Working Paper

Libra: insights into its expected stability[1]

Jonas Gross & Leon Landes

Abstract

Recently, stablecoins have gained high public attention. They provide a value-stable alternative to cryptocurrencies such as Bitcoin or Ethereum, which are volatile and, therefore, not suitable as means of payment. The announcement of the Libra project has further increased the public interest in stablecoins. In this paper, we study whether Libra might fulfill the function of money. We argue that Libra can only act as a proper unit of account and store of value if its value is relatively stable. To analyze the expected stability of Libra, we use the Special Drawing Rights as a proxy. For this purpose, we calculate common risk measures, namely, standard deviation, Value-at-Risk, and Maximum Drawdown. We show that Libra's exchange rate against strong currencies in industrialized countries can be expected to be relatively stable in the long-term, however fluctuating in the short-term. In emerging and developing countries, Libra can offer protection against the devaluation of local currencies. However, holding Libra will also entail a higher risk of loss for residents of these countries. Furthermore, we find from current stablecoins, as Tether or TrueUSD, that Libra will not necessarily be traded at par with the underlying reserves any time. Reasons for this divergence can be a perceived risk of default and incentives to carry out hedging transactions.

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1 Introduction

In recent years, cryptocurrencies have gained public attention and raised questions about their advantages and risks. Today, cryptocurrencies are not widely accepted as means of payment. It is often argued that the high price volatility is one of the key factors why demand remains low and why mass adoption seems rather unlikely. A good illustration of high price volatility is Bitcoin. In December 2017, Bitcoin's price fell by almost 25% from more than 16,000 US dollars to around 12,500 within a few hours.

In this context, stablecoins have been proposed to reduce price volatility. A stablecoin is a token that relies on a set of stabilization tools that aim to minimize its price fluctuations (see Bullmann, Klemm, Pinna, 2019). Stablecoins are cryptocurrencies predominantly backed by fiat currencies and cryptocurrencies but could also be backed by commodities or financial assets. Until June 2019, stablecoins have only been of minor interest, but the announcement of Libra drew public attention to stablecoins. Libra aims to be a global stablecoin backed by a basket of financial assets, mainly consisting of government bonds and currencies in the form of bank deposits. Libra is intended to start its operation in 2020.

To date, only a few studies focused on Libra. Mayer (2019) analyzes its concept, the challenges Libra aims to address and discusses how the euro area should react to Libra. Gross, Herz and Schiller (2019) examine the underlying concepts and discuss the stability, the market potential, systemic risks and monetary policy aspects of Libra. Schmeling (2019) studies the concept of Libra mainly from a balance sheet perspective. These papers briefly discuss the expected stability of Libra by comparing Libra to the Special Drawing Rights (SDR), a currency basket issued by the International Monetary Fund (IMF). They analyze the expected stability of Libra based on graphical representations of the SDR over time and by computing standard deviations of fiat currencies measured in terms of the SDR.

However, a high degree of uncertainty about the stability of Libra prevails. This ambiguity needs to be addressed to understand whether Libra has the potential to be globally adopted as a form of money. In this paper, we analyze the stability of Libra using standard deviations, and advanced risk measures, in our case interpreted as stability measures, such as Value-at-Risk (VaR) and Maximum Drawdown. We explicitly differentiate in our analysis between industrialized countries and developing and emerging economies.

Further, we discuss the possibility that the price of Libra can lie above or below the value of the underlying assets and currencies, in the case of Libra, the Libra Reserve. This question is

not sufficiently covered in the current literature. To address this gap, we analyze historical price patterns of existing stablecoins, such as Tether or TrueUSD, and identify and discuss drivers of price deviations from its reference value.

Our main findings are the following: The exchange rate between strong fiat currencies and Libra can be expected to be relatively stable in the long-term. Still, in the short-term fluctuations are likely. On the other hand, the exchange rate between local currencies from developing and emerging countries and Libra can be expected to fluctuate, both in the short- and the long-term. Libra will provide long-term protection against the depreciation of those local currencies. However, the short-term risk of loss connected to holding Libra will be higher for residents of developing countries, as short-term fluctuation will be stronger. Further, we conclude that Libra will not necessarily be traded at par with the Libra Reserve. A perceived risk of default and incentives to use Libra for hedging transactions might cause the exchange rate to fall below or exceed the value of the Libra Reserve.

This paper is structured as follows: In Chapter 2, the concept of Libra is summarized. Furthermore, we discuss whether Libra can be expected to fulfill the three functions of money. We argue that the aspect of price stability is essential to fulfill the functions of money. Chapter 3 analyzes the expected price stability of Libra. For this purpose, we examine financial market products that have similar characteristics as Libra but are already traded on the markets. We use them as a proxy for Libra, which is not traded yet. These products are the SDR and stablecoins such as Tether or TrueUSD. The stability of these instruments is analyzed by calculating various risk measures such as volatility, VaR, and Maximum Drawdown based on historical data.

2 Fundamentals of Libra

"Libra's mission is to enable a simple global currency and financial infrastructure that empowers billions of people." (Libra Association, 2019, p.1)

This section discusses the vision and the concept behind Libra. Furthermore, it is discussed if Libra will fulfill the functions of money and can, therefore, be seen as a form of money.[2]

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[2] The focus of this paper lies more on an economical than a technological perspective. Accordingly, the technological background of Libra, the Libra Blockchain, is only briefly discussed.

2.1 Libra's vision and concept

The Libra Association is the Switzerland-based institutional body behind the global cryptocurrency[3] Libra. The Libra Association consists of 21 founding members, including companies such as Facebook (through its subsidiary Calibra), Vodafone, the payment service provider PayU, several blockchain companies (e.g., Anchorage and Coinbase, Inc.) and technology companies (e.g., Uber, Lyft or Spotify). The Libra Association aims to increase financial inclusion for people that have restricted access to financial services. This applies in particular to individuals in emerging and developing countries. The main difference between Libra and existing stablecoins is that Libra is not only backed by fiat currencies but by a basket of fiat currencies and financial assets such as government bonds.

The Libra Reserve will not consist of a single currency, in contrast to stablecoins such as Tether or TrueUSD, but of a multitude of different currencies and financial assets. The value of Libra, thereby, is practically backed by a currency basket. From the perspective of local currencies, the price of Libra will, therefore, fluctuate when the currencies contained in the Libra Reserve depreciate or appreciate against the local currency. The Libra Association, however, intends to structure the reserve in a way that minimizes such fluctuations (see Libra Association, 2019).

According to the Libra Association (2019), the two main problems that have prevented cryptocurrencies from being highly accepted are limited scalability, which is often caused by the underlying blockchain protocol, and the high price volatility.

Since Libra is designed to serve as a global means of payment, the scalability of the underlying technology, the Libra Blockchain,[4] has to be ensured. Scalability is intended to be achieved by creating transaction consensus in the network with a different consensus mechanism than the proof-of-work mechanism used for Bitcoin[5] and other cryptocurrencies. This alternative mechanism is more energy-efficient and thus enables a high level of scalability (see Libra Association, 2019). The Libra Blockchain will operate as a permissioned blockchain at the beginning, which means that only the members of the Libra Association can act as validator nodes and can, therefore, confirm transactions. The Libra Blockchain is intended to become

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[3] Note that the term "cryptocurrency" is misleading. Whether Libra can be seen as a currency depends on the underlying definition of a currency since the term "currency" is not generally defined (for details see Chapter 2.2).

[4] In contrast to conventional blockchain systems, data on the Libra Blockchain will not be saved in blocks but in one single data structure (for details, see Loop, 2019). For the sake of simplicity, the term blockchain is used in the following.

[5] For a detailed discussion about proof-of-work see Nakamoto (2008).

permissionless within five years after its launch (see Libra Association, 2019) so that anybody can participate in the process of finding a consensus.

The second major issue, the high volatility of cryptocurrencies, is supposed to be solved by backing Libra by real assets, the so-called "Libra Reserve". The assets will mainly consist of bank deposits and liquid short-term government bonds issued by stable central banks (see Libra Association, 2019). Most of the cryptocurrencies, such as Bitcoin or Ether, which are already traded today, are not backed by any reserves. Therefore, fluctuations in expectations about their long-term price lead to massive changes in the exchange rate of these cryptocurrencies (see Catalini et al., 2019). Hence, speculation, with the risk of massive losses, has been a significant use case of cryptocurrencies.

The funds for the Libra Reserve will be obtained from two different sources. First, the members of the Libra Association have to provide some initial funding of at least 10 billion US dollars. Second, the purchase of a Libra Token by a user leads to an increase in the Libra Reserve. This process is illustrated by an example. Suppose a user buys one Libra Token for 10 euro, which must be backed by a respective amount of the reserve. The user does not interact directly with the reserve but buys the Libra Token from so-called "authorized resellers". It is planned to integrate the resellers into stock exchanges and other institutions. These resellers have previously purchased Libra Tokens from the Libra Association for the corresponding amount of 10 euro. Hence, the amount of Libra Tokens only changes if assets with corresponding value flow into or out of the Libra Reserve (see Catalini et al., 2019).

Note that the user does not receive interest income generated from bank deposits and government bonds. These funds will be allocated to the Libra Association, and they will be used to cover operating costs, keep transaction costs low, and pay dividends to investors (see Catalini et al., 2019).

2.2 Can Libra be seen as money?

After a brief introduction to Libra's concept, in the following chapter, we turn to the economic classification of Libra and discuss the potential of Libra to be considered as a currency and/or money. We argue that the classification of Libra as a currency depends on the underlying definition of a currency. If currencies are defined as legal tender, Libra most likely will not be a currency. If all forms of money in an economy are regarded as currencies, Libra could also be seen as a currency (see Wuermeling, 2018; Seiter, Sandner and Gross, 2019).

Money, in turn, can be defined as "anything, which is generally accepted for the payment of goods and services as well as for the settlement of debts" (Hanl and Michaelis, 2017, p. 363). Economists mainly consider an object to be money when the three functions of money are fulfilled. These are medium of exchange, unit of account, and store of value (see Gischer, Herz and Menkhoff, 2019). In the following, the three functions of money are described, and it is discussed whether Libra might fulfill the three functions of money.

The medium of exchange function describes the advantages of paying goods or services with money compared to paying in kind. Natural resources could be used as money, but they are often difficult to transport (see Gischer, Herz and Menkhoff, 2019). Without money, it is necessary that the preferences of the parties involved complement each other. Otherwise, a transaction cannot take place. If, for example, a baker wants to sell bread and wants to receive clothes in return, then at the same time, a person must be found who wants to consume bread and sell clothes. The use of money as a medium of exchange simplifies the exchange of goods and thus enables the division of labor.

The essential characteristics to be a suitable medium of exchange are divisibility, transportability, and scalability. Existing cryptocurrencies are divisible - Bitcoin, for example, to eight digits behind the decimal point. The transport of cryptocurrencies is also easy: any smartphone can carry out transactions and therefore transfer cryptocurrencies (see Ammons, 2016). However, this can also be seen as an entry barrier that can, in particular, exclude older generations from using cryptocurrencies. Further, existing cryptocurrencies often encounter issues with respect to scalability. For example, Bitcoin is not suitable as a general means of exchange, since the number of transactions per second is currently limited to seven (see Gross, Herz and Schiller, 2019). As previously described, the Libra Association is trying to solve this problem by using a different consensus mechanism. After the launch of Libra, the number of possible transactions per second on the Libra Blockchain is supposed to be 1,000 (see Amsden et al., 2019). This is a significant improvement compared to existing cryptocurrencies. However, traditional payment service providers, such as Visa, support a maximum of 65,000 transactions per second (see Visa, 2019).

The second function of money, unit of account, enables an easier comparison of different products. Without money, the number of relative exchange relations between goods increases rapidly with every additional good. If there are, for example, two goods, only one price is necessary to express the relative prices. If there are three goods, there exist three prices, with four goods, six prices and for 20 goods there already exist 190 prices. In general, for *n* products

$\frac{1}{2} * n * (n - 1)$, relative prices exist. The presence of money reduces this number to $n - 1$ price relations (see Gischer, Herz and Menkhoff, 2019, p.4).

In principle, it is possible to calculate and display prices in cryptocurrencies. Also, it is quite conceivable that members of the Libra Association, in particular, will indicate prices denominated in Libra in addition to the traditional fiat currencies (see Seiter, Sandner and Gross, 2019). The use of already existing cryptocurrencies as a unit of account is usually not reasonable due to the high price fluctuations (see Wanke, 2018; Ammous, 2016). However, this should not be an issue for Libra due to its design as a stablecoin.

The strong price fluctuations also make most cryptocurrencies unattractive as stores of value. Natural resources spoil over time and thus are not proper stores of value. Money, on the other hand, does not spoil. Therefore, transaction partners do not have to consume goods at the same time (see Gischer, Herz, and Menkhoff, 2019). Hence, saving becomes possible as people can shift consumption into the future. Cryptocurrencies do not spoil, as well. The high fluctuations in the price of many cryptocurrencies nevertheless limit their ability to store value as there are high risks of potential losses. Hence, Bitcoin, for example, is often regarded more as an object of speculation than money (see Catalini et al., 2019; Wanke, 2018). Due to its design as a stablecoin, those problems should not arise for Libra.

In summary, Libra might fulfill the means of payment function to a certain extent. The stability of Libra will play a key role by determining whether the function of a unit of account and store of value will be fulfilled. If Libra actually maintains a stable price over time and will be widely accepted as a means of payment, the three functions might be fulfilled. This would make Libra a form of money. Libra's success as a global stablecoin will, therefore, depend to a large extent on its stability. Accordingly, the following analysis focuses on the price stability aspects of Libra.

3 Libra's stability

The Libra Association aims to issue Libra in 2020, thus Libra is currently not traded. The structure of the Libra Reserve is not known yet, however, the whitepaper provides some insights. First, it indicates that the Libra Reserve will be backed "by a collection of low volatility assets, such as bank deposits and short-term government securities [denominated] in currencies from stable and reputable central banks" (Libra Association, 2019, p. 7). Second, only very liquid short-term government bonds with a daily trading volume of at least 10 billion US dollars

will be considered (see Catalini et al., 2019). Third, it is known that the Libra Reserve will mainly contain the US dollar, British pound, euro, and Japanese yen (see Marcus, 2019).

At this point in time, it is not known in which proportions the different currencies will be included. Also, it is not clear whether only these four currencies will back Libra, or whether additional currencies will also be part of the Libra Reserve. Inferences about the stability of Libra are generally speculative. Nevertheless, we provide a first estimate of how stable the price of Libra can be expected to be against other fiat currencies. Our analysis relies on existing financial market products for which historical prices can be analyzed. In a first step, the SDR are used to examine how the price of a basket of currencies has developed compared to various fiat currencies over the past 20 years. In the second step, it is analyzed to what extent the exchange rates of existing stablecoins backed by a currency reserve correspond to the value of this reserve.

3.1 Special Drawing Rights

As indicated above, the Libra Association intends to peg the Libra to a currency basket. Various economists such as Bofinger (2019) and Mayer (2019) compare Libra with the SDR in order to proxy Libra's exchange rate risk.

The SDR consists of a basket of five different currencies. The current composition includes 42% US dollar, 31% Euro, 11% Chinese yuan, 8% Japanese yen, and 8% British pound. The US dollar and the euro are the most significant components and together account for more than 2/3 of its value. It can also be seen that the four currencies mentioned in Marcus (2019) to be the main determinants of the Libra Reserve are included in the SDR. In addition, the Chinese yuan is also part of the SDR's currency basket. The yuan was added in October 2016 and accounts for only about 10% of the value of the SDR. Therefore, the expected currency basket of the Libra Reserve will be similar to the SDR.

Members of the IMF are obliged, within certain limits, to accept SDR and exchange them for their local currency. In return, they can also exchange SDR for the currency of other countries. The composition of the SDR is not permanently fixed but is adjusted by the IMF every five years. The criteria for determining the proportions are the share of total world exports and how widely the currency is used to make payments (see IMF, 2019).

However, there are also differences between the SDR and the anticipated structure of the Libra Reserve. Libra is intended to serve as an everyday means of payment and, in particular, to

facilitate access to the financial system for people in developing countries. The SDR, on the other hand, is not used for daily payment transactions. Also, the SDR is issued by the IMF, a specialized agency of the United Nations. Libra will be governed and issued by an independent association based in Switzerland. Still, most members of the Libra Association, are private non-profit companies. These differences limit the comparability of the SDR and the Libra Reserve. Furthermore, only a historical view of price developments is possible. Price patterns could, of course, change in the future. Nevertheless, the SDR can provide useful information to draw conclusions about the potential stability of Libra since it is the most Libra-like existing financial market product.

3.1.1 Risk measures for industrialized countries

The following analysis distinguishes between industrialized and developing and emerging countries due to the following reasons. First, the currencies of industrialized countries tend to be hard currencies. Hard currencies are easily convertible and highly fungible and can be regarded to be particularly stable in value.

Second, the Libra Reserve will consist of a currency basket, including government securities from stable economies. These are typically issued by industrialized countries, which means that the fluctuations in the price of the currency basket are even lower for people living in the corresponding industrialized countries.

Third, the level of financial inclusion in industrialized countries is significantly higher than in developing and emerging countries. In Germany, for example, 99% of all adults have a bank account, while in Brazil, only 70% and in Cameroon, only 35% (see Demirgüç-Kunt et al., 2018). In order to achieve the primary goal of the Libra project, namely a higher level of financial inclusion, the Libra Association must pay special attention to a relatively high stability of Libra's exchange rate against the currencies in developing and emerging economies.

As a first step, we will analyze how stable the price of the SDR, as a proxy for Libra, has been against currencies of industrialized countries. Figure 1 shows the exchange rate of the SDR against the euro (blue line) and the US dollar (red line) for the period from 1999 until 2019. It can be seen that the price of the SDR fluctuates within a range of about +/- 20% around its price in 1999. In the long-term, both exchange rates are very stable. The value of the SDR, expressed in US dollar, increased only slightly in the last 20 years. During the same period, the SDR depreciated by about 4% against the euro. A different picture emerges with the SDR's exchange rate against the British pound (green line). The SDR has appreciated by more than 30% against

the British pound over the past 20 years. In the short term, however, there are also considerable fluctuations in the value of the SDR expressed in US dollar and euro. Therefore, exchange rate risk can also be expected for Libra.

Figure 1: Euro, US dollar and British Pound exchange rate to SDR (1999=100)

Source: Own representation; Data: Datastream.

Risk measures are reported in Table 1. The exchange rate of the SDR/EUR fluctuates with a standard deviation of around ten euro cents (about 8.3% of the mean). The value of SDR expressed in the US dollar has a standard deviation of about nine dollar cents (about 6.5% of the mean). The standard deviation of the exchange rate SDR/GBP is approximately 10 pence (about 10.4% of the mean). In general, the result is not surprising: the US dollar makes up the largest part of the SDR's value. Accordingly, the exchange rate risk measured by the standard deviation for the US dollar is lower than for the euro and significantly lower than for the British pound.

Table 1: Risk Measures for SDR's exchange rate against selected currencies (industrialized countries)

Risk measure	SDR/EUR	SDR/USD	SDR/GBP
Standard deviation	0.10€ (8.27%)	0.09$ (6.52%)	0.10£ (10.40%)
VaR (95% & 1 Week)	- 1.20%	- 1.01%	- 1.34%
Maximum Drawdown	33.20%	18.97%	18.60%

Source: Own calculation; Data: Datastream.

However, the standard deviation is only suitable as a risk measure to a limited extent because the standard deviation is a symmetric risk measure, i.e., deviations below and above the mean are given equal weights (see Franzen and Schäfer, 2018). The standard deviation can, therefore, be used to quantify to what extent the exchange rates fluctuate over time. In this sense, a low standard deviation can be interpreted as an indicator of stability. However, downward deviations should be treated differently than upward deviations since deviations above the mean represent a financial profit for the holder of the SDR and, therefore, should not be considered as a risk. Downward deviations, on the other hand, represent financial losses and should be interpreted as a risk.

Downside risk measures avoid this issue since they focus on financial losses (downward deviation) and disregard financial profits (upside deviation) (see Franzen and Schäfer, 2018). In finance, the Value-at-risk (VaR) is a popular downside risk indicator. The VaR indicates – for a given probability – how many units an investment might lose in a given period (see Franzen and Schäfer, 2018). Assume that the distribution of returns of an asset is known. Furthermore, it is known that in five of 100 weeks, the price of the asset declines by more than 15 percent. The VaR for a holding period of one week and a 95% confidence level is then 15 percent. Under the more realistic assumption that the distribution of returns is not known, the VaR can be determined by historical returns. After sorting the returns according to their values, the VaR can be determined by looking at the return above the desired threshold. If, for example, 100 historical returns are used, the VaR is the sixth lowest return if a confidence level of 95% is desired. The advantage of using historical data to determine the VaR is that it is not necessary to assume that returns follow a normal distribution (see Franzen und Schäfer, 2018).

The VaR for holding the SDR for one week and a confidence level of 95% provides similar findings as for the standard deviations. The VaR is the lowest for the SDR/USD exchange rate. The SDR lost more than 1.0% against the US dollar in only five out of 100 weeks. This number is slightly higher for the euro (1.2%) and the British pound (1.3%). Accordingly, holding the SDR would entail a slightly higher risk for people in the UK and the euro area. However, note that the size of potential losses is quite small for all three currencies.

The Maximum Drawdown is calculated as a third risk measure. The Drawdown provides information about the maximum price drop. It is defined as the percentage deviation of a price compared to the previous maximum in the period considered. The Maximum Drawdown is often used as a measure to record how high a loss has been in the worst case (see Franzen and Schäfer, 2018).

Analyzing the Maximum Drawdown shows that holding SDR for a longer time was associated with the risk of high losses, especially in the euro area, where the price declined by more than 30%. This can be explained by the continuous appreciation of the euro against the SDR from October 2000 to July 2008 since SDR lost about 1/3 of its value against the euro during this period. Both the US dollar and the British pound have a significantly lower Maximum Drawdown of less than 19%.

To summarize, the following expectations emerge for Libra. First, the price of Libra expressed in the currencies of industrialized countries should stay relatively stable in the long-term, as the exchange rates of the SDR/USD and SDR/EUR are at a similar level as 20 years ago. In the short term, however, the exchange rate can be expected to fluctuate. Under normal economic conditions, however, these fluctuations can be expected to be small. A basket of currencies consisting of hard currencies should maintain a stable exchange rate against other hard currencies. However, these fluctuations might be higher in times of crisis (see Gross, Herz and Schiller 2019). This was apparent in the case of the global financial crisis when, in December 2008, the strongest one-week depreciation of the SDR against the euro occurred, and the SDR lost more than 5% against the euro while the SDR appreciated to the US dollar. Here, a potential risk becomes apparent: In situations where the exchange rate of two currencies included in the currency basket move in opposite directions, it is not possible to ensure stability for both currencies.

3.1.2 Risk measures for emerging and developing countries

As previously stated, the main goal of the Libra Association is to create an infrastructure that enables people a better inclusion in the global financial system. The vast majority of people without access to bank accounts live in emerging and developing countries. We focus on the stability of those countries in this section.

Most people without bank accounts live in India and China. Residents from those countries make up 25% of all people without a bank account worldwide (see Demirgüç-Kunt et al., 2018). Figure 2 shows the exchange rates of the Indian rupee and Chinese yuan to the SDR. It can be seen that the long-term SDR/INR exchange rate cannot be regarded as stable. The Indian rupee has depreciated massively over the past 20 years. Accordingly, the SDR have appreciated by almost 65% against the Indian rupee. The value of SDR expressed in yuan, on the other hand, has fallen by about 15%. The standard deviations for SDR/CNY and SDR/INR expressed as

proportions of the mean, are higher than for the Euro and US dollar analyzed above indicating more fluctuating exchange rates (see Table 2).

Figure 2: Chinese Yuan and Indian Rupee exchange rate to SDR (1999=100)
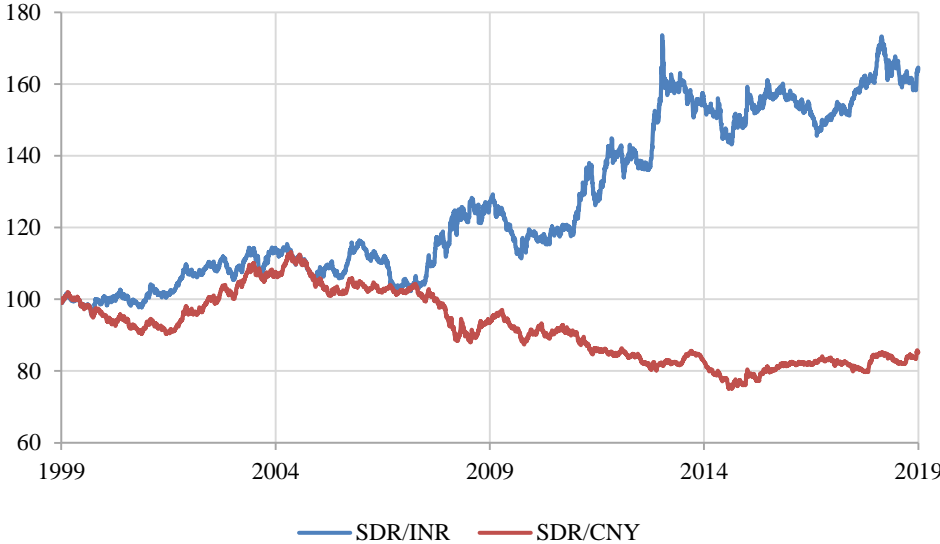
Considering downside risk measures, the findings differ. The VaR for holding SDR for one week and a confidence level of 95% is not higher than for the industrialized currencies discussed in the section above.

Also, the Maximum Drawdown is on a similar level than for the euro and the US dollar. The low maximum loss for holding SDR measured in Indian rupee (17.53%) can again be explained by the fact that the Indian rupee has depreciated significantly. Holding SDR would, therefore, have been particularly attractive for an Indian resident since holding SDR could have served as a protection against the depreciation of the Indian rupee.

Table 2: Risk measures for SDR's exchange rate against selected currencies (China and India)

Risk measure	SDR/CNY	SDR/INR
Standard deviation	1.06¥ (10.19%)	13.18₹ (17.42%)
VaR (95% & 1 week)	- 1.02%	- 1.35%
Maximum Drawdown	33.74%	17.53%

In addition to India and China, Mexico and Brazil are further countries potentially in the focus of the Libra Association: Mexico is one of the seven countries with the most unbanked people,

63% of all adults do not have a bank account. Brazil, with 30% of adults being unbanked, is also a country of high relevance (see Demirgüç-Kunt et al., 2018).

Figure 3 shows the SDR denominated in Brazilian real and Mexican peso. It can be seen that the SDR have also appreciated heavily over the last 20 years against the Brazilian real and the Mexican peso. The price of SDR, expressed in pesos or real, has more than doubled over this period. For the inhabitants of these countries, holding the SDR could have served as protection against depreciation, as well.

Figure 3: Brazilian Real and Mexican Peso exchange rate to SDR (1999=100)
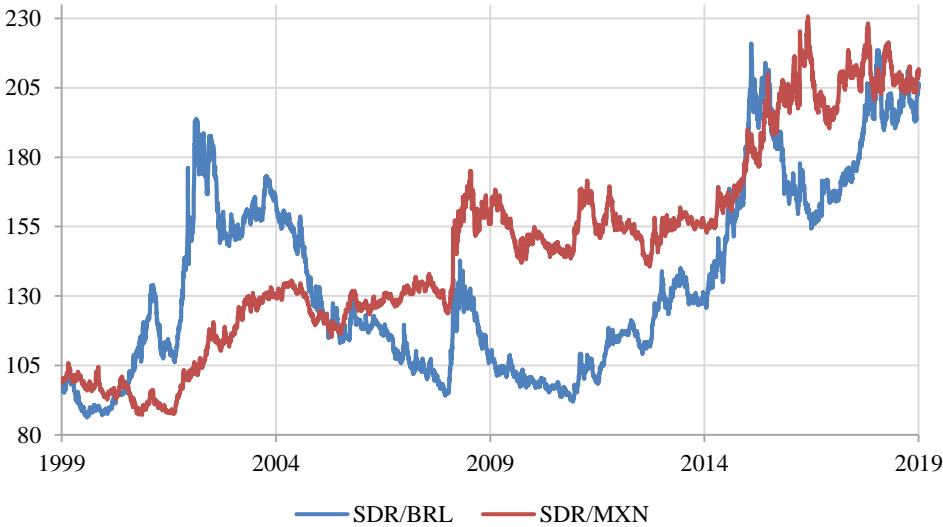
Source: Own representation; Data: Datastream; www.investing.com.

A look at the risk measures in Table 3 reveals, however, that holding the SDR in these countries would have entailed a significantly higher risk than in the countries previously considered. First, standard deviation is significantly higher than in the previous cases exceeding 20%. Furthermore, the VaR for a holding period of one week and a 95% confidence interval is higher than 2% for both countries and thus above the values previously observed. Furthermore, with regard to the Maximum Drawdown, the Mexican peso is on a similar level as the Indian rupee. The Maximum Drawdown for holding SDR against the Brazilian real is higher than 50% and, therefore, above the values of the other currencies.

The higher short-term exchange rate risk inferred above could, therefore, pose a problem for the Libra Association's goal of creating a stable cryptocurrency that significantly increases financial inclusion in emerging and developing economies.

Note that many counties with a high degree of financial exclusion such as the Côte d'Ivoire, Gabon, Bulgaria, Lebanon do often have a fixed exchange rate against the euro or the US dollar (see Martínez-Zarzoso, 2017). Not surprisingly, an analysis of these exchange rates yields results similar or equal to those of the SDR/EUR and SDR/USD exchange rate. It can, therefore, be expected that the exchange rate risk associated with holding Libra will be on a similar level for inhabitants of these countries as it is for inhabitants of the euro area or the US.

Table 3: Risk measures for SDR's exchange rate against selected currencies
(Mexico and Brazil)

Risk measure	SDR/BRL	SDR/MXN
Standard deviation	0.91 R$ (25.11%)	4.61 Mex$ (24.39%)
VaR (95% & 1 Week)	- 2.90%	- 2.10%
Maximum Drawdown	52.51%	19.70%

Source: Own calculation; Data: Datastream; www.investing.com.

To summarize, it can be expected that the value of Libra against the currencies of industrialized countries will remain relatively stable in the long-term. In the short term, however, there will be fluctuations that cannot be ignored, and which could lead to considerable changes in the value of Libra, especially in times of crisis. The actual target group of the Libra Association, people without bank accounts, live primarily not in industrialized countries but in developing and emerging countries. It cannot be expected that the exchange rate of Libra against the relevant local currencies will be stable in the long-term as for all considered cases, except China, the exchange rate of the SDR appreciated significantly in the last 20 years. Holding Libra may be of interest to people in these countries, as it protects against devaluation of the domestic fiat currencies. However, more significant fluctuations in Libra's exchange rate against these currencies could emerge. Therefore, the risk of loss will be higher for people living in these countries than for people living in the US or the euro area.

3.2 Existing Stablecoins

So far, our analysis focused on the expected stability of the Libra Reserve. However, the fundamental question arises whether Libra will be traded at an identical value or close to the value of the Libra Reserve (at par). In the following, existing stablecoins are addressed to analyze the question.

The largest cryptocurrency backed by fiat currency is Tether. Tether has been introduced in February 2015 and aims to trade at a ratio of 1:1 with the US dollar. The same applies to the

TrueUSD Token, which has been introduced in March 2018. According to their own information, both are backed exclusively by US dollar reserves to 100% (see Voshmgir, 2019). Stasis has issued the Stasis Euro[6], a stablecoin fully backed by euro reserves. Unlike Libra, the mentioned stablecoins are not pegged to a currency basket, but only to a single currency. Still, the mentioned stablecoins can provide useful information about factors leading to discrepancies between the value of the Libra Reserve and the actual exchange rate of Libra.

3.2.1 Historical price developments of stablecoins

The analysis of stablecoins is simplified by the fact that the reserve of the mentioned stablecoins consists only of one currency. If the exchange rate between one of the stablecoins and the euro or US dollar differs from one, the value of the stablecoin does not reflect the value of the reserve, assuming the reserve is fully backed by fiat currencies. Figure 4 shows the historical development of Tether (USDT) and TrueUSD (TUSD) exchange rates. It can be seen that the targeted exchange rate of 1 is both exceeded and undercut within a range of about +/-9%. The first four trading days of Tether can be seen as an exception on which the price for a Tether Token fluctuated between 1.21 US dollars and 0.60.[7]

Figure 4: USDT and TUSD exchange rate against the US dollar
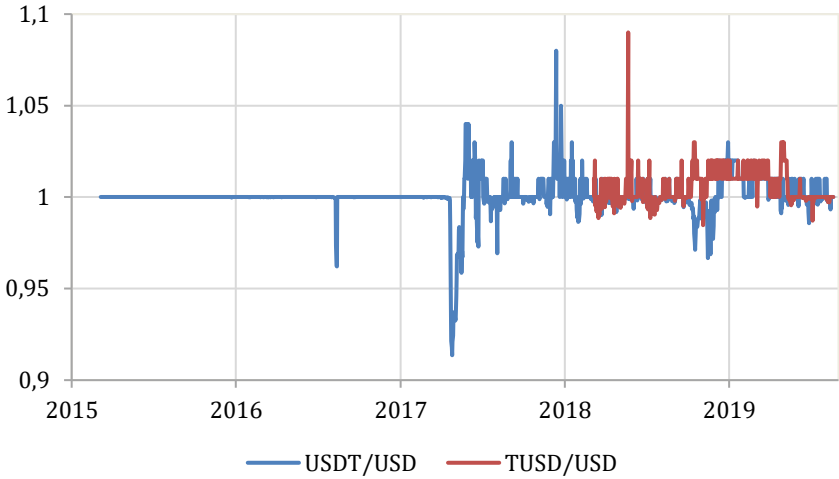
Source: Own representation; Data: www.coinmarketcap.com.

However, it should also be noted that after the first four days of trading, the exchange rate of Tether almost exactly reflected the value of the reserve for more than one year. The USDT/USD

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[6] Due to the lack of reliable data about the exchange rate between euro and Stasis euro we did not further analyze the Stasis euro. However, it can be noted that the targeted exchange rate is exceeded and undercut within a similar range as Tether and TrueUSD.

[7] Those days were excluded, from the following calculations and Figure 4.

exchange rate never deviated noticeably from 1 until 10 August 2016. Since the introduction of TrueUSD in March 2018, it has not been traded below 0.98 TUSD/USD. Overall, both stablecoins fluctuate with a standard deviation below 1.2 dollar cents. However, the main finding is that there are considerable deviations between the price of the stablecoin and the price of the underlying reserve assets.

3.2.2 Explanations for the deviations

Figure 4 shows that the price of fiat-backed stablecoins does not necessarily reflect the value of the underlying reserve. Historical data reveals deviations for existing stablecoins from its reference value. Thus, it is essential to analyze which mechanisms cause these deviations and whether it can be expected that they will also occur for Libra.

If it was certain that a stablecoin can always be exchanged exactly at the value of the reserve, arbitrage transactions would compensate high price fluctuations. If, for example, the price of a Tether Token was 0.95 US dollars, users would buy Tether and would sell it for the price of 1 US dollar. The demand for Tether would rise until the exchange rate has stabilized at 1.[8]

Downward deviations can be explained in case of perceived risk of default. If there is a reason to suspect that the stablecoin cannot be converted back into the corresponding fiat currency for any reason, the price of this cryptocurrency could drop, reflecting this risk. One example would be the suspicion that the stablecoin is actually not fully backed by the reserve. The most significant drop in the exchange rate between Tether and the USD in April 2017 can be explained by a decrease in trust. At that point in time, it became public that international transfers of the Tether Reserve from Taiwan were blocked (see Suberg, 2017). This led to doubts about whether the promised exchange between Tether and US dollar could be realized, leading to a depreciation of Tether.

It should be noted that there is and has always been distrust about the Tether Reserve. In April 2019, it even became public that Tether is backed by US dollars only up to 74% (see Kharif, 2019). However, this rumor has never been confirmed by officials. Here, trust is an essential element. At this point, it can only be speculated whether customers will trust the Libra Association and, thus, also the Libra Reserve. On the one hand, one could assume that the founding members have significantly more know-how, capital, and power than the companies issuing the previous stablecoins. Proponents could then argue that this will lead to a higher level

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[8] This example abstracts from transaction fees. They are also a possible reason why the exchange rate could fall below 1.

of trust and fewer fluctuations accordingly. On the other hand, Facebook is mainly associated with the Libra Association, and Facebook is repeatedly involved in data scandals, which could undermine trust in the Libra Association. It is quite conceivable that even if Libra is 100% backed by the Libra Reserve, such scandals could lower the exchange rate of Libra below the reference value.

The default risk identified as a key driver of changes in the exchange rate cannot explain a price increase above the reference value. In case of an exchange rate higher than 1, people must be willing to pay an additional premium that exceeds the value of the reserve. Which factors could justify such a premium? Despite the (small) fluctuations in the price of stablecoins, they are significantly less volatile than other cryptocurrencies not designed as stablecoins. Accordingly, Tether is used in particular to carry out hedging transactions. Hedging mainly takes place in times when prices of other cryptocurrencies drop significantly (see Martínez, 2018). If the demand for Tether increases, and there are shortages in the supply of Tether, users must purchase Tether from other users. In this case, users could be willing to pay a premium on the value of the reserve, at least as long as this premium is below the expected losses of the other cryptocurrencies. Note that some crypto exchanges, such as Coinbase, offer free transactions from one cryptocurrency into another cryptocurrency, such as Tether. Transactions between a cryptocurrency and a traditional fiat currency, on the other hand, are usually charged with transaction fees.

It can be assumed that incentives to pay such a premium could also arise for Libra. As an example, in case of the expectation of the massive depreciation of a fiat currency, holding Libra will become much more attractive. Accordingly, it seems plausible that users could be willing to pay a premium that exceeds the value of the reserve. The two reasons discussed above, the risk of default and hedging as an incentive to pay a premium, should not be seen as complete. There may be further factors that could cause the price of the stablecoins to fluctuate. For example, it is speculated that Tether was used to manipulate the prices of other cryptocurrencies, which could also have an impact on the price of Tether (see Griffin and Shams, 2018).

To summarize, price fluctuations of stablecoins can primarily be explained by perceived risks of default and a premium on the price of the underlying reserve. Deviations below the reference price are likely to occur if trust in the Libra Association decreases. Possible reasons for this are doubts about whether Libra is indeed fully backed, but also regulatory restrictions with regard to the use of Libra or reports on data scandals. Also, a premium above the value of the Libra

Reserve is possible. A premium could e.g. be driven by the fact that Libra could be used for hedging and has further advantages as compared to other stablecoins, e.g., it will be possible to introduce and conduct smart contracts via Libra.

4 Conclusion

The Libra project is undoubtedly ambitious and might transform the worldwide payment sector if Libra will be introduced. Before Libra can be launched, some fundamental questions have to be addressed: among others, the composition of the reserve, the infrastructure of authorized resellers, and regulatory compliance. As the stability of Libra is essential for mass adoption, this paper provides insights into the expected stability of Libra based on the performance of similar financial products such as the SDR, Tether, and TrueUSD. We analyzed whether Libra can be expected to maintain a stable exchange rate against conventional fiat currencies using the SDR and existing stablecoins as proxies. Analyzing time series over the past 20 years revealed that the exchange rate against the euro and the US dollar has been relatively stable. In the short term, however, there have been considerable fluctuations, especially in times of crisis such as 2008.

However, the target group, people without adequate access to financial services, mainly live in developing and emerging countries. Over the past 20 years, the SDR have appreciated substantially against currencies used in developing countries, offering proper protection against devaluation of the domestic currency. However, the risks of financial losses were in most cases also higher. Therefore, it can be expected that holding Libra will be riskier for its target group, people in developing and emerging countries, in the short run and beneficial in the long run.

The analysis of existing stablecoins shows that the exchange rate of Libra cannot be expected to be solely determined by the value of the Libra Reserve and thus by the reserve currencies. We identified two factors, why the price of Libra might diverge from the value of the Libra Reserve: Firstly, default risks perceived by users could lead to downward deviations from the value of the reserve. Secondly, incentives to use Libra for hedging transactions could lead to deviations above the value of the reserve.

This paper provides first insights into the expected stability of Libra, which is proxied by the SDR. As soon as the actual composition of the Libra currency basket is revealed, future research can focus on analyzing stability for the actual composition of the Libra Reserve to get more precise insights into expected price developments of Libra measured in various fiat currencies.

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