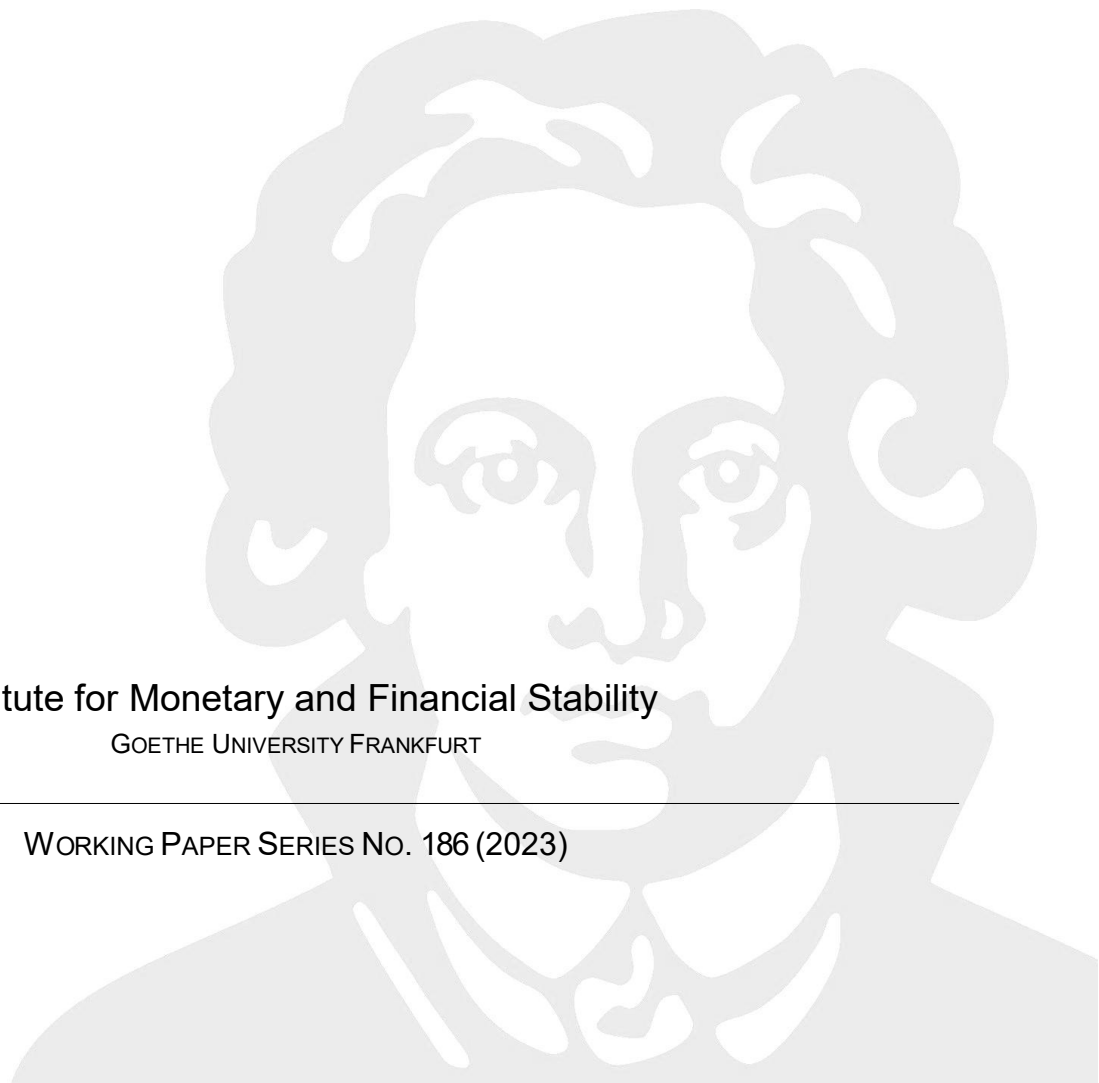


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Uncertainty, Politics, and Crises: The Case for Cash

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Uncertainty, Politics, and Crises: The case for cash *

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Abstract:

We analyze the repercussions of different kinds of uncertainty on cash demand, including uncertainty of the digital infrastructures, confidence crises of the financial system, natural disasters, political uncertainties, and inflationary crises. Based on a comprehensive literature survey, theoretical considerations and complemented by case studies, we derive a classification scheme how cash holdings typically evolve in each of these types of uncertainty by separating between demand for domestic and international cash as well as between transaction and store of value balances. Hereby, we focus on the stabilizing macroeconomic properties of cash and recommend guidelines for cash supply by central banks and the banking system. Finally, we exemplify our analysis with five case studies from the developing world, namely Venezuela, Zimbabwe, Afghanistan, Iraq, and Libya.

JEL: E41, E51, E58, O57

Keywords: Cash, banknotes, money, crises, stabilization, uncertainty

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"The greatest tragedies occur when people forget about uncertainty."
(Peter Bernstein)

I. Introduction

The ongoing discussion about the potential issuance of Central Bank Digital Currency (CBDC) and the resilience of the payments system brings also cash somewhat back into the research spotlight (Rösl & Seitz, 2022c). Anyhow, banknotes and coins remain an important, if not the most important means of payment at the point of sale (POS), not only in developing countries but also in emerging and advanced economies. In the euro area, for instance, cash still accounts for nearly 60% of all transactions at the POS (ECB, 2022a, 13). Although the international trend towards digitalization increased the relative importance of cashless payments in the retail sector in industrialized countries perceptibly over the past decade (Boar & Wehrli, 2021, 16), there was an enormous increase in cash demand during the same period creating the so-called cash paradox (Ashworth & Goodhart, 2020; Pietrucha, 2021; Zamora-Pérez, 2021). In addition, cash is in high demand especially in times of technological and financial crises as well as during natural disasters such as hurricanes or Covid-19 (Spicer, 2017; Ashworth & Goodhart, 2020; Rösl & Seitz, 2021). Hence, a fully elastic provision of cash helps to stabilize the economy since it is not only an efficient means of payment but also provides money holders with a highly liquid store of value (Rösl & Seitz, 2022a). Furthermore, the stabilizing role of cash can be extended to uncertainty in general, including political and inflationary crises. In these cases, however, the stabilizing properties of cash might mostly stem from foreign banknotes which either co-circulate with the national currency or substitute it (Calvo & Vegh, 1992).

The paper is structured as follows. Chapter II discusses the general role of (domestic) cash as a stabilizing factor for the home country. It emphasizes the USPs of cash which become prominent especially in times of uncertainty. Chapter III extends the view on cash demand to a potential stability import by means of foreign cash. The implications for cash supply are briefly discussed in chapter IV. Based on empirical and anecdotal evidence as well as the theoretical analyses of the preceding sections, chapter V conducts several case studies on selected developing countries with a large proportion of unbanked and underbanked people which provide additional insights into cash demand in times of political and inflationary crises and heightened uncertainty. Chapter VI summarizes and concludes.

II. Cash as a stabilizing factor for societies

A well-functioning economy needs a stable monetary system in which different types of money meet the demand for reliable and efficient means of payments. It comes therefore with no surprise that in modern economies several types of money co-exist in parallel, including cash. In the euro area, cash accounts for around 13 percent of all officially recognized means of payments in the hands of the public (nonbanks) at the end of 2022.¹

Table 1: Official types of money in the euro area

Category of money	Public-issued money						Private-issued money		
Type of money	Central bank money				Government money		Commercial bank money	E-money	
Kind of money	Transferable accounts with the central bank banks	Central Bank Digital Currency		Banknotes		Coins		Transferable accounts with commercial banks	E-money
Issuer	Eurosystem	Eurosystem		Eurosystem		Euro area governments		Commercial banks of the euro area	E-money institutions of the euro area
Money holders	Commercial banks	Nonbanks	Commercial banks	Nonbanks	commercial banks	Nonbanks	Commercial banks	Nonbanks	Nonbanks



Nonbank liquidity = Money stock

Source: Own table. See also Rösl & Seitz (2022c).

In this context, cash serves various useful functions for the society.² For once, it plays a dominant role for small and mid-sized payments in almost all countries over credit-transfers of commercial bank deposits.³ In addition, cash usually outcompetes e-money unambiguously at the POS. It is an open question whether CBDC will at least to some extent replace cash. The demand for a possible CBDC of the Eurosystem (the "digital euro"), however, seems to be limited since European money holders do currently see no need for such a new form of digital currency (Deutsche Bundesbank, 2021, Abramova et al, 2022, Zamora-Pérez et al. 2022). Although cash is hardly used for large-volume payments in advanced countries, it still serves as a fall-back solution and therefore limits the market power of payment service providers

¹ At the end of 2022, currency in circulation and overnight deposits in hands of nonbanks accounted for €1,541 bn and €9,909 bn, respectively. Latest available data (end of 2020) on e-money in the euro area (issued by MFIs and Non-MFIs) show €19 bn. See ECB, Statistical Data Warehouse, <https://sdw.ecb.europa.eu/>.

² The benefits of cash in general are intensively discussed in Krüger & Seitz (2017).

³ See, for instance, ECB (2022a), Kim et al. (2020), Caddy et al. (2020), Swiss National Bank (2021).

(PSP) and contributes to an environment of low fees for cashless payments.⁴ Cash also ensures privacy.⁵ It therefore enables economic transactions which would not happen otherwise, and it protects spending of citizens from being fully monitored. Furthermore, cash is easy to use and thus fosters financial and payments inclusion. It helps to control individual spending and thus contributes to a stable financial system (e. g., Hall et al., 2022, Deutsche Bundesbank, 2017). From an economy-wide perspective, cash – if provided in a fully-elastic way – is also an ideal means to combat macroeconomic crises: Cash not only stabilizes the domestic money supply (Rösl & Seitz, 2022a) but also provides the public with a widely accepted means of payment and a highly liquid store of value.⁶ Rösl & Seitz (2021) show that over the past 30 years global cash demand always increased in times of crisis-related uncertainty regardless of the nature of the crisis. They distinguish explicitly between a technological crisis around the millennium change (Y2K), the financial crisis 2008 and a global natural disaster (Covid-19), but also detect some other crises in their econometric estimates in which cash holdings soared. But without further analysis, it is hard to determine the motives that are behind such a crisis-driven increase in cash demand. International surveys on payment behaviour of domestic residents, however, unambiguously demonstrate that low banknote denominations and coins are mainly used for payments whereas larger banknote denominations are typically earmarked for non-transactional purposes.⁷ Therefore, an analysis of denominational groups of currencies (small versus large banknote denominations) can shed some light into the motives behind the increase in cash demand in times of uncertainty. Unfortunately, there are only a handful studies on that subject since most central banks do not publish their denominational cash data. Based on publicly available data for eight currencies (US dollar, Deutsche Mark, Euro, Great Britain Pound, Swiss Francs, Japanese Yen, Australian Dollar, and the Swedish Krona), Rösl & Seitz (2022b) present the following estimates (see table 2).

⁴ This argument was recently also put forward to justify the issuance of a possible digital euro by Bindseil et al. (2021).

⁵ Kahn et al. (2005) even state that cash *is* privacy.

⁶ For a theoretical model which includes the store of value function of cash in times of heightened uncertainty, see Muñoz & Soons (2023).

⁷ See, e. g., European Central Bank (2020b) and Swiss National Bank (2021).

Table 2: Domestic demand for small and large denominations during selected crises

Small banknote denominations								
	Euro area	USA	Switzerland	Japan	UK	Sweden	Australia	Germany
Y2K	n.a.	0.11	0.03	0.02	0.02	-	-	0.02
Fin	0.03	-	-	-	0.02	-0.02	0.05	n.a.
Cov	0.04	0.03	0.01	-	-	-	0.04	n.a.
Large banknote denominations								
	Euro area	USA	Switzerland	Japan	UK	Sweden	Australia	Germany
Y2K	n.a.	0.05	0.05	0.05	0.02	0.04	0.02	-
Fin	0.05	0.02	0.04	-	0.04	-	0.01	n.a.
Cov	0.03	0.02	0.02	0.02	0.02	0.04	0.02	n.a.

Notes: Small denominations: USD 1, 2, 5, 10, 20, 50; JPY 500, 1,000, 2,000, 5,000; DEM 5, 10, 20, 50, 100; EUR 5, 10, 20, 50, 100; CHF 5, 10, 20, 50, 100; GBP 5, 10, 20; SEK 5; 10; 20; 50; 100; 200; AUD 5, 10, 20, 50. Large denominations: USD 100; JPY 10,000; DEM 200, 500, 1,000; EUR 200, 500; CHF 200, 500, 1,000; GBP 50; SEK 10,000; 1,000; 500; AUD 100. The respective crisis periods are Q4/1999 (Y2K), Q4/2008 to Q1/2009 (Fin) and Q1/2020 to Q2(3)/2020 (Cov). Econometrically, they are captured via dummy variables which are one in the respective periods and zero otherwise. Values are only shown if statistically significant at least at the 10% level.

Source: Rösl & Seitz (2022b).

It seems that in times of amplified uncertainty about the resilience of the digital infrastructure such as the technological crisis around the millennium change (Y2K), people increase their cash demand for two reasons: On the one hand, they react to the rising uncertainty of the digital payment infrastructure by holding more transaction balances. On the other hand, they also increase their demand for non-transaction balances to hedge against the mounting uncertainty of their digitally stored savings (Assenmacher et al., 2017, 2019; Rösl & Seitz, 2021). Unsurprisingly, cash demand of low and high denominations increased significantly at the end of 1999 in many currency areas, but especially strong in the USA (see table 2). Since vault cash in the USA raised also at that time (and were reduced shortly afterwards), there is a clear sign that this development was driven by domestic demand (Judson, 2017, 218f.; Rösl & Seitz, 2021, 7).⁸ On a global scale, however, the digital uncertainty around Y2K led to a comparatively stronger increase in the demand for larger banknote denominations than smaller ones (see table 2). Although in the case of Swiss Francs (CHF), the increased surge in large denominations might also be attributed to some extent to foreign demand, the

⁸ In addition, Judson (2017, 218) states that "...the spike seen in total currency in circulation around 2000 (...) is absent in the shipment flows." Banknote shipments by domestic commercial banks to foreign counterparts play an important role in the international cash market. For data on shipments of euro banknotes see, for instance, Deutsche Bundesbank (2022, 72).

respective results for the Japanese Yen, Great Britain Pound, Swedish Krona, and the Australian Dollar – currencies with no substantial demand from abroad – suggest that it was largely domestic residents who piled up their precautionary cash holdings.⁹ A similar development can be observed after the start of the war in Ukraine which led to an increase in (domestic) cash holdings in several neighbouring countries, such as the Baltic and Scandinavian states due to a threat of possible attacks on the digital infrastructure by Russia. ESTA (2022) reports that the motivation behind that increase is clearly to store value. They do not find any significant differences in the transactional use of cash.

By contrast, in times of a confidence crisis of the financial system such as during the financial crisis (2008/9), the increased demand for cash is largely the result of consumers taking precautionary actions and building up non-transaction balances (see table 2 and in a theoretical model Muñoz & Soons, 2023). For this reason, there is greater demand for large banknote denominations as a store-of-value, both at home and abroad (and, e.g., Assenmacher et al., 2017, 2019; Rua, 2021; Rösl & Seitz, 2022b; Seitz et al., 2022; Deutsche Bundesbank, 2022).

In times of natural disasters, cash demand usually also increases. For instance, Spicer (2017) shows an immense increase in cash demand in the US even shortly before hurricanes are expected to hit mainland USA. In those types of crises (heavy thunderstorms, earthquakes, flooding, etc.),¹⁰ access to cash for (basic) domestic transactions is essential (Smith, 2014; Shephard-Barron, 2016; CashEssentials, 2021; Bautista-González, 2023). A special case for a crisis-related increase in cash demand due to a natural disaster is the Covid pandemic. After the outbreak of the SarsCov2-virus in December 2019, cash holdings around the globe surged drastically (Ashworth & Goodhart, 2020). This crisis, however, affected the demand for the whole range of banknote denominations (see table 2). But since Covid-19 led to a deep global recession, a stark decrease in turnover, and a general decline in cash usage at the POS due to (unjustified) fears of virus contagion,¹¹ the main factor behind the increase in global cash at that time was undoubtedly non-transactional demand implying a world-wide shift in precautionary cash holdings towards lower banknote denominations (Rösl & Seitz, 2022c).

⁹ In the case of Germany, the demand for large DEM banknotes were very limited at the end of 1999 due to the expected introduction of euro cash in 2002. Nonetheless, the crisis-related demand for small German banknotes increased significantly at that time by 2%, see table 2.

¹⁰ There is a more than tenfold increase in (recorded) natural disasters in the last six decades— from 39 in 1960 to 416 in 2020 (<https://www.visionofhumanity.org>).

¹¹ See Tamele et al. (2021).

According to Deutsche Bundesbank (2022, 72), the sharp increase in cash demand in Germany during the Covid pandemic was almost solely driven by domestic demand – an observation which also holds for the whole euro area and other currency areas due to worldwide travel restrictions.¹²

In the case of political uncertainty or even political crises, cash demand tends to increase as well. Lalouette et al. (2021, 10) and Rua (2021) find empirical evidence that the €100- and €200 bills increased extraordinarily in Q2/2016 which can be at least partly attributed to the heightened political uncertainty due to UK's vote on leaving the EU (BREXIT) in June 2016. In principle, the same pattern was observed during the two Greek Sovereign debt crisis in 2012 and 2015. At that time, the Bank of Greece issuance of high euro banknote denominations (€50 - €500) clearly reacted to the increased political uncertainty (Rösl & Seitz, 2022a, 41). Another example is the tensions within the European Monetary System in 1992/93. At that time, especially large DEM-denominations were in demand (Rösl & Seitz, 2021, 10).

With respect to inflationary crises and cash demand, we must distinguish between the initial phase of a considerably increasing inflation and the move towards hyperinflation. Regarding cash demand for daily transactions in times of sizeable price increases, money holders at first tend to hold more domestic cash to compensate for losses in the purchasing power of money (Cagan, 1959). But for the same reason, the demand for cash as a store of value typically erodes quickly and money holders often turn to commodities or, if available, to stable foreign currencies. In times of hyperinflation, however, domestic cash will finally lose its unit of account and thus its payment function when ever-increasing prices reach levels that most citizens cannot cognitively handle any more. As shown in the case studies of chapter V, countries often try in these circumstances to keep domestic cash (and bank accounts) as a means of payment alive by cutting zeroes from its denominational value. But as long as the underlying causes for inflation are not properly addressed, there will always be an additional transactional demand for foreign (more stable) cash especially for high-value payments.

Based on the literature surveyed and the case studies of this paper (see chapter V), the following table 3 shows in tendency how domestic demand for domestic cash as a means of

¹² Since travel came almost to a complete hold and net shipments by wholesale banks of euro banknotes showed even a net inflow from abroad (ECB, 2022c, 34), the stark increase in euro cash demand at that time can only stem from domestic residents. In addition, the share of US dollars circulating abroad decreased in 2020, see Bertaut et al. (2021).

payment or as a store of value typically reacted in times of uncertainty since the beginning of the 1990s.

Table 3: Domestic demand for domestic cash in times of uncertainty

Types of uncertainty/crises		Domestic demand for domestic cash as a	
		means of payment	store-of-value
Uncertainty of digital infrastructure		+	++
Confidence crisis of financial system		+	++
Natural disasters		++	+
Political uncertainty		+	++
Inflationary crises	considerable	++	--
	hyper	--	

Notes: ++ = strong increase in demand; + = perceptible increase in demand; - = perceptible decrease in demand; -- = strong decrease in demand

Source: Own table.

III. Importing stability – domestic demand for foreign cash

Although, from a global point of view, financial markets became much more integrated over the past decades, developing countries are still lagging considerably. Therefore, it is very costly and time-consuming for residents in under-developed or even unbanked regions to transfer (part of) their savings abroad. But even in countries with hardly any digital financial infrastructure, there is one way every citizen can still make foreign investments without having access to a bank account or paying high fees: holding foreign cash. Judson (2012, 2017) finds that when a country starts using US dollars, subsequent crises bring about additional cash dollar inflows, which are only reversed following economic stabilisation and modernisation. The studies on "dollarization"¹³ show that this is especially relevant for citizens in countries with high (and variable) inflation rates (e.g., Feige, 2003; Kamin & Ericsson, 2003; Hanke, 2008a; Banegas et al., 2015; Imam, 2022; Neely, 2022). According to Hellerstein & Ryan (2011), a high level of historical, rather than current inflation increases the probability of using the US

¹³ Traditionally, the term dollarization is shorthand for the use of any foreign currency by another country. It also comprises the adoption of other foreign currencies like euro (euroization), the Swiss Franc or the South-African Rand in other African countries. See, for instance, Hanke (2018) and Berg & Borensztein (2000).

dollar as a secondary currency.¹⁴ In addition, Lebre de Freitas (2004) points out that even temporary increases in inflation may have permanent effects on the use of a foreign currency. In that case, the demand for foreign cash is not only limited to banknotes to store value but also to get a means of payment with adequate purchasing power. This contradicts Gresham's law in the sense that the more stable "good" (foreign) currency drives out the less stable (domestic) one at the POS. Bernholz (2011) labels this phenomenon "Thiers' law" although "Anti-Gresham's Law" is more common in the literature (see, for instance, Neumann, 1992, 752).¹⁵

There is evidence that foreign cash (especially USD, EUR, CHF, in Africa also the SAR) is in high demand also in other types of crises.¹⁶ For instance, foreign demand for euro banknotes increased considerably after US-based Lehman Brothers went bankrupt in autumn 2008. In particular, the demand for €500 banknotes skyrocketed especially in those Bundesbank branches known for their exporting role of euro banknotes for residents outside the euro area (Bartzsch et al., 2011, 8).¹⁷ A similar pattern emerged with the foreign demand for high denomination Swiss banknotes, although to a lesser extent (Assenmacher et al., 2019, 12). The same was true during the later stages of the "political" euro-crisis (2012 – 2019) when the demand for the CHF200 and CHF100 bills increased perceptibly (Assenmacher et al., 2017; 2019, 12). Rösl & Seitz (2022a) analyse the net issuance of euro banknotes by the Bank of Greece during the Greek sovereign debt crisis. Although Greece is a member of the euro area, Greek demand for euro banknotes can also be partly interpreted as foreign demand since euro bills keep their purchasing power also in the event of a possible euro area exit by Greece. Interestingly, like the demand for CHF banknotes, the sovereign debt crisis-related demand for euro banknotes affected exclusively higher denominations (Rösl & Seitz, 2022a, 42).

Of course, domestic political crises can also lead to an increase in demand for foreign cash for transactional purposes. An extreme case here is Montenegro which first adopted the

¹⁴ Neanidis & Savva (2006) stress that uncertainty about inflation and currency substitution exert a positive influence on both the average rates of inflation and currency substitution.

¹⁵ See chapter V.2. (Venezuela) and V.3. (Zimbabwe) for recent examples of Thiers' law.

¹⁶ See, for instance, Seitz (1995), Porter & Judson (1996), Feige (2003), Bartzsch et al. (2011), Bangeas et al. (2015), Judson (2017), Assenmacher et al. (2019), Deutsche Bundesbank (2022), Neely (2022) and ECB (2022c).

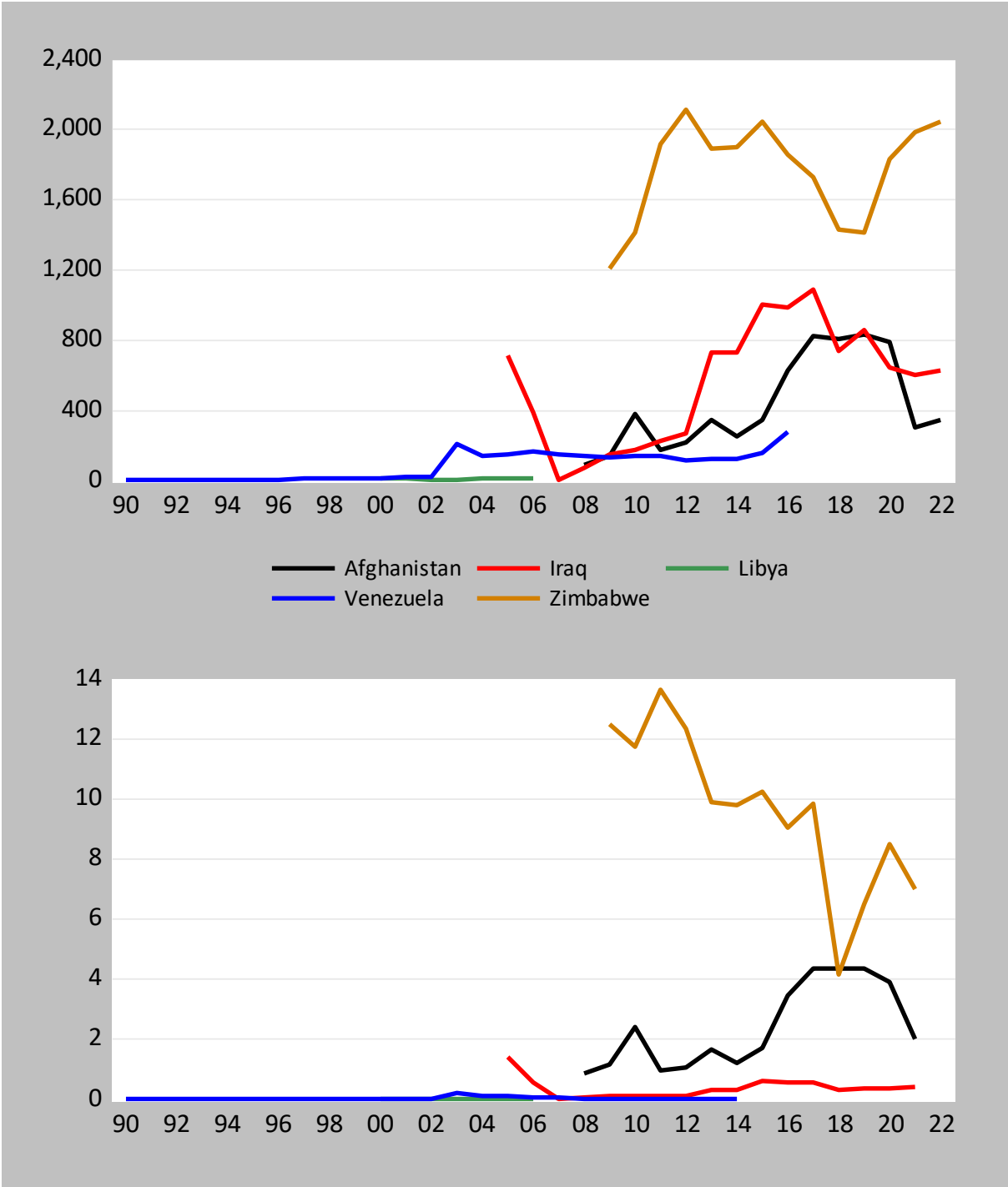
¹⁷ In the euro area, euro banknotes are put into circulation only by the national central banks (NCBs) of the Eurosystem. The Eurosystem consists of the European Central Bank (ECB) and currently 20 NCBs. The ECB as an institution has also the right to issue banknotes but refrains from doing so. The item "banknotes in circulation" in the ECB's balance sheet does not reflect the actual net issuance of banknotes by the ECB. For details see ECB (2022b, 28ff.) and the Decision of the ECB on 13 December 2010 on the issue of euro banknotes (ECB/2010/29; 2011/67/EU).

Deutsche Mark stepwise as a parallel currency after becoming independent from former Yugoslavia and later (1999) introduced the German currency even de jure as its sole legal tender. In 2002, it officially adopted the euro without being a member of the euro area/EU ("full and unofficial euroization") as did Kosovo. Examples of (effective) full dollarization are Panama since 1904 (Goldfajn & Olivares, 2001) as well as Ecuador and El Salvador in 2000 and 2001, respectively (Quispe-Agnoli, 2002). In addition, Zimbabwe was completely dollarized between 2009 and 2019 (see chapter V.3). Since adopting a foreign currency is typically a long process (Adam et al., 2004), it seems plausible that on a global level the store of value motive should be on average more important than the transactional demand for aggregate foreign cash demand in times of domestic political crises. At least, if there is still a domestic currency available for domestic payments.

From a logistical point of view, there are three major ways to import foreign cash: By private travel, e. g., tourism, by cash remittances, and by international banknote shipments of specialized financial institutions. Information about international cash distribution through tourism is very limited. Based on respective surveys from German tourists, Bartzsch et al. (2011) and Deutsche Bundesbank (2011, 2022) show, however, that travel is indeed relevant for explaining how euro banknotes issued by the Deutsche Bundesbank reach other euro area countries and regions outside the euro area. At least for the euro area, also cash remittances seem to play an important role for banknote (net) exports. Lalouette et al. (2021, 44) estimate that in 2018 cumulated net cash remittance outflows represented between 6.6% (€81 bn) and 24.6% (€303 bn) of total euro cash in circulation. Cash remittances are especially important for "fully dollarized" countries.¹⁸ Figure 1 shows personal remittances received by selected developing countries further analysed in chapter V.

¹⁸ For a general discussion of the role of remittances in crises and their possible stabilization role see Grigorian & Kryshko (2017), Hosny (2020), Jidoud (2015), Bettin et al. (2014).

Figure 1: Personal remittances received



Notes: Upper panel: USD million; lower panel: % of GDP.
 Source: World Bank

Since those countries are either mostly unbanked and/or suffer from high credit transfer fees, one can safely assume that the data presented in figure 1 mostly represent cash remittances. For example, full dollarization of Zimbabwe in 2009 (see also chapter V.3) becomes immediately visible. In the international wholesale market for cash – the third channel of cross-border cash deliveries – only a handful of currencies are traded by banks in substantial quantities: US Dollars, Euros, and Swiss Francs. These official net shipments are generally

discussed in Croatian National Bank (2002), Bartzsch et al. (2011), Hellerstein & Ryan (2011), Judson (2012; 2017) and ECB (2022c). Banegas et al. (2015) assess the global and local factors determining net shipments of US dollars. Measures of global financial and economic uncertainty have a considerable impact on net shipments (especially since 2008). Country-specific factors (e.g., domestic inflation, past dollar use, local economic uncertainty, and local economic conditions) also play a role in explaining currency flows. Lalouette et al. (2021) find that in the case of the euro, banknote flows have mainly local determinants.¹⁹ Consequently, global economic uncertainty does not significantly affect net shipments of euros abroad. However, local (national, regional) uncertainty and shocks exert a significant influence (ECB, 2022c, 33).²⁰

Table 4 summarizes how several types of uncertainty affect domestic demand for foreign cash based on the references mentioned and the case studies of chapter V over the past 30 years.

Table 4: Domestic demand for foreign cash in times of uncertainty

		Domestic demand for foreign cash as a	
Types of uncertainty/crises		means of payment	store-of-value
Uncertainty of digital infrastructure		0	0
Confidence crisis of financial system		+	++
Natural disasters		0	+
Political uncertainty		+	++
Inflationary crises	considerable	++	++
	hyper	++	

Notes: ++ = strong increase in demand; + = perceptible increase in demand; 0 = demand not affected/negligible; - = perceptible decrease in demand; -- = strong decrease in demand

Source: Own table.

Foreign cash hereby always serves as a vehicle that is used by domestic money holders to import stability from abroad.²¹ This can either be a more stable means of payment which

¹⁹ By far the most part of official euro banknote shipments is provided by the German banking system which in turn get the banknotes from the Deutsche Bundesbank. According to Deutsche Bundesbank (2022, 72), German euro banknote shipments came to a full stop during the Corona virus pandemic. See also ECB (2022c, 34).

²⁰Rua (2021) uses two variables to proxy the uncertainty motive for holding cash in the case of the euro. The first is volatility on financial markets, the second is a measure of economic policy uncertainty.

²¹ In this respect, the decision (as part of the sanctions against Russia) of the European Council of 2 March, 2022, to prohibit to "sell, supply, transfer or export euro denominated banknotes to Russia or to any natural or legal

stabilizes domestic demand and production in the local (regional, national) goods and services markets or helps to safeguard domestic savings by providing a foreign store of value (Neely, 2022). For those imported money services, however, the domestic foreign cash holders pay a price in terms of foregone interest income on foreign savings by granting an interest-free credit to the cash exporting country leading to an increase in seigniorage there.²²

IV. Implications for cash supply

The findings of the previous chapters imply that central banks should – besides maintaining price stability – always be able and willing to provide cash in a perfectly elastic way, i.e., meet any demand (see also Rösl & Seitz, 2022a). Since people tend to increase their cash holdings especially in times of uncertainty as a means of payment and/or as a store of value, central banks should also not restrict their banknote denominations only to lower ones.²³ In addition, a conscientious central bank stockpiles sufficient cash in its vault to meet even an unexpected demand in times of crises.²⁴ The production and storage costs of cash, however, might seem unnecessarily high at first glance but the social benefits in uncertain and unstable times unambiguously outweigh the costs. Therefore, those costs might be interpreted as an insurance premium the society pays for unanticipated events. Environmental concerns necessitate the reduction of the environmental impact of the whole cash cycle and that banknotes should either remain longer in circulation or become "greener".²⁵

Due to regulatory reasons and the special characteristics of cash (see Rösl & Seitz, 2022a, ch. II.4), a public money in form of CBDC can never be a perfect substitute for cash. Especially in times of crisis, people exert a strong demand for physical cash not only due to psychological reasons but sometimes simply out of necessity if the digital (payment) infrastructure is at stake (see chapter II). Central banks should also be willing to meet foreign demand for domestic

person, entity or body in Russia, including the government and the Central Bank of Russia, or for use in Russia" (European Council, 2022) has to be interpreted as trying to destabilize Russia.

²² Neely (2022) estimates that foreigners holding US dollars are currently giving the US government an interest-free loan of \$1.03 trillion each year.

²³ In this sense, the decision of the ECB to no longer issue €500 banknotes has to be seen critical.

²⁴ This includes a sufficient supply of raw materials and other production factors for further production of cash.

²⁵ See, e.g., the green banknote initiative of Giesecke & Devrient (2022), Reconnaissance (2022) and Swiss National Bank (2022). With respect to a longer lifetime, polymer banknotes might be an alternative to cotton banknotes, see Bank of England (2013) and Wakefield et al. (2019). However, such banknotes currently account for only 4 % of total volume of banknotes in circulation worldwide (Reconnaissance, 2022, 22).

cash.²⁶ As shown in chapter III, foreign cash helps to import stability. Therefore, the seigniorage of the banknote exporting country is well earned. As foreign cash does not flow back quickly in practice (hysteresis effect), it helps to stabilize in a persistent way.

Governments should refrain from restricting the use of cash, especially in times of uncertainty, to allow the stabilizing role of money developing its full potential.²⁷ To ensure its positive role in crises, central banks must ensure that cash remains broadly available in normal times even if its use for daily transactions is more and more declining. Hereby, maintaining a suitable cash infrastructure includes broad access to cash via commercial banks and other payment service providers (for instance through ATMs or cash-back-solutions at the POS) and acceptance of cash by retailers.

V. Case studies

V.1. General remarks

As already mentioned, research on cash demand in times of uncertainty is notoriously difficult due to the anonymity of cash, the reluctance of most central banks to publish (denominational) cash data, and the lack of comprehensive payment surveys. Since this is especially true for developing countries, the following analysis has to remain tentative and based mostly on anecdotal evidence. Nonetheless, the following cases studies provide additional insights on cash demand in times of political and inflationary crises in selected (mostly) unbanked countries. We choose Venezuela and Zimbabwe as two prominent examples for recent inflationary crises and Libya, Iraq, and Afghanistan for political crises. Of course, crises are usually complex in their nature and our classification is hence somewhat arbitrary.

V.2. Venezuela

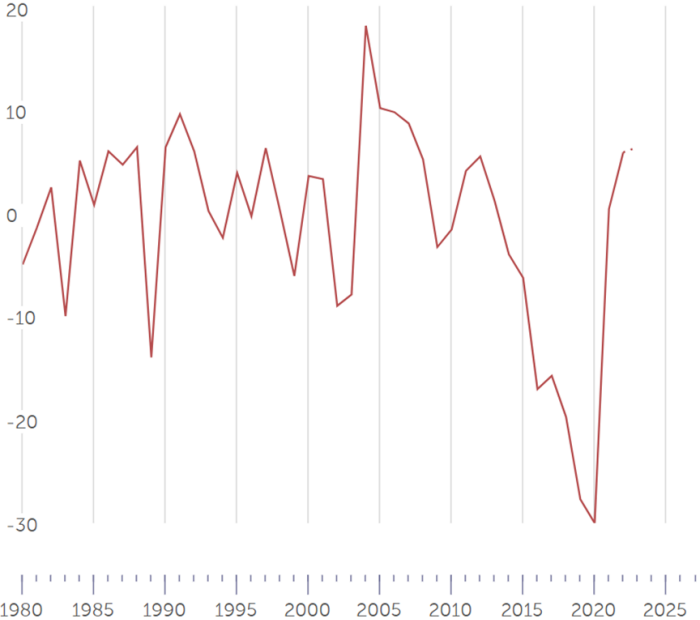
Since the start of the "Bolivarian Revolution" led by the former president Hugo Chávez (1954 – 2013) in 1999, Venezuela fully transformed into a socialist economy. In particular, the oil industry which is central for domestic production and thus for government's revenue was completely "nationalized" (Beland & Wiseman, 2010). *Petróleos de Venezuela S.A. (PDVSA)*,

²⁶ The ECB is neutral in this regard. She does neither foster the international use of the euro nor does she hamper it (see <https://www.ecb.europa.eu/press/key/date/2004/html/sp040514.en.html>).

²⁷ For an overview of cash usage restrictions in the EU see, for instance, Rösl & Seitz (2022c).

the national oil company, which was previously allowed to base its decisions on internal guidance to increase profits, is since directly run by the Venezuelan government. Over the next 20 years, however, due to lack of necessary investments and politically motivated mass-firing of qualified staff, oil production of PDVSA decreased and state income from oil sales plummeted especially after the decline in global oil prices in 2008 and in 2015. Additionally, shortly after the newly elected president of Venezuela, Nicolás Maduro, took office in 2013, Venezuela faced severe international sanctions by Western governments which also contributed to an enormous reduction in oil exports since 2015 and amplified the already existing severe economic downswing (see figure 2).

Figure 2: Real GDP growth in Venezuela

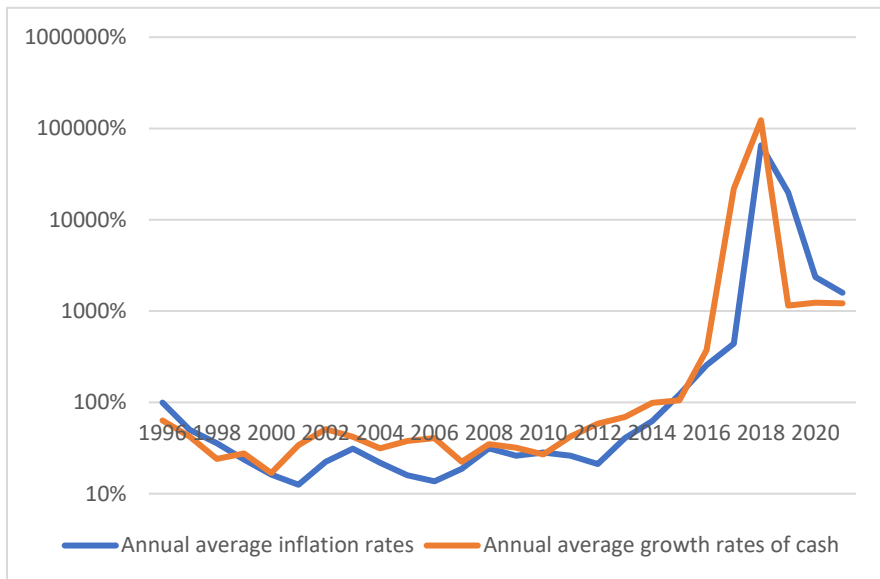


Source: IMF

The main reason for the great depression in Venezuela at that time, however, can be attributed to hyperinflation (see figure 3). Since 1999 domestic inflation rates ranged between 13% and 62% per year but went completely out of control between 2015 (122%) and 2018 (65,374%) when the Venezuelan government utilized the money press to compensate for the income losses from the oil industry.²⁸

²⁸ Measuring inflation in hyper-inflationary environments is often difficult. The Central Bank of Venezuela stopped publishing its data on inflation in 2016. For further discussion see, for instance, Bushnell & Hanke (2017).

Figure 3: Cash and inflation in Venezuela



Notes: Growth rates of cash in circulation are based on original Bolivares.

Source: IMF

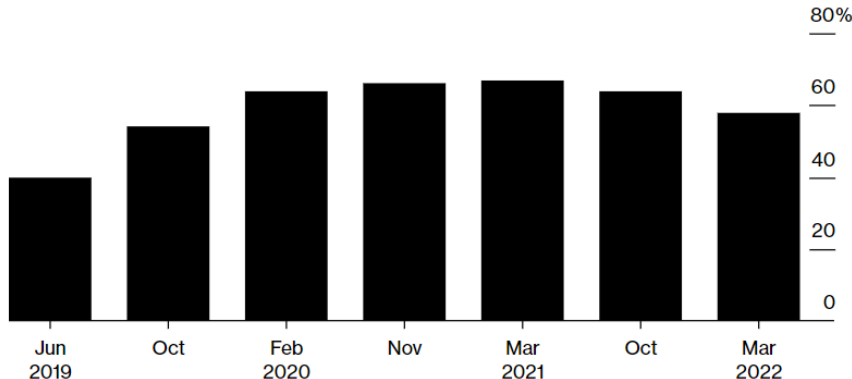
Indeed, currency in circulation rose along with inflation to such enormous levels that the Venezuelan government needed to redenominate its currency three times since. In 2008, the original Bolivares (Bs) were replaced by the Bolivares fuerte (Bs.F) with a fixed conversion rate of 1 Bs.F/1,000 Bs (Republica de Venezuela, 2008). In other words, this currency reform led to a cut of three zeroes in monetary value – a common practice in hyper-inflating countries. In 2018, the Bolivar fuerte (Bs.F) was exchanged again for the Bolivar soberanos (Bs.S) at a rate of 1 Bs.S/100,000 Bs.F (further cut by 5 zeroes) and in 2021 1 Bolivares digital (Bs.D) was renominated for 1,000,000 Bs.S (further cut by 6 zeroes) although Bs.S and Bs.D banknotes remained in co-circulation for some time (Banco Central de Venezuela, 2018, 2021).²⁹ In total, one original Bolivar (Bs) is currently worth of 1/100,000,000,000,000 Bs.D. These redenominations were necessary to keep the national currency in circulation as a useable unit of account and thus as a means of payment in daily practice.

As already mentioned in chapter II, demand for domestic cash as a means of payment usually increases at first in countries with inflationary crises to compensate for ever rising domestic sales prices at the POS. The enormous increase in the demand for Bolivares banknotes, as shown in figure 3, was therefore unambiguously driven by transaction motives. At the same time, however, the demand for Bolivares banknotes as a store-of-value eroded completely

²⁹ The term "digital" is misleading since "Bolivares digital" are just ordinary banknotes, see www.banknoteworld.com.

due to the immense loss in purchasing power (Bushnell & Hanke, 2017). However, US-dollar cash became finally – as predicted by Thiers’ law – the primary choice not only in terms of storing value but over the past years also as a means of exchange. The later was possible after the Maduro government abandoned price and currency controls (established by Chávez in 2003) in 2019 when country-wide energy blackouts made the access to the national currency very hard (De Mello, 2021). According to recent estimates, around 60% of all transactions at the POS in Venezuela are currently conducted in US dollars (see figure 4).

Figure 4: Estimated share of US dollar transactions (%) in total currency transactions at the POS in Venezuela



Source: Yapur (2022) based on data estimated by Ecoanalitica.

This dollarization process had an immediate stabilizing effect on the Venezuelan economy in terms of stopping its free fall in 2019 (see figure 2) and was even openly admitted by President Maduro at that time.³⁰ For instance, newly established private commercial shops called "bodegons" that specialize in selling imported goods helped to overcome import limitations set by the government and started to provide almost everything – from basic food to medications. In addition, traditional supermarkets were also able to re-supply (Cordova, 2020). This was especially important at times when fuel shortages, problems in water and energy supply, and the degradation of national roads imposed high domestic production costs, making imports more attractive (De Mello, 2021). Against this background, it is surprising that Maduro lately tried to re-bolivarize the highly dollarized Venezuelan economy in 2022 by imposing a 3% tax on purchases made in US dollars in shops, restaurants and grocery stores.³¹ In fact, a law that already passed Venezuela's National Assembly even allows for taxes on US dollar transaction of up to 20% (teleSUR, 2022).

³⁰ In an interview, Maduro described dollarization as an "escape valve" that helps the recovery of the country, the spread of productive forces in the country and the economy (Reuters, 2019).

³¹ Briceño et al. (2019) recommend such a step to regain monetary autonomy.

V.3. Zimbabwe

Over the past 30 years, Zimbabwe was plagued by two periods of hyperinflation.³² The first started in March 2007 with a month-over-month inflation rate of just over 50%, reaching a staggering annual inflation rate of 89.7·10²²% in November 2008 (Hanke & Kwock, 2017, 353). It ended with the total breakdown of Zimbabwe's monetary system in January 2009. As shown by Koech (2011), this skyrocketing rise in prices was fuelled by a corresponding increase in the Zimbabwean money stock M3 as the Reserve Bank of Zimbabwe (RBZ) started to print cash exceedingly (Hanke, 2008a, 24) to finance government spending (Noko, 2009, 344 ff; Makochehanwa & Kambarami, 2011).³³ In addition, extraordinary high reserves for commercial banks were provided by the RBZ (IMF, 2009, 8) which were later exchanged for banknotes to meet the rising cash demand by the public due to ever increasing prices. To avoid an inflation-induced scarcity of cash, however, four redenominations of the Zimbabwe dollar were deemed necessary: In August 2006, one "original Zimbabwe dollar" (ZWD) was replaced by the "second Zimbabwe dollar" (ZWN) at a rate of 1 ZWN/1,000 ZWD (cut by three zeroes). Two years later, a "third Zimbabwe Dollar" (ZWR) was introduced worth of ZWN 10 bn per one ZWR (cut by further 13 zeroes) and in February 2009 – shortly before the total collapse of the Zimbabwean monetary system – a "fourth Zimbabwe dollar" (ZWL) was set into circulation with a further cut by 12 zeroes (1 ZWL for 1,000,000,000,000 ZWR). At the end, even redenomination did not help anymore as the loss of purchasing power of the Zimbabwe dollar due to hyperinflation was quicker than new ZWL banknotes could be printed (IMF, 2009).

Following Thiers's law (see chapter III), Zimbabwe was already heavily dollarized at the end of 2008 when its citizens turned to foreign cash as a means of payments, store of value, and unit of account.³⁴ Interestingly, the Zimbabwean population opted not for a single but a multiple currency system comprising several currencies such as the South African Rand, Euro, British pound, US dollar, Mozambique's Metical, and Zambian Kwacha (Noko, 2009, 348). Consequently, the (fourth) Zimbabwe dollar (ZWL) was officially suspended as legal tender on April 12, 2009 (VOA News, 2009). Although the people seemingly favoured the South African

³² Following Cagan (1956), the established definition of hyperinflation starts at a price level increase of at least 50 percent per month.

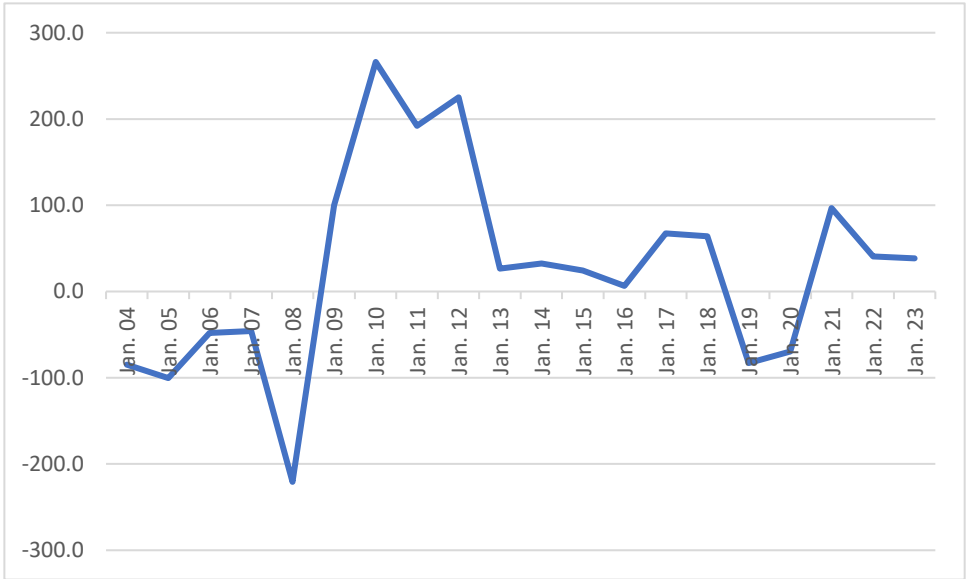
³³ The IMF (2009, 7) estimates a ratio of M3 to GDP of 36% in 2008.

³⁴ Then-finance minister Biti stated even before parliament while presenting a revised 2009 budget "The death of the Zimbabwe dollar is a reality we have to live with. Since October 2008 our national currency has become moribund". See, The Zimbabwe Independent (2009).

Rand at the time, the Zimbabwean government decided to adopt the US dollar for conducting official business (Bostrom, 2017, 2). Consequently, nine foreign currencies were official means of payment in Zimbabwe in June 2016, but it was estimated that 90% of transactions were made in US dollar and 5% in South African Rand (International Finance, 2017; Imam, 2022, 772).

The use of foreign currency in general and foreign cash for daily transactions had an immediate stabilising effect on Zimbabwe’s economy (Hanke, 2008b). The multi-currency system adopted in early 2009 helped to restore price stability, permitted the banking system to stabilize, and imposed fiscal discipline by precluding the option of budget deficit monetization (IMF, 2010, 4; Imam, 2022, 771). Figure 5 shows how this switch to a more stable monetary system in 2009 had an instant effect on domestic production and income (see Sikwila, 2013, and figure 5).

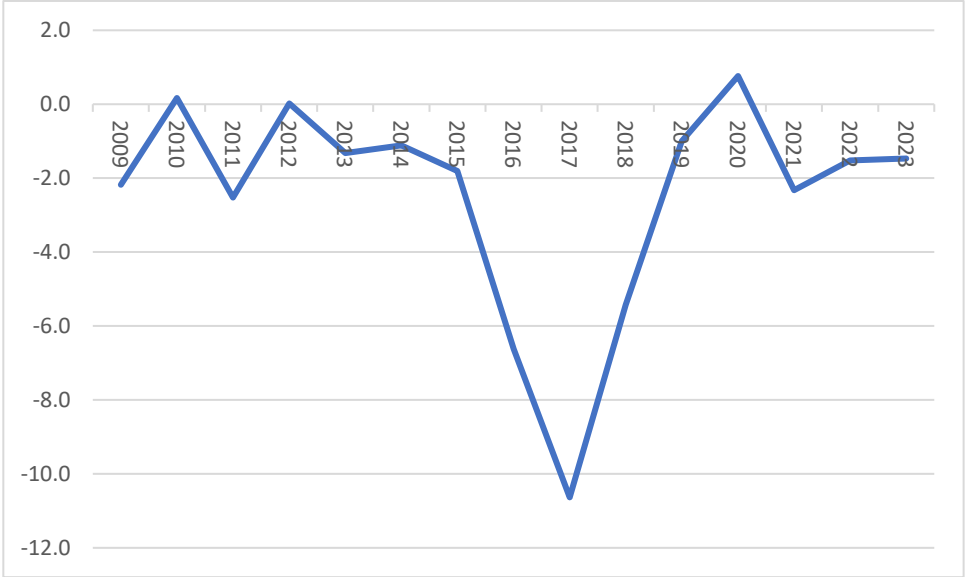
Figure 5: Real GDP growth in Zimbabwe



Source: IMF

The remaining Zimbabwe dollar (ZWL) were officially demonetized in 2015 (RBZ, 2015). In 2016/2017, however, the public deficit started to increase sharply (see figure 6).

Figure 6: Net lending/borrowing of General Government for Zimbabwe



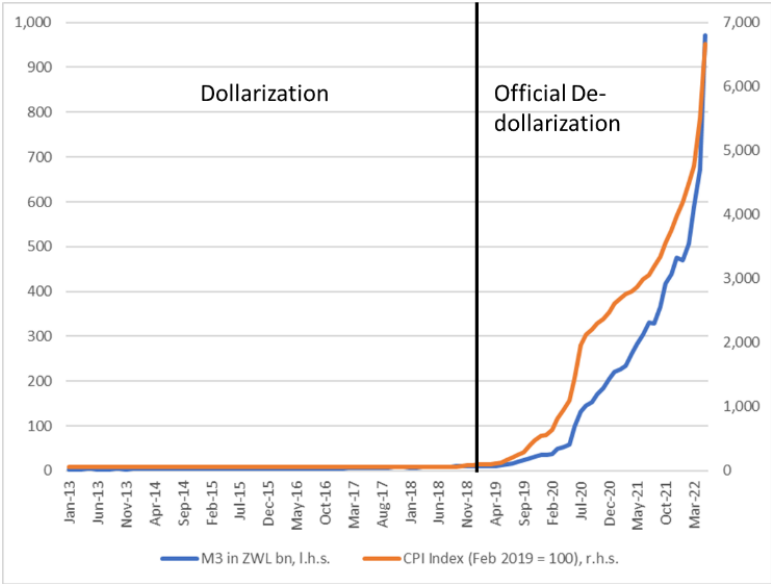
Source: IMF

According to Imam (2022, 771), this was caused by several factors: A considerable decline in key commodity prices since 2013 deteriorating Zimbabwe’s term-of-trade, poor weather conditions severely damaging the agricultural production, and finally a return to fiscal profligacy. Hence, the money press was needed again (Bostrom, 2017). In 2016, the RBZ started to issue so-called bond notes³⁵ – a new form of domestic cash with an official exchange rate of 1:1 to the US dollar (BBC, 2016).³⁶ In addition, the RBZ began directly financing government expenditure up to 8% of GDP in 2017 (Imam, 2022, 771). On 20 January 2019, Zimbabwe abolished its multiple-currency system and replaced it with a new Zimbabwe dollar, the RTGS Dollar or more commonly "Zimdollar". The Zimbabwean money stock and consumer price index skyrocketed again entering the second period of hyperinflation (see figure 7). Annual inflation increased from 10% in 2018 to more than 800% in 2020.

³⁵ "Bond coins" were issued already on 18 December 2014

³⁶ Black market rates quickly deviated from parity (Zwinoira, 2017) and capital controls were imposed.

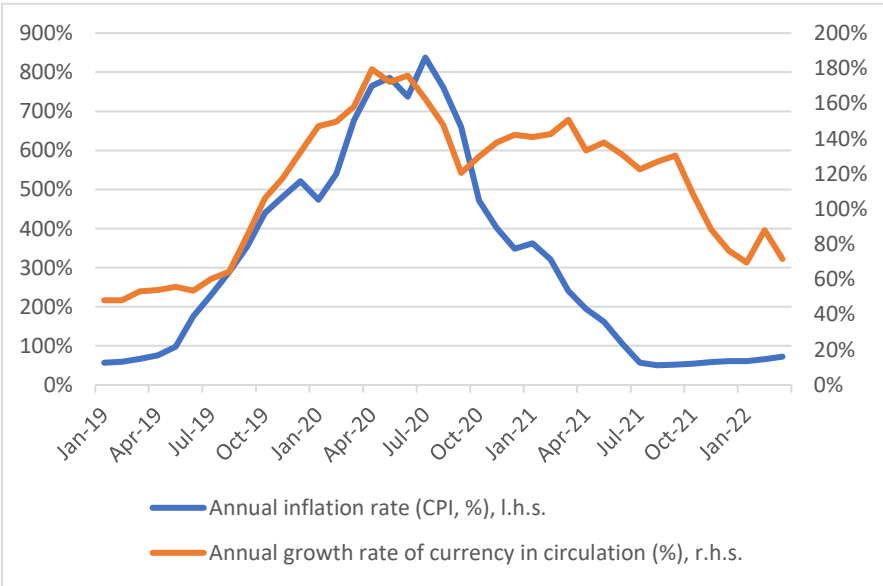
Figure 7: M3 and consumer price index for Zimbabwe



Source: RBZ and IMF

As expected, demand for domestic cash responded very quickly in 2019/2020 to rising inflation rates as consumers needed more banknotes at the point of sale (see figure 8).

Figure 8: Annual inflation rates (CPI) and growths rates of cash in Zimbabwe



Source: RBZ and IMF

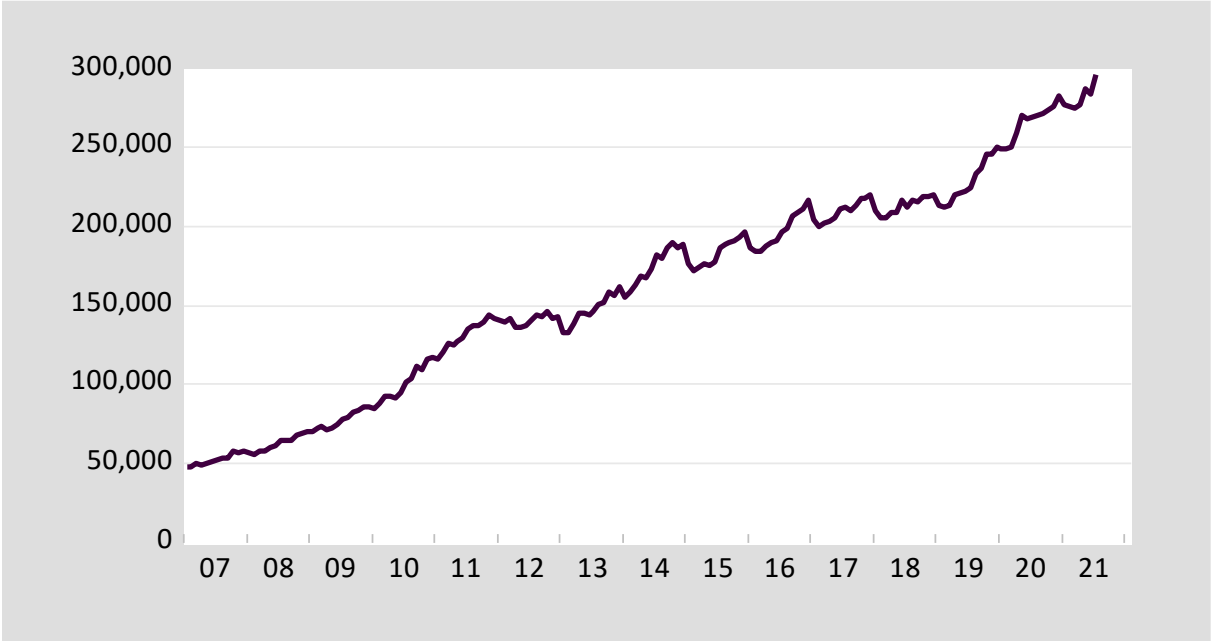
This seems to show again that Gresham’s law dominates in the first phase of inflation when at the POS "bad" domestic cash drives out the "good" (more stable) foreign cash which is then predominantly used as a store of value. But once inflation dynamics turn into hyper mode, domestic cash loses all its monetary functions and people switch to foreign cash (if available) as a means of payment as well as store of value and Thiers’ law, where good money outcompetes bad money, strikes back. Therefore unsurprisingly, Zimbabwe re-dollarized

unofficially very quickly again after the official de-dollarization in 2019 (Imam, 2022, 775). In March 2020, the Zimbabwean government even allowed people to use foreign currency to pay for goods and services for easier transactions following the outbreak of the COVID-19 pandemic. The use of the US dollar has since grown in the economy, but members of the Zimbabwean government still affirm that there will be no return to official dollarization (Xinhua, 2022).

V.4. Afghanistan

After the first Taliban regime (1996-2001) fell at the end of 2001, Afghanistan’s financial system had largely ceased to exist and the country became almost entirely cash based. In 2002, the Afghan central bank, Da Afghanistan Bank (DAB), redominated its currency by removing three zeroes from its currency and introduced a new banknote and coin series of afghanis (AFN) which are all still legal tender (Bautista-González, 2021). Against the background of past and present political uncertainties (see chapter 2), AFN notes found unsurprisingly wide acceptance in daily payments across Afghanistan (see figure 9).

Figure 9: Currency in circulation in Afghanistan



Notes: Million afghani; DAB stopped publishing data on currency in circulation after July 2021.

Source: DAB.

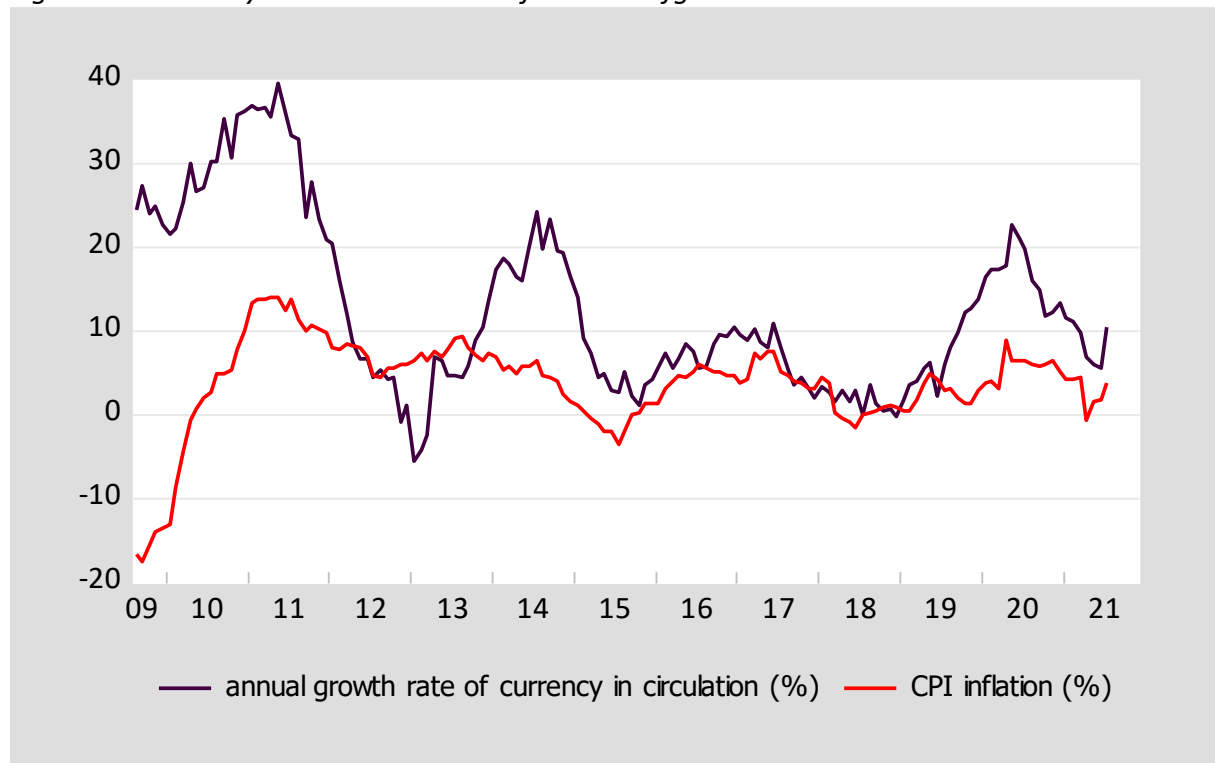
However, at the time, confidence in the Afghan currency was low due to high inflation rates. Moreover, DAB had little or no control over total issuance of currency as three versions of the national currency were circulating in the country (van Rooden & Dicks-Mireaux, 2005). First, there was the official Afghani, which had been issued prior to the Taliban rule and which the

Taliban had continued to issue. Second, duplicates of the official banknotes had been put into circulation during the Taliban years by the then internationally recognized government in exile. It had ordered reruns of earlier issued series from the country's regular printer and had issued these notes in the northern parts of the country. By using the same serial numbers, the government in exile ensured that the new notes could not be distinguished from those already in circulation. Third, two warlords had issued their own counterfeit versions of the official currency. While these counterfeits were very similar to the official currency, they did have some distinguishing features and were typically traded at a discount. Reflecting the limited confidence in the national currency, foreign currencies were also widely used, including the US dollar and currencies of neighboring countries, e. g., Pakistani Rupees and Iranian Toman. Foreign currencies were used especially for larger transactions and as store of value (van Rooden & Dicks-Mireaux, 2005), as suggested by the theoretical analysis in chapter 3.

The authorities realized that the exchange of old banknotes for new ones has to be implemented smoothly and that running out of new banknotes before all old ones would be converted would fatally undermine the public's confidence in the new currency. However, the Afghan government and DAB consciously decided against official dollarization as this might have been potentially difficult to reverse even if it would have provided immediate monetary stability. Nonetheless, unofficial dollarization took place anyway. Mostly US dollars are since used widely as medium of exchange and store of value by businesses and households (Sadat & Khan, 2020).³⁷ This contributes to controlling inflation and providing macroeconomic stability. Moreover, dollarization in largely unbanked Afghanistan helped the population to hedge against internal and external devaluation of the national currency. Even if inflation did not enter the hyperinflationary territory, however, there were some years with inflation rates above 20% (see figure 10).

³⁷ Muzaffari & Miraj (2018) estimate the total value of foreign currency in circulation from December 2002 up to April 2015 to be equivalent to 476 bn afghanis (around USD 8 bn at 2015 exchange rates).

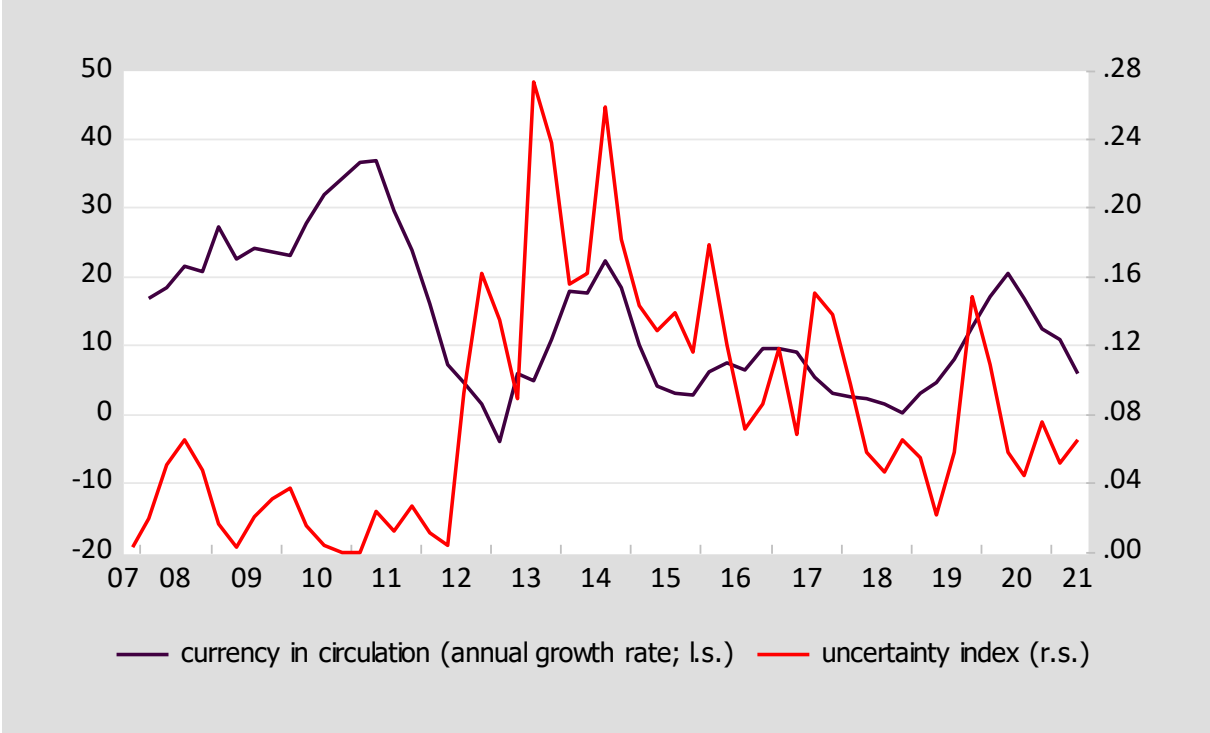
Figure 10: Currency in circulation and inflation in Afghanistan



Source: DAB.

Despite positive GDP growth rates in the first two decades of the 21st century (which at times reached double-digit levels), (political) uncertainty was elevated from time to time which stimulated precautionary cash holdings, even in the national currency (see figure 11 and chapter 2). In 2013/14 and 2019, there was a trend increase in uncertainty together with higher growth rates of cash in circulation. In contrast, from 2014-2018, uncertainty decreased and so did the growth rates of cash. There were also certain crisis events in which cash demand increased in Afghanistan (see figure 11), especially during the global financial crisis in Q4/2008 (Rösl & Seitz, 2022b) and the Covid-19 pandemic at the beginning of 2020 (Niazai, 2021 and table 3). On a national level, too, there was a further special crisis (Bautista-González, 2021a) that boosted cash demand: In 2010, the Kabul Bank, the country's then-largest financial organization, nearly went into bankruptcy after corrupt elites pilfered USD 861 million in bogus loans to shareholders. Some stolen funds were taken away from Afghanistan in airplane food trays. Kabul Bank customers withdrew more than USD 200 million, or about 60% of their deposits in a bank run (see figure 11). The government, DAB, and Afghan banks had to step in and bailed out Kabul Bank. Its near collapse diminished the public's trust in banking organizations in the country.

Figure 11: Uncertainty and cash in Afghanistan



Notes: Growth rate in %; uncertainty measured by the frequency of the word "uncertainty" in the quarterly Economist Intelligence Unit country reports of the IMF for Afghanistan, see Ahir et al. (2022).

Source: DAB and Ahir et al. (2022).

A new and severe crisis emerged after the second Taliban take-over in August 2021. It brought the Afghan banking system on the brink of collapse and led to an extreme shortage of cash. Even if Afghanistan has its own currency, it relies on companies in other countries to print its money, like many smaller economies. The former government had signed agreements with a Polish company on the printing of 10 billion afghani banknotes and with a French firm for the supply of another 100 billion afghanis for the following year. These deliveries, however, never happened. No new banknotes have since been circulated (Jumazada, 2023).

The U.S. administration froze Afghan reserves abroad and suspended air shipments of U.S. dollars to DAB. Until August 2021, Afghanistan received cash shipments of \$249 million every three months in boxes of bound \$100 notes that were kept safe in the DAB’s vaults and the presidential palace. Since then, US dollars have nearly disappeared from circulation. This is the more serious, as the US dollar was formerly used nearly by everyone and for everything (Beras, 2021). Foreigners did not accept the afghani to settle international transactions, and only the Afghan public used it on daily transactions. Money-transfer services like Western Union and Moneygram suspended payments into Afghanistan. In 2020, personal remittances to Afghanistan amounted to USD 789 million, nearly 4% of the country’s GDP (Bautista-

González, 2021b).³⁸ In 2021 and 2022, remittances declined drastically to values of USD 300 million and USD 350 million, respectively (see figure 1). As banknotes continue to deteriorate, the country faces a massive liquidity crisis. The economy has become cash-only without a functioning banking system but faces a severe cash shortage. It is challenging for Afghans to withdraw funds from their bank accounts. The Taliban have imposed capital controls, including limits to bank withdrawals (first to \$200 and then \$400 a week) and a complete ban on the use of foreign currency, despite the heavy reliance on US dollars.

Afghanistan's cash shortage resembles similar crunches in countries such as Zimbabwe, Venezuela, Lebanon, Syria, and Myanmar, with its destabilizing effects. However, the situation in Afghanistan is even worse as national and international cash is lacking as well as other payment opportunities. Furthermore, banknotes of all denominations have become old, but the 10, 20, 50 and 100 afghani bills have become so ragged that they cannot be used any longer (Jumazada, 2023). At the beginning of 2023, new banknotes from overseas arrived to replace damaged notes. DAB distributed a volume of 100 million to private banks, but it seems that the distribution is not enough to replace the worn-out notes. (Qooyash, 2023). And firms and money traders complain that branches of DAB refuse to accept small denomination. To conclude, the scarcity of cash magnifies the economic collapse (Bautista-González, 2022).

V.5. Iraq

Since 1932, Iraq had its banknotes traditionally printed abroad, but after the first Gulf War in 1991, the Central Bank of Iraq (CBI) started to print its own currency. These banknotes were informally called Saddam dinars and were of lower quality, but both series remained in circulation for over a decade. Of these, the old dinars, however, had much more purchasing power than the Saddam dinars implying that the latter continuously lost value compared to the old notes (Beras, 2021). To end this double domestic currency scheme, the CBI introduced the New Iraqi Dinar in October 2003, replacing both currencies.³⁹

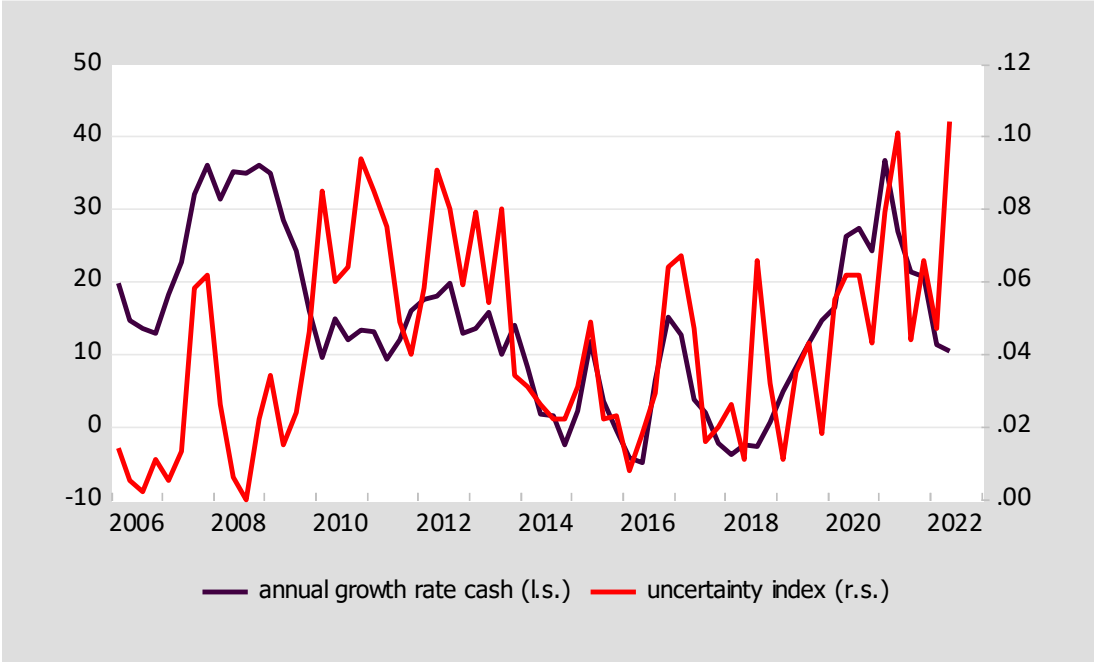
After decades of war, ethnical conflicts, displacements, and sanctions, Iraq remains cut off from the global financial system and is heavily relying on cash, both domestic Iraqi dinar as well as foreign currencies, of which US dollars and Iranian toman are most commonly used (Rodgers, 2023). The population in Iraq seems to trust cash more than electronic payments

³⁸ In Afghanistan, mostly informal channels are used for remitting funds, see Faqeerzai & Faryad (2018).

³⁹ The published series on cash of the CBI start in 2004.

since only one fourth of Iraqi households have a bank account (Bertelsmann Stiftung, 2022a, 22).⁴⁰ Consequently, cash dominates the Iraqi economy both as the most important means of payment and as a store of value of the general public⁴¹ and even commercial banks (Tabaqchali, 2021). Ahmed et al. (2022) find that the main reasons for the high dollarization in Iraq are the application of the hawala system for money transfers, the weakness of the central bank and other financial regulatory authorities, the increase in imports and the lack of exports other than oil exports, and, most importantly, the lack of confidence in the home currency, the dinar. Consequently, dollarization acts, as predicted (see chapter III), as a stabilizing tool. Economic crises and conflicts led to ever-returning phases of high uncertainty together with its high volatility and coincided with increasing growth rates in domestic cash in circulation (see figure 12). The correlation coefficient between the two series from Q1/2010 – Q2/2022 is +0.43 which supports the view that (even dinar) cash was a stabilizing factor in times of political crises and general uncertainty (see table 3). Against this background, it is not surprising that Iraqi banks hold a high proportion of deposits with the CBI to be able to meet any unexpected cash withdrawals (Tabaqchali, 2021, 8).

Figure 12: Uncertainty and domestic cash in Iraq



Notes: Growth rate in %; uncertainty measured by the frequency of the word "uncertainty" in the quarterly Economist Intelligence Unit country reports of the IMF for Iraq, see Ahir et al. (2022).

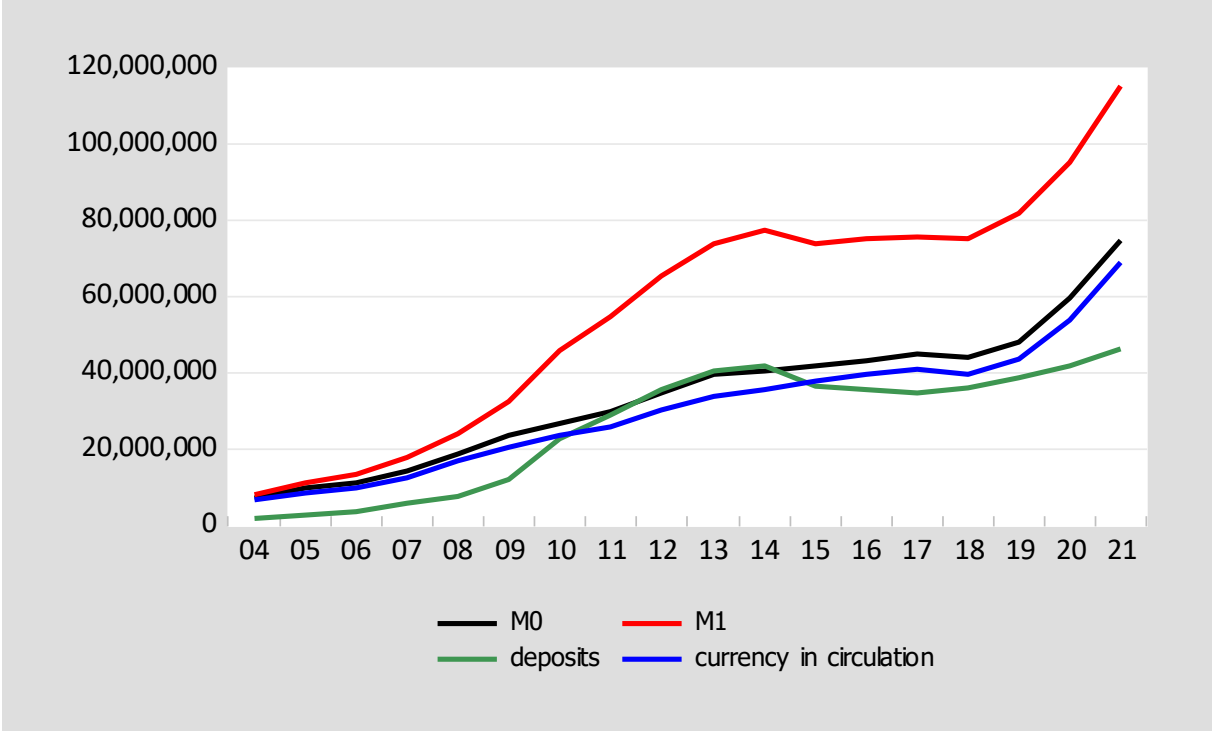
Source: Central Bank of Iraq and Ahir et al. (2022).

⁴⁰ This is one of the lowest rates in the Arab world.

⁴¹ Estimates reveal that Iraqis hoard nearly USD 38 million at home (Bertelsmann Stiftung, 2022a, 22).

Iraq’s lack of a viable banking system and heavy reliance on cash is visible in figure 13. The ratio of the monetary base (M0) to M1 is very high (it varies between 53% and over 80%). And most of the sample period, cash in circulation is higher than deposits included in M1. Especially from 2015 to 2017 (armed clashes with the IS), cash helped to stabilize the money stock M1 (see also Rösl & Seitz, 2022a). What is also obvious from figure 13 is the sharp increase in cash holdings in 2020/21, the first two years of Covid-19 (see table 3). An underdeveloped banking system together with a low number of bank branches across the country quite naturally creates problems with access to cash: The number of ATMs in Iraq is low even if it increased from 0.6 per 100,000 inhabitants in 2013 to around 3 in 2020.

Figure 13: Monetary developments in Iraq



Notes: Million IRD.

Source: CBI.

An experimental study of the Cash Consortium for Iraq, a partnership of the five large international NGOs delivering cash transfers in Iraq, in 2019/20, supports these conclusions (see Kurtz et al., 2021).⁴² Their survey with impoverished and conflict-affected households ("the extreme poor") yields that

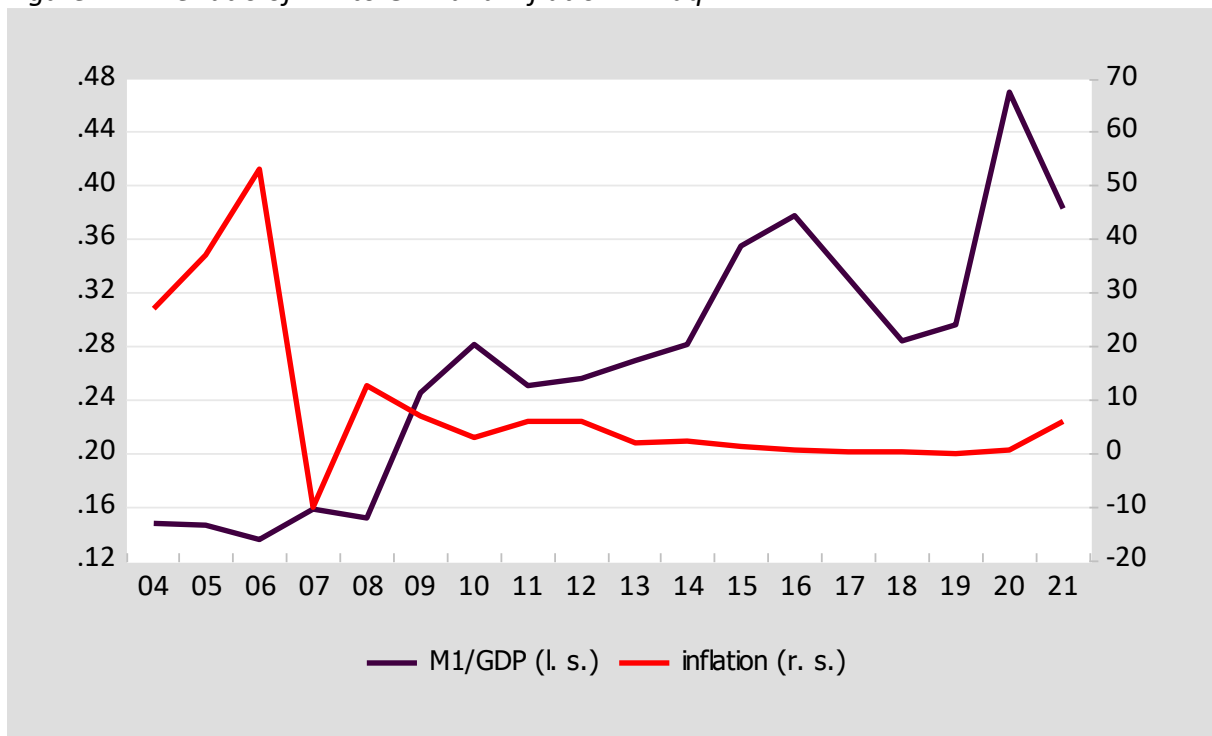
- cash transfers make households more food secure and enable them to invest more in meeting critical needs,

⁴² On cash assistance programs in Iraq see also Smart (2017).

- cash improves households’ economic recovery prospects by boosting or stabilizing their employment and productive asset ownership in the face of multiple shocks and
- cash contributes to a resilient development in the sense of learning, coping, adapting and transforming in the face of shocks and stresses.

Al-Tamimi & Attia (2022) find that domestic cash in circulation not only helped to stabilize the ratio of M1 to GDP and thus ensured that money was always sufficiently available to the public, but even contributed to its increase (see figure 14 as well as Rösl & Seitz, 2022a).⁴³ This is all the more interesting as inflation, at least since 2009, was kept at single-digit levels. In this respect, the pegging of the Iraqi dinar to the US dollar was obviously very helpful.

Figure 14: The ratio of M1 to GDP and inflation in Iraq



Notes: M1/GDP in decimal; inflation measured by the CPI, in %.

Source: CBI and IMF.

V.6. Libya

Libya is the largest oil producer in Africa. Efforts to diversify Libya’s economy have been more than offset by political crises and civil wars after the fall of the Gaddafi regime in 2011. The financial sector is traditionally underdeveloped and dominated by banks either owned or heavily regulated by the Central Bank of Lybia (CBL). The payment infrastructure is especially

⁴³ M1 does exclude foreign cash, but usually includes foreign currency deposits.

lagging behind western standards: Less than a quarter of the population holds cards, and, if any, predominantly debit cards. ATMs are hampered by low connectivity and further strained by the overall lack of cash, which in turn reinforces their disuse and low maintenance. Moreover, ATM distribution is skewed towards large banks and the capital Tripoli (Warfali, 2020). For the rest of the country, tellers are the main source of cash for the population. Nonetheless, with respect to payments for goods and services as well as wages, Libya is primarily a cash-based economy (World Bank Group, 2020).

Since 2014, Libyan households face a chronic shortage of dinar banknotes, along with a weak valuation of the Libyan dinar (LD) in the black market. In Libya, each family is entitled to apply through their local bank for an annual per person family allowance or letters of credit to convert dinars into US dollars, in 2017/18 at the official-exchange rate of about 1.40 LD per USD, later at a higher fee-based exchange rate. The idea is to facilitate access to foreign currency for Libyans travelling abroad or to pay for imported goods. This is deemed necessary, as Libyan banks are in general prevented from selling foreign currency to their (domestic) customers due to shortages in foreign banknotes (International Crisis Group, 2019). However, many Libyans used this allowance, charged on debit cards, to withdraw foreign currency abroad and return to Libya with cash in hand, which they then sold at the higher black market exchange rate. To avoid these practices and as the CBL did not want US dollars to circulate within Libya, it introduced a strict policy whereby it has become nearly impossible for ordinary requesters to convert LD into hard currency through official channels, e.g., via the official exchange rate (Harchaoui, 2018).⁴⁴ The following run on banks and hoarding of LD banknotes, as the analysis in chapter III suggested, caused supplies of physical dinar banknotes to dry up. Cash withdrawal limits and stopped cash deliveries led to informal or unofficial dollarization (again, in line with our theoretical analysis) and the emergence of a black market for foreign exchange.⁴⁵

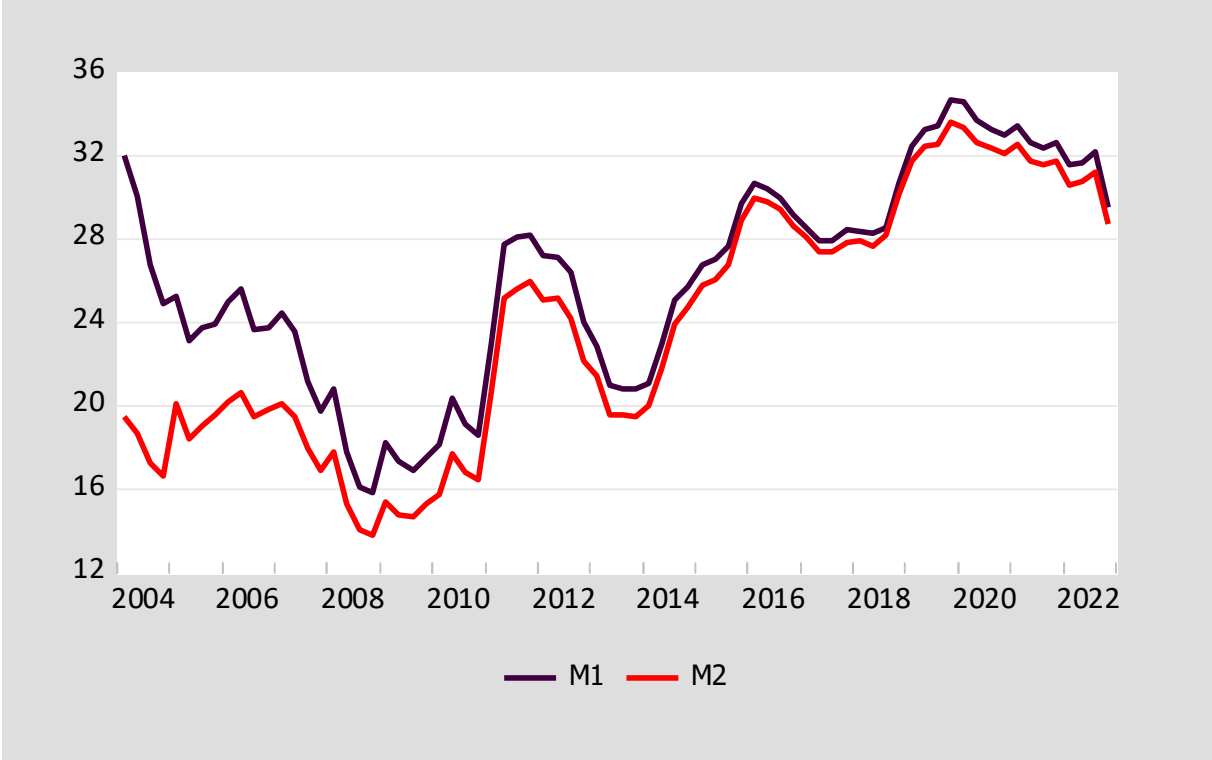
The political rivalry between the two parallel central banks, one in Tripoli and, since 2014, one branch operating autonomously in the eastern parts of the country (International Crisis Group, 2018), has only made the crisis more difficult to resolve. Both central banks have independently commissioned the production of billions of new dinars (the CBL from England,

⁴⁴ Several bank robberies led the CBL to stop supplying commercial banks with foreign currencies (Libyan Organization of Public Policies & Strategies, 2016).

⁴⁵ Several cash assistance programs for displaced persons as well as migrants and refugees originated from these circumstances, see, e.g., Norwegian Refugee Council (2022).

the eastern branch from Russia) which again caused distrust in the banking system. The trust crisis has led to a flight out of the banking system, with most Libyans holding financial assets in cash, and due to the developments described in the last paragraph, not in foreign, but mostly in domestic currency (World Bank Group, 2020; Bertelsmann Stiftung, 2022b). Figure 15 shows the share of currency in circulation in M1 and M2. These ratios more than doubled to around 30% from the end of 2008 until the 2020s. What is also evident is that in the last decade the difference between M1 and M2 is nearly negligible. Consequently, and as foreign currency deposits are included in M2, dollarization in Libya is solely present in cash holdings, not deposits. The general distrust in the banking system shows up in this respect, too. The decline in the ratios since 2021 is mainly due to a decrease in domestic (and forced) currency in circulation.

Figure 15: The share of cash in M1 and M2



Notes: In %. Cash refers to currency in circulation; M1 consists of currency in circulation and demand deposits; M2 additionally includes time and savings deposits in domestic and foreign currency.

Source: CBL.

The whole situation in the last decade can be characterized as one with periods of heightened and sometimes quickly increasing political uncertainty. Especially in the years after the fall of the Gaddafi regime (especially 2014) and in 2016, this stimulated cash demand, both of banks and the public, enormously. For instance, banknotes issued grew with annual rates of around 25% in 2014 and nearly 50% at the end of 2016. Against the background of the supply-driven

liquidity problems described, however, these increased uncertainties often did not show up in the official figures on national cash in circulation.

VI. Summary and conclusions

In this paper, we established a theoretical and empirically-based classification scheme how cash demand as a payments medium and as a store of value typically evolves during different periods of uncertainty since the beginning of the 1990s. Hereby, we distinguished not only five different types of uncertainty (uncertainty of the digital infrastructure, confidence crisis of the financial system, natural disasters, political uncertainty, and (considerable and hyper-) inflationary crises), but also separated between uncertainty-related demand for domestic and for foreign cash. Our results imply that cash always stabilizes the overall situation and leads to a more resilient economy, but the type of crisis determines if this stabilizing role is exerted by domestic or foreign cash. Therefore, it is essential for central banks to guarantee a proper functioning of the domestic cash cycle in normal times including access and acceptance of cash, but also sufficient production and storage capacities. In addition, central banks of internationally accepted currencies such as US dollar and euro should be willing to meet foreign demand for their currencies in a fully elastic way. This stabilizes foreign economies in times of turmoil and the associated seigniorage income of the cash exporting country is therefore well-earned. In a second part, we contribute to the literature by analyzing cash holdings in countries plagued by inflationary crises and political uncertainty, namely Venezuela, Zimbabwe, Afghanistan, Iraq and Libya. These case studies confirm the theoretical assertions in the first part of the paper.

It seems that uncertainty has increased worldwide in the last two decades (<https://worlduncertaintyindex.com/>). Therefore, our analysis on the repercussions on cash demand and its implications for stability or vulnerability of countries is highly topical. Christine Lagarde (2023), the President of the European Central Bank, stated in a speech at the ECB Watchers Conference 2023: "Faced with new and overlapping shocks, we have no choice today but to deal with uncertainty." If this is true, cash may play an important role in this environment.

What does our analysis imply for a possible future issuance of Central Bank Digital Currency (CBDC)? The essential question in this respect is whether CBDC will also be able to stabilize in times of crisis and uncertainty. This will only be possible if CBDC from the point of view of

money holders resembles cash as closely as possible. However, this is hard to imagine. Hence, from the current perspective, a co-circulation of cash and CBDC seems to be the preferred solution. Muñoz & Soons (2023) show in a theoretical model with three assets – cash, CBDC and bank deposits – how increased (financial market) uncertainty affects the demand for public and private money, respectively. They find that the demand for public money as a safe liquid asset and the proportion of consumers who prefer to hold cash rather than bank deposits increase with uncertainty. Especially in developing countries, there should be a potential for CBDC demand to facilitate remittances and to offer a low-fee based cashless payment instrument. For this demand to materialize, trust in the government and central bank as well as credibility in public institutions are essential.

An issue widely discussed internationally, also with respect to payments media, is sustainability. This is usually only discussed with respect to the environment, i. e., the ecological footprint and the repercussions on climate change of the production and logistics of banknotes and coins. However, this important but narrow perspective disregards the fact that sustainability is more than the environment (see, e. g., the 17 sustainable development goals of the UN). It includes financial (or payments) inclusion, the stabilization of the economy, well-being, proper functioning of society, sustainable private finance, social aspects, etc. In these areas, it seems that cash has an important role to play within the payments landscape. Due to its unique properties (see Rösl & Seitz 2022a, ch. II.4), cash supports the transition to and is a necessary part of a long-term sustainable future.

A more thorough investigation of these topics is beyond the scope of the present paper and is left to future research.

References

- Abramova, S., R. Böhme, H. Elsinger, H. Stix & M. Summer (2022), What can CBDC Designers Learn from Asking Potential Users? Results from a survey of Austrian residents, OeNB Working Paper 241.
- Adam, C., M. Gopujon & S. Guillaumont Jeanneney (2004), The Transactions Demand for Money in the Presence of Currency Substitution: Evidence from Vietnam, *Applied Economics* 36, 1461–1470.
- Ahir, H., N. Bloom & D. Furceri (2022), The World Uncertainty Index, NBER Working paper 29763, February.
- Al-Tamimi, S. O. M. & S. H. R. Attia (2022), Testing the Causal Relationship between Money Supply and Economic Growth in Iraq using Granger Test and Toda Yamamoto Test, *World Economics & Finance Bulletin* 15, 70-81.
- Ashworth, J. & C. A. E. Goodhart (2020), The Surprising Recovery of Currency Usage, *International Journal of Central Banking* 16, 239-277.
- Assenmacher, K., F. Seitz & J. Tenhofen (2017), The Use of Large Denomination Banknotes in Switzerland, in: Deutsche Bundesbank (ed.), *War on cash: Is there a future for cash?*, conference volume "International Cash Conference 2017", Seiters, Frankfurt am Main, 148-196.
- Assenmacher, K., F. Seitz & J. Tenhofen (2019), The Demand for Swiss Banknotes: Some new evidence, *Swiss Journal of Economics and Statistics* 155, article number 14.
- Banco Central de Venezuela (2018), Resolución N° 18-03-01 RM - Mediante la cual se dictan las Normas que Rigen en el Proceso de Reconversión Monetaria, <https://www.bcv.org.ve/marco/resolucion-ndeg-18-03-01-rm-mediante-la-cual-se-dictan-las-normas-que-rigen-en-el-proceso-de/>
- Banco Central de Venezuela (2021), Billetes del cono monetario actual coexistirán con los billetes y monedas de la Nueva Expresión Monetaria.
- Banegas, A., R. Judson, C. Sims & V. Stebunovs (2015), International Dollar Flows, *International Finance Discussion Paper*, No 1144, Board of Governors of the Federal Reserve System.
- Bank of England (2013), *LCA of Paper and Polymer Bank Notes*, Final Study Report.
- Bartzsch, N., G. Rösl & F. Seitz (2011), Foreign Demand for Euro Banknotes Issued in Germany: Estimation using direct approaches, *Deutsche Bundesbank Discussion Paper*, Series 1: Economic Studies (20/2011).
- Bautista-González, M. A. (2021a), The Forever War and a Pandemic: Cash and payments in Afghanistan, *Cash Essentials*, September 21, 2021.
- Bautista-González, M. A. (2021b), Trouble Ahead: Cash shortage and economic crisis in Afghanistan, *Cash Essentials*, September 13, 2021.
- Bautista-González, M. A. (2022), Revisiting the Cash Shortage in Afghanistan, *Cash Essentials*, January 9, 2022.
- Bautista-González, M. A. (2023), New Zealand: Cash after the Cyclone, *Cash Essentials*, March 27, 2023.

BBC (2016), Zimbabwe to Print Own Version of US Dollar, <https://www.bbc.com/news/world-africa-36210680>.

Beland D. & C. Wiseman (2010), The Politics of Institutional Change in Venezuela: Oil policy during the presidency of Hugo Chavez, *Canadian Journal of Latin American and Caribbean Studies* 35, No. 70, 141-164.

Beras, E. (2021), Afghanistan's Economy is in Trouble after the Taliban took Control, NPR, October 1, 2021.

Berg, A. & E. Borensztein (2000), Full Dollarization: The Pros and cons, *International Monetary Fund, Economic issues*, No. 24.

Bernholz, P. (2011), Understanding Early Monetary Developments by Applying Economic Laws: The monetary approach to the balance of payments, Gresham's and Thiers' laws, March 31, 2011.

Bertaut, C., B. von Beschwitz & S. Curcuru (2021), The International Role of the U.S. Dollar, *FEDS Notes*, October 06, 2021.

Bertelsmann Stiftung (2022a), *BTI 2022 Country Report — Iraq*, Gütersloh.

Bertelsmann Stiftung (2022b), *BTI 2022 Country Report — Libya*. Gütersloh.

Bettin, G., A. F. Presbitero, A. Berg & C. Pattillo (2014), Remittances and Vulnerability in Developing Countries, *IMF Working Paper 14/13*, January.

Bindseil, U., F. Panetta & I. Terol (2021), Central Bank Digital Currency: Functional scope, pricing and controls, *ECB Occasional Paper Series No 286*, December.

Boar, C. & A. Wehrli (2021), Ready, Steady, Go? – Results of the third BIS survey on central bank digital currency Bank of international Settlements, *BIS Papers No 114*, January.

Bostrom, E. (2017), Zimbabwe's Unorthodox Dollarization, *Studies in Applied Economics* 85, The Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise.

Briceño, A.J.H., de Hurtado, S.Z. & J.U.M. Mora (2019), Dollarization or Monetary Independence? Evidence from Venezuela, *Asian Journal of Latin American Studies* 32(4), 53-71.

Bushnell C. & S. Hanke (2017), On Measuring Hyperinflation – Venezuela's Episode, *World Economics* 18(3), 1-18.

CashEssentials (2021), The Resilience of Cash before, during and after Hurricane Ida, <https://cashesentials.org/the-resilience-of-cash-before-during-and-after-hurricane-ida/> (last access 27.04.2022).

Caddy, J., L. Delaney & C. Fisher (2020), Consumer Payment Behaviour in Australia: Evidence from the 2019 Consumer Payments Survey, Reserve Bank of Australia, *Research Discussion Paper 2020-06*, September.

Calvo, G. A. & C. A. Vegh (1992), Currency Substitution in Developing Countries: An Introduction, *IMF Working Paper No 92/40*.

Cagan, P. (1956), The Monetary Dynamics of Hyperinflation, in: Friedman, M. (ed.) *Studies in the Quantity Theory of Money*, The University of Chicago Press, Chicago, 25–117.

Cordova, M. (2020), The Dollarization of Venezuela: A case study, <https://globalisationguide.org/dollarization-of-venezuela/>.

Croatian National Bank (2002), How much Foreign Currency Circulated in Croatia on the Eve of Cash Conversion?, Bulletin (Quarterly Report), 24.

De Mello, M. (2021), Dollarization in Venezuela Causes a Boom in Imported Goods Stores, <https://peoplesdispatch.org/2021/05/17/dollarization-in-venezuela-causes-a-boom-in-imported-goods-stores/>.

Deutsche Bundesbank (2011), Foreign Demand for Euro Banknotes Issued in Germany, Monthly report, January, 29-41.

Deutsche Bundesbank (2017), Payment Behaviour in Germany in 2017, Fourth study of the utilisation of cash and cashless payment instruments, Frankfurt am Main.

Deutsche Bundesbank (2021), What Do Households in Germany Think about the Digital Euro? First results from surveys and interviews, Monthly report, October, 65-84.

Deutsche Bundesbank (2022): Demand for Euro Banknotes issued by the Bundesbank: Current developments, Monthly Report, April, 67-83.

ESTA (2022), Demand for Cash at a Time of War in Ukraine Statement – 8 March 2022.

European Central Bank (2020a): Report on a Digital Euro, October.

European Central Bank (2020b), Study on the Payment Attitudes of Consumers in the Euro Area (SPACE), December.

European Central Bank (2022a), Study on the Payment Attitudes of Consumers in the Euro Area (SPACE) - 2022, December.

European Central Bank (2022b), Annual Accounts of the ECB for 2021.

European Central Bank (2022c), The international Role of the Euro, June.

European Council (2022), Russia's Military Aggression against Ukraine: EU bans certain Russian banks from SWIFT system and introduces further restrictions, press release of 2 March, 2022.

Faqeerzai, M. & J. Faryad (2018), Remittances to Afghanistan: An examination of transfer cost, identification of transfer channels and volume, Da Afghanistan Bank, November.

Feige, E.L. (2003), The Dynamics of Currency Substitution, Asset Substitution and De facto Dollarization and Euroization in Transition Countries, Comparative Economic Studies 45, 358-383.

Giesecke & Devrient (2022), A Whitepaper about Green Paper: A holistic view on the future of the sustainable banknote.

Goldfajn, I. & G. Olivares (2001), Full Dollarization: The Case of Panama, Economía 1(2), 101–155.

Grigorian, D. A. & M. Kryshko (2017), Deposit Insurance, Remittances, and Dollarization: Survey-based evidence from a top remittance-receiving country, IMF Working Paper 17/132, June.

Hall, M., A. Singh, J. Morrison & A. O'Doherty (2022), The Cash Census - Britain's relationship with cash and digital payments, March.

Hanke, S. (2008a), How to Kill Zimbabwe's Hyperinflation, Global Dialogue, August, 23-36.

Hanke, S. (2008b), Zimbabwe: From Hyperinflation to Growth, Cato institute, Center for Global Liberty and Prosperity, Development Policy Analysis, June, 1-33.

Hanke S. & A. Kwok (2009), On the Measurement of Zimbabwe's Hyperinflation, The Cato journal 29 (2), 353-364.

Hanke, S. (2018), Dollarization, The SAGE Encyclopedia of Business Ethics and Society, SAGE Publications, 962-964.

Harchaoui, J. (2018), Libya's Monetary Crisis, Lawfare, January 10, 2018.

Hellerstein, R. & W. Ryan (2011), Cash Dollars Abroad, Federal Reserve Bank of New York Staff Report, No 400.

Hosny, A. (2020), Remittance Concentration and Volatility: Evidence from 72 Developing Countries, IMF Working Paper 20/15, January.

Imam, P.A. (2022), De-dollarization in Zimbabwe: What lessons can be learned from other sub-Saharan countries?, International Journal of Finance & Economics 27, 770– 801.

International Crisis Group (2018), After the Showdown in Libya's Oil Crescent, Middle East and North Africa Report N°189, 9 August 2018.

International Crisis Group (2019), Of Tanks and Banks: Stopping a dangerous escalation in Libya, Middle East and North Africa Report N°201, 20 May 2019.

International Finance (2017), Zimbabwe Offers Workers Land Instead of Bonuses, <https://internationalfinance.com/zimbabwe-offers-workers-land-instead-bonuses/>.

International Monetary Fund (2009), Country Report (on Zimbabwe), No. 09/139, May.

International Monetary Fund (2010), Country Report (on Zimbabwe), No. 10/186, July.

Jidoud, A. (2015), Remittances and Macroeconomic Volatility in African Countries, IMF Working Paper 15/49, March.

Judson, R. (2012), Crisis and Calm: Demand for U.S. Currency at Home and Abroad from the Fall of the Berlin Wall to 2011, in: Deutsche Bundesbank (ed.), The usage, costs and benefits of cash: Theory and evidence from macro and micro data, conference volume "International Cash Conference 2012", Frankfurt am Main, 71-116.

Judson, R. (2017), The Future of Cash in Crisis and Calm: Demand for US dollar banknotes, in: Deutsche Bundesbank (ed.), War on cash: Is there a future for cash?, conference volume "International Cash Conference 2017", Seiters, Frankfurt am Main, 201-248.

Jumazada, W. (2023), Ripped Banknotes Problematic: Ghazni residents, Pajhwok Afghan News, 18 Jan 2023.

Kahn, C. M., J. McAndrews & W. Roberds (2005), Money is Privacy, International Economic Review 46, 377-399.

Kamin, S. B. & N. R. Ericsson (2003), Dollarization in Post-Hyperinflationary Argentina, Journal of International Money and Finance 22, 185–211.

Kim, L., R. Kumar & S. O'Brien (2020), 2020 Findings from the Diary of Consumer Payment Choice, Cash Product Office, Federal Reserve System, July.

Koech, J. (2011), Hyperinflation in Zimbabwe, Federal Reserve Bank of Dallas, Annual Report, Globalization and Monetary Policy Institute, 2–12.

Krüger, M. & F. Seitz (2017), *The Benefits of Cash (Module 2)*, Fritz Knapp Publisher, Frankfurt/Main.

Kurtz, J., V. Krishnan, V. Leape, V. Jovanovic, M. Ross & R. Macaranas (2021), *A Million-Dinar Question: Can cash transfers drive economic recovery in conflict-driven crises? Experimental evidence from Iraq*, Mercy Corps.

Lagarde, C. (2023), *The path Ahead*, speech at "The ECB and Its Watchers XXIII" conference, 22 March 2023.

Lalouette, L., A. Zamora-Pérez, C. Rusu, N. Bartzsch, E. Politronacci, M. Delmas, Rua, A., M. Brandi, & M. Naksi (2021), *Foreign Demand for Euro Banknotes*, Occasional Paper Series, No. 253, European Central Bank, Frankfurt am Main, January.

Lebre de Freitas, M. (2004), *The Dynamics of Inflation and Currency Substitution in a Small Open Economy*, *Journal of International Money and Finance* 23, 133-142.

Libyan Organization of Public Policies & Strategies (2016), *The Libyan Dinar Crisis: Causes, impacts and solutions*, April.

Makochekanwa, A. & P. Kambarami (2011), *Zimbabwe's Hyperinflation: Can dollarization be the cure?*, in: Besada, Hany (ed.), *Zimbabwe – Picking up the Pieces*, New York, 107-129.

Muñoz, M. A. & O. Soons (2023), *Public Money as a Store of Value, Heterogeneous Beliefs, and Banks: implications of CBDC*, ECB Working Paper Series No 2801, March.

Muzaffari, S. M. & A. K. Miraj (2018), *Dollarization in Afghanistan: Issues and concerns*, Da Afghanistan Bank.

Neanidis, K. C. & C. S. Savva (2006), *The Effects of Uncertainty on Currency Substitution and Inflation: Evidence from Emerging Economies*, Economics Discussion Paper 0609, The University of Manchester.

Neely C. J. (2022), *The Innocent Greenbacks Abroad: U.S. Currency Held Internationally*, Federal Reserve Bank of St. Louis, *The Economy Blog*, October 18, 2022.

Neumann, M. J. M. (1992), *Monetary Reform*, *Palgrave Dictionary of Money and Finance*, Palgrave Macmillan, London and Basingstoke, Vol. 2, 751-756.

Niazai, M. D. (2021), *Covid-19 Pandemic in the SAARC Countries: Policy responses and its impact*, Da Afghanistan Bank.

Norwegian Refugee Council (2022), *NRC's Operations in Libya*, Fact Sheet, May 2022.

Pietrucha, J., (2021), *Drivers of the Cash Paradox*, *Risks* 9: 227.

Porter, R. D. & R. Judson (1996), *The Location of U.S. Currency: How much is abroad?*, *Federal Reserve Bulletin*, 82(10), 883-903.

Quispe-Agnoli, M. (2002), *Costs and Benefits of Dollarization*, LACC Conference on Dollarization and Latin America, Miami.

Qooyash, H. R. (2023), *Kabul Residents Call for Better Care of Banknotes*, *TOLONews*, 31 January 2023.

Reconnaissance (2022), *Cash: A roadmap to sustainability*.

Republica de Venezuela (2008), *Currency of Venezuela*, <http://www.republica-de-venezuela.com/about-venezuela/currency-of-venezuela.php>.

Reserve Bank of Zimbabwe (2015), Demonetization of the Zimbabwe Dollar, Press statement, 9 June.

Reuters (2019), Maduro says 'thank God' for dollarization in Venezuela, <https://www.reuters.com/article/us-venezuela-economy-idUSKBN1XR0RV>.

Rodgers, W. (2023), Why Cash is still King in Iraq, Rest of World, 8 February 2023.

Rösl, G. & F. Seitz (2021), Cash and Crises: No surprises by the virus, IMFS Working Papers, No 150, Institute for Monetary and Financial Stability, Frankfurt.

Rösl, G. & F. Seitz (2022a), On the Stabilizing Role of Cash for Societies, IMFS Working Papers, No. 167.

Rösl, G. & F. Seitz (2022b), Cash Demand in Times of Crisis, Journal of Payment Systems & Strategies 16(2), 107-119.

Rösl, G. & F. Seitz (2022c), Central Bank Digital Currency and Cash in the Euro Area: Current developments and one specific proposal, Credit and Capital Markets 55, forthcoming.

Rua, A. (2021), Modelling Currency Demand: The case of the euro, Empirical Economics 61, 1865-1881.

Sadat, S. M. & H. Khan (2020), The Unofficial Dollarization: A turning point for the troubled financial system of Afghanistan, South Asia Journal, September 14, 2020.

Seitz, F. (1995), The Circulation of Deutsche Mark Abroad, Discussion paper 1/95, Economic Research Group of the Deutsche Bundesbank, May.

Seitz, F., L. Devigne & R. de Pastor (2022), Different Motives for Holding Cash in France: An analysis of the net cash issues of the Banque de France, Banque de France Working paper 888, October.

Shepherd-Barron, J. (2016), Cash is Critical to Disaster Response, CashEssentials, November 8, 2016.

Sikwila, M.N. (2013), Dollarization and the Zimbabwe's Economy, Journal of Economics and Behavioral Studies, 5 (6), 398-405, June. Smart, K. (2017), Challenging the System: Humanitarian cash transfers in Iraq, Overseas Development Institute, Working paper 508, March.

Smith, M (2014), Cash is Vital to Disaster Recovery: How IADs can help, ATM Marketplace.

Spicer, J (2017), Cash Demand Doubled for Fed in Hurricane-hit Florida, Reuters, September 15, 2017.

Swiss National Bank (2021), Survey on Payment Methods 2020.

Swiss National Bank (2022), Life Cycle Assessment of the Ninth Banknote Series.

Tabaqchali, A. (2021), Cash is King: Money and the banking sector in Iraq, Iraq Economic Review, September, 5-12.

Tamele, B., A. Zamora-Pérez, C. Litardi, J. Howes, E. Steinmann & D. Todt (2021), 'Catch me (if you can): Assessing the risk of SARS-CoV-2 transmission via euro cash', ECB Occasional Paper No. 259.

TeleSUR (2022), Venezuela - Law Authorizes Tax on Foreign Currency Transactions, <https://www.telesurenglish.net/news/Venezuela-Law-Authorizes-Tax-on-Foreign-Currency-Transactions-20220203-0021.html>.

The Zimbabwe Independent (2009), <https://reliefweb.int/report/zimbabwe/zimdollar-officially-dead-mangoma>, April 15.

van Rooden, R. & L. Dicks-Mireaux (2005), Monetary and Exchange Rate Policy in a Postconflict Environment, in: Bennett, A., Schaetzen, B., Dicks-Mireaux, L., Kalfon, T., Fischer, F., van Rooden, R. (eds.), *Reconstructing Afghanistan*, International Monetary Fund, Washington.

VOA News (2009), Zimbabwe Suspends Use of Own Currency, 12 April.

Wakefield, M., L. Delaney & R. Finlay (2019), A Cost-benefit Analysis of Polymer Banknotes, Reserve Bank of Australia, Bulletin, December, 24-35.

Warfali, A. (2020), Cash Shortage Adds to Weary Eastern Libyans' Woes, Reuters, October 7, 2020.

World Bank Group (2020), *Libya Financial Sector Review*, February.

Xinhua (2022), Zimbabwean Finance Minister Affirms no Dollarization as Local Currency severely Weakens, <https://english.news.cn/africa/20220617/f3379faeb4d843759b2be046f056a1f3/c.html>.

Yapur, N. (2022), Maduro's 3% Dollar Tax Is Pushing Venezuelans Back into Bolivars, <https://www.bloomberg.com/news/articles/2022-05-03/venezuela-reins-in-dollarization-in-risky-bid-to-revive-bolivar>.

Zamora-Pérez, A. (2021), The Paradox of Banknotes: Understanding the demand for cash beyond transactional use, European Central Bank, Economic Bulletin 2/2021, 121-137.

Zamora-Pérez, A., E. Coschignano & L. Barreiro (2022): Ensuring Adoption of Central Bank Digital Currencies – An easy task or a Gordian knot?, ECB Occasional Paper Series No 307, October.

Zwinoira, T. (2017), Zimbabwe: Cash Dealers Swell on Harare's Streets, 9 July, <https://allafrica.com/stories/201707090004.html>

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