses, and individuals, improving financial inclusion. Another impact might be even more detailed money flows tracking. However, the CBDC is not completely observed due to its short existence time. It should be noticed that researchers usually observe the CBDC and cryptocurrency together, inseparably from each other. Alqarni (2024) discovers cryptocurrency and the central bank digital currency as an international transfers instrument and observing the potential impacts of digital currency on international trade. The results of the survey are as follows.

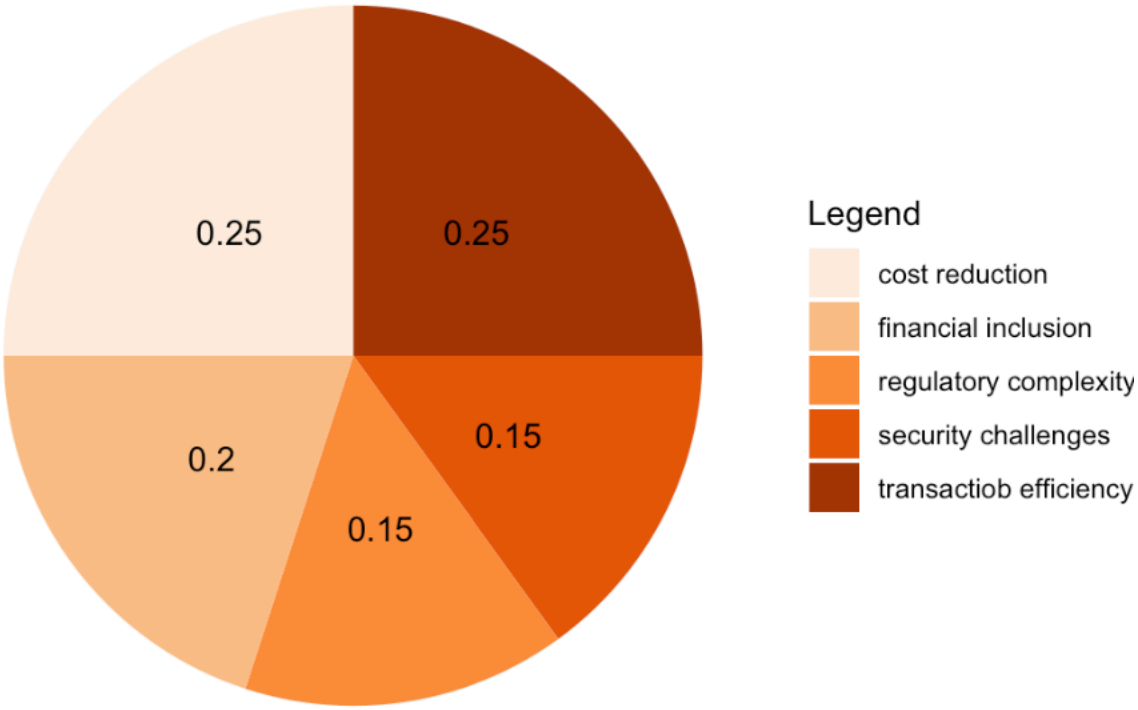


Figure 1. The Analysis of the Cryptocurrency Impact

From the survey (Alqarni, 2024) follows several findings: 85% of respondents noted a significant increase in transaction speed due to digital currencies eliminating traditional banking intermediaries. 75% of participants highlighted reduced transaction costs, primarily due to lower processing fees and the absence of exchange rate disparities. 65% observed an increase in trade activities, particularly benefiting smaller enterprises by reducing entry barriers. 55% of respondents cited regulatory uncertainty as a primary barrier, stemming from the lack of a harmonized legal framework. 45% expressed worries about hacking and fraud risks despite blockchain's inherent security features.

Study suggests that the regulatory basis, standardized security standards and protocols, and even enlightenment should be applied regarding the cryptocurrency field (Alqarni, 2024). The cryptocurrency market is a very rapidly progressing, relatively open, and highly potential

phenomenon of the modern economy. However, it is still unregulated and unsecured from the institutional point of view.

Of course, the cryptocurrency is a high potential field to explore and develop, but the fundamental part of international financial relationships remains fiat money flows.

Returning to Instant Payment Systems, despite their development, they encounter challenges. The effects of globalization, evidenced by international trade, have been previously noted, yet some governments maintain more significant economic relationships with certain groups of countries compared to others. Consequently, the payment systems among these nations are likely more advanced, as the economy drives the improvement and strengthening of financial relations.

For instance, the European Union with its SEPA or even world alliances. Iranmanesh N. (2025) explores the issue of globalisation and its benefits for countries taking part in such unions as BRICS and OECD. Observing the phenomenon of globalisation, the author mentions global cooperation and the necessity of cross-border and international

partnerships for more intensive countries' development. It provides competitive markets and the availability of resources, goods, and technologies for developing countries. Therefore, in the case of global cooperation it is crucial to provide an advanced system of international payments for governments, companies, and citizens.

Two criteria of financial convergence could be outlined:

- Cross border financial activity (International Monetary Fund (IMF) (2008) "the level of relationship among countries through cross-border financial assets, and total gross foreign assets and debt to GDP"),
- The level of the convergence and integration among markets.

From the research, the main challenge is that most of the BRICS and OECD members have a different governmental, financial, and institutional structure. However, a number of countries, which have advanced and powerful economies, establish new groups into these international organizations (China and European countries, for instance). The other barrier is different targets and problems to solve among the OECD and the BRICS.

Another difficulty consists of the country's economic isolation. For example, Russia participates in international financial relations, although with a limited number of countries, but it is impossible to make the payments for foreign services and transfer money across the border,

apart from cryptocurrency transfers. However, using a cryptocurrency for international transfers does not guarantee a successful receipt due to probable difficulties with the exchange of cryptocurrency for regular money. Such difficulty is caused by the shutdown of the domestic banks from SWIFT.

Society for Worldwide Interbank Financial Telecommunication is an important part of banks' payments across the world. According to the survey of De Oliveira Dias et al. (2022), approximately 11.000 banks and institutions from over 200 countries stick to the standard of SWIFT financial communication. The SWIFT provides a constant flow of transactions seven days a week and 24 hours a day. Hence, the system provides a possibility to financially connect banks, and what is more, businesses and individuals, from different parts of the world, countries with different economies. However, to make Russia's economy vulnerable in 2022 (after the beginning of the Russian-Ukrainian war). This decision would be vulnerable to Russia's economy and not allow the state to take a part in the worldwide trade and relationships, such as gas export revenue, or banking trades. Over 1% of those transactions were thought to involve Russian payments. Alexei Kudrin, Russia's former finance minister, has suggested being cut off from Swift could shrink Russia's economy by 5 percent. Of course, this is followed by economic, financial, and social consequences, but Russia's SBP (the Fast Payment System) or partnership with other members of SWIFT smooths out the edges, but not radically.

It is a fact that the SWIFT system is the crucial part of the international transfers world. According to the BBC newsletter agency, SWIFT sends more than 40 million messages a day, as trillions of dollars change hands between companies and governments.

Nevertheless, the SWIFT is under control of the US and EU laws and states. It does not make the SWIFT an ultimate international payment mechanism (should be noticed that Iran, Russia, and Venezuela are disconnected). Thus, the SWIFT is not only a bridge between countries, but also a powerful instrument of economic influence today (Tulun, 2022). So, is there any significant non-crypto tool of international transactions?

Unfortunately, local payment systems cannot compete with the global system. Nevertheless, attempts are underway. Russia's SBP is available in a limited number of countries (Belarus, Kazakhstan, Armenia, Kyrgyzstan), and negotiates with the BRICS partners, and key trade allies like Iran, UAE, and especially China to integrate their payment systems (Filatov, 2024). Anyway, the unavailability of robust financial infrastructure possible can slow down the economic growth and increase the cost of cross-border transactions, declining the trust for such payments (Becker et al., 2018). The World Bank research (Acosta, et al., 2007) believes that an

increase in the level of international payments can help alleviate poverty in recipient countries and reduce the difference between ‘rich and poor’ on the example of Caribbean and Latin American countries.

Another advantage of the development of the international transfers might lie in such a social area as migration on the example of the US and Brazil (Selbach and Lana, 2015). In the 19th century, Western Union was started to make payments, operating in several US states. Now the company produces the services of moving resources from individual to individual across the world. It becomes supportive for some countries: according to this survey, the transactions from Brazilians working in the US to their families are greater than Foreign Direct Investments (FDI) in developing countries. Moreover, the study finds that remittances play a significant role in reducing poverty, improving household living conditions, and even supporting local economies in developing nations.

Thus, such services as Western Union could be the only way to support workers’ families. Despite the significance of the transactions the service provides, it still has a noticeable commission up to 8.2 percent.

Moreover, international payments are crucial for international students. For a student who is a citizen of a Eurozone country or Ireland and studies there, they can receive money and pay tuition fees using SEPA Instant Credit Transfers (European Payments Council, 2023). If the student studies in Europe but lives in a third country, such as Turkey or the United States, the money may be transferred directly via SWIFT or through payment platforms like Wise (Bank for International Settlements, 2022). For a student from Russia or Iran, paying tuition fees or covering living expenses can be challenging due to financial sanctions, as transactions from these countries are often restricted (European Commission, 2023). The maximum amount of cash that can be carried across borders is $10,000 or its equivalent in local currency and a traveler’s check, as per international financial regulations (International Monetary Fund, 2023; Таможенные правила Российской федерации). Furthermore, as Gnanaraj Chellaraj mentioned in his study, countries with lower labor force participation rates, such as those in the Former Soviet Union, had a higher share of students studying abroad. Economic wealth and population of the home country, bilateral trade, and visa approval rates were significant factors influencing international student mobility (Chellaraj, 2019). Moreover, it is not a secret that the international students count on their relatives’ finansial support. According to Internationalstudent.com, about 65 percent of international students in the United States are

funded by their families. The opportunity to obtain external transactions must also be included in this list.

Housing prices vary significantly, from $400 per room in Hungary to $1,500 in Ireland (Numbeo, 2024). For instance, tuition fees in Sweden range from €6,000 to €45,000 per academic year, while in Ireland, they follow a similar structure (Study in Sweden, 2023; Education in Ireland, 2023). However, some public universities in the EU offer tuition fees as low as €500 per year, making education more accessible in certain countries (European Commission, 2023).

The key point is that students from sanctioned countries face significant barriers when studying abroad. The rising cost of living, housing shortages, and dormitory limitations not only restrict student mobility but also hinder international integration in science and human development.

Therefore, the problems of international students with cross-border payments and money transfers are becoming an agenda for the scientific community nowadays.

Taking together these findings, the role of the international transfers for local and world economy is colossal. The number of constantly developing ways for cross-border transfers competes with its challenges. From the lack of infrastructure and restrictions to the insecurity of crypto transfers and the lack of empirical basis in new methods of international transfers. The facilities and challenges directly affect the quality of people’s lives.

METHODOLOGY

This research combines a theoretical analysis of international payment systems with quantitative time series modeling of transaction data. The primary goal is to evaluate the evolution of cross-border transfers, focusing particularly on the increasing role of stablecoins such as USDT and the financial challenges faced by international students from sanctioned economies.

The study relies on secondary data collected from international organizations, public databases, and market analytics platforms, including the World Bank, Visa Onchain Analytics, European Commission publications, and Google Trends. The volume of international transfers was analyzed across selected countries (e.g., the U.S., Germany, U.K., Switzerland, and the Netherlands), along with the usage trends of stablecoins from 2018 to 2025.

To forecast transaction behavior and identify trends, the ARIMA (AutoRegressive Integrated Moving Average) model was employed. The stationarity of the time series was tested using the Augmented Dickey-Fuller (ADF) test. Differencing was applied to remove trend and seasonality, allowing for accurate model fitting. The Shapiro-Wilk test was conducted to assess the normality of residuals, and the ACF and PACF plots were reviewed to verify the randomness of residuals.

All statistical analyses and modeling were performed using the R programming language. Key packages included *forecast*, *tseries*, and *ggplot2*. The ARIMA(1,1,1) model was selected based on diagnostic performance and theoretical appropriateness. Forecasts were interpreted to assess the future trajectory of international transfers, particularly in the context of the rising use of decentralized alternatives like stablecoins.

RESULTS & ANALYSIS

As was mentioned before, the main challenge of modern international transfers is their physical unavailability, including sanctions that affect the quality of social life. This also affects the lives of international students.

According to the data provided by the World Bank Group (2025), the number of international transfers received is continuously rising from the 1970s to 2025.

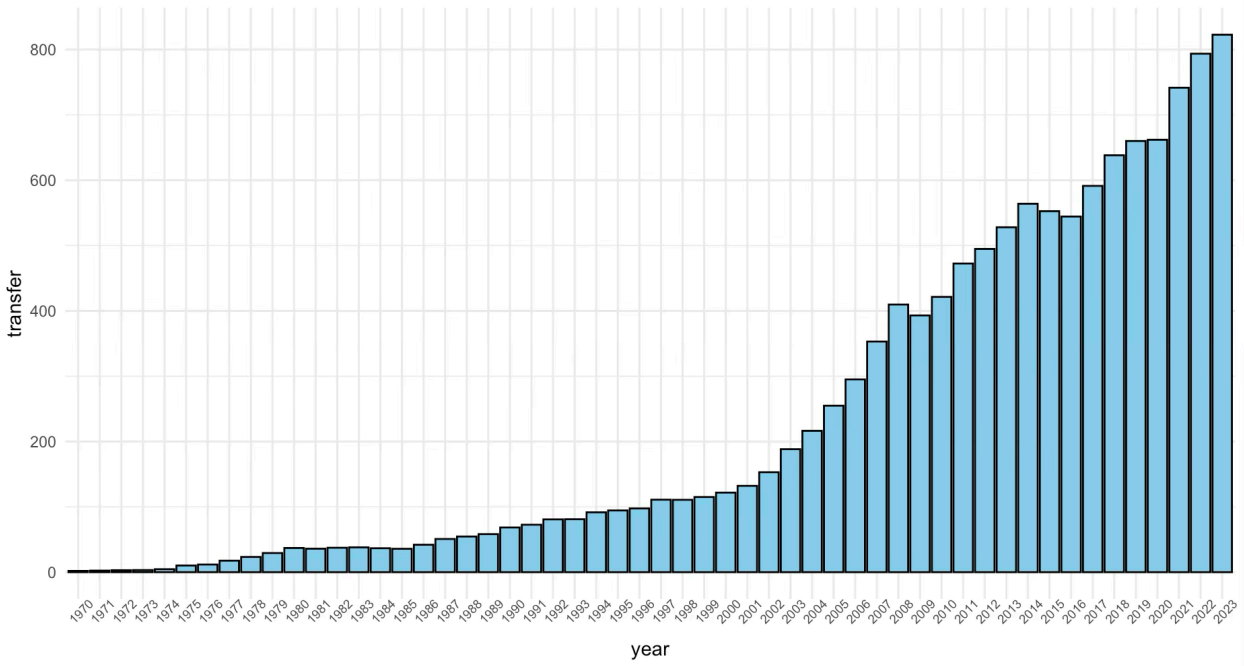


Figure 2. The Number of International Transfers Worldwide

The Figure 2 illustrates the increase in international transfers on the timescale from 1970 to 2023. The amount of money received is represented on the Y-axis in billions of U.S. dollars.

Such a significant rise in transactions might occur due to banking system development, international integration, and the increasing amount of goods and services on the market.

The most popular countries for international students to study are the Netherlands, Germany, Switzerland, the UK, and the USA. Therefore, the dynamics of international transfers in these countries will be observed further.

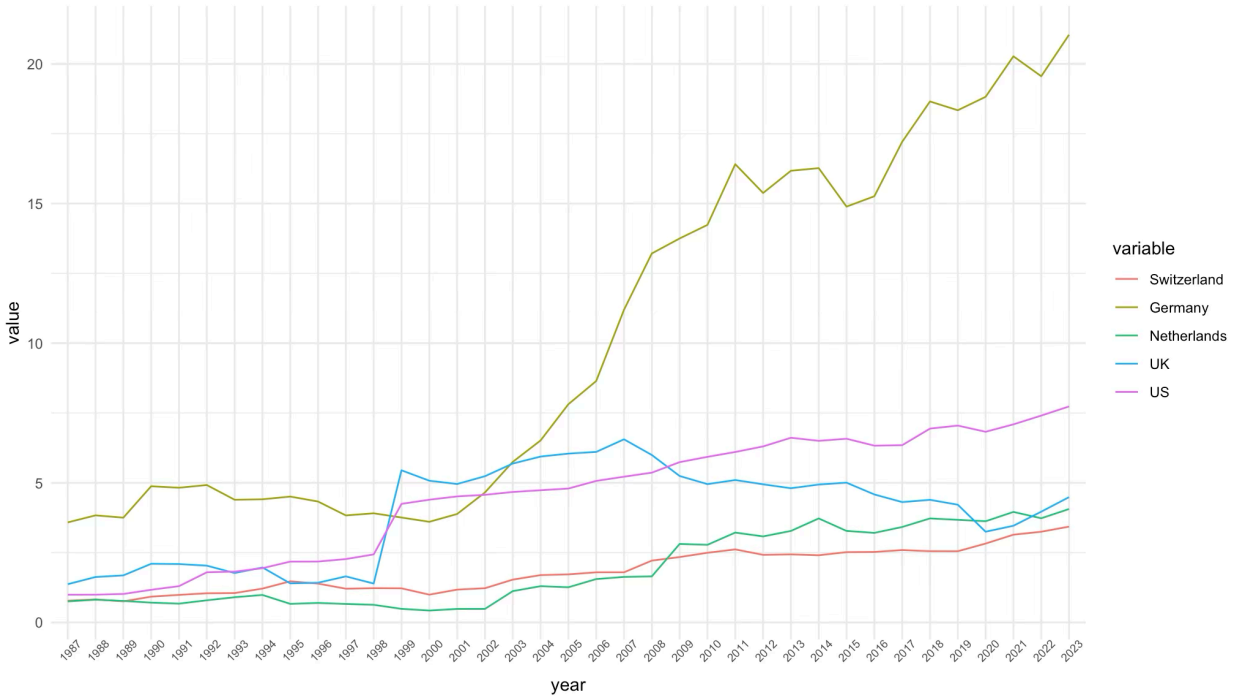


Figure 3. The Volume of the Transfers Received

From the Figure 3, Germany is leading in receiving international transfers among the five countries mentioned.

Moreover, let's explore the Google search statistics (Google Trends, 2025). It is obvious that after February 2022, when Russia was cut off from SWIFT, the interest in international transfers from Russia significantly increased.

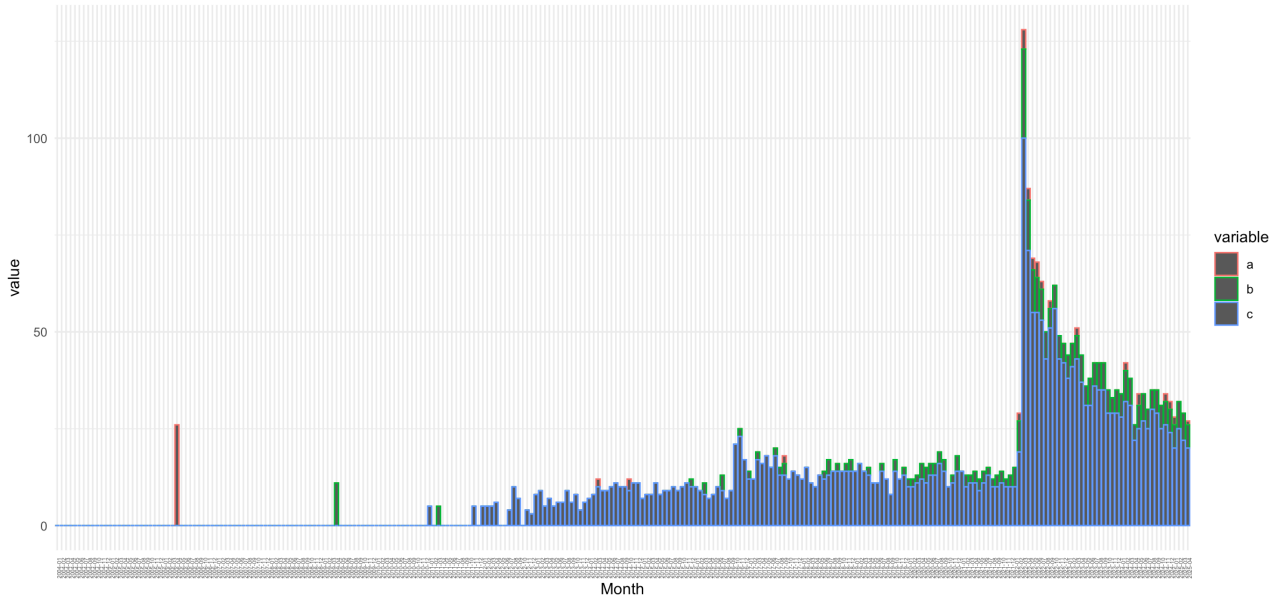


Figure 4. The Number of the Searches in Google

In Figure 4, the popularity of three popular search requests is demonstrated. Where a – 'transfers from russia', b – 'how to send money from russia', and c – the same option but in Russian - 'как перевести деньги из россии'.

It is evident that the number of search requests related to international transfers from the Russian Federation surged after the war between Russia and Ukraine began, and Russia lost the ability to make transfers via SWIFT. Although this sharp increase in requests was somewhat noticeable, it still remains popular. This case supports the relevance of the research.

First of all, the structure of international transfers is presented.

Data consists of the value of transfers in billions of euros from 2014 to 2025 made in a cash-free and e-money manner. In Figure 5 the dynamics of transfers made are given. Data encompasses money sent from the following countries:

Switzerland,

Germany,

United Kingdom,

Netherlands,

United States.

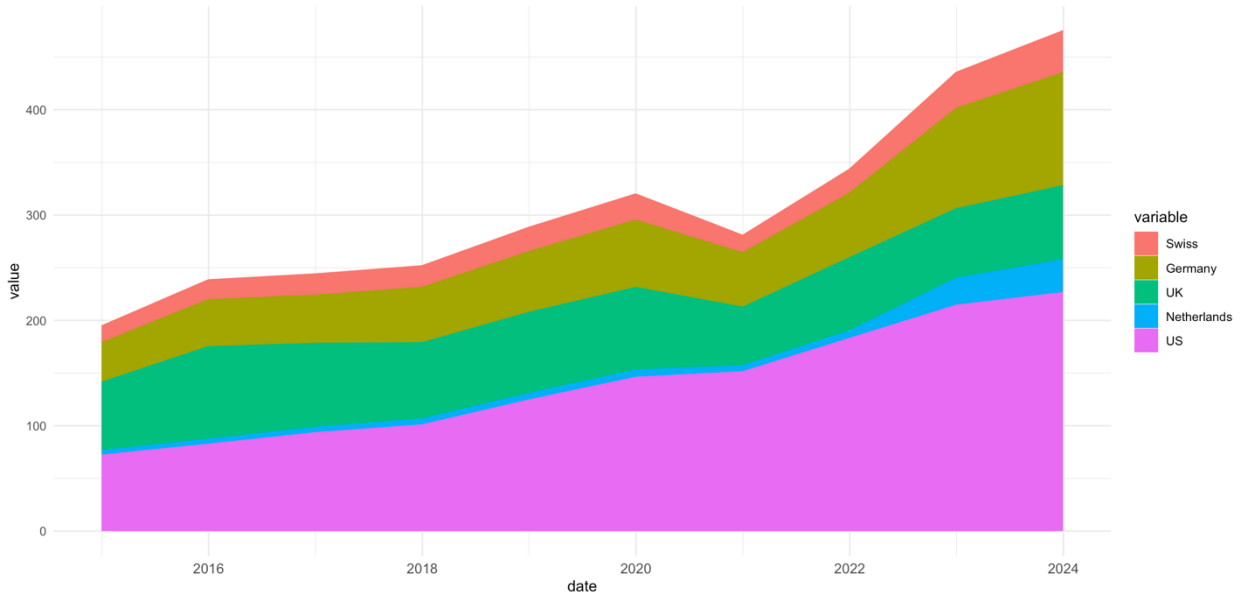


Figure 5. The Dynamics of Cross-Border Transfers Sent Including Cash-free And E-money by Five Countries

The majority of the money sent belongs to the US, and its number significantly increased from the beginning of the time scale. Other countries presented have their own growth. However, it is not as noticeable as in the US. For instance, the volume of transfers from the Netherlands was the smallest among the countries observed, but by 2024, it almost reached the volume of the transfers from Switzerland.

Here, the existing data, including the percentage dynamics, is provided.

Table 1. The Dynamics of Cross-border Transfers Sent by Five Countries and Its Alterations in %

DATE	SWITZERLAND, EUR BN	GERMANY, EUR BN	UK, EUR BN	NETHERLANDS, EUR BN	US, EUR BN	SWITZERLAND, %	GERMANY, %	UK, %	NETHERLANDS, %	US, %
2014	16.093	37.348	64.762	4.512	71.886					
2015	18.823	44.613	87.743	4.942	82.268	16.96	19.45	35.49	9.53	14.44
2016	20.218	45.642	79.740	5.214	93.197	7.42	2.31	-9.12	5.49	13.28
2017	20.450	52.561	72.369	5.720	100.635	1.15	15.16	-9.24	9.72	7.98
2018	23.168	57.602	76.864	6.393	124.232	13.29	9.59	6.21	11.76	23.45
2019	24.822	63.882	78.450	6.949	145.808	7.14	10.90	2.06	8.70	17.37
2020	16.641	51.556	55.567	5.830	151.051	-32.96	-19.30	-29.17	-16.11	3.60
2021	22.937	61.079	69.574	7.134	182.686	37.83	18.47	25.21	22.38	20.94
2022	34.298	95.202	66.028	25.662	214.199	49.53	55.87	-5.10	259.72	17.25
2023	39.865	107.207	70.217	31.345	226.262	16.23	12.61	6.34	22.14	5.63

It should be mentioned that the countries' portions are generally different each year. The dynamic is as follows:

• Switzerland's portion in international transfers remains almost the same: around 7 – 8 percent,

• Germany's proportion increased slightly, reaching 22.57% in 2023,

• There are noticeable falls in the UK's international transfers: from 33.28 percent in 2014 to 14.79 percent in 2023,

• The Netherlands started as an outsider with its 2.32 percent at the beginning of the time scale. However, in 2022, the proportion showed a positive dynamic, ending with 6.6 percent in 2023,

• The United States remains the leader among the observed countries, with a percentage of 47.64 at the end of the period.

It is evident that each country experienced various decreases from 2021 to 2022, which can be attributed to the COVID-19 pandemic.

The detailed shares of each country are depicted in Table 2.

Table 2. The Proportion of 5 Countries in International Transfers from 2014 to 2023

DATE	SWITZERLAND	GERMANY	UK	NETHERLANDS	US	TOTAL
2014	8.27%	19.19%	33.28%	2.32%	36.94%	194.60
2015	7.90%	18.71%	36.81%	2.07%	34.51%	238.39
2016	8.29%	18.70%	32.68%	2.14%	38.19%	244.01
2017	8.12%	20.88%	28.75%	2.27%	39.98%	251.74
2018	8.04%	19.98%	26.66%	2.22%	43.10%	288.26
2019	7.76%	19.97%	24.52%	2.17%	45.58%	319.91
2020	5.93%	18.37%	19.80%	2.08%	53.82%	280.64
2021	6.68%	17.79%	20.26%	2.08%	53.20%	343.41
2022	7.88%	21.87%	15.17%	5.89%	49.20%	435.39
2023	8.39%	22.57%	14.79%	6.60%	47.64%	474.90

Further, the following forecast used the time series models of each observing country, which were made using the R Programming Language.

The ARIMA(1,1,1) model was selected based on theoretical plausibility and diagnostic performance. While the ADF test confirmed non-stationarity and differencing rendered the series stationary, residual analysis showed slight autocorrelation at lag 1. The Shapiro-Wilk test confirmed normality of residuals ($p = 0.4659$). The Ljung-Box test returned undefined values, likely due to short data length ($n = 10$), but ACF/PACF plots indicated no strong pattern in residuals beyond the first lag. Thus, the model is accepted as a reliable basis for mid-term forecasting.

The printed results of the forecasting are shown in Figure 6.

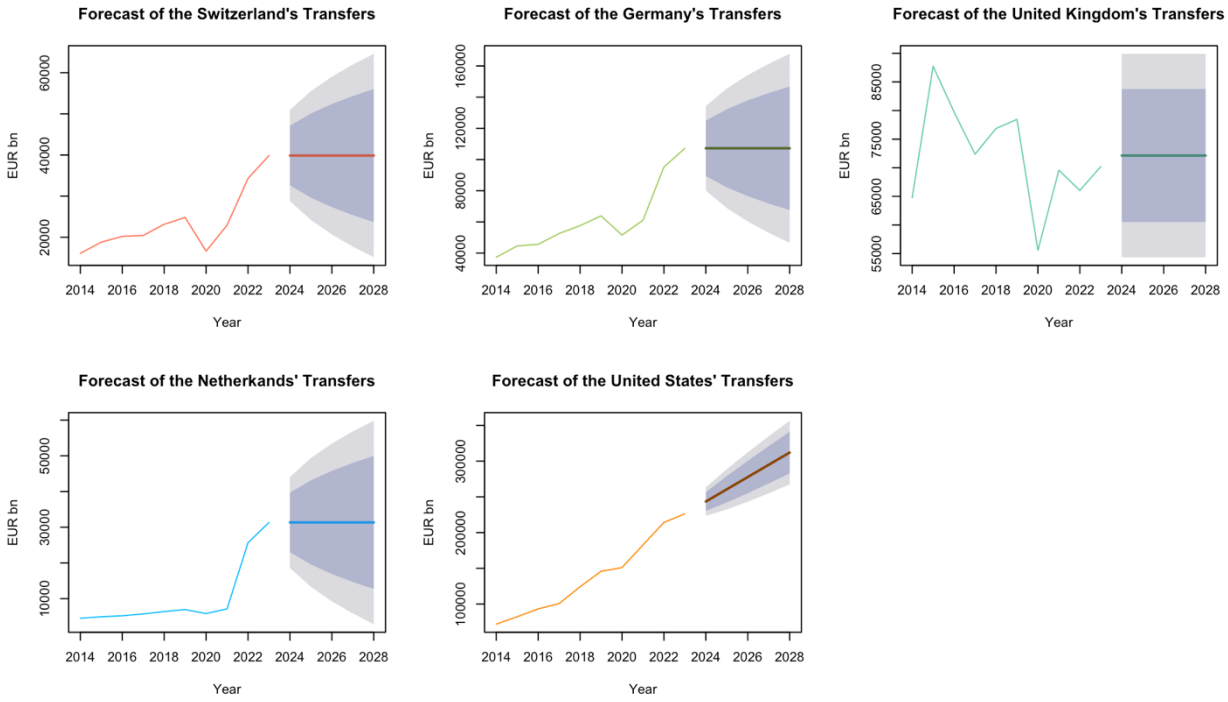


Figure 6. The Forecasting of Transfers

As follows, the only country with a straight trend in the volume of international transfers is the United States. In the next three years, the volume of international transfers could increase further.

Therefore, we can state that the market of transfers, especially cross-border, has a considerable volume, which is continuously increasing.

As mentioned, cross-border payment institutions are crucial for business, marketing, and science development, because studies are primarily funded and involve additional expenses. The rest of the study will be dedicated to international students and their challenges.

The most restricted countries (excepting North Korea as a highly closed country) are Russia, Belarus, Iran, Syria, Venezuela, Cuba, Sudan, Palestine, Argentina, and Turkey.

The Figure 7 displays the number of international students from the sanctioned countries relatively to the total amount of international students in the United States in 2022.

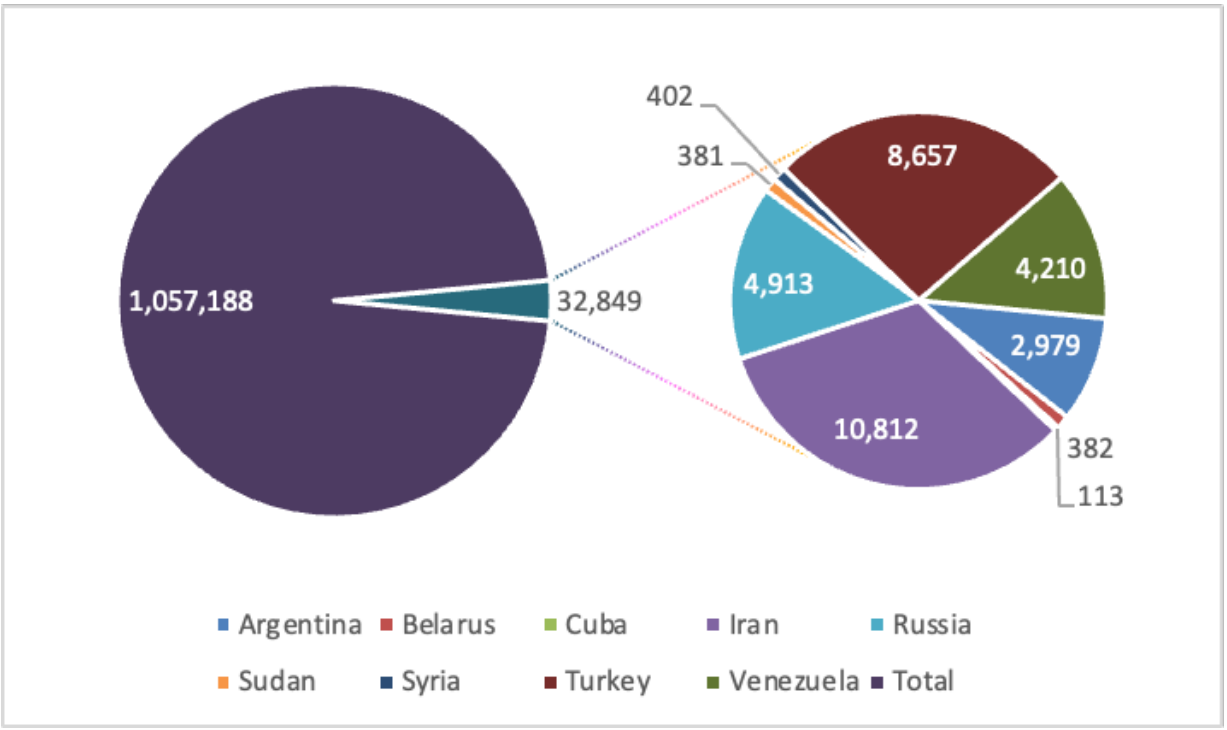


Figure 7. The Share of Students from Sanctioned Countries in the US in 2022

The alternative to traditional cross-border money transfers is cryptocurrencies, including stablecoins, which are tied to the exchange rates of traditional currencies, such as EUR or USD, for instance.

The data observed contains the volume of transactions made in stablecoins such as USDC, USDT, PYUSD, USDP, and FDUSD from November 2018 to May 2025.

Figure 8 illustrates the timescale of the transactions of stablecoins. Since 2020, a noticeable rise in popularity has been observed, which has continued to increase throughout the observed period.

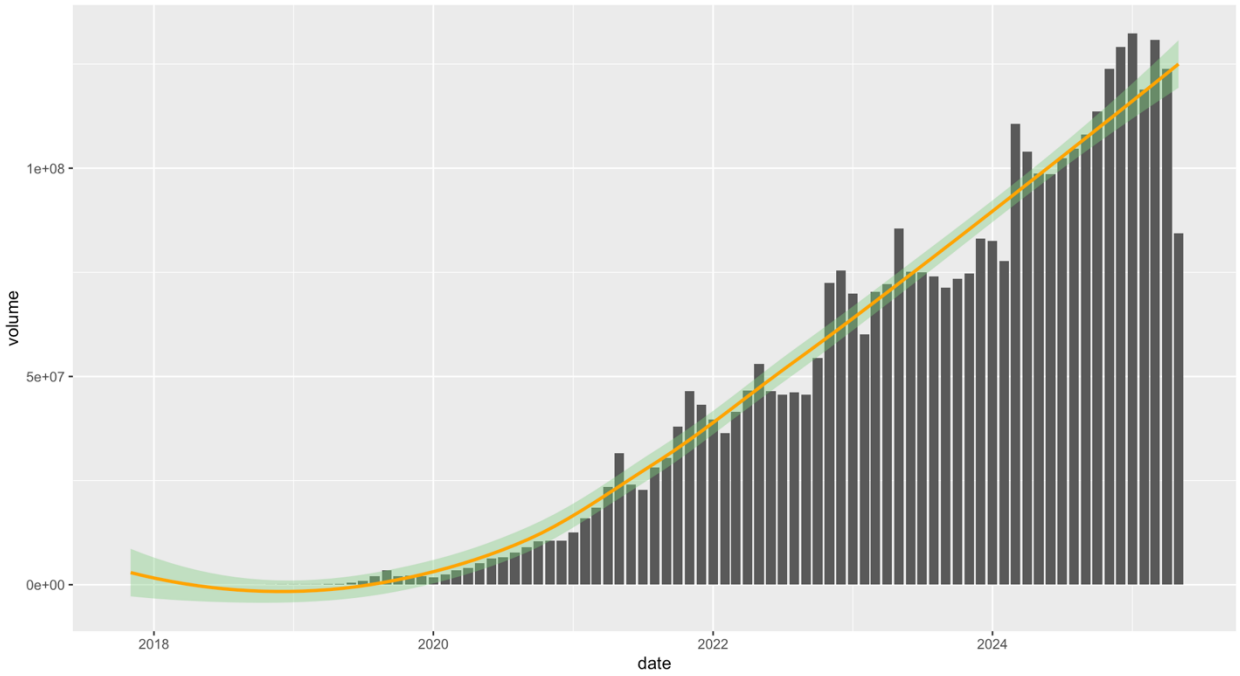


Figure 8. Stablecoin Transactions Volume

In April, the number of stablecoin transactions totaled 130.76 million, with a corresponding volume of $717.99 billion. However, the peak was in $719.31 billion in December 2024, accounting for 132.4 million transactions.

The seasonality of the data is noticeable, indicating that the data is non-stationary, which violates the conditions for an ARIMA forecast (Figure 9). It probably may drive the accuracy of the prediction, because ARIMA might incorrectly assume past values predict future values indefinitely, overestimating or underestimating future points, as well as seasonality violates this assumption and reduces accuracy. Hence, for the forecast of the future number of transactions, the trend and seasonality were removed.

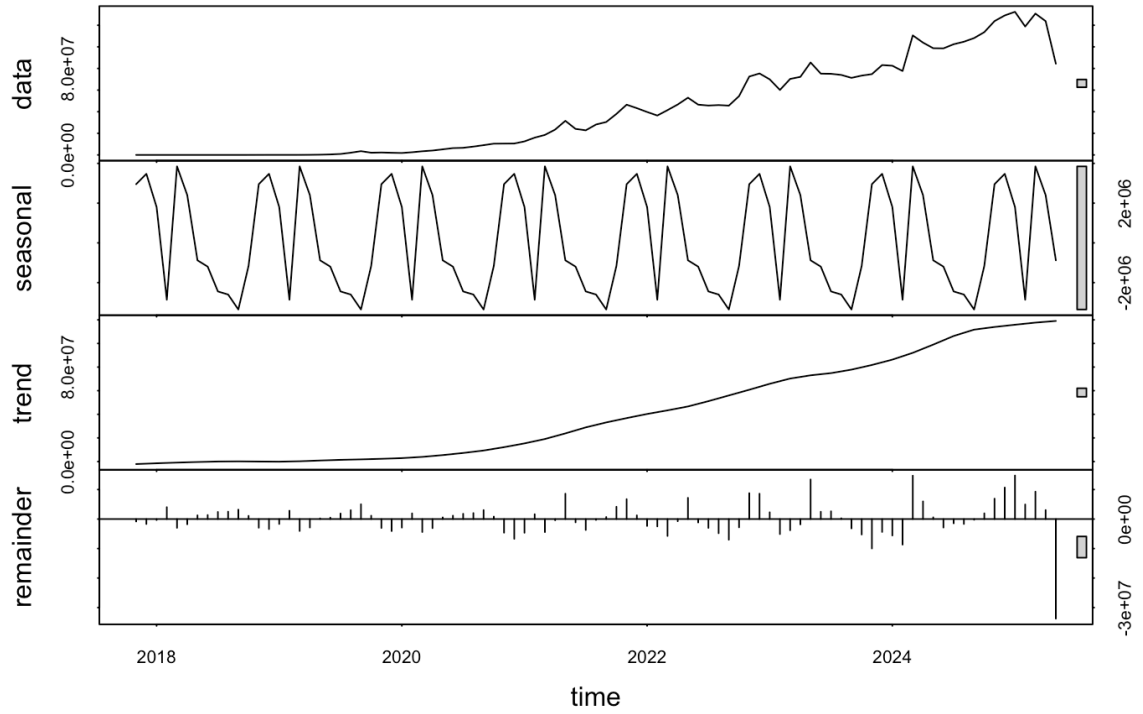


Figure 9. Stationarity Checking

For removing trend, seasonality, and forecasting with ARIMA, the differencing approach is used (Hyndman and Athanasopoulos, 2021):

$$y'_t = y_t - y_{t-1}$$

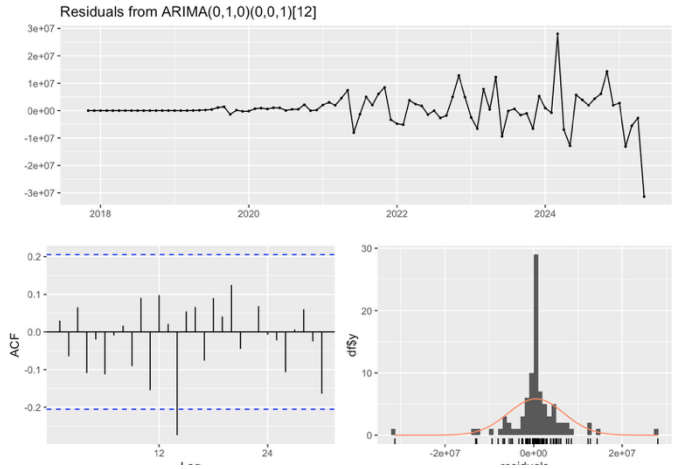


Figure 10. Residuals Plot

After that, the model becomes accessible for an ARIMA forecast:

- Residuals are mostly white noise,
- Normality is close enough for forecasting,
- ACF doesn't show strong autocorrelation (Figure 10).

ARIMA indicates that after an increase in the number of transactions, they will rise slightly and, in 2026, stabilize at approximately the 2023 level (Figure 11).

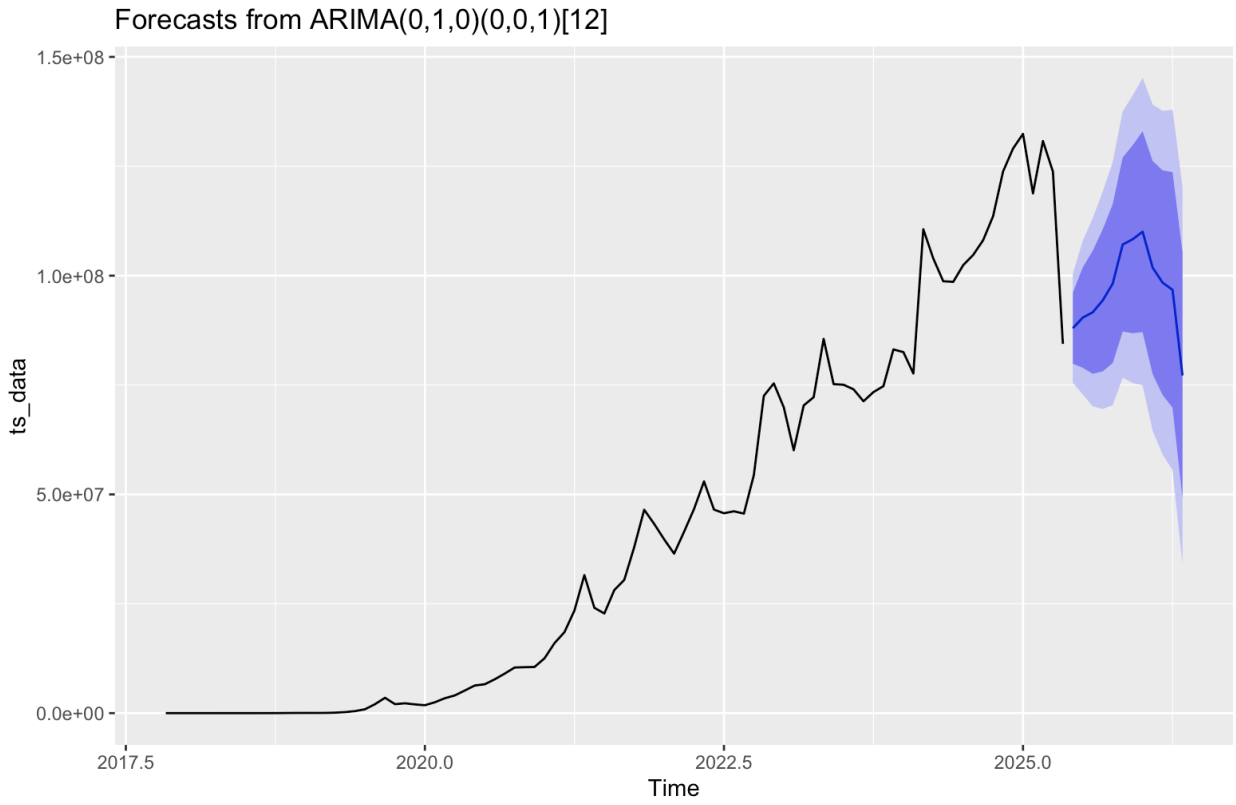


Figure 11. The ARIMA Forecast of Stablecoin Transactions Behavior

Nevertheless, despite stablecoins' popularity and relative stability, their prices are variable and do not resemble the USD price. Figure 12 illustrates the scatter of the relationship between USD and USDT prices from February 2018 to February 2023.

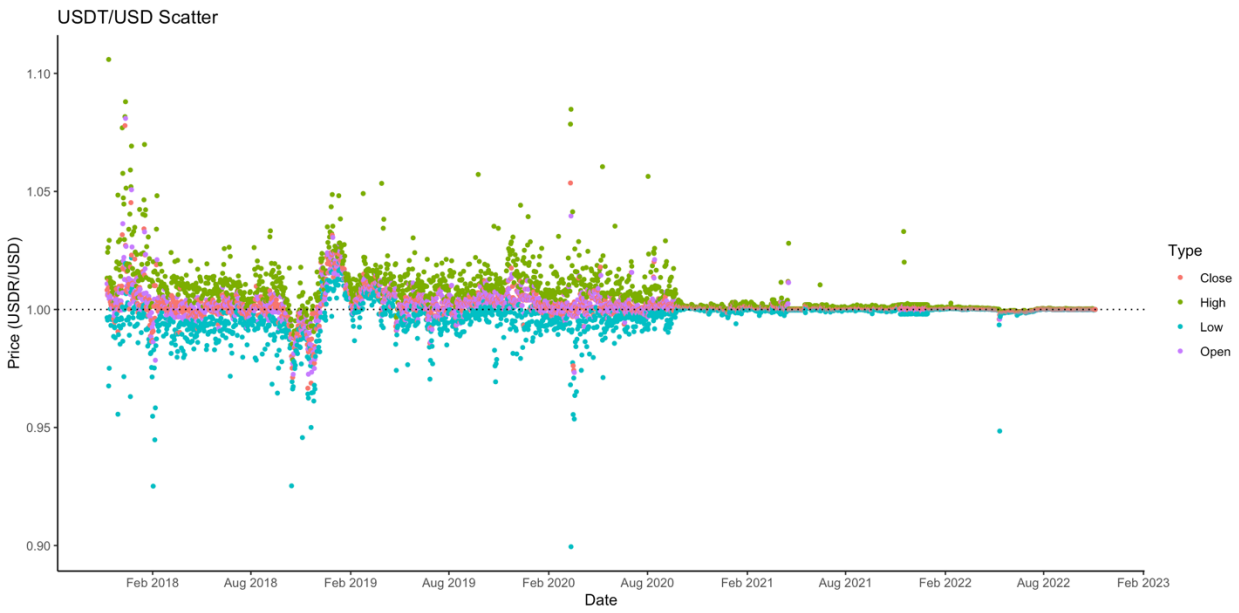


Figure 12. USD/USDT Scatter Plot

Here, the dispersion is significant. However, after August 2020, the level became noticeably lower, yet it remains present. Consequently, the probable outcomes when transferring money have increased.

Moreover, it takes additional time and risk. The recent findings suggest that there are more than 1500 scam domains and over 300 fake apps (Xia et al., 2020). The detection of scams and viruses that antivirus software cannot completely detect. It poses additional difficulties that can be hazardous for unprepared individuals.

DISCUSSION

The ongoing process of international integration has necessitated the evolution of payment systems capable of supporting global financial flows. Over the past five decades, traditional methods of cross-border money transfers have undergone considerable transformation, significantly improving accessibility and speed. Today, a multitude of digital and institutional payment systems connect people and businesses across borders, enabling a level of global interaction that was previously unattainable.

However, these advancements do not benefit all users equally. For certain groups — particularly international students from politically or economically sanctioned countries — access to mainstream financial infrastructure remains limited or entirely blocked. In such cases, it becomes nearly impossible for families to send money abroad to support their relatives' education or living expenses. This issue is especially critical for students whose academic progress and well-being depend on timely financial support.

Faced with such restrictions, alternative mechanisms have emerged. Chief among them is the use of stablecoins — cryptocurrencies that are pegged to traditional fiat currencies (e.g., USDT to the U.S. dollar). Due to their relative stability and the speed of blockchain-based transactions, stablecoins have become increasingly popular among those unable to use traditional transfer systems. They offer a lifeline in otherwise inaccessible financial conditions.

However, these alternatives are not without limitations. Stablecoin use involves additional technical complexity, limited financial literacy among the general population, and an elevated risk of fraud, especially when transacted through informal or peer-to-peer channels. Moreover, legal uncertainties and regulatory inconsistencies across jurisdictions make the use of stablecoins unreliable or even legally risky in some regions.

For many students, the only available options for receiving funds are cryptocurrency transfers or physically transporting cash across borders. Both options are suboptimal, insecure, and impractical in the context of modern international education. These workarounds function more as temporary "crutches" than as legitimate, sustainable solutions to cross-border financial exclusion.

Therefore, this study strongly advocates for the development of inclusive, secure, and politically neutral international payment mechanisms. A robust financial infrastructure should ensure that students, regardless of their country of origin, retain the right to access funds legally sent by their families. Access to education should not depend on geopolitical constraints. If a student has been accepted to an institution and has the means to fund

their education, they must not be barred from doing so due to financial isolation. The international community, financial regulators, and payment platforms must collaborate to develop solutions that uphold this principle, which necessitates a robust global conversation.

CONCLUSION & RECOMMENDATIONS

This research has examined the evolving structure of international payment systems, focusing particularly on their accessibility and limitations for international students from sanctioned or financially isolated economies. In an increasingly interconnected world, where education and migration intersect with politics and finance, the ability to send and receive cross-border payments is not just a matter of convenience — it is a fundamental necessity for academic participation and personal sustainability. The study shows that, despite significant advances in formal payment infrastructures over the past fifty years, global systems such as SWIFT, SEPA, and IPS remain structurally exclusive in key ways.

For many students, these exclusions are not merely hypothetical. Sanctions, regulatory overcompliance, and restrictions on financial intermediaries have made it challenging — and often impossible — for families in countries such as Russia, Iran, or Venezuela to send tuition fees or living stipends to their relatives abroad. While systems like SEPA offer real-time transactions within certain regions, and services like Wise or Western Union provide alternative channels, these options are either regionally limited or economically inefficient due to high fees or restricted availability.

As this research has shown, traditional financial systems have left a gap that has been partially filled by digital alternatives, particularly stablecoins like Tether (USDT). These blockchain-based assets are pegged to fiat currencies and provide borderless, near-instant transfers without the need for conventional banks. Their popularity — as evidenced by transaction volume data from 2018 to 2025 — reflects both their increasing technological relevance and their practical utility as emergency infrastructure. However, the data also reveals volatility in price parity and susceptibility to seasonal trends, highlighting that stablecoins remain far from stable in a regulatory or institutional sense.

The forecasting conducted using ARIMA models indicates a maturing adoption pattern. Transaction volumes are expected to stabilize around the levels observed in 2023, signaling both market saturation and a potential normalization of stablecoin usage for international transfers. However, this stabilization does not eliminate the underlying risks. Stablecoins, despite being technologically innovative, remain vulnerable to fraud, phishing, infrastructure gaps, and legal ambiguity. Their primary strength—being decentralized and minimally regulated—also poses a weakness when viewed as long-term instruments for supporting something as sensitive as education finance.

Crucially, this research also emphasizes that financial exclusion is not merely a technical problem but a geopolitical and human one. Students who have successfully enrolled in

universities, secured accommodations, and planned their education should not be denied the ability to access lawful support from their families simply due to the limitations of current payment systems. The very purpose of international education — to foster global understanding and mutual development — is undermined when financial systems fail to accommodate those who need them most.

In conclusion, although the global architecture of cross-border payments has made impressive strides in speed and efficiency, it still falls short in inclusivity. This creates systemic disadvantages for international students from sanctioned countries, reinforcing inequalities that contradict the ethos of global higher education. Until the structure of international transfers is reimagined to prioritize accessibility over political compliance, alternative methods like stablecoins will remain necessary, not because they are ideal, but because, for many, they are the only option.

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APPENDIX

R Code

```
#Addessential packages
library(readxl)
library(openxlsx)
library(writexl)
library(corrplot)
library(dplyr)
library(tidyr)
library(tibble)
library(stringr)
library(ggplot2)
library(lmtest)
library(stargazer)
library(EnvStats)
library(RColorBrewer)
library(reshape2)
library(FinCal)
library(FinancialMath)
library(pander)
library(car)
library(lubridate)
library(forecast)
library(tseries)
library(FinTS)
library(nls2)
library(reticulate)

#Importexcel file
data <- read_excel(path = '/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/Transfers
Worldwide.xlsx')
data <- t(data)
data <- as.data.frame(data)
data <- data %>%
  rownames_to_column(var = 'year') %>%
  rename(transfer = V1)
data$transfer <- data$transfer/1000000000
data

ggplot(data = data, aes(x=year, y=transfer)) +
  geom_bar(stat = 'identity', color='black', fill = 'skyblue')+
  theme_minimal()+
  theme(axis.text.x = element_text(size=7, angle = 45))
```

```
#Import excel file
top5 <- read_excel(path = '/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/top5.xlsx')
top5 <- t(top5)
top5 <- as.data.frame(top5)

colnames(top5) <- as.character(unlist(top5[1, ]))
top5 <- top5[-1, ]

top5 <- top5 %>%
  rownames_to_column(var = 'year')
top5$Switzerland <- as.numeric(top5$Switzerland)
top5$Germany <- as.numeric(top5$Germany)
top5$UK <- as.numeric(top5$`United Kingdom`)
top5$Netherlands <- as.numeric(top5$Netherlands)
top5$US <- as.numeric(top5$`United States`)
top5 <- top5 %>%
  select(-`United Kingdom`, -`United States`)

top5$Switzerland <- top5$Switzerland/1000000000
top5$Germany <- top5$Germany/1000000000
top5$UK <- top5$UK/1000000000
top5$Netherlands <- top5$Netherlands/1000000000
top5$US <- top5$US/1000000000
top5 <- top5 %>%
  drop_na(Switzerland)%>%
  drop_na(Germany)%>%
  drop_na(UK)%>%
  drop_na(Netherlands)%>%
  drop_na(US)
top5

#long data
top5_melt <- melt(top5, id.vars = 'year')

#plot
ggplot(data = top5_melt, aes(x=year, y=value, color = variable,
group = variable))+
  geom_line(stat = "identity")+
  theme_minimal()+
  theme(axis.text.x = element_text(size=7, angle = 45))

# Searches

searches <- read.csv('/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/search.csv')
searches_melt <- melt(searches, id.vars = 'Month')
```

```
ggplot(data = searches_melt ,aes(x=Month, y = value, color =
variable, group = variable))+
  geom_bar(stat = 'identity')+
  theme_minimal()+
  theme(axis.text.x = element_text(angle = 90, size = 4))

# DATA
rates <- read_excel(path = '/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/rates.xlsx')

rates
#Import excel file
df <- read_excel(path = '/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/data.xlsx')
df$date <- df$Unit
df <- df %>%
  select(-Unit)
df$date <- as.Date(df$date)
df
df <- left_join(df, rates, by = 'date')
df
df$Swiss <- df$Swiss/df$chf
df$UK <- df$UK/df$gpb
df$US <- df$US/df$usd
df

df_plot <- df %>%
  select(date, Swiss, Germany, UK, Netherlands, US)
df_plot <- df_plot %>%
  mutate(
    Swiss = Swiss/1000,
    Germany = Germany/1000,
    UK = UK/1000,
    Netherlands = Netherlands/1000,
    US = US/1000)
df_plot
df_plot_melt <- melt(df_plot, id.vars = 'date')
ggplot(data = df_plot_melt ,aes(x=date, y = value, color =
variable, fill = variable, group = variable))+
  geom_area(stat = 'identity')+
  theme_minimal()+
  theme(axis.text.x = element_text(angle = 0, size = 10))
```

```
df_plot <- df_plot %>%
  arrange(date) %>%
  mutate(across(c(Swiss, Germany, UK, Netherlands, US),
                ~ c(NA, diff(.) / lag(.)[-1] * 100),
                .names = "{.col}_pct,%"))
df_plot
file_path <- "/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/df_plot.xlsx"
# Сохранение файла в указанную директорию
write_xlsx(df_plot, file_path)
df_n <- df_plot %>%
  select(date, Swiss, Germany, UK, Netherlands, US)
df_n
file_path <- "/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/df_n.csv"
# Сохранение файла в указанную директорию
write.csv(df_n, file_path)

colors()

#Swiss
swiss_ts <- ts(df$Swiss, start = 2014, frequency = 1)
plot(swiss_ts, main = "Swiss Transfers Time Series", ylab = "EUR
bn", xlab = "Year")
model_swiss <- auto.arima(swiss_ts)
summary(model_swiss)
forecast_swiss <- forecast(model_swiss, h = 5)
plot_swiss <- plot(forecast_swiss, main = "Forecast of the
Switzerland's Transfers", ylab = "EUR bn", xlab = "Year", col =
'coral1', fcol = 'coral3')

adf.test(model_swiss)
Box.test(residuals(model_swiss), lag = 10, type = "Ljung-Box")
shapiro.test(residuals(model_swiss))
acf(residuals(model_swiss))
pacf(residuals(model_swiss))
ArchTest(residuals(model_swiss))

# Germany
germany_ts <- ts(df$Germany, start = 2014, frequency = 1)
plot(germany_ts, main = "Germany Transfers Time Series", ylab =
"EUR bn", xlab = "Year")
model_germany <- auto.arima(germany_ts)
summary(model_germany)
forecast_germany <- forecast(model_germany, h = 5)
```

```
plot_germany <- plot(forecast_germany, main = "Forecast of the
Germany's Transfers", ylab = "EUR bn", xlab = "Year", col =
'darkolivegreen3', fcol = 'darkolivegreen')

adf.test(model_germany)
Box.test(residuals(model_germany), lag = 10, type = "Ljung-Box")
shapiro.test(residuals(model_germany))
acf(residuals(model_germany))
pacf(residuals(model_germany))
ArchTest(residuals(model_germany))

#UK
uk_ts <- ts(df$UK, start = 2014, frequency = 1)
plot(uk_ts, main = "Swiss Transfers Time Series", ylab = "EUR
bn", xlab = "Year")
model_uk <- auto.arima(uk_ts)
summary(model_uk)
forecast_uk <- forecast(model_uk, h = 5)
plot_uk <- plot(forecast_uk, main = "Forecast of the United
Kingdom's Transfers", ylab = "EUR bn", xlab = "Year", col =
'aquamarine3', fcol = 'aquamarine4')

adf.test(model_uk)
Box.test(residuals(model_uk), lag = 10, type = "Ljung-Box")
shapiro.test(residuals(model_uk))
acf(residuals(model_uk))
pacf(residuals(model_uk))
ArchTest(residuals(model_uk))

#Netherlands
netherlands_ts <- ts(df$Netherlands, start = 2014, frequency =
1)
plot(netherlands_ts, main = "Swiss Transfers Time Series", ylab
= "EUR bn", xlab = "Year")
model_netherlands <- auto.arima(netherlands_ts)
summary(model_netherlands)
forecast_netherlands <- forecast(model_netherlands, h = 5)
plot_netherlands <- plot(forecast_netherlands, main = "Forecast
of the Netherkands' Transfers", ylab = "EUR bn", xlab = "Year",
col = 'deepskyblue1')

adf.test(model_netherlands)
Box.test(residuals(model_netherlands), lag = 10, type = "Ljung-
Box")
shapiro.test(residuals(model_netherlands))
acf(residuals(model_netherlands))
pacf(residuals(model_netherlands))
```

```
ArchTest(residuals(model_netherlands))

#US
us_ts <- ts(df$US, start = 2014, frequency = 1)
plot(us_ts, main = "Swiss Transfers Time Series", ylab = "EUR
bn", xlab = "Year")
model_us <- auto.arima(us_ts)
summary(model_us)
forecast_us <- forecast(model_us, h = 5)
plot_us <- plot(forecast_us, main = "Forecast of the United
States' Transfers", ylab = "EUR bn", xlab = "Year", col =
'darkorange', fcol = 'darkorange4')

adf.test(model_us)
Box.test(residuals(model_us), lag = 10, type = "Ljung-Box")
shapiro.test(residuals(model_us))
acf(residuals(model_us))
pacf(residuals(model_us))
ArchTest(residuals(model_us))

par(mfrow = c(2, 3))
plot_swiss <- plot(forecast_swiss, main = "Forecast of the
Switzerland's Transfers", ylab = "EUR bn", xlab = "Year", col =
'coral1', fcol = 'coral3')
plot_germany <- plot(forecast_germany, main = "Forecast of the
Germany's Transfers", ylab = "EUR bn", xlab = "Year", col =
'darkolivegreen3', fcol = 'darkolivegreen')
plot_uk <- plot(forecast_uk, main = "Forecast of the United
Kingdom's Transfers", ylab = "EUR bn", xlab = "Year", col =
'aquamarine3', fcol = 'aquamarine4')
plot_netherlands <- plot(forecast_netherlands, main = "Forecast
of the Netherkands' Transfers", ylab = "EUR bn", xlab = "Year",
col = 'deepskyblue1')
plot_us <- plot(forecast_us, main = "Forecast of the United
States' Transfers", ylab = "EUR bn", xlab = "Year", col =
'darkorange', fcol = 'darkorange4')
par(mfrow = c(1, 1))

df_n

df_n$total <- df_n$Swiss + df_n$Germany + df_n$UK +
df_n$Netherlands + df_n$US
df_n

df_n$swiss_prop <- df_n$Swiss/df_n$total
df_n$germany_prop <- df_n$Germany/df_n$total
df_n$uk_prop <- df_n$UK/df_n$total
```

```
df_n$netherlands_prop <- df_n$Netherlands/df_n$total
df_n$us_prop <- df_n$US/df_n$total

df_proportion <- df_n %>%
  select(date, swiss_prop, germany_prop, uk_prop,
netherlands_prop, us_prop, total)

df_proportion

# Установка директории для сохранения файла
file_path <- "/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/df_proportions.xlsx"
# Сохранение файла в указанную директорию
write_xlsx(df_proportion, file_path)

# Students
students <- read.csv('/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/International Student
Demographics/origin.csv')
students

students <- students %>%
  filter(origin %in% c('Russia', 'Belarus', 'Iran', 'Syria',
'Venezuela', 'Cuba', 'Sudan', 'Palestine', 'Argentina',
'Turkey'))
students_2023 <- students %>%
  filter(year %in% c(2022)) %>%
  select(origin, students) %>%
  group_by(origin) %>%
  summarise(students = sum(students))


students
students_2023

# Установка директории для сохранения файла
file_path <- "/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/students_2023.xlsx"
# Сохранение файла в указанную директорию
write_xlsx(students_2023, file_path)

#Create a circle plot
ggplot(data = students_2023, aes(x="", y= students, fill=
origin))+
geom_bar(stat = "identity", width = 10, show.legend = TRUE)+
coord_polar("y", start = 0)+
labs(x = "", fill = NULL)+
```

```
#Change colours
scale_fill_brewer(palette = "Set1")+
theme_void()+
#labels settings
geom_text( aes (label = paste0(students)), position =
position_stack(vjust= 0.5 )) +
labs(x = NULL, y = NULL, fill = NULL)

date <- as.Date(c('2017-11-01','2017-12-01','2018-01-01','2018-
02-01','2018-03-01','2018-04-01','2018-05-01','2018-06-
01','2018-07-01','2018-08-01','2018-09-01','2018-10-01','2018-
11-01','2018-12-01','2019-01-01','2019-02-01','2019-03-
01','2019-04-01','2019-05-01','2019-06-01','2019-07-01','2019-
08-01','2019-09-01','2019-10-01','2019-11-01','2019-12-
01','2020-01-01','2020-02-01','2020-03-01','2020-04-01','2020-
05-01','2020-06-01','2020-07-01','2020-08-01','2020-09-
01','2020-10-01','2020-11-01','2020-12-01','2021-01-01','2021-
02-01','2021-03-01','2021-04-01','2021-05-01','2021-06-
01','2021-07-01','2021-08-01','2021-09-01','2021-10-01','2021-
11-01','2021-12-01','2022-01-01','2022-02-01','2022-03-
01','2022-04-01','2022-05-01','2022-06-01','2022-07-01','2022-
08-01','2022-09-01','2022-10-01','2022-11-01','2022-12-
01','2023-01-01','2023-02-01','2023-03-01','2023-04-01','2023-
05-01','2023-06-01','2023-07-01','2023-08-01','2023-09-
01','2023-10-01','2023-11-01','2023-12-01','2024-01-01','2024-
02-01','2024-03-01','2024-04-01','2024-05-01','2024-06-
01','2024-07-01','2024-08-01','2024-09-01','2024-10-01','2024-
11-01','2024-12-01','2025-01-01','2025-02-01','2025-03-
01','2025-04-01','2025-05-01'))
volume <-
c(7,23,349,995,1100,2190,2650,2290,2850,2370,4640,7930,28980,457
30,49460,47190,55140,115350,238160,467860,896630,2060000,3510000
,2060000,2250000,2000000,1810000,2490000,3410000,4050000,5170000
,6320000,6600000,7730000,9030000,10430000,10510000,10560000,1253
0000,16000000,18510000,23450000,31550000,24080000,22780000,28130
000,30460000,37960000,46490000,43260000,39730000,36460000,414600
00,46670000,52960000,46530000,45690000,46140000,45610000,5442000
0,72520000,75380000,69920000,60100000,70330000,72220000,85540000
,75210000,75060000,74020000,71290000,73390000,74750000,83130000,
82530000,77640000,110600000,103920000,98720000,98580000,10240000
0,104730000,108100000,113590000,123810000,129050000,132400000,11
8810000,130760000,123780000,84410000)

stablecoins<-data.frame(date,volume)
stablecoins
ggplot(data = stablecoins, aes(x= date, y = volume)) +
  geom_bar(stat = 'identity')+
```

```
  geom_smooth(color = 'orange', fill = 'palegreen3')
colors()

# Check the structure
str(stablecoins)

ts_data <- ts(stablecoins$volume, start = c(2017, 11), frequency
= 12)
plot(ts_data, main = "USDT Volume Time Series")

adf.test(ts_data)

diff_ts <- diff(ts_data)
plot(diff_ts)

diff2_ts <- diff(diff_ts)
plot(diff2_ts)

decomposed <- stl(ts_data, s.window = "periodic")
plot(decomposed)


deseasoned <- ts_data - decomposed$time.series[, "seasonal"]
plot(decomposed)

model <- auto.arima(ts_data)
forecasted <- forecast(model, h = 12)
autoplot(forecaste)
checkresiduals(model)
accuracy(forecasted$MAPE)

# Print summary of fitted model
summary(model)

# Predict values and plot
df$predicted <- predict(model, newdata = df)

# Plot actual vs predicted
plot(df$time, df$adopters, type = "p", col = "blue", pch = 16,
     xlab = "Time (months)", ylab = "Cumulative Transactions
(millions)",
     main = "Bass Diffusion Model")
lines(df$time, df$predicted, col = "red", lwd = 2)
legend("bottomright", legend = c("Observed", "Predicted"),
       col = c("blue", "red"), pch = c(16, NA), lty = c(NA, 1))

# USDT - USD
```

```
usdt_usd <- read.csv('/Users/grigoriiegorov/Library/Mobile
Documents/com~apple~CloudDocs/HSE/Research/USDT-USD.csv')
usdt_usd
usdt_usd <- usdt_usd %>%
  select(Date, Open, High, Low, Close)

usdt_usd_long <- usdt_usd %>%
  pivot_longer(cols = c(Open, High, Low, Close),
               names_to = "Type",
               values_to = "Price")

class(usdt_usd_long$Date)
usdt_usd_long$Date <- as.Date(usdt_usd_long$Date)
usdt_usd_long$Price <- as.numeric(usdt_usd_long$Price)
class(usdt_usd_long$Price)
usdt_usd_long <- usdt_usd_long %>%
  drop_na(Price)
usdt_usd_long

# Plot
ggplot(usdt_usd_long, aes(x = Date, y = Price, color = Type)) +
  geom_point(size = 1) +
  labs(title = "USDT/USD Scatter",
       x = "Date",
       y = "Price (USDR/USD)") +
  theme(axis.text.x = element_text(size=7, angle = 90, hjust =
0.95, vjust=0.95))+
  theme(axis.text.y = element_text(size=7, angle = 0, hjust =
0.95, vjust=0.95)) +
  scale_x_date(date_breaks = "6 month", date_labels = "%b %Y") +
  geom_hline(yintercept = 1, linetype = 'dotted', color =
"black")+
  theme_classic()
```