

Financial and monetary stability aspects of global stablecoins

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Abstract

Global stablecoins (GSCs) like Facebook's Libra could prove much more instable than they might appear at first sight. Not only can their exchange rates against individual fiat currencies fluctuate substantially; theoretically, they also have the potential to replace national currencies, constitute "digital currency areas" and become the basis of a two-tier banking system with one and more GSC issuers, on the one hand, and, on the other hand, commercial banks that can create GSC deposit money. Against that background, all steps taken so far by supervisors and central banks can only be the starting point of what is necessary to effectively regulate the new normal of the world of money that is emerging.

Globale Stablecoins: Aspekte der Finanz- und Währungsstabilität

Globale Stablecoins (GSCs) wie Facebooks Libra könnten sich als wesentlich instabiler erweisen als ihr Name verspricht. Ihr Wechselkurs gegenüber den einzelnen Fiatwährungen könnte nicht nur erheblich schwanken; theoretisch haben sie auch das Potenzial, nationale Währungen zu ersetzen, sich zu digitalen Währungsräumen zu entwickeln und die Basis eines zweistufigen Bankensystems mit einem oder mehreren Emittenten von Stablecoins auf der einen und Stablecoins schöpfenden Geschäftsbanken auf der anderen Seite zu werden. Vor diesem Hintergrund können die bisher von Aufsichtsbehörden und Zentralbanken ergriffenen Maßnahmen nur der Beginn all dessen sein, was notwendig ist, um die sich abzeichnende neue Welt des Geldes effektiv zu regulieren.

Keywords: Stablecoins, Libra, Crypto-Assets, Virtual assets, Blockchain

JEL Classification: E42, F65, G28, K24

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I. Introduction

By announcing the introduction of its global stablecoin (GSC) “Libra” last summer, Facebook has sparked an intensive and still ongoing debate among economists, regulators and central bankers about the pros and cons of that move and about how governments should react to it. This debate gained new momentum, when the Libra initiators presented a revised concept – called “Libra 2.0” – in April 2020 (*Libra Association* 2020).

The contributions made so far cover a wide spectrum of Libra-related issues, ranging, among other things, from micro-regulation (Know Your Client rules, anti-money laundering, consumer protection etc.) and technological questions (e.g., which type of blockchain Libra is based on) to competition policies (regarding the rising market power of social networks) and macroeconomic considerations.

The article at hand focuses on the latter. It provides an overview of the monetary-policy and financial-stability aspects of GSCs. For the sake of our analysis, we broadly define a global stablecoin as a token issued in exchange for fiat money which the GSC issuer invests in short-term debt securities denominated in a basket of the most prominent global fiat currencies.² In addition, we assume the GSC to be issued by a large tech company with a far-reaching market penetration.³ This makes it realistic to assume that consumers and businesses worldwide quickly and comprehensively accept the new payment tool. Our stylized GSC is clearly based on the initial Libra concept (“Libra 1.0”). However, our analysis applies to all kinds of GSCs that are directly (like Libra 1.0) or indirectly (like Libra 2.0) backed by a basket of safe assets that are denominated in various currencies.

Our article is structured as follows: Chapter 2 briefly describes how Facebook’s Libra sparked academics’ and regulators’ interest in stablecoins. Chapter 3 provides for a survey of the literature on the macroeconomics of global stablecoins. Chapters 4 and 5 then aim at challenging two major propositions that are often put forward regarding the pros and cons of GSCs: First, according to GSC proponents, GSCs are stable because they are backed by a fiat-money reserve: “As long as the Libra Association backs each Libra coin with an identical pool of safe and liquid assets, its value should be stable” (*Claeys/Demertzis* 2019,

² See *European Central Bank* (2019) for a brief overview of the terminological basics of the concept of stablecoins and *Copeland* (2019) for the distinction between the definitions of global stablecoins, central bank digital currency and single hegemonic currencies.

³ For a comprehensive overview of efforts made by big corporations, see *Bilotta/Botti* (2019), pp. 2-10.

p. 93). In chapter 4, we challenge this proposition by undertaking a simple simulation that demonstrates the exchange rate risk inherent to the reserve. Second, GSC sceptics emphasize the risk that a GSC could lead to a massive disintermediation of the financial system and thereby make it unstable. In chapter 5, we focus on a potential development that is quite often being neglected in that context and show that a GSC could not only affect disintermediation, but also lead to new forms of intermediation because profit-oriented banks increasingly see the potential of providing GSC deposit accounts and of granting GSC loans.⁴ This again would trigger macroeconomic risks traditionally associated with the money creation process (runs on commercial banks, boom and bust-cycles etc.). Chapter 6 summarizes the findings.

II. Facebook's Libra as a catalyst for the academic and regulatory engagement in stablecoins

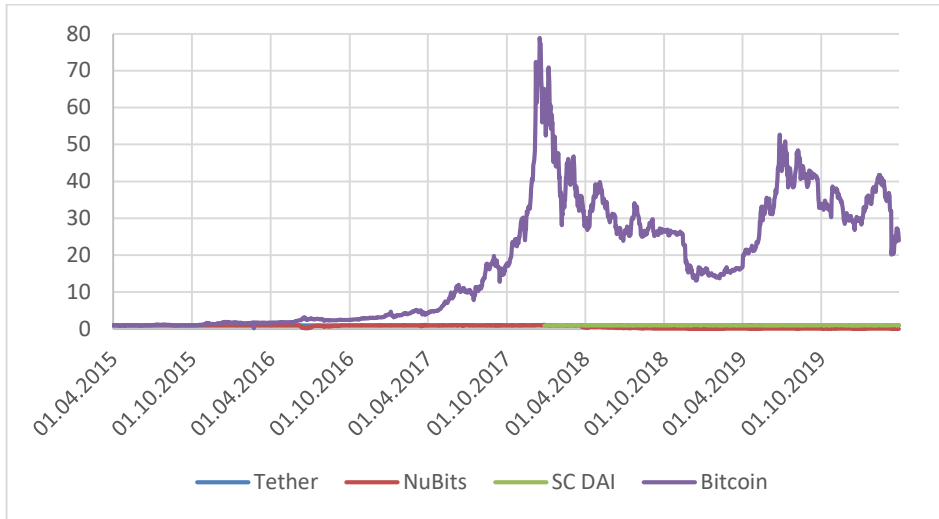
The development of so called “stablecoins” was a market reaction to overcome the significant volatility seen in the price of crypto-assets like the Bitcoin and Ethereum. The term “stablecoin” denotes crypto-assets that are supposed to have a stable value over time (see our definition above).⁵

There are already more than 50 active stablecoin initiatives worldwide. Tether was the first stablecoin issued (in 2014) and is currently the largest in terms of market capitalisation.⁶ Figure 1 compares the relative price development of the stablecoins Tether, NuBits and Single Collateral DAI relative to Bitcoin in the past 5 years.

⁴ *G7 Working Group on Stablecoins* (2019) dedicates only a footnote (No 16, p. 13) and a distinct hint (p. 15) at this topic, stating: “Of course, banks may in the future offer deposit products (and even credit) denominated in the GSC. This could mitigate the decline in deposits, but may lead to new forms of foreign exchange risk and operational dependencies.”

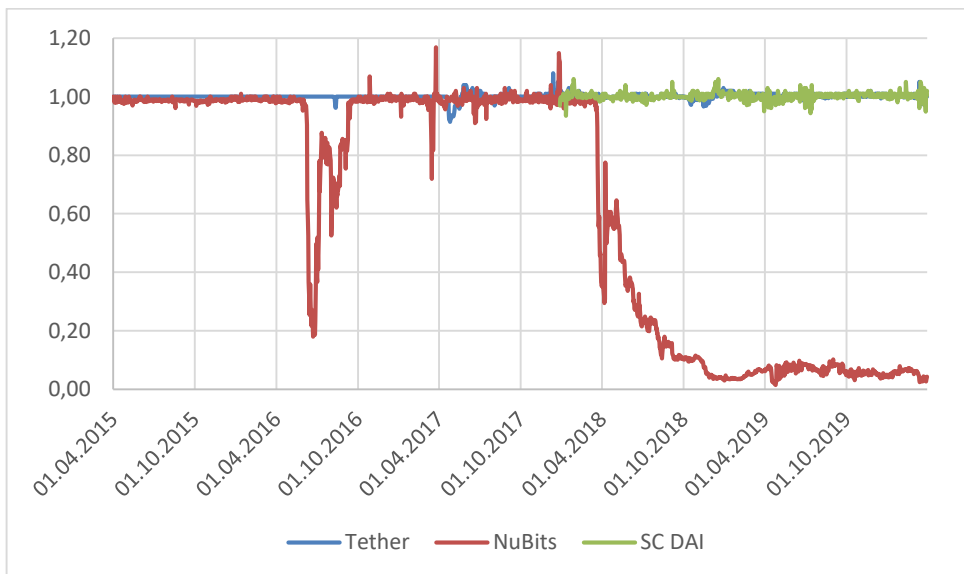
⁵ See *ECB Crypto Asset Task Force* (2019), p. 14 and *Bullmann/Klemm/Pinna* (2019), p. 10 and *European Central Bank* (2019), pp. 2-3

⁶ See *European Securities and Markets Authority* (2020), p. 39.



*Figure 1: Price development of stablecoins compared to Bitcoin
(Own calculations with data from coinmarketcap.com)*

Figure 2 shows a close-up of the price development of the stablecoins only.



*Figure 2: Price development of stablecoins
(Own calculations with data from coinmarketcap.com)*

Until the summer 2019 stablecoins slowly started drawing attention of researchers and central banks, particularly in conjunction with the topics of central bank digital currencies, digital money and cross-border payments.⁷ This changed very suddenly with the announcement of the Libra initiative sponsored by the Facebook group on 18 June 2019.

⁷ See Mancini-Griffoli et al (2018), Duffie (2019), International Monetary Fund (2018a), Adrian/Mancini-Griffoli (2019) and ECB Crypto Asset Task Force (2019), all published prior to 18 June 2019.

The planned Libra stablecoin, governed by the non-profit organization Libra Association, based in Geneva, Switzerland, was deemed to go live sometime in 2020. Calibra, a subsidiary of Facebook, is one of the founding members of the association.⁸ The project was described in a white paper by the Libra Association and technical papers by Calibra staff, all posted on the website libra.org.⁹

The Libra project immediately became topic of interest for academics across the globe (see section III.). Due to the large user base of the Facebook group (Facebook, Messenger, WhatsApp, Instagram) with more than 2 billion users, the initiative also attracted the attention of central banks, regulators and international organizations looking after the stability of the financial system. For example, the Libra announcement in June 2019 moved the global stablecoin topic right at the top of the agenda of the Group of Seven (G7). The G7 Finance Ministers and Central Bank Governors agreed at their meeting in Chantilly on 17-18 July 2019, that stablecoins and other products being developed raised serious regulatory and systemic concerns. Stablecoin initiatives and their operators would have to meet the highest standards of financial regulation in order to go ahead without affecting the stability of the financial system. Facebook's project, the big elephant in the room, is not mentioned in the written announcement.¹⁰ The G7 presidency set up the new G7 Working Group on Stablecoins. This group was tasked with examining the challenges, risks and benefits that global stablecoins may pose. The group is composed of senior officials from the G7 central banks as well as the International Monetary Fund (IMF), the Bank for International Settlements (BIS) and the Financial Stability Board (FSB).

In September 2019, the governments of France and Germany went a step further compared to the G7, by issuing a joint written statement explicitly warning against the Libra project. In their opinion the Libra blueprint provided failed to convince that risks identified by the G7 would be properly addressed. Paris and Berlin took the view, that no private entity should claim monetary power, which is inherent to the sovereignty of nations.¹¹

At the G7 meeting in Washington in October 2019, the G7 Finance Ministers and Central Bank Governors welcomed the report "Investigating the impact of global stablecoins"

⁸ See *European Securities and Markets Authority* (2019), p. 34.

⁹ See *Libra Association* (2019), *Amsden et al* (2019), *Catalini et al* (2019).

¹⁰ See *G7 France* (2019b), pp. 2-3.

¹¹ See *French Ministry of Economy / German Ministry of Finance* (2019).

submitted by the G7 Working Group on Stablecoins.¹² The report lists challenges and risks of stablecoins for public policy, oversight and regulation regardless of scale as well as inherent in potential global stablecoins. Stablecoins have implications ranging from anti-money laundering efforts across jurisdictions to operational resilience, consumer/investor and data protection, and tax compliance. For the subgroup of global stablecoins (GSC), which build on an existing customer base (e.g. Libra), some risks might get amplified and new risks arise. GSC could also pose challenges to competition policy, financial stability, monetary policy and, in the extreme, the international monetary system.

Since the publication of the G7 report, significant regulatory work on GSC has been carried out by the Group of Twenty (G20), several international standard-setting bodies (including FSB, Financial Action Task Force, International Organization of Securities Commissions) and the institutions of the European Union. This work includes setting up dedicated working groups, issuing warning statements, running consultation processes, updating standards and drafting new recommendations. The initiators of Libra have reacted to these concerns and presented a revised concept – called “Libra 2.0” – in April 2020, simultaneously resubmitting an application for a payment system license with the Swiss Financial Market Supervisory Authority (FINMA) under Swiss law. Yet while the Libra Association’s new white paper addresses some points of criticism and even offers an adjusted design of its coin, the main questions – especially those regarding the consequences a truly global stablecoin could have for the international monetary order – still remain unanswered. The following section III therefore provides for an overview of the literature that deals with the macroeconomic effects a global stablecoin could have.

III. The macroeconomics of global stablecoins: a brief survey of the literature

We start our analysis of the macroprudential risk aspects of GSCs with a brief overview of the relevant literature. In doing this, we try to avoid a mistake that is sometimes made in public discourse, namely the lack of differentiation between the macroeconomics of Bitcoin-like crypto-assets and Libra-like stablecoins. For a macroeconomic and financial stability analysis it makes a substantial difference whether “money” is being created algorithmically as a type of a fiat crypto-currency or, in the GSC case, simply represents a

¹² See *G7 France* (2019c), p. 1.

token for fiat money deposited beforehand. Therefore, insights gained with respect to the economics of crypto-assets can sometimes, but certainly not always, be transferred to stablecoins. E.g., when it comes to the transmission of risks from the sphere of digital money to the real economy, crypto-assets and GSCs share several, but definitely not all channels (*G7 Working Group on Stablecoins* 2019, p. 14).

In general, there are two main differences between the two kinds of digital “money”, which refer to the flexibility of the supply of crypto-assets versus that of stablecoins, and to their respective influence on the financial markets: First, whereas the quantity of “money” is restricted in the crypto-asset case (depending on an underlying algorithm), it is demand-driven in the stablecoin case. The inflexibility of the supply of crypto-assets makes them vulnerable when sharply rising demand directly pushes the crypto-assets’ price up.¹³ Second, GSCs directly affect markets of short-term debt and foreign-exchange markets of the reserve currency countries, whereas crypto-assets exert a more indirect influence on financial markets. Rising or falling demand for a GSC directly results in rising or falling demand for the reserve-stock assets. In contrast, the demand for a crypto-asset does not directly affect other financial market variables.

Table 1
Estimates of the global demand for Libra

Source	Estimate
<i>Blummer</i> 2019	150-170 bn USD
<i>Brühl</i> 2020	Annual Libra demand of 600 bn USD
<i>Demary/Demary</i> 2019	240 bn USD
<i>Groß et al.</i> 2019	250 bn USD
<i>Handelsblatt</i> 2019	100 to 500 bn USD
<i>Sandner</i> 2019	250 bn USD (up to 5 trn USD)
<i>Adachi et al.</i> 2020	153 bn USD (up to 3 trn USD)

The degree of influence a GSC can have on the economy and on global financial markets is a function of the global level of acceptance the GSC can be expected to gain. The latter is being discussed at least since Facebook unveiled its plan to launch its GSC called Libra

¹³ See *Baur/Hoang* 2020 for some interesting considerations regarding the changes in prices of crypto-assets and GSCs, respectively.

(*Financial Times* 2019). Economists, regulators and political commentators see the imminent danger that a new “big fish” called GSC could become a dominant actor in the limited global “pond” of short-term debt, which would aggravate the global shortage in safe assets (Caballero/Farhi/Gourinchas 2017; G7 Working Group on Stablecoins 2019). Preliminary estimates of the quantitative importance of the Libra reserve, which were made after Facebook announced its respective plan last summer, range from lower three-digit billions to trillions of USD.¹⁴

Zetzsche et al (2019, p. 15-16) convincingly make the point that a GSC like Libra has a massive potential to disrupt established banking in the developed world. They present two arguments to support this claim: First, according to their analysis, the future of finance will be “datafied.” In this specific, but very probable scenario, data giants like Facebook operate with a tremendous competitive advantage. Second, a GSC like Libra would thrive on the tremendous positive network externalities Facebook is constantly creating with its subsidiaries WhatsApp and Instagram. This could be the basis for providing highly profitable savings and loan products that are tailored to specific customers on the basis of massive quantities of data gathered from these customers’ user behavior in the world wide web.

This article is based on the premise that a GSC could combine features of a payment product, an investment vehicle, a currency and an infrastructure for sending money (Bilotta/Botti 2019; Zetzsche et al. 2019)). The implementation of such a GSC would finally lead to an entirely new financial ecosystem. Against that background, Zetzsche et al. 2019 (p. 21) come to the following conclusion: If a GSC like “Libra becomes the coin of fashion among Facebook and WhatsApp users around the world, numbers in the trillion USD range are possible.” Yuebao, the money market fund of Ant Financial, the subsidiary of the Chinese online giant Alibaba, is an example for the disruptive potential a new financial product can have in this context, and it has in fact become the biggest money market fund worldwide.¹⁵ And indeed a GSC can be seen as a money market fund, because like a money market fund, a GSC allots shares (=coins) to investors (=future holders of the coin) against fiat money and it invests the raised sums in short-term interest-bearing papers and bank deposits. Although a number of differences between money market funds and GSCs do

¹⁴ For a model-based assessment of the global demand for basket-based stablecoins, see Baughman/Flemming 2020.

¹⁵ See Zhang, L./Chen, S. (2019), p. 13 and Xie, S. (2019).

exist¹⁶, money market funds and GSCs are very similar with regard to the market risk they carry.¹⁷

For the following considerations we assume that a GSC gains widespread acceptance across developing as well as industrialized countries (*Claeys/Demertzis* 2019, pp. 91/92). Technical problems of a GSC platform could then delay or disrupt payments for hundreds of millions of users and thereby compromise the functioning of markets for goods and services. The assumed high extent of market penetration would generate a new dimension not only of a too-big-to-fail, but also of a too-connected-to-fail problem (*Zetzsche et al.* 2017; *Zetzsche et al.* 2019, p. 21-22). Fluctuations in the value of the GSC would produce wealth effects and thereby influence the consumption patterns of private households holding savings denominated in the GSC. On the debtor side, higher GSC values could make it more difficult for GSC-indebted banks, firms and households to afford interest and loan redemption payments, which would again impact their consumption and investment patterns (*G7 Working Group on Stablecoins* 2019, p. 14).¹⁸

As Brühl 2020 (p. 61) points out, a GSC's value, as is represented by its exchange rate, is a function of both the price of the reserve assets and the (relative) exchange rate developments of the fiat currencies the GSC reserve is invested in.¹⁹ If the prices of the reserve-stock assets fall, it becomes difficult for the GSC provider to guarantee the value of the GSC. In the opposite case, if the value of the reserve stock rises, the value of the GSC rises accordingly. Both cases could trigger speculative buying or selling of the GSC, which would translate into in- or deflationary price movements in the reserve assets as well as in hefty repercussions in the foreign exchange markets. Deflationary effects are more critical, because they could raise suspicion that the GSC issuer might not be able to redeem the GSC holders as expected.

The resulting possible run on the GSC would then imply the need for the GSC issuer to exchange large quantities of GSCs against fiat money, which would have to be generated by divesting reserve assets, i.e. short-term bonds and bank deposits. This could induce a downward spiral beginning with a loss of confidence in either the GSC and/or the GSC's

¹⁶ See *Schmeling* (2019), p. 6.

¹⁷ For a critical appraisal of Facebook's Libra as an exchange-traded money market fund, see *Vasudevan* (2020, p. 21).

¹⁸ For an in-depth analysis of the emergence of GSC-denominated savings and loan products, see below.

¹⁹ For an analysis of the effects of relative exchange rate movements, see below.

reserve assets and leading to widespread redemptions of GSCs and sales of reserve assets at fire sale prices, which would reinforce the loss of confidence in both the GSC and in the value of its reserve assets. Regardless of the true quality of the reserve assets, the resulting panic would affect the short-term debt markets of the reserve currency countries at full tilt (*G7 Working Group on Stablecoins* 2019, p. 13).

The consequences for central banks and their monetary and exchange rate policies are another widely discussed topic in the literature on GSCs. On the one hand, referring to the currency competition literature (*Brunnermeier et al.* 2019b, pp. 7-18), one could argue that the emergence of a readily available and easy-to-handle digital alternative to traditional fiat money could have a disciplining effect on monetary policy makers around the world. On the other hand, the widespread use of a monetary substitute and the potential disintermediation of financial systems could limit the central banks' ability to implement monetary policy (*Brühl* 2020, p. 60; *G7 Working Group on Stablecoins* 2019, p. 15-16). Thus, the more popular the GSC becomes, the more difficult it becomes for central banks and financial regulators to provide for safe and stable financial and monetary systems – thereby, ironically, the GSC would damage the stability of its own reserve fund.

When it comes to assessing the extent to which currency substitution could affect different countries, low-income countries with weak monetary institutions come to mind. In addition to this weakness, these countries often lack a basic payment infrastructure, which makes a user-friendly stablecoin even more attractive. More importantly even, low-income countries tend to be the destination of massive remittance payments, which are predestined to be operated through the network of a GSC issuer.²⁰ Against the background of the presumed high popularity of GSCs in developing countries and emerging markets, GSCs could be used to bypass capital controls. If the custodians of the GSC wallets are located outside the respective countries, those countries would suffer from a fiat drainage (*Zetsche et al.* 2019, p. 23-24). Or, to put it as bluntly as the *G7 Working Group on Stablecoins* (2019, p. 14): "...GSCs may serve as a highway for capital outflows."

Insofar as the GSC becomes a dominant payment instrument and forms an entirely new financial ecosystem, as described above, buyers and sellers are likely to be increasingly willing to hold the GSC in their wallets in order to make future payments more convenient

²⁰ For a detailed consideration of the importance a GSC can have for remittances, see *Kulkarni et al.* (2020).

(in the sense that they do not need to change their home currency into the GSC each time they wish to make a purchase). Thereby, this specific form of digital dollarization will expand beyond the traditionally dollarized low- and middle-income countries and encroaches upon high-income countries. Here, we have to differentiate between high-income country currencies that are part of the reserve stock and those that are not. In the former, people will probably change fiat money into GSC, and the GSC issuer will then use the funds received to buy reserve assets denominated in the reserve stock currencies. The immediate consequences for foreign exchange markets would be limited. In contrast, in non-reserve-currency countries, people change their domestic fiat money into one of the reserve-stock currencies in order to buy GSCs afterwards. The GSC issuer then buys reserve-stock assets denominated in the reserve stock currencies. Summing up, reserve-stock currencies are likely to appreciate, whereas the other currencies will probably depreciate.

Apart from such considerations focusing on international economics, a GSC with widespread popularity could also have significant repercussions in the domestic setting of a closed economy (*G7 Working Group on Stablecoins* (2019, p. 13-14). Retail deposits at banks may decline, thereby increasing these banks' dependence on costlier and more volatile sources of funding, including wholesale funding. In those countries whose currencies are part of the reserve, the GSC issuer will reinvest a part of deposits into domestic bank deposits. This implies that some banks may have larger wholesale deposits from stablecoin issuers than small retail deposits from individual customers. In addition, if new financial intermediaries in the GSC ecosystem gain a significant share of financial intermediation activity, this could further reduce bank profitability, potentially leading banks to take on more risks or to reduce lending to the real economy. This is likely to especially affect smaller banks and banks in countries with non-basket currencies.

IV. How stable can a global stablecoin be as a “currency”? Some basic considerations

1. Determining changes in the GSC exchange rate

Based on the GSC specifications introduced above, a global stablecoin can be interpreted as a currency board. Both GSCs and currency boards are geared to achieving exchange rate stability. Yet while a traditional currency board fixes the value of one currency against

another, the value of the GSC as we define it is being fixed against a currency basket.²¹ This design resembles a multi-currency reserve system like the IMF's Special Drawing Rights (SDR) rather than a traditional currency board.²² Hence, like the SDRs, GSCs do not guarantee a fixed value against one specific currency, but against the basket. Consequently, the GSC exchange rates of all fiat currencies fluctuate constantly.²³ This phenomenon can be observed on the IMF website, where the respective SDR exchange rates of most of the world's fiat currencies are documented on a daily basis.²⁴

A simple example may clarify this basic mechanism (Table 2). Imagine the exchange rates between three currencies A, B and C are as follows: One A equals ten Bs, one B equals ten Cs and, accordingly, one A equals one hundred Cs. We further assume that initially one unit of the GSC is backed by a reserve basket consisting of 1 A, 10 Bs and 100 Cs. Thus, an inhabitant of country A, B or C must put up the equivalent of 1 A, 10 Bs and 100 Cs calculated in units of his domestic currencies. That means that an inhabitant of country A needs 3 As to buy one GSC unit; an inhabitant of country B needs 30 Bs to buy one GSC unit, and, finally, an inhabitant of country C needs 300 Cs to buy one GSC unit.

Table 2

Stylized GSC with three-currency-basket reserve stock, initial bilateral exchange rates

Reserve stock	1 GSC =	1 A +	10 Bs +	100 Cs
GSC price measured in units of A	3 As =	1 A +	1 A +	1 A
GSC price measured in units of B	30 Bs =	10 B +	10 Bs +	10 Bs
GSC price measured in units of C	300 Cs =	100 Cs +	100 Cs +	100 Cs

Now we assume that the price of currency A doubles (c.p.), which means that A now equals 20 Bs and 200 Cs, while one B still equals 10 Cs. If the composition of the reserve stock stays the same, the following new GSC exchange rates emerge (Table 3):

²¹ *Giudici et al.* (2020) compare single currency-pegged vs. basket-based GSCs with regard to the mitigation of foreign exchange volatility spillovers.

²² Please note that our comparison between GSCs and SDRs only refers to the multi-currency character of SDRs and the resulting exchange rate implications. We are fully aware of the fundamental differences between currency boards on the one hand, and the SDRs on the other hand, especially regarding their completely different properties as monetary instruments. For a detailed analysis of the current and potential future role the SDRs could play within the world monetary order see *International Monetary Fund* (2018b).

²³ Economic agents using GSCs can escape this kind of currency risk only if they are able to carry out all transactions – including paying taxes or conducting financial operations – on a GSC basis. For the time being, this is highly unlikely.

²⁴ See https://www.imf.org/external/np/fin/data/rms_five.aspx.

Table 3

Stylized GSC with three-currency-basket reserve stock after exchange rate shock

Reserve stock	1 GSC =	1 A +	10 Bs +	100 Cs
GSC price measured in units of A	2 As =	1 A +	0,5A +	0,5A
GSC price measured in units of B	40 Bs =	20 Bs +	10 Bs +	10 Bs
GSC price measured in units of C	400 Cs =	200 Cs +	100 Cs +	100 Cs

Eventually, the appreciation of currency A (and the corresponding depreciation of currencies B and C) has led to upward (B, C) and downward (A) changes in the GSC price by a third.

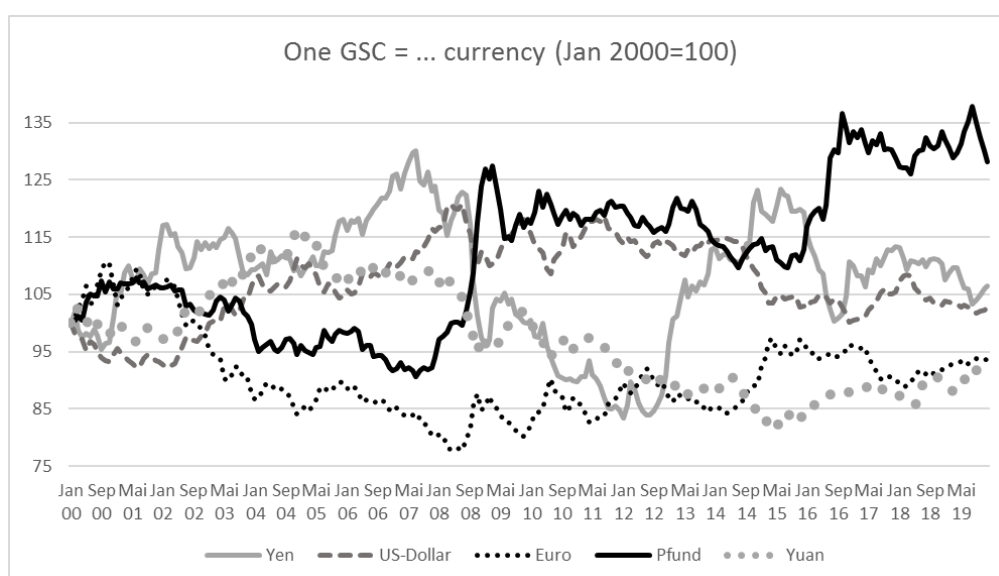
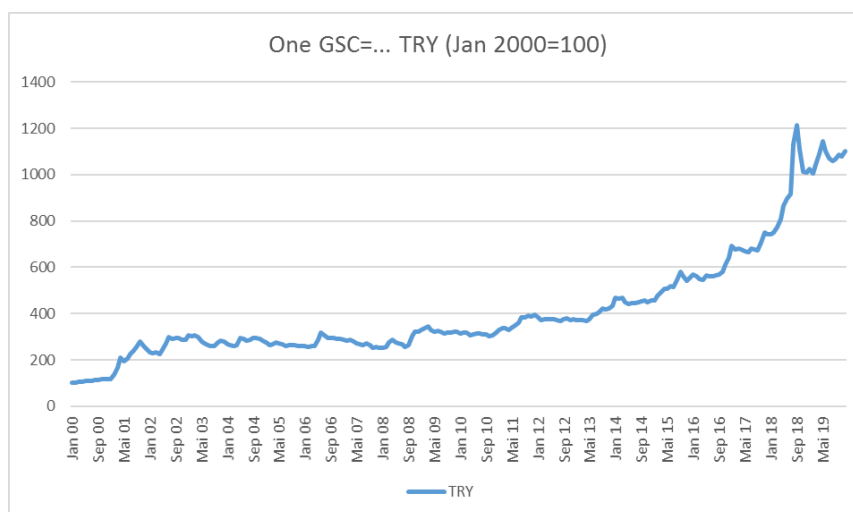


Figure 3: Value of a model GSC measured in each of the basket currencies (January 2000=100)
(Own calculation based on Bundesbank data)

Beyond such simple exemplifications we now take a closer look at the potential exchange rate instability of a GSC. To this end, we start out with a GSC whose reserve-stock assets are denominated in the reserve-basket currencies as follows: 42% USD, 31% Euro, 11% Chinese Yuan and British Pound and Japanese Yen 8% each. Here, we let the current SDR composition guide us (*International Monetary Fund 2019*). We define the starting value of one unit of the GSC as per January 2000 as one USD. Based on this basket composition and the exchange rate of January 2000, the reserve stock for one GSC unit then consists of 0.42

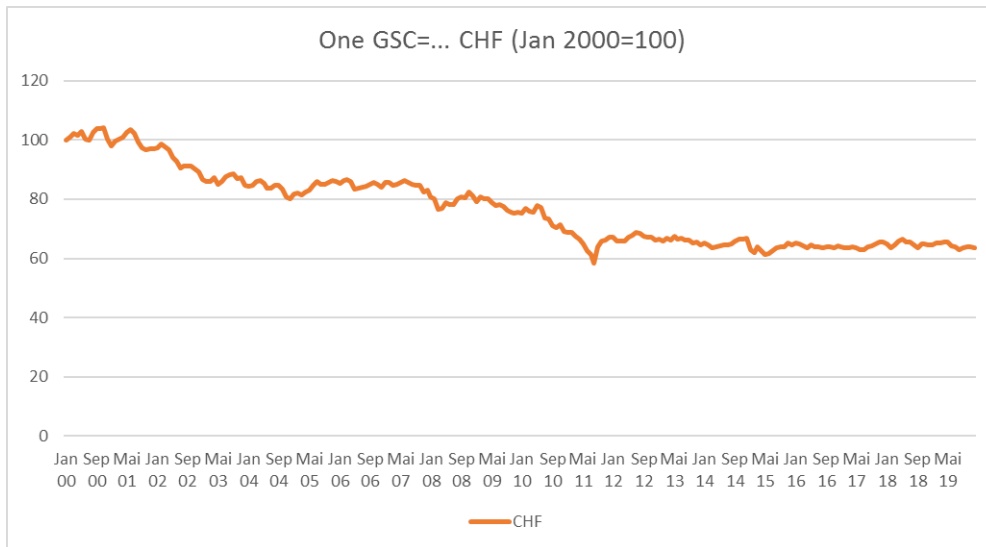
USD, 8.407221071 Yen, 0.048798658 GBP, 0.305810398 Euros and 0.868106935 Yuan. On a monthly basis, we then calculate the GSC price for American, Japanese, European, British and Chinese economic agents willing to exchange their respective home currency into the GSC. Figure 3 displays how the courses develop.

The resulting changes in the exchange rates are substantial, with depreciations of more than 35% (GBP since the Brexit referendum) compared to January 2000, and appreciations of about 20% (Euro before the Lehman Brothers collapse). The Yen would have taken a particularly rough ride with depreciations of 30% (2007) and appreciations of about 15% (2012). Owing to the US dollar's high share in the basket, the greenback price of the GSC saw the smallest changes (between +20% and -8%). That is a fair way off what proponents of global “stable”coins promise when they talk about making the stablecoin stable by backing it with a reserve stock.



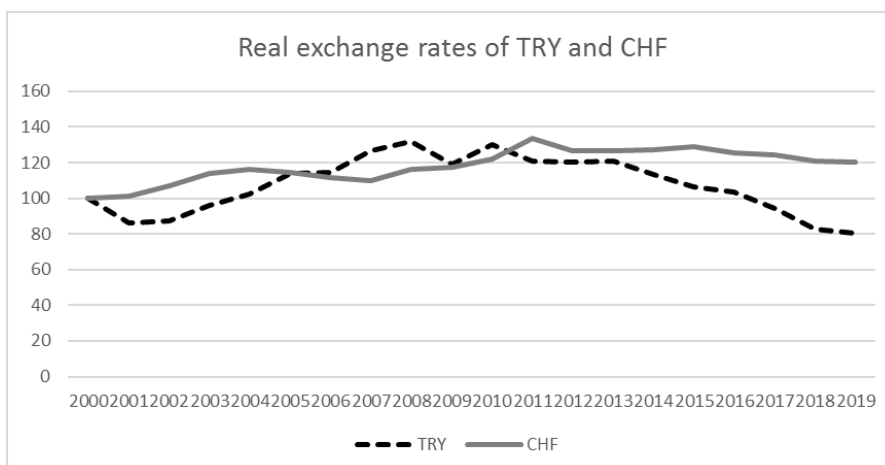
*Figure 4: Value of a model GSC measured in Turkish Lira (January 2000=100)
(Own calculation based on Bundesbank data)*

Of course the same holds true when it comes to non-basket currencies. We made the same calculations as above based on the Turkish Lira (Figure 4) and the Swiss Franc (Figure 5). In nominal terms the Turkish Lira would have depreciated heavily against the GSC: Here, it is especially the Lira crisis of the last years that becomes effective. In contrast, the Swiss Franc appreciated significantly, among other things because of its status as a safe-haven currency.



*Figure 5: Value of a model GSC measured in Swiss Francs (January 2000=100)
(Own calculation based on Bundesbank data)*

Yet an analysis that simply takes nominal exchange rates into consideration falls short. A closer look at real exchange rates is necessary especially with respect to the competitiveness of countries and enterprises outside the “GSC currency area.” In real terms, the depreciation of the Turkish Lira and the appreciation of the Swiss Franc seem less dramatic than in nominal terms.



*Figure 4: Real exchange rates of Swiss Franc and Turkish Lira against the model GSC
(Own calculation based on Bundesbank and IMF data)*

2. How optimal is “GSC land” as a currency area?

The changes in real exchange rates point to a question that by and large has been neglected by the literature on GSCs so far: Is the GSC universe an optimum currency area? A widely accepted GSC would become something similar to a global currency.²⁵ *Brunnermeier et al.* (2019a and 2019b, pp. 19-23) call that phenomenon “digital currency areas” (DCA). In a DCA, regardless of macroeconomic or political affiliation the GSC circulation is a matter of membership in a particular social network rather than of citizenship of a given country.

Yet in contrast to the US dollar, which is sometimes labelled “world currency”, the GSC would not only be a unit of account in the foreign exchange and some commodity markets (as the greenback is), but a means of payment and store of value for billions of consumers and millions of businesses across the globe. Similarly, this would differentiate the GSC from the IMF’s Special Drawing Rights (SDR), which are likewise used by central banks and international institutions as a store of value and a unit of account, but at the same time do not have any impact on everyday economic life.²⁶

The more the GSC would grow into the role of a universal currency, the more the world economy would display the characteristics of a currency union. Having said this, we abstain from going into detail about how this specific currency union would be embedded into the institutional setting of the global monetary order. Instead, we focus on only one feature of a currency union namely the simple fact that there would be a common currency used in a variety of countries that is not at the same time the official national currency of one of the respective countries. Thus, the following remarks consider our “GSC currency union” from the perspective of the theory of international macroeconomics, whereas we do not take into account any insights from the institutional economics literature.

Depending on the degree to which the GSC becomes established in their respective countries, governments would proportionally lose their ability to implement monetary and exchange rate policies. On the upside, their economies would be much better integrated in the world economies, thereby providing consumers with better access to products from abroad and producers with better access to foreign markets. How far this can be beneficial for the members of the currency union has been subject of the optimum currency area literature since the 1960s.²⁷ It is not completely unreasonable to assume that a GSC currency

²⁵ *Giudici et al.* (2020), p. 2 and p. 5 provide a short survey of the literature on global currencies.

²⁶ See *Ocampo* (2019).

²⁷ See *Kunroo* (2015).

union, which for a variety of reasons could be attractive for businesses and consumers in countries as different as the United States and Zimbabwe, would not meet the requirements deemed necessary for its success (mobility of labor and capital, high degree of integration in international trade, symmetrical shocks, product diversification etc.).²⁸

Against this backdrop, changes in as well as abrupt shocks to the competitiveness of individual countries could no longer be cushioned by national monetary and exchange rate policies. Instead, businesses would have to react to competitive pressure by cutting costs and raising efficiency. National governments would be forced to accommodate these developments by providing a better framework for doing business and lowering tax and social security burdens. In short, there would be no way around measures of internal devaluation. Here, the current problems in the Euro area come to mind, and the question arises which country in such a digital currency area would be the first to play the role that Greece has been playing in the Euro area since 2010.

3. Will central banks or the GSC issuer pursue exchange rate policies?

As shown above, due to the multi-currency nature of the reserve, the GSC exchange rate cannot be fixed against all basket currencies. Yet there might be incentives for the GSC management as well as for central banks to fix the value of the GSC against one of the basket currencies. E.g., in a world economy that is still dominated by the US dollar, the respective GSC-USD exchange rate would be of major importance for sellers, consumers, banks and, consequently, the GSC issuer as well as the Fed. Pursuing a managed floating approach, the GSC management could create GSCs and sell them in exchange for US dollar-denominated assets every time the GSC is considered too strong or sell assets in exchange for GSCs in the opposite case. The latter requires large fiat-money reserves that are substantial enough to have the desired effects on the foreign exchange market.

While we do not know how long it takes before a GSC reserve is big enough to become a significant player in global foreign exchange markets, central banks would certainly have the fire power to influence the USD price of the GSC. In order to flatten the development of the exchange rate, central bankers could buy and sell GSC or GSC-denominated assets.²⁹ Again, the latter requires reserves (in this case: GSC reserves) built up before.

²⁸ See *Marthinsen/Gordon* (2019), who transfer the basic idea of the OCA approach to crypto-currencies.

²⁹ Of course the same is true for central banks of non-reserve currency countries, which for a variety of reasons could be incentivized to pursue a managed-floating approach.

In the following, we focus on exchange rate policies conducted by the GSC issuer, rather than by central banks, and we focus on one special aspect, namely changes of the composition of the reserve stock.³⁰ When managing the reserve stock, the management of the GSC can basically follow three approaches, which again impact international foreign exchange and money markets:

- A passive, medium-term approach: Consists of a reassessment of the composition of the reserve stock in regular intervals, favorably on a rule-based basis. E.g., the GSC management could adjust the composition every five years according to a transparent formula that calculates the weights of the underlying reserve currencies on the basis of the respective countries' share in global GDP, international trade flows etc. That would make changes in the composition of the reserve stock predictable; the ramifications on the foreign exchange market would be limited.
- A passive, short-term approach: Consists of measures as above, yet the reassessment of the composition takes place more often, e.g. on an annual basis.
- An active approach: The GSC issuer constantly adjusts the composition of the reserve stock in order to keep the exchange rate against one of the basket currencies stable.

Referring to the simple example above (see section IV.1, Tables 2 and 4) we now illustrate the mechanism behind the active approach: Above, the price of currency A doubled (c.p.), meaning that A equaled 20 Bs and 200 Cs, while one B still equaled 10 Cs. There, we kept the composition of the reserve stock constant, which resulted in an appreciation of A (2 instead of 3 As for one GSC). *Ceteris paribus* the GSC issuer could prevent that appreciation from happening by adjusting the composition of the reserve stock. In order to keep the GSC exchange rate of currency A stable at 3 As against one GSC, the reserve stock composition would have to be: 1 A + 20 Bs + 200 Cs

Table 4 shows that the stabilization of the GSC exchange rate of A comes at a cost, namely a further depreciation of currencies B and C. In order to achieve the goal of stabilizing the GSC's value in terms of currency A, the GSC issuer would need to buy B- and C-denominated assets. If investors knew about or anticipated the stablecoin issuer's intention

³⁰ Please note that the following remarks are a series of highly simplified *ceteris-paribus* examples, which assume the actions of the GSC issuer to be completely exogenous.

to rebalance the basket of assets, they could front-run their purchases by buying and selling different assets in tandem with their stablecoin investment/redemption requests (*G7 Working Group on Stablecoins 2019*, p. 9).

Table 4

Stylized GSC with three-currency-basket reserve stock whose composition has been adjusted after an exchange rate shock

New reserve stock	1 GSC =	1 A +	20 Bs +	200 Cs
GSC price measured in units of A	3 As =	1 A +	1 A +	1 A +
GSC price measured in units of B	60 Bs =	20 Bs +	20 Bs +	20 Bs
GSC price measured in units of C	600 Cs =	200 Cs +	200 Cs +	200 Cs

V. Money creation in a GSC environment: future turbulences in the making?

The more popular a specific GSC becomes, the more prominent the exchange rate risk described above is for individual users. In order to avoid that risk, firms and those of their customers who operate in the GSC environment are likely to strongly demand GSC-denominated loan and asset management products in order not to have to switch from the GSC to their local currency (and vice versa) to finance their business or consumption expenditure, respectively, or to invest their surpluses. In this context, *Briühl* (2020) points to the fact that the GSC and the blockchain it is based on could be the starting point for an entirely new financial ecosystem. Thus, innovative savings and loan products could operate on the GSC blockchain and embody further smart contract-enabled functions.³¹ Only with such loan and asset management products the GSC could fulfill the function as store of value, which is the core feature of any kind of “money”. Granting loans, in turn, leads to money creation by commercial banks, which in turn could require a lender of last resort institution that allocates the GSC to commercial banks in times of need, e.g. during a systemic crisis.

Here, a terminological differentiation becomes necessary. Whereas so far we referred to

³¹ It should be mentioned, however, that *Briühl* (2020, p. 59) deems it “questionable whether Libra...really does have a sustainable competitive advantage over existing financial infrastructures...”.

“GSCs” when we meant the “money” issued by the GSC issuer, we now distinguish between “GSC coins”, which are issued by the GSC issuer, and “GSC deposits”, which are created by commercial banks.

In the following, we thus do not consider commercial banks to be mere custodians providing customers with wallet services to store their GSC coins; neither do we consider them to be mere financial intermediators channeling funds (in the form of GSC coins) from savers to investors. In both cases, the overall stock of “money” (i.e., the number of GSC coins) does not change and there are no newly created GSC deposits. Instead, by transferring the insights of the money creation view of commercial banking to the realm of digital currencies we make “GSC money” an endogenous variable (*Gross/Siebenbrunner 2019*).³²

Table 5

Inside versus outside money in the fiat and GSC universe

	Traditional fiat money universe	GSC universe
Outside money	Cash Reserves held by commercial banks in central banks accounts	GSC coins [GSC reserves held by commercial banks in accounts provided by the GSC issuer]
Inside money	Fiat deposits on accounts held with commercial banks	GSC deposits on accounts held with commercial banks

In a modern two-tier banking system, any commercial bank is able to create inside money by granting loans to customers and by crediting these customers’ deposit accounts accordingly. The difference between the account balance before and after paying out the loan represents the amount of newly created money. As a consequence, all funds held in deposit accounts can be considered money that has been created by banks. In their daily routines, customers have three options: They can leave the money in their accounts, they can transfer (part of) it to other accounts held in other banks, or they can withdraw cash. Whereas the first option does not pose any challenge for commercial banks, options two and three require banks to hold liquid funds, or base money, either in the form of coins and

³² Regulators can be expected to disapprove of such developments and act accordingly. Nevertheless, by way of regulatory arbitrage in the medium- and long-term, a shadow GSC system can be expected to emerge (*Vasudevan 2020*, p. 35). Consequently, thinking about money creation in a GSC setting is a worthwhile exercise far beyond mere intellectual shadowboxing.

bills (option 3), or in the form of reserves held with the central bank (option 2). The latter is necessary if, as we assume here, any transfer of funds from one commercial bank to the other is undertaken by transferring the funds between the respective banks' accounts with the central bank.

Here, the risk of a bank run looms, which does not interfere with the banks' ability to create money. Bank deposits are inside money (which commercial banks can create), but represent a claim on outside money (which for commercial banks is an exogenous variable) either in the form of cash or of central bank reserves (*Brunnermeier et al. 2019b*, p. 4; *Lagos 2006*). If too many customers want to withdraw funds from their deposit accounts (in cash) or transfer the funds to accounts held with other commercial banks, and the individual banks are not able to get access to additional reserves, these banks can easily go bankrupt. So can the system as a whole. In this case, commercial banks need access to liquid funds provided by the central bank (*Gross/Siebenbrunner 2019*, p. 23).

Table 6

Balance sheet of a commercial bank

Assets	Commercial Bank	Liabilities
Cash		Fiat deposits
GSC coins		GSC deposits
Fiat reserves with central bank		Fiat liabilities with central bank
Fiat loans		
GSC loans		

This basic mechanism also works in a private digital currency environment, as has been studied, among others, by *Skeie (2019)*.³³ Here, banks make crypto-asset-denominated loans and can pay a return on crypto-asset deposit holdings. The newly created crypto-asset deposits are inside money and represent a claim to the outside money in the form of crypto-asset coins, which can be issued by the crypto-asset issuer only (Table 5). In contrast to GSC coins as defined above, this kind of money, "GSC money", represents a debt relationship (*Copeland 2019*, p. 312).

As *Posner* pointed out already in 2015, crypto-asset holders cannot be expected to hold their coins completely in non-interest-bearing wallets or custody accounts. Instead, they

³³ See *Skeie (2019)*, p. 2, for an overview of the literature on Bitcoin-based fractional reserve banking.

will deposit the share of crypto-assets they do not intend to use immediately on deposit accounts held with profit-oriented banks.³⁴ These banks will retain a certain amount of coins as a reserve to satisfy short-term needs of their depositors and lend out the difference to borrowers. In a second step, they can create crypto-asset deposits by granting loans as shown above. Again, commercial banks now face the problem that by crediting accounts with a crypto-asset, they generate inside money which represents a claim to outside money (i.e., the crypto-asset coin), which they cannot create themselves. Because if depositors lose confidence in a bank's (or in the entire banking system's) ability to fully serve the depositors' wishes to "withdraw" their crypto-asset holdings and instead put the coins in their wallets, a bank run is the most probable consequence. As this can be done electronically (as opposed to the physical run to the bank in the case of fiat money), digital bank runs can be expected to happen faster and therefore more often (*G7 Working Group on Stablecoins* 2019, p. 13).

In a traditional monetary order with fiat money issued by central banks and created by commercial banks, at this point the central bank would come into play by providing commercial banks with base money (cash or reserves) and by thus acting as a lender of last resort. In a digital currency environment, the central bank is unable to fulfill this role because it cannot issue the digital currency (as long as it is not a central bank digital currency). Typically, blockchain-based digital money is being "mined" on a decentralized basis, which means that a traditional lender of last resort simply does not exist in the cryptocurrency universe.

In a GSC setting, the situation is slightly more complicated, because the banks that are potential subjects to a run on their GSC-denominated accounts could buy the GSC coins in exchange for fiat money. The required fiat money, in turn, could be provided by the central bank. Thus, the central bank would in fact serve as an indirect lender of last resort. If the central bank had accumulated substantial amounts of GSC coins in advance, it could also act as a direct lender of last resort. However, it could play that role only as long as its stocks of GSC coins last.

³⁴ For the sake of the following considerations, we assume that the GSC balance on a deposit account represents a credit relationship between the depositor and the bank entered on the liability side of the bank's balance sheet. By way of contrast, GSCs held in a custody account represent a contract on custodial services and are subject to securities segregation and do not appear on the custodial firm's balance sheet. Thus, a GSC account on a deposit account can be created by a bank by granting a loan to the holder of the account, whereas GSCs in a custody account must have been put into it physically.

Table 7

Central bank balance sheet

Assets	Central Bank	Liabilities
Loans to commercial banks in domestic fiat currency	Cash	
GSC coins	Reserves in domestic fiat currency	

Alternatively, the issuer of the GSC could provide the banks with GSC coins on a credit basis and thereby assume the lender of last resort's role. Yet that would entail a departure from the commitment to fully back all issued coins with reserve assets. On the other hand, the GSC issuer could thereby generate seigniorage revenues, which could be a temptation too difficult to resist, at least in the long run (*Velasco/Chang 2019; Claeys/Demertzis 2019*).

Table 8

Balance sheet of a GSC issuer before creation of "fiat GSC coins"

Assets	GSC issuer	Liabilities
Reserve assets	GSC coins	

Money creation by commercial banks and the issuance of "fiat GSC coins" by GSC issuers would turn over a new leaf in the history of global stablecoins. Especially the latter would be tantamount to the departure from the concept of stablecoins. Similar to the history of paper money, which originated as a receipt for coins deposited, after a certain period of trust-building, GSC issuers could theoretically gradually reduce the backing of their coins and thus become a type of central banks in the digital currency area they themselves created in the first place.

Table 9

Balance sheet of a GSC issuer after creation of "fiat GSC coins"

Assets	GSC issuer	Liabilities
Reserve assets	GSC coins (issued against fiat currency)	
GSC-denominated loans to commercial banks	GSC coins (issued as loans to commercial banks)	

VI. Concluding remarks

Stablecoins are not necessarily as stable as their proponents claim that they are. Therefore, the alertness regulators and central bankers have displayed since Facebook announced that it would enter the sphere of digital money is justified. Financial supervisors as well as monetary policy makers point to an extensive list of potential risks they associate with that particular kind of digital money. The findings in our article contribute to this debate.

Based on a simple simulation, we have shown that the value of a stablecoin can only be kept stable in relation to the reference asset it is based on. In our case, that reference asset is a basket of fiat currencies. In relation to individual fiat currencies, whether or not they are part of the reserve basket, the value of the GSC may exhibit substantial fluctuations. If the GSC evolves further and constitutes something akin to a world currency (“digital currency area”), the difficulties related to currency areas – as analyzed by the literature on optimum currency areas – come into play: Monetary authorities would lose their ability to influence interest rates and monetary aggregates in proportion to the popularity increase of the stablecoin among the populations of their respective countries. Governments could still adjust the exchange rates of their fiat currencies in the face of external imbalances; yet this measure would only affect the share of economic activity that is still carried out in the fiat currency. With regard to the part of the economy that is already GSC-based, competitive pressure from abroad, for example, could only be countered by internal devaluation measures, because national authorities would not have any influence on monetary conditions any more. Nevertheless, for a variety of reasons central banks as well as the issuer of the GSC could be induced to influence the exchange rate between individual fiat currencies and the GSC.

Transferring the insights of the money creation view of commercial banking to the realm of digital currencies makes “GSC money” an endogenous variable. In this case, by granting a loan and by offering a deposit account that is denominated in units of the GSC, a bank can create far more units of the GSC than were originally issued by the GSC issuer. In addition to the GSC coins, which are comparable to base money in the world of fiat money, GSC deposits, which are conceptually very similar to demand deposits in the world of fiat money, emerge as a new means of transfer and a storage of value, which in turn raises a broad range of financial stability questions.

To sum up, stablecoins prove to be much more instable than they might appear at first

sight. Theoretically, they have the potential to replace national currencies, constitute “digital currency areas” and become the basis of a two-tier banking system with one and more GSC issuers on the one hand, and commercial banks that can create GSC deposit money on the other hand. Against that background, all steps taken so far by supervisors and central banks can only be the starting point of what is necessary to effectively regulate the new world of money that is emerging. Because if this vision became reality, the respective roles of institutions like central banks or the IMF would have to be defined in a completely new manner. Which concrete shape the global monetary order could take under these circumstances, would be a rewarding starting point for future research.

References

- Adachi, M. et al.* (2020): A regulatory and financial stability perspective on global stablecoins, ECB Macroprudential Bulletin, May 5th 2020, available at: https://www.ecb.europa.eu/pub/financial-stability/macprudential-bulletin/html/ecb.mpbu202005_1~3e9ac10eb1.en.html
- Adrian, T./Mancini-Griffoli, T.* (2019) The rise of digital money, IMF FinTech notes, July 2019, available at: <https://www.imf.org/en/Publications/fintech-notes/Issues/2019/07/12/The-Rise-of-Digital-Money-47097>.
- Amsden, Z. et al.* (2019): The Libra Blockchain, Calibra staff paper, 25 September 2019, available at: <https://developers.libra.org/docs/assets/papers/the-libra-blockchain/2019-09-26.pdf>.
- Baughman, G./Flemming, J.* (2020): Global Demand for Basket-Backed Stablecoins, February 7, 2020, available at: https://www.jeanflemming.com/libra_main.pdf.
- Baur, D./Hoang, L.* (2020): A Crypto Safe Haven against Bitcoin, Finance Research Letters, January 2020, available at: https://www.researchgate.net/profile/Lai_Hoang2/publication/338577400_A_Crypto_Safe_Haven_against_Bitcoin/links/5e27ee544585150ee7785ee2/A-Crypto-Safe-Haven-against-Bitcoin.pdf.
- Bilotta, N./Botti, F.* (2019): Libra and the Others – the Future of Digital Money, Istituto Affari Internazionali, Vol. 19/22, November 2019, available at: <https://www.iai.it/en/pubblicazioni/libra-and-others-future-digital-money>.
- Blummer, T.* (2019): What if Libra is a Success? June 20th, 2019, available at: <https://medium.com/@tamas.blummer/what-if-libra-is-a-success-661ca2f9c934>.
- Brühl, V.* (2020): Libra – A Differentiated View on Facebook’s Virtual Currency Project, *Intereconomics*, 2020(1), pp. 54-61.

- Brunnermeier, M. et al.* (2019a): Digital Currency Areas, available at: <https://voxeu.org/article/digital-currency-areas>.
- Brunnermeier, M. et al.* (2019b): The Digitalization of Money, Working Paper, Princeton University, August 2019, available at: <https://scholar.princeton.edu/markus/publications/digitalization-money>.
- Bullmann, D./Klemm, J./Pinna, A.* (2019): In search for stability in crypto-assets: are stablecoins the solution?, ECB Occasional Paper Series, No 230, August 2019, available at: <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op230~d57946be3b.en.pdf>.
- Caballero, R./Farhi, E./Gourinchas, P.-O.* (2017): The Safe Assets Shortage Conundrum, Journal of Economic Perspectives, Vol. 31, pp. 29-46 .
- Catalini, C. et al.* (2019): The Libra Reserve, Calibra staff paper, 14 August 2019, available at: https://libra.org/en-US/wp-content/uploads/sites/23/2019/06/TheLibraReserve_en_US.pdf.
- Claeys, G./Demertzis, M.* (2019): The Next Generation of Digital Currencies: In Search of Stability, in: The Future of Money, European Parliament, Econ Committee Monetary Dialogue, December 2019, pp. 83-101.
- Copeland, R.* (2019): A Global Stablecoin – Revolutionary Reserve Asset or Reinventing the Wheel? Journal of Payments Strategy&Systems, Vol. 13 (2019), pp. 310-321.
- Demary, M./Demary, V.* (2019): Kryptowährungen – alles anders mit Libra? Ifo-Schnelldienst, Vol 72(17), 2019, pp. 17-19.
- ECB Crypto-Assets Task Force* (2019): Crypto-Assets: Implications for financial stability, monetary policy, and payments and market infrastructures, ECB Occasional Paper Series, No 223, May 2019, available at: <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op223~3ce14e986c.en.pdf>.
- European Central Bank* (2019): Stablecoins – No Coins, but Are They Stable? In Focus, Vol. 3(2019), November 2019, available at: <https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.mipinfocus191128.en.pdf>.
- European Securities and Markets Authority* (2019): ESMA Report on Trends, Risks and Vulnerabilities, 10 September 2019, Report No 2, 2019, available at: https://www.esma.europa.eu/sites/default/files/library/esma_50-165-883_report_on_trends_risks_and_vulnerabilities_no.2_2019.pdf.
- European Securities and Markets Authority* (2020): ESMA Report on Trends, Risks and Vulnerabilities, 19 February 2020, Report No 1, 2020, URL: https://www.esma.europa.eu/sites/default/files/library/esma_50-165-1040_trv_no.1_2020.pdf.
- Financial Times* (2019): Carney Keeping ‘Open Mind’ to Facebook Backed Digital Currency, June 18th, 2019, available at: <https://www.ft.com/content/189c1c66-91dd-11e9-aea1-2b1d33ac3271>.
- French Ministry of Economy / German Ministry of Finance* (2019): Joint Statement on Libra, 13 September 2019, available at:

- https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/Financial_markets/Articles/2019-09-17-Libra.html.
- G7 France* (2019a): Update from the Chair of the G7 working group on stablecoins, G7 Finance Ministers and Central Bank Governors Meeting 17-18 July 2019, available at: <https://www.bis.org/cpmi/speeches/sp190718.htm>.
- G7 France* (2019b): Chair's Summary: G7 Finance Ministers and Central Bank Governors' Meeting, Chantilly, 17-18 July 2019, available at: https://www.banque-france.fr/sites/default/files/media/2019/08/02/g7_chairs_summary_vff_en.pdf.
- G7 France* (2019c): Chair's Statement on Stablecoins, Washington, 17 October 2019, available at: https://www.mof.go.jp/english/international_policy/convention/g7/g7_20191017_01.pdf.
- G7 Working Group on Stablecoins* (2019): Investigating the Impact of Global Stablecoins, October 2019, available at: <https://www.bis.org/cpmi/publ/d187.pdf>.
- Giudici, P. et al.* (2020): Libra or Librae? Basket-based Stablecoins to Mitigate Foreign Exchange Volatility Spillovers, DEM Working Paper Series, 183, 02-2020, available at: <http://economieaweb.unipv.it/wp-content/uploads/2018/01/DEMWP0183.pdf>.
- Groß et al.* (2019): Libra – Konzept und wirtschaftspolitische Implikationen, *Wirtschaftsdienst – Zeitschrift für Wirtschaftspolitik*, 2019(9), pp. 625-631.
- Gross, M./Siebenbrunner, C.* (2019): Money Creation in Fiat and Digital Currency Systems, IMF Working Paper, WP/19/285, available at: <https://www.imf.org/en/Publications/WP/Issues/2019/12/20/Money-Creation-in-Fiat-and-Digital-Currency-Systems-48843>.
- Handelsblatt* (2019): Warnung vor Libra – Wie gefährlich ist Facebooks Kryptowährung? June 27th, 2019, available at: <https://www.handelsblatt.com/finanzen/banken-versicherungen/experten-in-alarmbereitschaft-warnruf-vor-libra-wie-gefaehrlich-ist-facebooks-kryptowaehrung/24496570.html?ticket=ST-6011400-71YWPwZMaD5Fh5x9AXC4-ap3>.
- International Monetary Fund* (2018a): Stablecoins, Central Bank Digital Currencies, and Cross-Border Payments: A New Look at the International Monetary System, Remarks by Tobias Adrian at the IMF-Swiss National Bank Conference, Zurich, May 2019, available at: <https://www.imf.org/en/News/Articles/2019/05/13/sp051419-stablecoins-central-bank-digital-currencies-and-cross-border-payments>.
- International Monetary Fund* (2018b): Considerations on the role of the SDR, IMF Policy Paper, April 2019, available at: <https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/04/11/pp030618consideration-of-the-role-the-sdr>
- International Monetary Fund* (2019): Special Drawing Rights, Fact Sheet, March 8, 2019, available at: <https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/14/51/Special-Drawing-Right-SDR>.

- Kulkarni, R. et al.* (2020): Cryptocurrency, Stablecoins and Blockchain: Exploring Digital Money Solutions for Remittances and Inclusive Economies, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3511139.
- Kunroo, M.* (2015): Theory of Optimum Currency Areas – a Literature Review, *Review of Market Integration*, Vol. 7(2), pp. 87-116.
- Lagos, R. (2006): Inside and Outside Money, Research Department Staff Report 374, Federal Reserve bank of Minneapolis, available at: <https://www.minneapolisfed.org/research/sr/sr374.pdf>.
- Libra Association (2019): An Introduction to Libra, White Paper, June 2019, available at: https://libra.org/en-US/wp-content/uploads/sites/23/2019/06/LibraWhitePaper_en_US.pdf
- Libra Association (2020): Libra White Paper V2.0, 2020, available at: <https://libra.org/en-US/white-paper>.
- Mancini-Griffoli, T. et al (2018): Casting Light on Central Bank Digital Currency, IMF Staff Discussion Note, November 2018, available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/11/13/Casting-Light-on-Central-Bank-Digital-Currencies-46233>.
- Marthinsen, J./Gordon, S. (2019): A Theory of Optimum Cryptocurrency Scope, *Economics of Innovation and New Technology*, 2019, available at: <https://www.tandfonline.com/doi/full/10.1080/10438599.2019.1687395>.
- Ocampo, J.* (2019): Is It Time for a “True Global Currency”? April 8th, 2019, available at: <https://www.weforum.org/agenda/2019/04/is-it-time-for-a-true-global-currency/>.
- Sandner, P.* (2019): Facebook Coin: What would be the market capitalization of Libra? Would Libra be rated higher than Bitcoin? June 22nd, 2019, available at: <https://medium.com/@philippsandner/facebook-coin-what-would-be-the-market-capitalization-of-libra-125f58645729>.
- Schmeling, M.* (2019): What is Libra? Understanding Facebook’s Currency, SAFE Policy Letter, No. 76, September 2019, available at: https://safe-frankfurt.de/fileadmin/user_upload/editor_common/Policy_Center/SAFE_Policy_Letter_No_76.pdf.
- Skeie, D.* (2019): Digital Currency Runs, January 30, 2019, available at SSRN: <https://ssrn.com/abstract=3294313>.
- Vasudevan, R.* (2020): Libra and Facebook’s Money Illusion, *Challenge*, Vol. 63(1), pp. 21-39.
- Velasco, A./Chang, R.* (2019): Will Facebook’s Libra Turn into a Cancer? Project Syndicate, July 16, 2019, available at: <https://www.project-syndicate.org/commentary/facebook-libra-becomes-cancer-by-andres-velasco-and-roberto-chang-2019-07?barrier=accesspaylog>.

- Xie, S.* (2019): More Than a Third of China is Now Invested in One Giant Mutual Fund, *The Wall Street Journal*, 27 March 2019, available at: <https://www.wsj.com/articles/more-than-a-third-of-china-is-now-invested-in-one-giant-mutual-fund-11553682785>.
- Zetzsche, D. et al.* (2017): From FinTech to TechFin: The Regulatory Challenges of Data-Driven Finance, *European Banking Institute*, 6/2018, available at <https://orbilu.uni.lu/bitstream/10993/38944/1/SSRN-id2959925.pdf>.
- Zetzsche, D. et al.* (2019): Regulating Libra: The Transformative Potential of Facebook's Cryptocurrency and Possible Regulatory Responses, *University of New South Wales Law Research Series*, 2019/042, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3414401.
- Zhang, L./Chen, S.* (2019): China's Digital Economy: Opportunities and Risks, *IMF Working Paper*, Vol 16/2019, available at: <https://www.imf.org/~media/Files/Publications/WP/2019/wp1916.ashx>.