

Comments by Rafael Repullo on

A Model of Monetary Singleness

Benjamin Hemingway

Conference on the Future of Money in celebration of Charles Goodhart

Bank of England, 1 October 2026

“... it is with peculiar diffidence and even apprehension that one ventures to open one’s mouth on the subject of money.”

John Hicks (*Economica*, 1935)

“A Suggestion for Simplifying the Theory of Money,”

→ **Not diffidence or apprehension in the case of Charles...**

MONEY,

INFORMATION, AND

UNCERTAINTY

SECOND EDITION

Charles Goodhart

The functions of money (i)

“We have seen that three inconveniences attach to the practice of simple barter... Money remedies these inconveniences... acting as (1) a medium of exchange and (2) a common measure of value.”

William Stanley Jevons (1875)

Money and the Mechanism of Exchange

The functions of money (ii)

“A third function of money soon develops itself. Commerce cannot advance far before people begin to borrow and lend... But the lender will often not wish to have things returned to him... when their value is unusually low.”

→ A standard of value

William Stanley Jevons (1875)

Money and the Mechanism of Exchange

The functions of money (iii)

“It is worthy of inquiry whether money does not also serve a fourth distinct purpose. At times a person needs to condense his property into the smallest compass, so that he may hoard it away for a time.”

→ A store of value

William Stanley Jevons (1875)

Money and the Mechanism of Exchange

Modern literature on the functions of money (i)

- Store of value: Samuelson (*Journal of Political Economy*, 1958)
 - Transferring purchasing power in an OLG model with single perishable good
 - Decentralized trading cannot implement a Pareto optimal allocation
 - Fiat money can
- Medium of exchange: Kiyotaki and Wright (*Journal of Political Economy*, 1989)
 - Economy with agents producing one good and consuming another good
 - Agents meet randomly and trade bilaterally (no centralized market)
 - Goods can endogenously emerge as media of exchange
 - Fiat money may dominate commodity money

Modern literature on the functions of money (ii)

- Unit of account: Doepke and Schneider (*Econometrica*, 2017)
 - Model that rationalizes the use of a dominant unit of account
- Unit of account: Hemingway (2026)
 - Model in which banks choose the unit of account of their liabilities
 - Banks also choose whether those liabilities circulate as media of exchange

This discussion

- Part 1: Brief review of Doepke and Schneider (*Econometrica*, 2017)
- Part 2: Brief review of Hemingway (2026)
- Part 3: Some comments on Hemingway (2026)

Part 1

Doepke and Schneider (2017)

Model setup

- Two dates ($t = 0, 1$) and two agents: **Supplier** (S) and **Customer** (C)
- S provides x units of labor at $t = 0$ to deliver customized good to C at $t = 1$
- Two other goods at $t = 1$ tradable at exogenous random prices $p \in P \subset \mathbb{R}_+^2$
- C has endowment $y \in \mathbb{R}_+^2$ at $t = 1$ and promises to pay S an amount $z \in \mathbb{R}_+^2$
- Utility functions: $\rightarrow$ Supplier: $E[p'z] - x$
 $\rightarrow$ Customer: $E[p'(y - z)] + (1 + \lambda)x$
- It is assumed that $\lambda > 0$, so there are gains from trade
 $\rightarrow x$ should be made as large as possible

Contract

- A contract between S and C specifies
 - Units of labor x provided by S at $t = 0$
 - Payment $z \in \mathbb{R}_+^2$ promised by C at $t = 1$
- Key constraint: C never defaults on its debt

$$p'z \leq p'y \text{ for all } p \in P \subset \mathbb{R}_+^2$$

→ Value of payment to $S \leq$ Value of endowment of C for all possible prices

Optimal contract

- Two additional assumptions
 - C has all the bargaining power
 - $E(p) = 1$ (normalization)
- These assumptions imply
 - Utility of supplier: $E[p'z] - x = z_1 + z_2 - x = 0$
 - Utility of customer: $E[p'(y - z)] + (1 + \lambda)x = y_1 + y_2 + \lambda x$
- Optimal contract

$$\max x = z_1 + z_2$$

$$\text{subject to: } p'z \leq p'y \text{ for all } p \in P \subset \mathbb{R}_+^2$$

Why the unit of account matters (i)

- A special case
 - Endowment of the customer only has good 1: $y = (y_1, 0)'$
- Two possible units of account
 - Debt denominated in terms of good 1: $z = (z_1, 0)'$
 - Debt denominated in terms of good 2: $z = (0, z_2)'$

Why the unit of account matters (ii)

- In first case key constraint becomes

$$p_1 z_1 \leq p_1 y_1 \text{ for all } p = (p_1, p_2)' \in P$$

→ which gives

$$x = z_1 = y_1$$

- In second case key constraint becomes

$$p_2 z_2 \leq p_1 y_1 \text{ for all } p = (p_1, p_2)' \in P$$

→ which gives

$$x = z_2 \leq \min_{p \in P} \frac{p_1}{p_2} y_1 < y_1$$

Why the unit of account matters (iii)

- Summing up: using good 1 as the unit of account for C 's debt
 - Increases the output of the customized good x
 - relative to the case where good 2 is used as the unit of account

Part 2

Hemingway (2026)

Model setup (i)

- Three dates ($t = 0, 1, 2$) and two regions ($j = 1, 2$)
- In each region j there are three agents: **Bank** (B_j), **Laborer** (L_j) and **Artisan** (A_j)
- At $t = 0$, L_j provides labor input n_j to B_j in exchange for a debt contract
- At $t = 2$, there are two goods tradable in both regions at random prices $p \in P \subset \mathbb{R}_+^2$
- At $t = 2$, B_j produces output of the two goods $y_j = f(n_j)\hat{y}_j \in \mathbb{R}_+^2$
→ and pays L_j an amount $z_j \in \mathbb{R}_+^2$

Model setup (ii)

- At $t = 1$, laborer L_j in region j
 - meets artisan A_j in the same region j with probability α
 - meets artisan A_k in the other region k with probability β
- If meeting occurs, artisan provides x labor to deliver customized good to L_j at $t = 2$
- Payment takes place by transferring fraction χ of bank debt from laborer to artisan
- Utility functions:
 - Bank: $E[p'(f(n)\hat{y}) - z]$
 - Laborer: $E[p'(1 - \chi)z] + (1 + \lambda)x - n$
 - Artisan: $E[p' \chi z] - x$

Model setup (iii)

- Key constraint (as in Doepke and Schneider): Banks never default on their debt

$$p'z_j \leq p'y_j \text{ for all } p \in P \subset \mathbb{R}_+^2$$

→ Value of debt to L_j $\leq$ Value of output of B_j for all possible prices

Optimal contract (i)

- Special case: when laborer never meets artisan from the other region
- As in Doepke and Schneider
 - It is optimal to use B_j 's bundle $\hat{y}_j$ as the (natural) unit of account
 - If B_j only produces good 1, it should write its debt in terms of units of good 1

Optimal contract (ii)

- What happens when artisans meet laborers from the other region?
 - Banks choose whether their debt is transferable across regions
 - as well as the terms (and the cost) of these transfers
- What would be the unit(s) of account when the banks' bundles differ?
 - Will there be “monetary singleness”?

Main results: equilibrium

- Characterize Nash equilibrium in which banks simultaneously choose
 - Units of account as well as interoperability and transfer fees
- Autarky (no interbank transfers) is always a Nash equilibrium
- Under certain conditions
 - There may be Nash equilibria with debt transferable across regions
 - There may be Nash equilibria with a common unit of account

Main results: policy analysis

- Mandating a common unit of account may or may not be efficient
 - Depending on extent of alignment with banks' production bundles
- Redistribution of a proportional tax on banks' output improves welfare
 - Because it makes banks' bundles (after taxes and transfers) more similar

Part 3

Some comments

Are we talking about banks?

- In model banks are firms producing fixed proportion of goods with labor input
 - Paying the labor input with debt with a denomination of their choice
 - This does not look like a bank
- However, model can be reinterpreted as one in which
 - Banks lend to firms producing fixed proportion of goods with labor
 - Firms pay laborers with their bank deposits

Too many restrictive assumptions?

- Unit of account results require combination of two assumptions
 - Banks never default on their debt
 - Prices of the two goods at $t = 2$ are random
- In addition, it is assumed that agents have the same preferences over the two goods
- These assumption imply that unit of account matters for debt capacity
 - and production of customized goods
- But they seem overly restrictive

Why not focus on unit of account function?

- In his model banks' debt determines the unit of account
 - and also serves as means of payment (from laborers to artisans)
- Could think of a simpler (possibly more realistic) model of the unit of account
 - Banks lend to many firms with different production bundles
 - Banks fund their lending by issuing deposits that firms use to pay laborers
 - Banks enjoy benefits of diversification
- Can we characterize the optimal unit of account in such a model?
 - and then extend it in different directions?

Final message



Devon Sheep Wishing Charles a Happy 90th Birthday