



EUROPEAN CENTRAL BANK

EUROSYSTEM

Zahlungsverkehr und Marktinfrastruktur Gegenwart und Geschichte



Frankfurt am Main
CFS

21 Februar 2024

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Struktur

- 1** Zahlungsverkehr und Marktinfrastruktur – Gegenwart (Buchvorstellung)
- 2** Geschichte des Zahlungsverkehrs

Ulrich Bindseil
George Pantelopoulos

Introduction to Payments and Financial Market Infrastructures

1. Zahlungsverkehr und Marktinfrastruktur: Buchvorstellung

Andere einführende Bücher zu dem Thema...

Europa-spezifische Sammelbände:

Kokkola (ed) (2008), *The payment system*, ECB.

www.ecb.europa.eu/pub/pdf/other/paymentsystem201009en.pdf

Russo (ed) (2021). *Payments and market infrastructure two decades after the start of the European Central Bank*, ECB.

www.ecb.europa.eu/pub/pdf/other/ecb.paymentsmarketinfrastructure~a5f9e40c69.en.pdf

Allgemein, als Einführungswerk mit zahlreichen Beispielen konzipiert:

Banque de France (2018/2021), *Payments and market infrastructures in the digital era*,

<https://publications.banque-france.fr/en/economic-and-financial-publications/book-payments-and-market-infrastructures-digital-era>

Konzeptuell ambitionierter:

Berndsen, R. J. (2017). *Financial Market Infrastructures and Payments*. Warehouse Metaphor Textbook.

Bauer, Hans F. (2021). **Unbarer Zahlungsverkehr und die Rolle des Zentralbankgeldes**, Springer Verlag

Was ist „Zahlungsverkehr und Marktinfrastruktur“ (ZM)?

„Payments and market infrastructures“ (PMI) Umbenennungswelle: CPSS=>CPMI; DG-P=>DG-MIP

Zahlungsverkehr:

- Zahlungsinstrumente (POI und P2P - [Bargeld], Karten, mobile payments; ApplePay, PayPal, EPI, Bizum, etc)
- Zahlungsverkehrssysteme (T2, TIPS, EBA clearing RT1, Iberpay, Fedwire, FedNow)
- Korrespondenzbanken und Internationaler Zahlungsverkehr

Marktinfrastrukturen

- CSDs und Sicherheitenabwicklung
- CCPs
- CLS

Weitere Parteien: SWIFT, andere Anbieter von sicheren Kommunikationsnetzwerken

Standardisierungsinitiativen: ISO20022 message format; Schemen (EPC: SEPA SCT, SCT INST)

Warum für Ökonomen interessant?

Privateigentum und vertragliche Übertragung davon: rechtlich und operational effiziente und sichere Dokumentierung. One-leg vs. two-leg – letztere sollten DvP/PvP sein

1% des GDP in Europa, 2% in USA, aber außerdem...

1. *Voraussetzung der arbeitsteiligen Wirtschaft;*
 2. *Netzwerkeffekte; Two-sided markets; Marktmacht; industrial organisation*
 3. *Systemische Relevanz und Externalitäten*
 4. *Pfadabhängigkeit und stabile inferiore Gleichgewichte*
 5. *Strategische Unabhängigkeit*
 6. *Stabilität des Geld- und Finanzsystems; Zentralbankpolitik;*
- **Geldpolitik: Zahlungsmittel sind Geld; private Zahlungsmittel sind potentiell zyklisch**
 - => **Regulierung (PFMIs + Implementierung, zB in Europa: EMIR, CSDR, SIPS-R)**
 - => **Zentralbank: als Betreiber von Systemen (öffentliche Bereitstellung), Katalysator und Aufseher**

Was sollte eine Semestervorlesung über Zahlungsverkehr abdecken?

A. Grundsätzliche Logik von Zahlungsverkehrssystemen und Marktinfrastrukturen

B. Ökonomische Fragestellungen. Notwendig für sinnvolle Zahlungsverkehrspolitik und Regulatorik (zB in Zentralbank; Standardisierungskomitee wie BIS-CPMI; EU-Kommission -FISMA, Industrielobby). Akademische Literatur teilweise spezialisiert, manchmal verwirrend.

C. Rechtsrahmen und Regulatorik

D. Realität in der Industrie:

- IT Systeme (Datenbanken, Kommunikation; Projekte, IT operations); Message standards (ISO20022); Cyber Sicherheit
- Compliance; Betriebswirtschaft; public relations
- Aktuelle Trends und Industriestruktur

Regulierung

CPSS-IOSCO (2012): Principles of Financial Market Infrastructures

www.bis.org/cpmi/publ/d101a.pdf

180 Seiten regulatorische Prinzipien für ZuM

Umsetzung in europäisches Recht:

EMIR (CCPs)

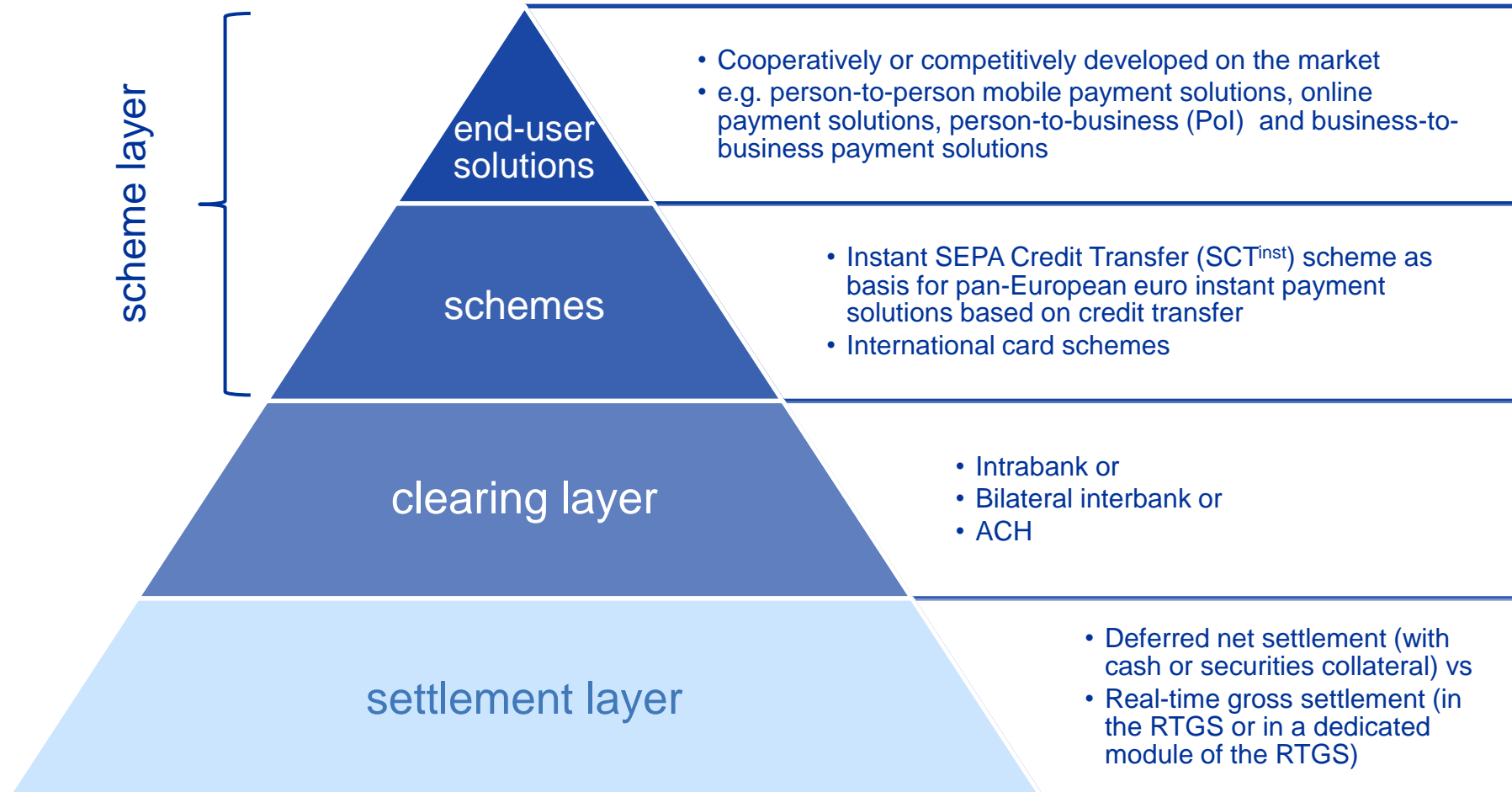
CSDR (CSDs)

SIPS-Regulation (EZB, für Systemrelevante Zahlungsverkehrssysteme)

Schichtungsphänomene

- 1. Im Zahlungsverkehr: Konteneinräumung kann beliebig viele Ebenen schaffen, aber: Interoperabilität? (Beispiel: SCT ACHs in Europa: 8 + TIPS, welches zugleich die Interoperabilität herstellt)**
- 2. Tiering: direct vs. indirect participants, auch in anderen Infrastrukturen (Beispiel CCPs; CLS); Custodian banks, links zwischen CSDs; custody chains**
- 3. Instrument (EPI; Bizum, Swish) ; Schema (SCT INST); System (TIPS, EBA Clearing RT2)**

Schichtung im retail payment



Moderne elektronische Zahlungsinstrumente, die alle auf Bankengeld basieren

1. Debit card
2. Credit card
3. Overlay with ApplePay / GooglePay
4. E-money (e.g. PayPal)
5. Stablecoin (fully backed)
6. INST basierte Schemen (EPI, BIZUM, iDEAL, PIX; UPI)

Zahlungsverkehrssysteme

Definition laut settlement finality directive:

Eine förmliche Vereinbarung, die, ohne Mitrechnung einer etwaigen Verrechnungsstelle, zentralen Vertragspartei oder Clearingstelle, oder eines etwaigen indirekten Teilnehmers, zwischen mindestens drei Teilnehmern getroffen wurde und gemeinsame Regeln und vereinheitlichte Vorgaben für die Ausführung von Zahlungs- bzw. Übertragungsaufträgen zwischen den Teilnehmern vorsieht,

Vereinfacht dramatisch das Netz der Korrespondenzbankenbeziehungen: statt $N \cdot (N-1)$ Konten nur noch N Konten

Korrespondenzbankensystem spielt nur noch im internationalen Zahlungsverkehr eine Rolle
Einstufiger, zweistufiger, dreistufiger Zahlungsverkehr (Beispiele)

Korrespondenzbanken (1-layer, ohne ZVsystem)

Table 4.3 Payment with correspondent banking

Country X – in currency X			
Person 1			
Other assets	X	Equity	X
Car	+a		
Deposits at Bank 1	X -a		
Bank 1			
Nostro with Bank 2	X -a	Deposits Person 1	X -a
Other assets	X	Vostro Bank 2	X
Deposits at central bank	X	Equity	X
Bank 2			
Nostro with Bank 1	X	Deposits Person 2	X +a
Other assets	X	Vostro Bank 1	X -a
Deposits at central bank	X	Equity	X
Person 2			
Other assets	X	Equity	X
Car	-a		
Deposits at Bank 2	X +a		

Interbankzahlung (1-layer)

Table 4.4 Interbank payment

Country X – in currency X			
Bank 1			
Other assets	X	Deposits	X
Deposits at central bank	X +a	Credit from Bank 2	+a
		Equity	X
Bank 2			
Other assets	X	Deposits	X
Deposits at central bank	X -a	Equity	X
Credit to Bank 1	+a		
Central Bank X			
Other assets	X	Deposits Bank 1	X +a
		Deposits Bank 2	X -a
		Banknotes	X
		Equity	X

Bank transfer (2 layer)

Country X – in currency X			
Person 1			
Other assets	X	Equity	X
Car	+a1		
Deposits at Bank 1	X -a1		
Banknotes	X		
Bank 1			
Other assets	X	Deposits Person 1	X -a1
Deposits at central bank	X -a3	Equity	X
Deposits at ACH	-a2 +a3		
ACH			
Other assets	X	Deposits Bank 1	-a2 +a3
		Deposits Bank 2	+a2 -a3
		Other Liabilities	X
Bank 2			
Other assets	X	Deposits Person 2	X +a4
Deposits at central bank	X +a3	Equity	X
Deposits at ACH	+a2 -a3		
Person 2			
Other assets	X	Equity	X
Car	-a1		
Deposits at Bank 2	X +a4		
Banknotes	X		
Central Bank X			
Other assets	X	Deposits Bank 1	X -a3
		Deposits Bank 2	X +a3
		Banknotes	X
		Equity	X

Bank transfer (3 layer – 2 ACH)

Table 4.10 Payment with instant payment via ACH with prefunded central bank money

Eurosystème – in euros				
Person 1				
Other assets	X		Equity	X
Car		+c		
Deposits at Bank 1	X	-c		
Banknotes	X			
Bank 1				
Other assets	X		Deposits Person 1	X -c
Deposits at central bank	X -a		Equity	X
Deposits at ACH 1	+a	-c		
ACH 1				
TIPS account	+a	-c	Deposits Bank 1	+a -c
Other assets	X		Other Liabilities	X
TIPS				
Deposits at central bank	+a	+b	ACH 1	+a -c
			ACH 2	+b +c
ACH 2				
TIPS account		+b +c	Deposits Bank 2	+b +c
Other assets			Other Liabilities	X
Bank 2				
Other assets	X		Deposits Person 2	X +c
Deposits at central bank	X	-b	Equity	X
Deposits at ACH 2		+b +c		
Person 2				
Other assets	X		Equity	X
Car		-c		
Deposits at Bank 2	X	+c		
Banknotes	X			
Central Bank				
Other assets	X		Deposits Bank 1	X -a
			Deposits Bank 2	X -b
			Banknotes	X
			Deposits TIPS	+a +b
			Equity	X

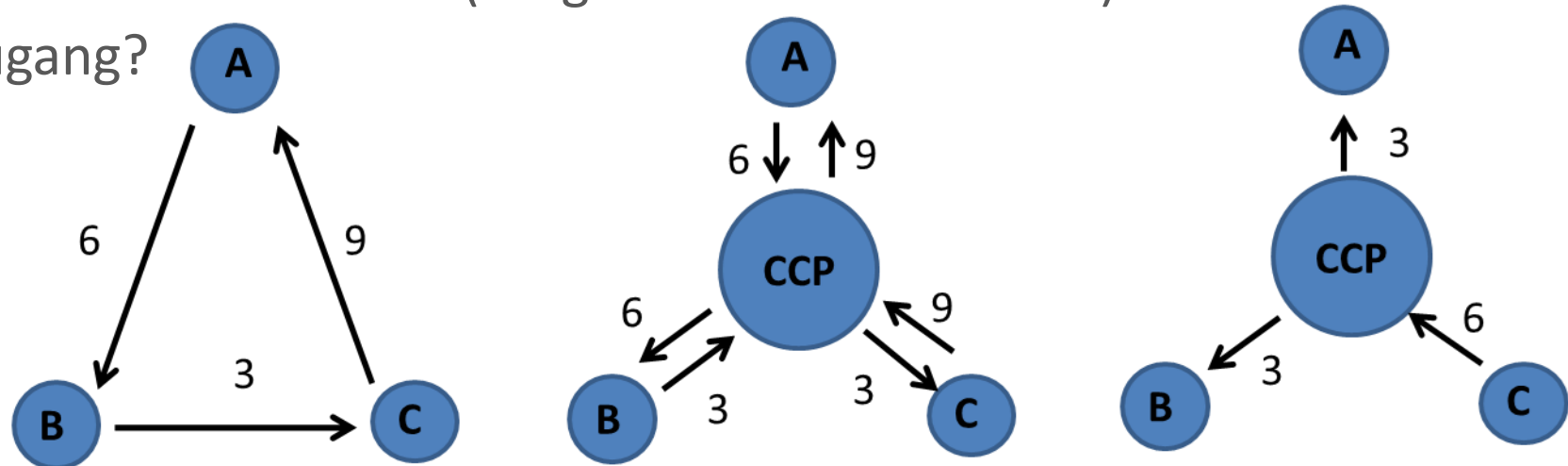
CCPs (Central counterparties)

BIS-Definition: “An entity that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the performance of open contracts.”

Prinzip: Novation, netting, initial margins, variation margins. Risikomanagement

IRS, futures, commodities, equity, bonds – letztere nur für kurze Zeit der Abwicklung

Risiko: Skaleneffekte. Prozyklichkeit durch Kombination von regulatorisch verlangter Risikofreiheit und Systemischer Relevanz (Vergleich zur Zentralbank). Ein Element der Lösung: Zentralbankzugang?



CSDs (Central securities depositories)

BIS-Definition: An entity that provides securities accounts, central safekeeping services and asset services, which may include the administration of corporate actions and redemptions, and plays an important role in helping to ensure the integrity of securities issues (that is, ensure that securities are not accidentally or fraudulently created or destroyed or their details changed).

T2S: „Mit TARGET2-Securities (T2S) bietet das Eurosystem eine harmonisierte und zentrale Wertpapierabwicklung in Zentralbankgeld für ganz Europa an. Das Konzept von T2S basiert auf der Integration der Zentralbankgeld- und Wertpapierabwicklung auf einer Plattform. T2S hat im Juni 2015 seinen Betrieb aufgenommen.“ (Deutsche Bundesbank)

CSD – Gruppen in Europa: Clearstream, Euroclear, Euronext, Six

Von T+2 zu T+1 Abwicklung

CSDs (Central securities depositories)

Internationale custodian chain,
sanctions, and how to hide behind
the international custody chain

Table 8.4 Example of foreign reserve protection amid the application of sanctions

Russia			
Central Bank of Russia			
Deposits at G7 CB	C	-c	
Nostro at G7 Bank 1	B +a	-a -b	
Securities at G7 CSD	A	-a	
Deposits at G7 CSD			
Nostro at NSC 1 Bank		+a +b +c -d	
Nostro at NSC 2 Bank		+d -e	
Securities at NSC 2 Bank		+e	
Liabilities			
			X
G7 country			
G7 Bank 1			
Deposits at central bank	X	-a -b	
Deposits at CSD	X		+e
Securities account CSD	X +a		-e
Vostro CBR			
			B +a -a -b
G7 Bank 2			
Deposits at central bank	X	+a +b +c	-e
Vostro NSC 1 Bank			
	X	+a +b +c -d	
Vostro NSC 2 Bank			
	X	+d -e	
G7 Central Bank			
Other assets	X		
Deposits CBR			
		C	-c
Deposits G7 Bank 1			
	X	-a -b	+e
Deposits G7 Bank 2			
	X	+a +b +c	-e
G7 CSD Bank			
Deposits at central bank	X		
Securities issued CSD	X		
Sec. account CBR			
		A -a	
Sec. account G7 Bank 1			
	X +a		-e
Sec. account NSC 2 Bank			
	X		+e
NSC 1			
NSC 1 Bank			
Nostro G7 Bank 2	X	+a +b +c -d	
Securities at G7 CSD	X		
Vostro CBR			
		+a +b +c -d	
NSC 2			
NSC 2 Bank			
Nostro G7 Bank 2	X	+d -e	
Sec. account G7 CSD	X	+e	
Vostro CBR			
		+d -e	
Securities account CBR			
		+e	

Internationaler Zahlungsverkehr (cross border payments)

„Cross-currency Zahlungen zu verstehen bedeutet, zu verstehen, dass sie nicht existieren“. Ein euro beim Eurosystem wird nicht umgewandelt in einen dollar bei der Fed. Jede Internationale Zahlung besteht aus zwei lokalen Zahlungen

G20 Initiative: Kosten, Geschwindigkeit, Zugang; 19 BB; 2027 Targets, KPIs

Ansätze: effizienteres Korrespondenzbankensystem; Interlinking von lokalen Systemen; closed loop Lösungen; stablecoins

Compliance und Rechtsrisiken

Internationale Zahlungen

Interlinking

Table 5.10 Instant cross-border payment with central FX conversion layer

Country A (in A currency)			
Firm A			
Real goods	$X + \beta a$	Equity	X
Account Bank B	$X - \beta a$		
Bank A			
Dep. at central bank	$X - \beta a$	Deposits	$X - \beta a$
Other assets		Credit central bank A	X
		Equity	X
Central Bank A			
Credit to banks	X	Deposits Bank A	$X - \beta a$
		Deposits FX Bank A	$X + \beta a$
		Banknotes	X
		Equity	X
FX Bank – A-country subsidiary			
Dep. at central bank	$X + \beta a$	Cred. central bank A	X
Other assets	X	Intra-Group liability	$X + \beta a$
FX Bank – B-country subsidiary			
Dep. at central bank	$X - a$	Cred. central bank B	X
Intra-Group claims	$X + a$		
Other assets	X		
Country B (in B currency)			
Firm B			
Real goods	$X - a$	Equity	X
Account Bank B	$X + a$		
Bank B			
Dep. at central bank	$X + a$	Deposits	$X + a$
Other assets	X	Credit central bank B	X
		Equity	X
Central Bank B			
Credit to banks	X	Deposits Bank B	$X + a$
		Deposits FX Bank B	$X - a$
		Banknotes	X
		Equity	X

FX settlement

FX settlement

- Herstatt Risiko => PvP durch CLS; CLS netting und/oder settlement
- Non PvP ist heute höher als 1990 (trotz CLS)

FX settlement

Table 7.1 FX Spot trade outside of CLS.

Turkey - accounts in Turkish Lira					
Denizbank					
Deposits at CB Turkey	X	-βb2		Deposits of importer	X -βa
USD Nostro with Citibank	X	+βb3	-βa	Liability to Deutsche NY	+βb1 -βb2
USD claim on Deutsche NY		+βb1	-βb3	Equity	X
Deutsche Bank subsidiary in Turkey					
Deposits at CB Turkey	X	+βb2		Intra-DB group liability	X +βb2
				Equity	X
Central Bank of Turkey					
Other assets	X			Deposits Deutsche Bank	X +βb2
				Deposits of Denizbank	X -βb2
				Equity	X
United States – accounts in US Dollars					
Citibank					
Deposits at Fed	X	+b3	-a	Vostro Denizbank	X +b3 -a
				Equity	X
Deutsche Bank NY					
Deposits at Fed	X	-b3		Liability to Denizbank	+b1 -b3
Lira Claim on Denizbank	X	+b1	-b3	Equity	X
Intra-DB group claim	X	+b3			
Pacific Western Bank					
Deposits at central bank	X		+a	Deposits of Exporter	X +a
				Equity	X
US central bank - Fed					
Other assets	X			Deposits Citibank	X +b3 -a
				Deposits Deutsche NY	X -b3
				Deposits Pacific Western	X +a
				Equity	X

Table 7.2 FX Spot trade settlement with CLS.

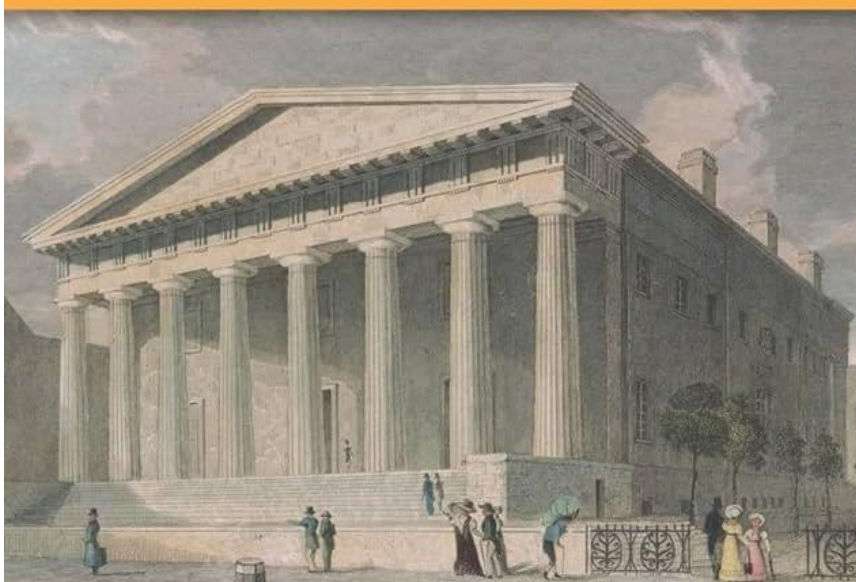
Mexico - accounts in Mexican Pesos (MXN)					
Banco Azteca					
Deposits at CB Mexico	X	-βb2		Deposits of importer	X -βa
USD Nostro Citibank NY	X		+βb6 -βa	Equity	X
USD claim on DB NY		+βb1	-βb6	Liability to DB NY	+βb1 -βb6
Claim on Citibank Mex		+βb2	-βb6		
Citibank Mexico					
Deposits with CB Mexico	X	+βb2 -βb3		Liability to Banco Azteca	+βb2 -βb6
Account with CLS			+βb3 -βb4	liability	
Intra-Citi group claim			+βb4 -βb6	Equity	X
Deutsche Bank Mexico					
Deposit with CB Mexico	X		+βb5	Intra-DB group liability	+βb4
Account with CLS			+βb4 -βb5	Equity	X
CLS Bank Mexico					
Deposits with CB Mexico		+βb3	-βb5	Account of Citibank Mex	+βb3 -βb4
				Account of DB Mex	+βb4 -βb5
Central Bank of Mexico					
Other assets	X			Deposits of Banco Azteca	X -βb2
				Deposits DB Mex	X +βb5
				Deposits Citibank Mex	X +βb2 -βb3
				Deposits CLS Bank	+βb3 -βb5
				Equity	X
United States – accounts in US Dollars					
Citibank NY					
Deposits at Fed	X		+b5 -a	Vostro Banco Azteca	X +b6 -a
Intra-Citi group claim				Intra-Citi group liability	+b4 -b6
Account with CLS			+b4 -b5	Equity	
Deutsche Bank NY					
Deposit with Fed	X	-b3		Liability to Banco Azteca	+b1 -b6
MXN claim on B. Azteca	+b1		-b6	Equity	X
Account with CLS		+b3 -b4			
Intra-DB group claim			+b4		
Pacific Western Bank					
Deposits at Fed	X		+a	Deposits of Exporter	X +a
				Equity	X
CLS Bank United States					
Deposits with Fed		+b3	-b5	Account of DB NY	+b3 -b4
				Account of Citibank NY	+b4 -b5
US central bank - Fed					
Other assets	X			Deposits Citibank NY	X +b5 -a
				Deposits DB NY	X -b3
				Deposits Pacific Western	X +a
				Deposits CLS Bank	+b3 -b5
				Equity	X

2. Geschichte des Zahlungsverkehrs

ULRICH BINDSEIL

Central Banking before 1800

A Rehabilitation



OXFORD



A Brief History of Payment Netting and Settlement

Ulrich Bindseil, European Central Bank
George Pantelopoulos, University of Newcastle (Australia),

Abstract:

In earlier times, societies relied extensively on "IOUs" ("I owe you") to avert the need for settlement in specie. However, an IOU reliant economy is complex and fraught with financial stability risks. These problems can be overcome through clearing, netting and settlement, either without or with novation. From the perspective of creditors, the most expedient solution is for residual claims to be denominated in a large-scale, risk-free and divisible IOU that is analogous to settlement in specie, but without incurring the disadvantages of settlement in precious metal coins. If such solutions are not feasible, it is then desirable that (1) networks of IOUs are simplified through netting, and (2) residual claims are denominated in relatively high-quality claims, which can be readily converted into risk-free positions. The purpose of this paper is to explore how such outcomes have been achieved through the lens of history. As will be shown - whilst netting and settlement with novation is an effective technique to mitigate financial instability risks - it is only through central banks acting as correspondents to the domestic financial system that the drawbacks of the IOU economy can be alleviated to the largest extent in order to attain lean balance sheets, lower credit risk and improved financial stability. At the same time, such a solution also ensures that the financial system remains layered.

JEL-Classification: F33, G21, N20, N24

IBF Paper Series

01 - 22

Zahlungsinstrumente

The BIS money flower

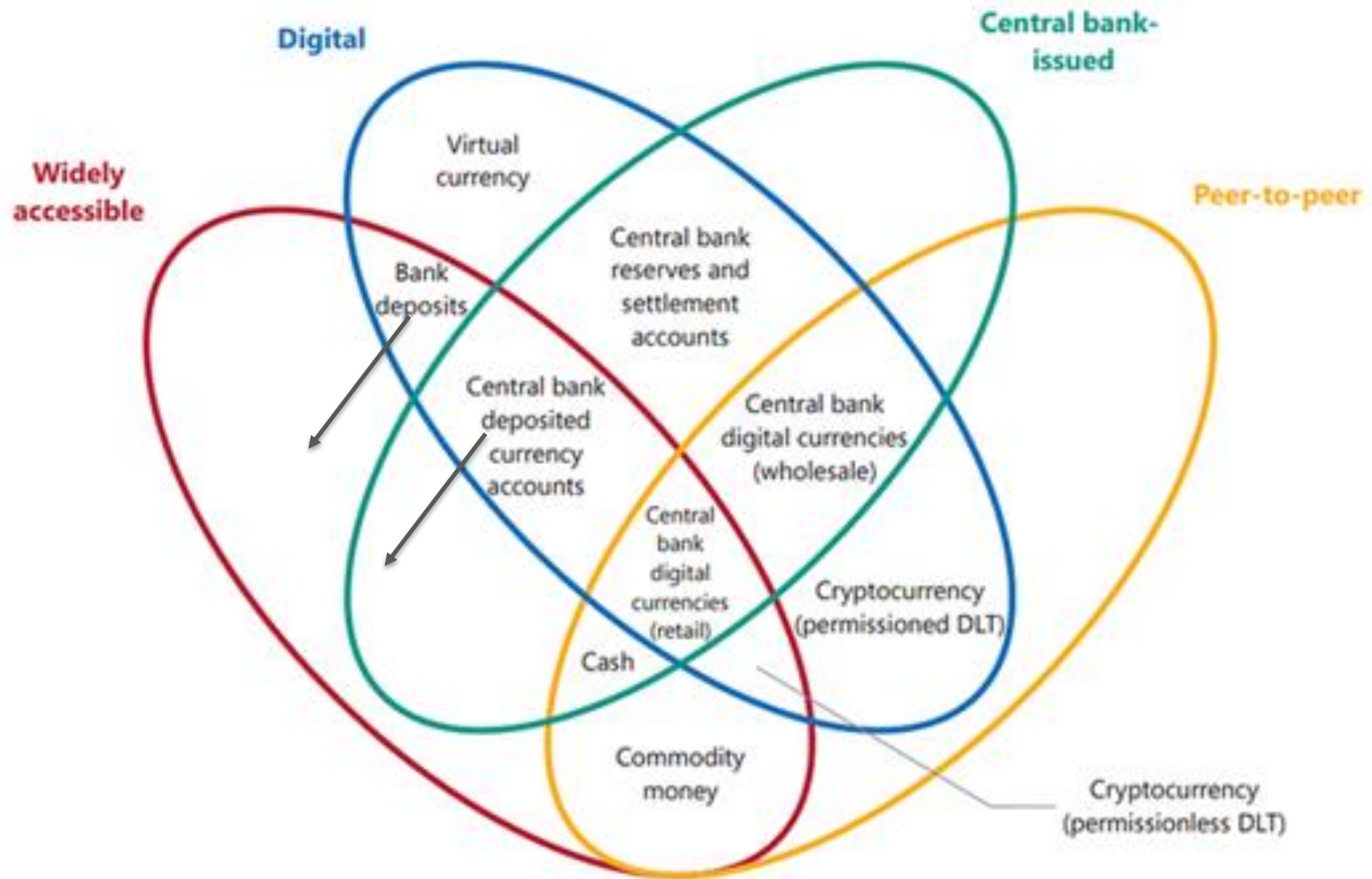


TABLE 3.1 Historical, current and prospective means of payments across six classification categories

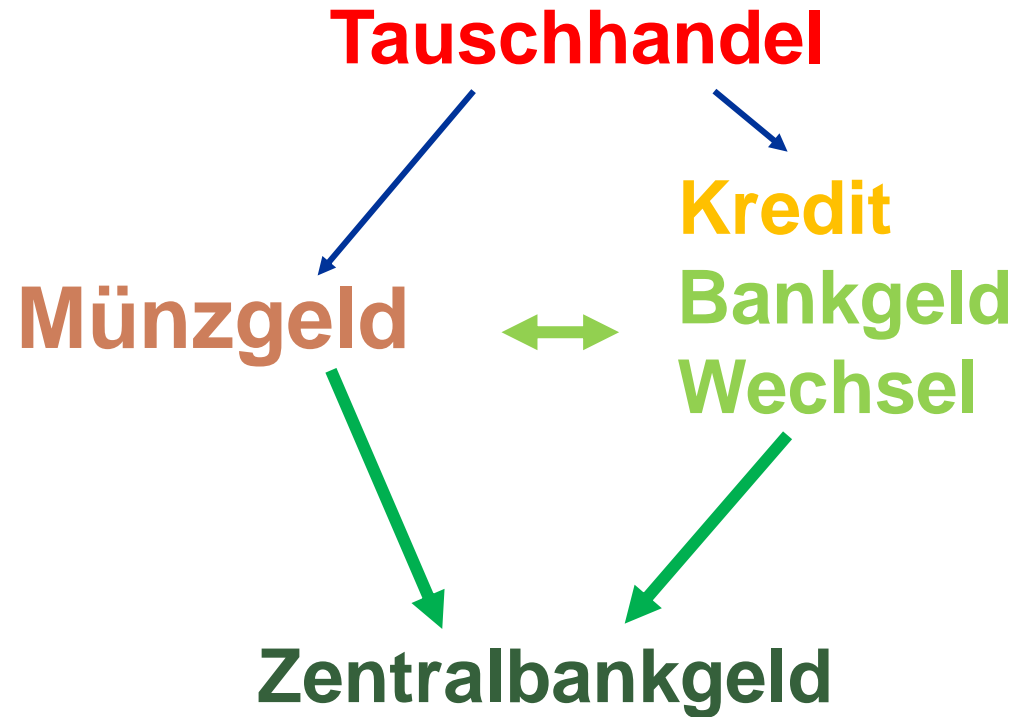
	<u>State of matter:</u> Material (M) Paper (P) Digital (D)	<u>Issuer:</u> None (N) Private (P) Public (C)	<u>Access:</u> All (A) Constrain (C)	<u>Recording:</u> Bearer based (B); central; distributed; multiple ledger (CL) (DL) (ML)	<u>Legal Basis:</u> None (N) Legislative (L) Contract (C)	<u>Connectivity:</u> Offline payments (Off) online (On) presence (P)
Historical						
(h1) Cowrie shells; early gold coins	M	N	A	B	N	Off
(h2) Gold coins 1875	M	N	A	B	L	Off
(h3) Giro banking – Venice 1300	P	P	A/C	ML	C	P
(h4) Public Giro bank, (1401-1875)	P	C	A/C	CL	L	P
(h5) Fede di Credito (Naples), 1600	P	C	A/C	CL+	L	Off
(h6) Bill of exchange, 1300-1960	P	P	A/C	B/ML	C	Off
(h7) Chinese state paper money 1000	P	C	A	B	L	Off
Current						
(c1) Banknotes	P	C	A	B	L	Off
(c2) Bank deposits with CB	D	C	C	CL	L	On
(c3) Commercial bank deposits	D	P	A/C	ML	C	On
Future						
(f1) Unbacked crypto-asset (“Bitcoin”)	D	N	A	DL	N	On
(f2) Stablecoin	D	P	A/C	CL/DL/B (?)	C	On (Off)
(f3) Retail CBDC	D	C	A (C)	CL/DL/B (?)	L	On (Off)
(f4) Wholesale CBDC	D	C	C	DL	L	On

Vom Tauschhandel zum Zentralbankgeld

John Law(1705): “Before the use of money was known, goods were exchanged by **barter**, ... This state of barter was inconvenient, and disadvantageous... there was little trade”

William Potter (1650):

“The greatest part of men’s returns in most places of the world, are either upon the **credit of particular persons, as here in England**, or else, **by means of some brass or copper money made current by law, as in Spain, Holland and other places**, both which are bad enough, though **the former much more liable to hazard than the latter**, as I could prove at large. And considering, that notwithstanding the **so many and great inconveniences of trading upon such private credit, so long experienced by men of all trades and nations, it still continues so common a thing amongst them, to make use of their own words and credits, instead of money, for transferring goods to and from one another...**”



=> Private kreditbasierte Zahlungsmittel die das Kreditrisiko und Instabilitäten so gut es geht verringern, und die Probleme von Münzgeld vermeiden:
Bank-Giralgeld und Wechsel

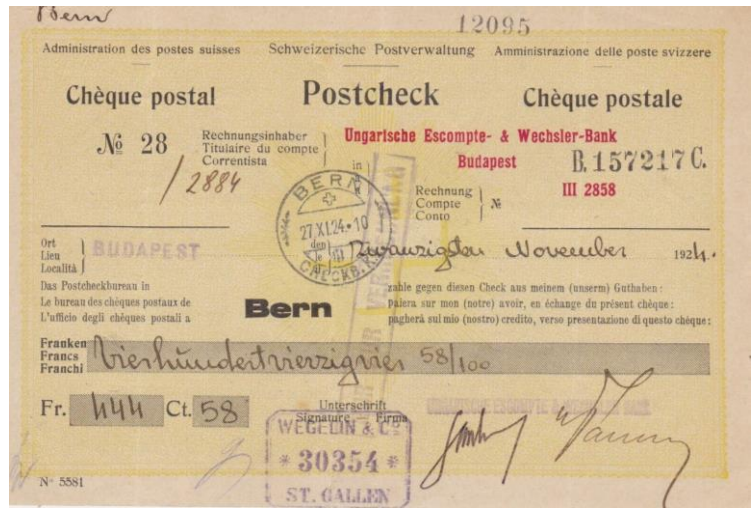
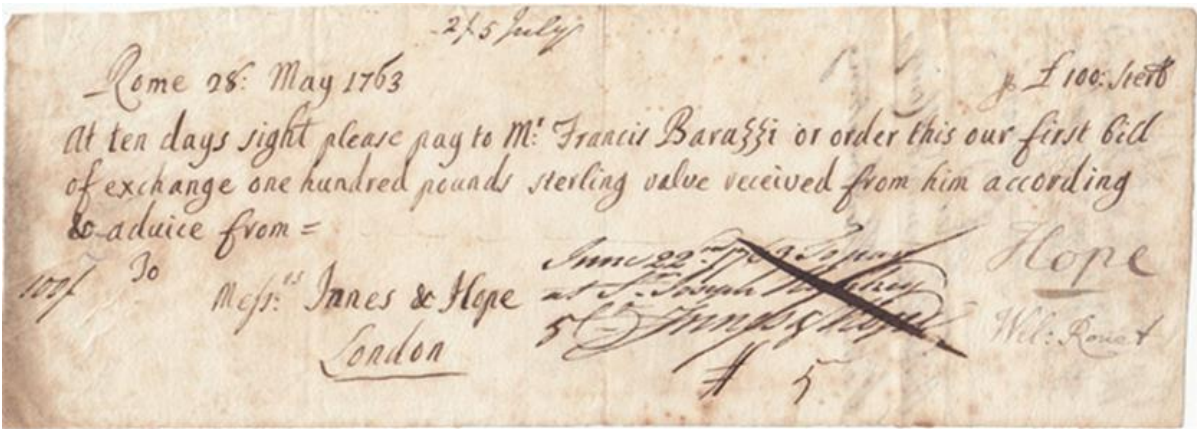
= ein ultimates Mittel zur Begleichung von Forderungen, so universell akzeptiert und Kreditrisikofrei wie Edelmetallmünzen, aber ohne deren Probleme (Gresham's law, Gewicht, Diebstahlrisiko, Verfügbarkeit, d.h. elastisches Angebot)

Historische Zahlungsmittel

Münzgold; privates und öffentliches Giralgeld; Wechsel; Fede di Credito: Banknotes



IK



Zentralbankgeld, Bank-Giralgeld und Wechsel lösen Greshams's law, ...



... nur so lange, wie nicht am Ende eine Auszahlung in Münzen erfolgt. => Zahlreiche Techniken, wie das verhindert werden konnte

- (i) Netting der Wechsel zwischen Bankhäusern:
- (ii) saldo als neue Wechsel gezogen; oder ausgezahlt in Bank- oder ZBK-Konto

Analyse der Hamburger Bank von 1761 (200 von 830 Tausend Talern, Schneider, 1986, 86.

Weight* at least	Hamburger Taler	Other Taler
100,0%	9%	2%
98,6%	57%	25%
97,2%	2%	4%
< 97.2%	0%	1%
Total	68%	32%

“the fairs acted as a form of suction pump that would attract bills from all over Europe, settle them with a multiple clearing system that was a fore runner of today’s clearing houses, and issue new bills for use on individual trading markets or later exchange fairs (Felloni, 2012)

Universelle Probleme des internationalen Zahlungsverkehr

Table 5.1 Universal challenges of cross-border payments

	2020	1200–1900
1. Data standards and formats vary significantly	Adoption of new more comprehensive ISO20022 messaging format vs different insufficient legacy message formats (as supported in building block 14 of FSB 2020b).	Variety of conventions for example for the specification of bills of exchange. Handbooks like Kruse (1782) contain hundreds of pages explaining the different standards for coins and bills of exchange across global trade and settlement places.
2. Complex processing of compliance checks	AML/CFT and other compliance checks have been perceived as heavy by banks, also as their implementation across jurisdictions is heterogeneous, creating high costs and legal risks (discussed in building blocks 4–8 of FSB, 2020b).	Challenging compliance with usury prohibition in international bills of exchange in the Middle Ages and early modern times. See e.g. De Roover (1953).
3. Limited operating hours	If RTGS systems and correspondent banks have no overlapping opening hours, then the payment chain may be delayed awaiting the re-opening of a relevant system (covered in building block 12 of FSB, 2020b).	In the Middle Ages and in early modern times, documents or value tokens travelled slowly, so that daily operating hours per se did not matter. However, in case there were regular settlement days for bills of exchange (e.g. quarterly), then the combination of infrequent settlement days and slow travel of e.g. bills of exchange could lead to even longer settlement lags.
4. Legacy technology platforms	Payment systems may follow old standards and that are costly to modernise because they would require to be completely redone because of outdated standards or programming languages (building block 17 of FSB, 2020b explores the feasibility of new multilateral platforms for cross-border payments).	Technology per se was not a relevant category before the second half of the nineteenth century. Outdated standards and conventions could be classified as “legacy systems” but would be covered under 1.
5. Funding costs	Inefficient payment and settlement typically requires higher liquidity. Building block 11 of (FSB, 2020b) proposes liquidity bridges to address these challenges.	Interest rates and access to credit and thus the costs of liquidity were often significantly higher than today and therefore the need for liquidity in early trade was at least as pervasive as today.
6. Long transaction chains	Several correspondent banks may be needed in an international payment chain before settlement, delaying settlement and making it more expensive as each intermediary must be compensated (including for compliance related	Long payment chains were experienced with bills of exchange, which were often endorsed and passed on multiple times. However, this may also have been useful as in this way the bill could be used several times as a means of

	2020	1200–1900
	work), making the chain less traceable and more opaque.	payment. The key trick of the bill of exchange was that all signatures in the chain of endorsements remained liable, so that the credit quality of a bill of exchange did not deteriorate when being passed on. On the other side that meant contingent liabilities for all signatories.
7. Weak competition	The high costs and risks associated with AML/CFT regulation and fines applied to banks led to a withdrawal of many banks from this business (“de-risking”), providing the remaining actors more market share and thus pricing power.	Cross-border payments were often dominated by relatively few internationally active banking houses (like the Fuggers, Medicis, or later the Rothschilds). As a result, these banking houses were able to gain market power and accumulate significant wealth.
8. Crime threat	Cyber-risk management creates significant costs and entry barriers and is perceived to be an increasing challenge and cost factor for any bank, payment system and market infrastructure.	Physical extortion of value token, robbery (both in transport and in vault) etc. Reduced significantly through a reliance on bills of exchange.
9. Slow speed and high costs of shipment	Hardly relevant today as costs of international data transmission have collapsed over the last decades.	Highly relevant in the past when value tokens or paper credit had to travel physically over long distances.
10. Relevance and challenges of currency conversion	International payments are typically done in international currencies, implying local currency conversion relying on banks offering such services at a cost to the end user (taken up in building block 13 of FSB, 2020b).	Numerous coin types and qualities circulating in parallel. Heterogeneous coinage and Gresham’s law as major driver of reliance on paper instruments and the emergence of early commercial and public giro banking.

Der Wechsel (neben den Korrespondenzbanken) als entscheidendes Instrument des nationalen und internationalen Zahlungsverkehrs vom 14. bis zum 20. Jahrhunderts

Logik des Wechsels:

[Date of the drawing]	
Against this bill pay [definition of timing] to	
to [Name of beneficiary] the sum of [Amount and currency]	
Drawee: [name of drawee]	
Payable at bank X	[Name and address of drawer]
	[signature of drawer]

Handwritten text in a historical script, likely Spanish or Italian, from Salamanca to Rome, 1484.

Salamanca to Rome, 1484

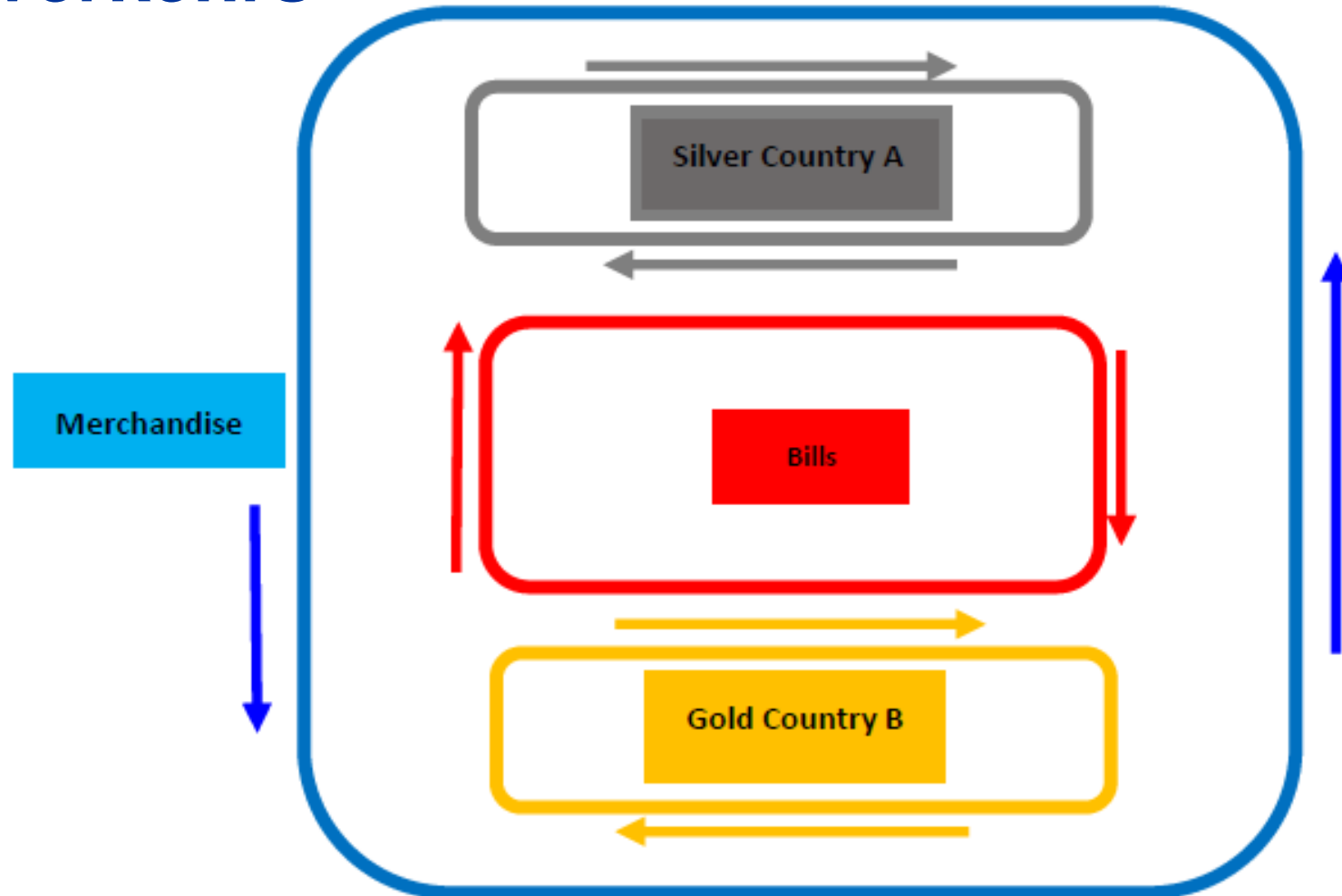
Rome 28. May 1763
 At ten days sight please pay to M^r Francis Barazzi or order this our first bill of exchange one hundred pounds sterling value received from him according to advice from =
 Mess^{rs} James & Hope London
 Hope
 100. Sterl

Paris 26. Apr. 1798
 Philadelphia ce 6. Juin. 1798.
 Messieurs! A trente jours de Vie il vous plaira payer par cette premiere de change / la seconde & troisieme ne l'etant pas / a Mess^{rs}. Joseph Coulon ou a son ordre, deux cents soixante quatre Mars banco, Valeur recue, que vous passerez suivant l'avis de Messieurs Vidal & Comp^{ie} Hambourg
 Votre tres humble serviteur
 Wm. L. Sonntag
 Premiere
 2974. a. proteste le 16 Mars 1798.

Berlin, 16 de Abril de 1913 Por No. 164.40
 Al 16 de Octubre 1913 se servira V^o pagar por esta PRIMERA de cambio (no habiendolo hecho por la segunda) a la orden de nosotros mismos la cantidad de Marcos: Cuarenta y cuatro 40/100
 Pagadero al cambio del dia del vencimiento de letras a vista sobre Berlin.
 Por recibido se entregara V^o en cuenta segun aviso de S. P. P.
 Sr. D^{na}. Rosario Vda de Mora
 Quito
 13661
 Quito
 Libeck & Servos

Frankfurt/Main, 25th March 1955.
 At 90 d/s pay this first Bill of Exchange (second unpaid) to the order of Mercantile Bank of India Ltd., Calcutta
 Pound Sterling
 To Messrs. Capco Limited, 14, Netaji Subhas Road, Calcutta - 1 / India
 CAPCO LIMITED
 ACCEPTED
 No. 76

Wechsel ermöglichten (bei ausgeglichener Zahlungsbilanz) eine rein papierbasierte Abwicklung des internationalen Zahlungsverkehrs



Korrespondenzbankensystem

- **Komplementär zum Wechsel; Wechsel wurden (möglichst immer) in Buchgeld (oder später evtl auch in Banknoten) bezahlt**
- **Korrespondenzbanken sind so alt wie der Wechsel, haben aber den Wechsel überlebt.**
- **Noch heute sind Korrespondenzbanken die Standard-Lösung für internationale Zahlungen. Früher auch für Währungen ohne Zentralbank**
- **Project Global Correspondent Banking 1870–2000 (GloCoBank) led by Catherine R. Schenk, <https://glocobank.web.ox.ac.uk/>**
- **EZB veröffentlicht regelmäßig Überblick über Entwicklung in Europa**
- **<https://www.ecb.europa.eu/pub/pdf/other/ecb.eleventhurveycorrespondentbankingeuro202011~c280262151.en.pdf>**

Zurück in die Zukunft

- Innovationen (mobile payments; biometrics; eID; open banking und automatisierte Zahlungen)
- Zeitkompression: INST 24/7; Von T+2 zu T+1 (zu T+0 zu T+0.0?); von batching zu Echtzeit?
- Retail CBDC: elektronisches Zentralbankgeld für alle ? Privacy und offline?
- Unbacked crypto-assets und Stablecoins: Zahlung und Abwicklung auf der Blockchain?
- Wholesale Zentralbankgeld auf der Blockchain oder interoperabel?