

# An Early Experiment with “Permazero”

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\*Views expressed are those of the authors and not of the Federal Reserve Bank of Atlanta or the Federal Reserve System.

# Motivation

- What determines the long-term stability of near-zero target rates?
- What challenges await?
- The need for historical examples.

# Bank of Amsterdam?

An example of a documented, long-term “permazero” regime in a leading economy.

- From 1683 to 1795, the Bank’s lending rate was fixed at one-half percent for the most common type of collateral.
- The Bank’s ledger money (*bank florin*) was a dominant European currency.
- Amsterdam was a top financial center with an advanced money market built on merchant banks and acceptance credit
- Extensive, detailed records remain with no lawyers, yet.

# Research Methodology

- We reconstruct changes in the level of bank money from 1736 through 1791. We decompose the series by type of transaction: market funding, open market operations, and loans.
- We then apply statistical analysis to
  - Test potential determinants of policy transition (multinomial logit).
  - Forecast the Bank's behavior under the counterfactual that collateral limitations did not constrain open market sales at critical times (VAR).

# Conclusions

- Under permazero, the Bank sustained its policy goals of a stable domestic exchange rate and a stable quantity of bank money.
- Large-scale open market operations assisted stabilization when collateral was available. When collateral was insufficient, policy failed.
- The details of the Bank's design often assisted stability, but the design could also undermine stability in certain circumstances.

# Outline

Quantity of Bank Money

Price of Bank Money

Periods of Instability

Statistical Analysis



- 1609 to 1820
- City of Amsterdam
- Only giro transfer
- No banknotes
- After 1683, quasi-fiat

# Master account: specie kamer

1503

1737  
Specie kamer

Debet

Arnoud Borchers	1490	50000
13 maart N. Hier	434	100000
Joh. g. van der	453	50000
Arnoud Borchers	1490	25000
15 Gilles van der	1408	6000
		231000
9 B. d. van der	1404	25000
Arnoud Borchers	1490	25000
22 J. van der	1308	12400
		295000

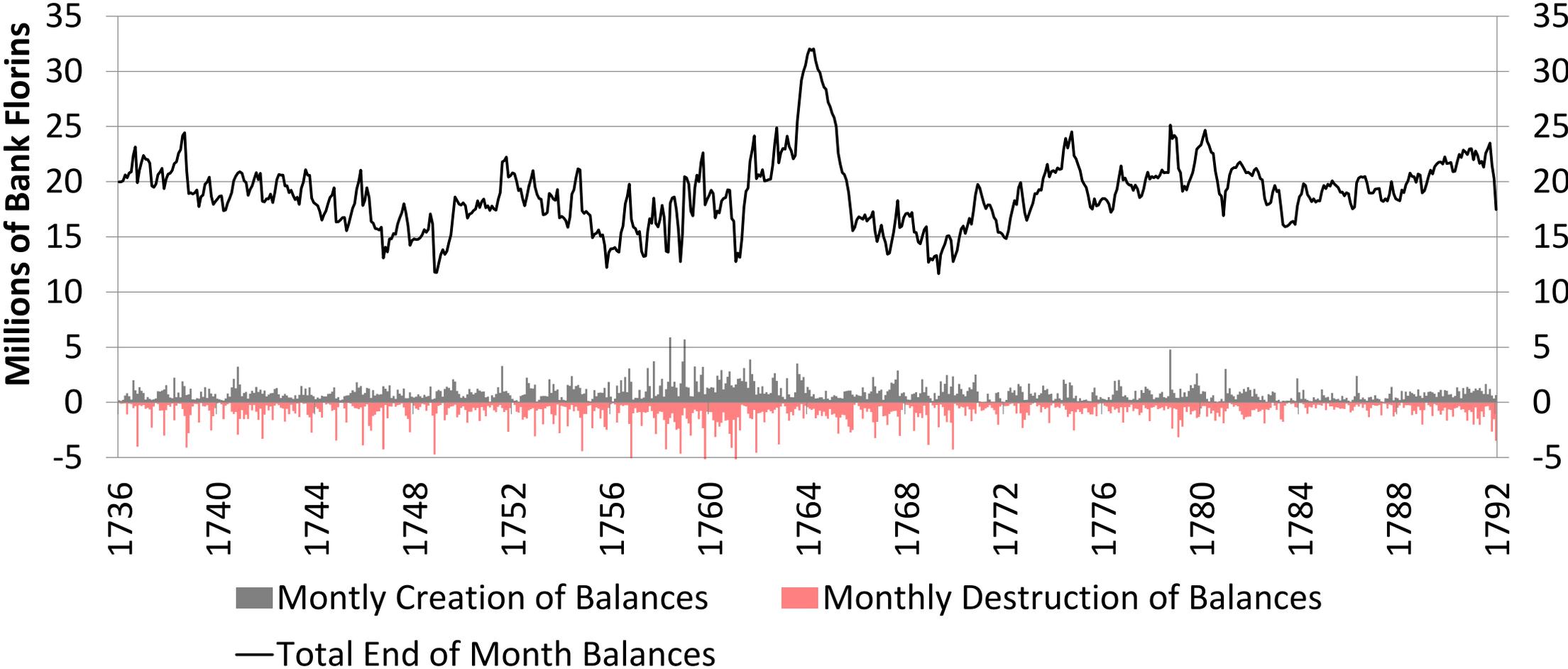
do 1515  
R

1737

Credit

14. H. van der	1482	18000
Jacob de Marten	469	4055
Jac. alexander	1271	1028
15. H. van der	79	1003
L. van der	93	1024
14. H. van der	1156	25109
15. H. van der	1460	13
Pierre de la	2274	4411
Peter de la	1411	8802
Etienne de la	1076	26466
Jacob de la	2004	64826
16. H. van der	664	2003
17. H. van der	837	1076

# Figure 1. Monthly level of monetary liabilities



# Table 1. Bank's balance sheet in 1737

In bank florins

<u>Assets</u>		<u>Liabilities</u>	
<b>Coins</b>	17,477,325	<b>Accounts</b>	22,370,103
<b>Loans</b>			
Company	4,800,000		
Holland	227,264	<u>Equity</u>	134,486
	22,504,589		22,504,589

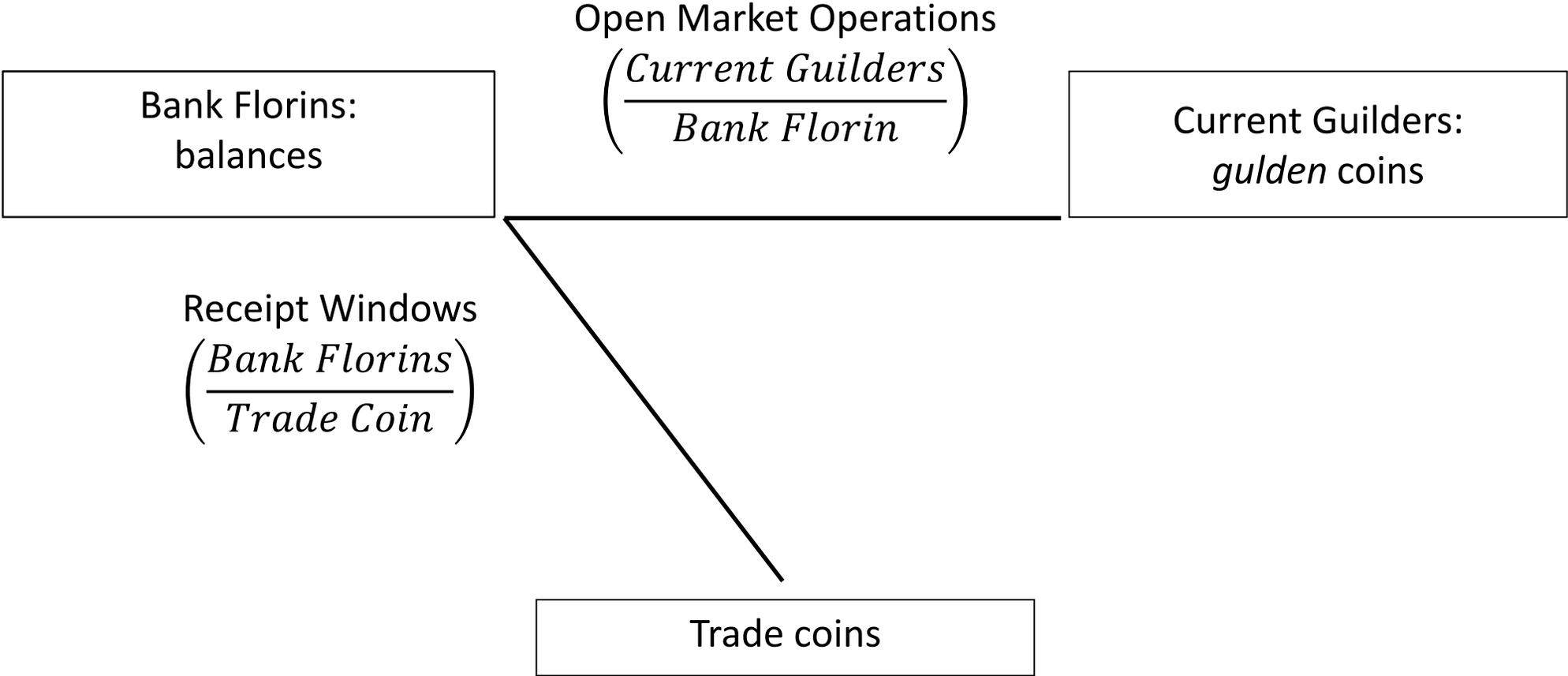
# Market funding

- A depositor of a *trade coin* (high denomination, high quality) received account credit for the coin at an official value, and a *receipt*.
- A receipt was a renewable, negotiable American option to repurchase the same coin, with
  - Expiration date: six months after deposit.
  - Strike price: sale price + 25 BP.
- The receipt system pegged the 6-month, risk-free lending rate at 25 BP. The Bank had no mechanism to vary this rate.
- Without a receipt, accounts could not be withdrawn: they were fiat money.

# Outright ownership

- The Bank acquired coins through outright purchases and sales (*open market operations*).
- OMOs were usually of 1-guilder coins called *gulden*. *Gulden* coins circulated as the anchor media of exchange in the domestic economy outside the Bank.
- *Gulden* coins were not eligible for receipts, so they traded at a market price.
- Also, if a receipt was abandoned, then the coin became owned outright by the Bank.

# Figure 2. Channels into Bank money



# Table 1. Bank's balance sheet in 1737

In bank florins

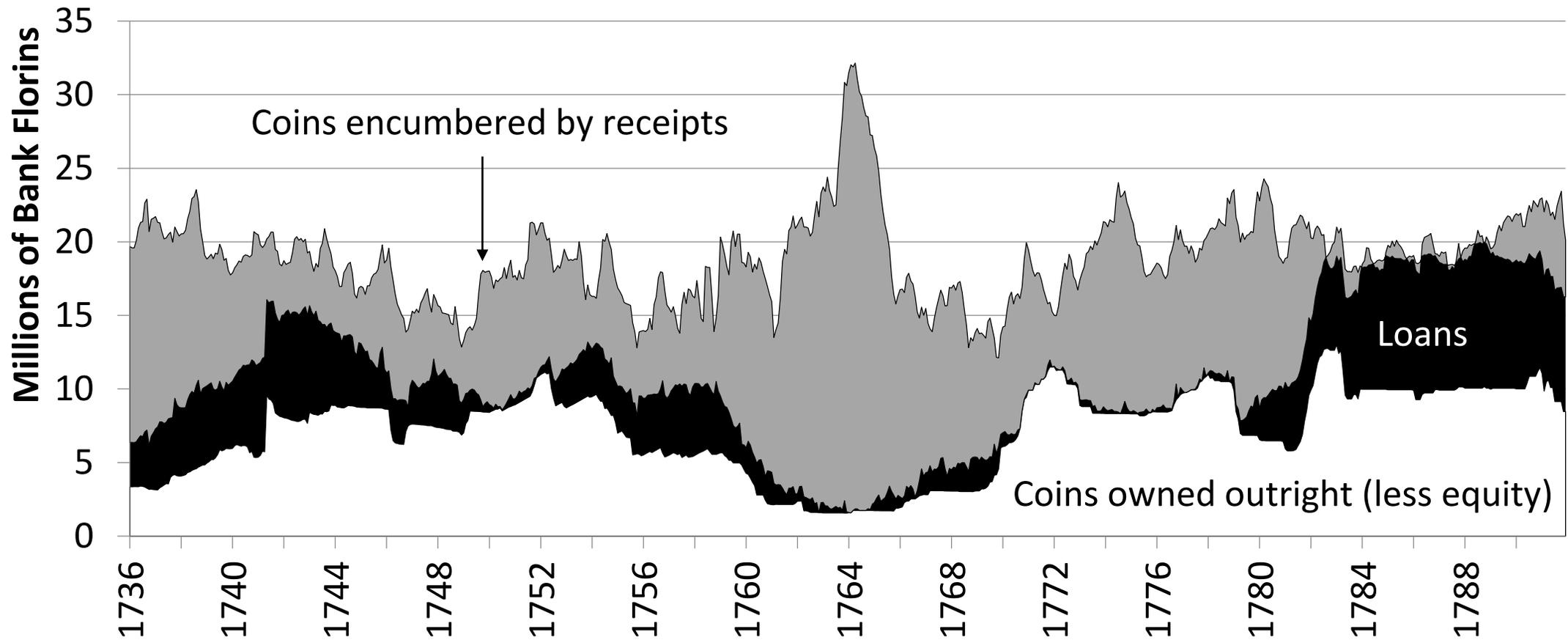
<u>Assets</u>		<u>Liabilities</u>	
<b>Coins</b>		<b>Accounts</b>	
Under receipt	14,465,530	<b>Encumbered</b>	<b>14,465,530</b>
Owned outright	3,011,795	Unencumbered	7,904,573
<b>Loans</b>			
Company	4,800,000		
Holland	227,264	<u>Equity</u>	134,486
	22,504,589		22,504,589

# Table 1. Bank's balance sheet in 1737

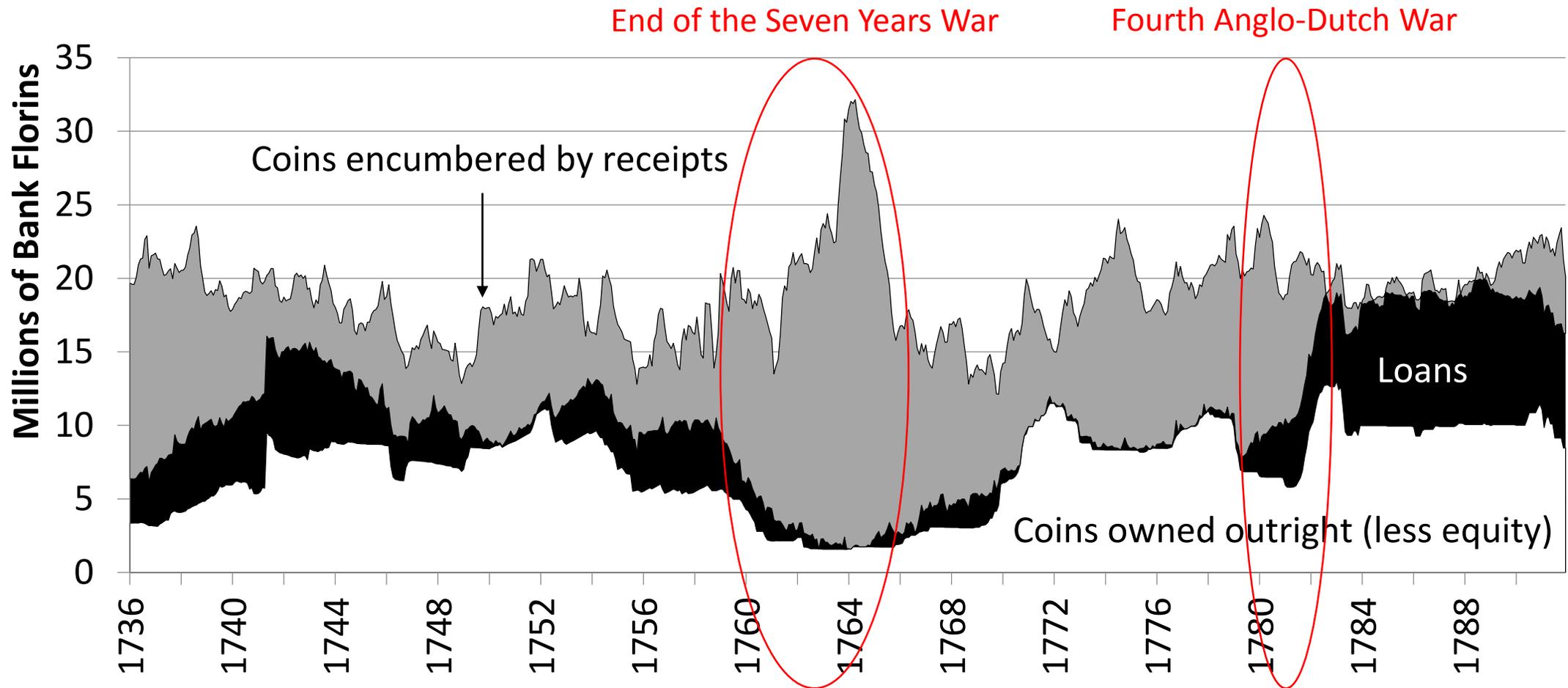
In bank florins

<u>Assets</u>		<u>Liabilities</u>	
<b>Coins</b>		<b>Accounts</b>	
Under receipt	14,465,530	Encumbered	14,465,530
Owned outright	3,011,795	Unencumbered, backed by coin (less equity)	2,877,309
<b>Loans</b>			
Company	4,800,000	Unencumbered, backed by loans	5,027,264
Holland	227,264		
		<u>Equity</u>	134,486
	22,504,589		22,504,589

# Figure 3. Decomposition of Bank money by type of backing



# Figure 3. Decomposition of Bank money by type of backing



# Recap

- The quantity of Bank money saw large swings in market funding.
- Lending and open market operations often offset market swings.
- Market funding veered to an extreme twice:
  - At the end of the Seven Years War (1763).
  - During the Fourth Anglo-Dutch War (1781).

# Outline

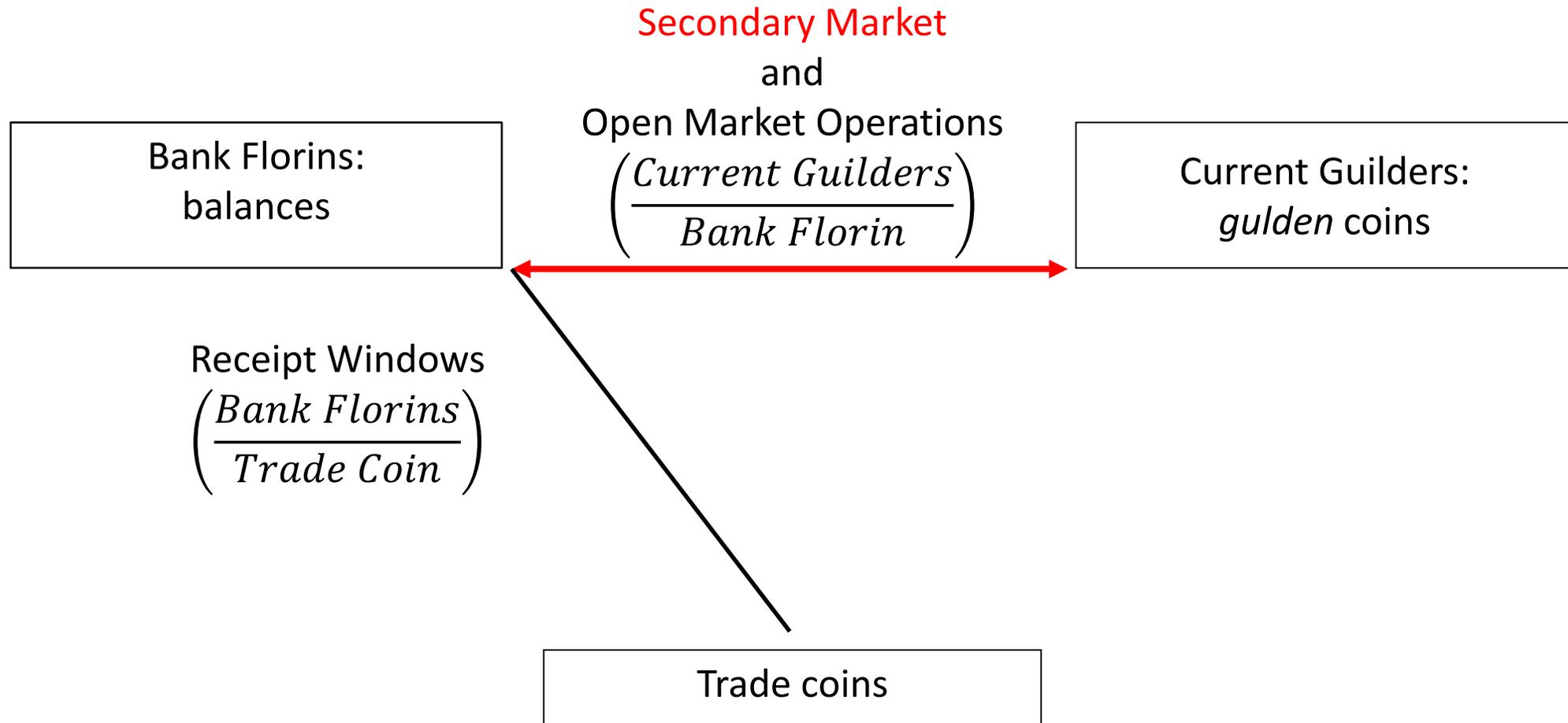
Quantity of Bank Money

Price of Bank Money

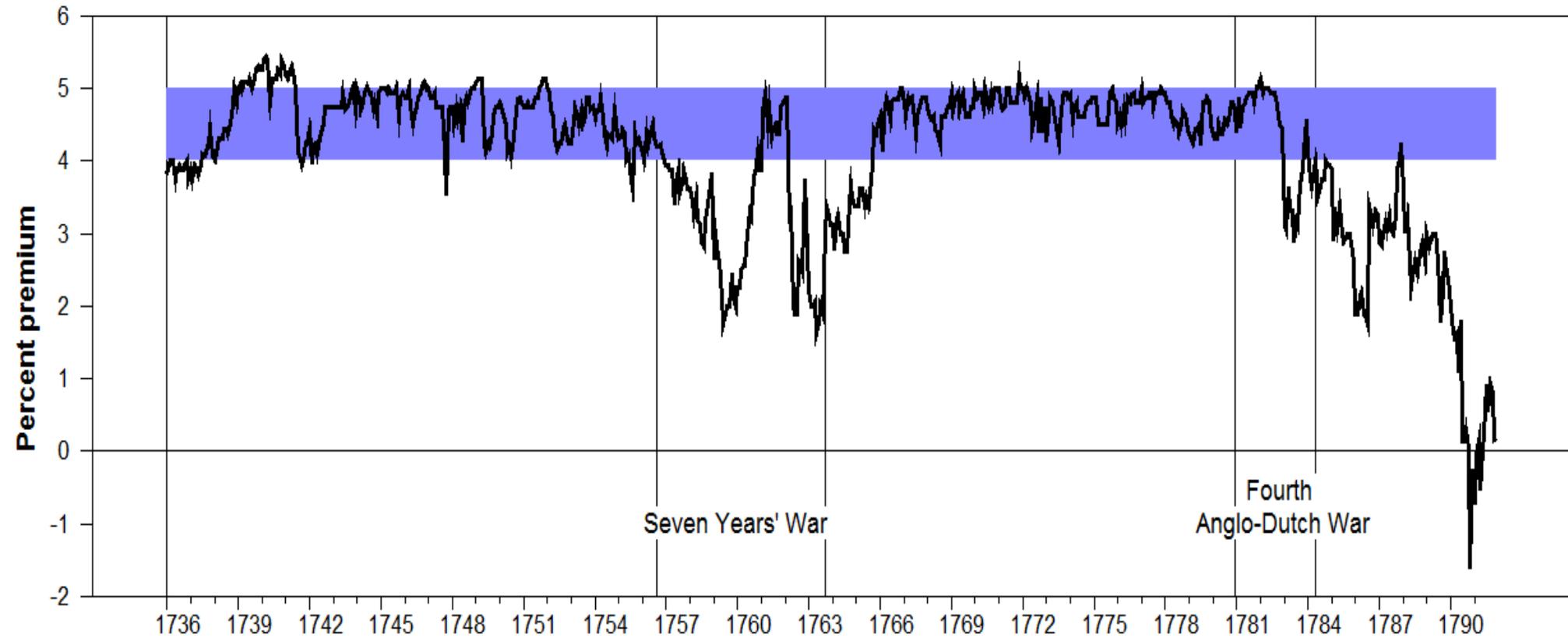
Periods of Instability

Statistical Analysis

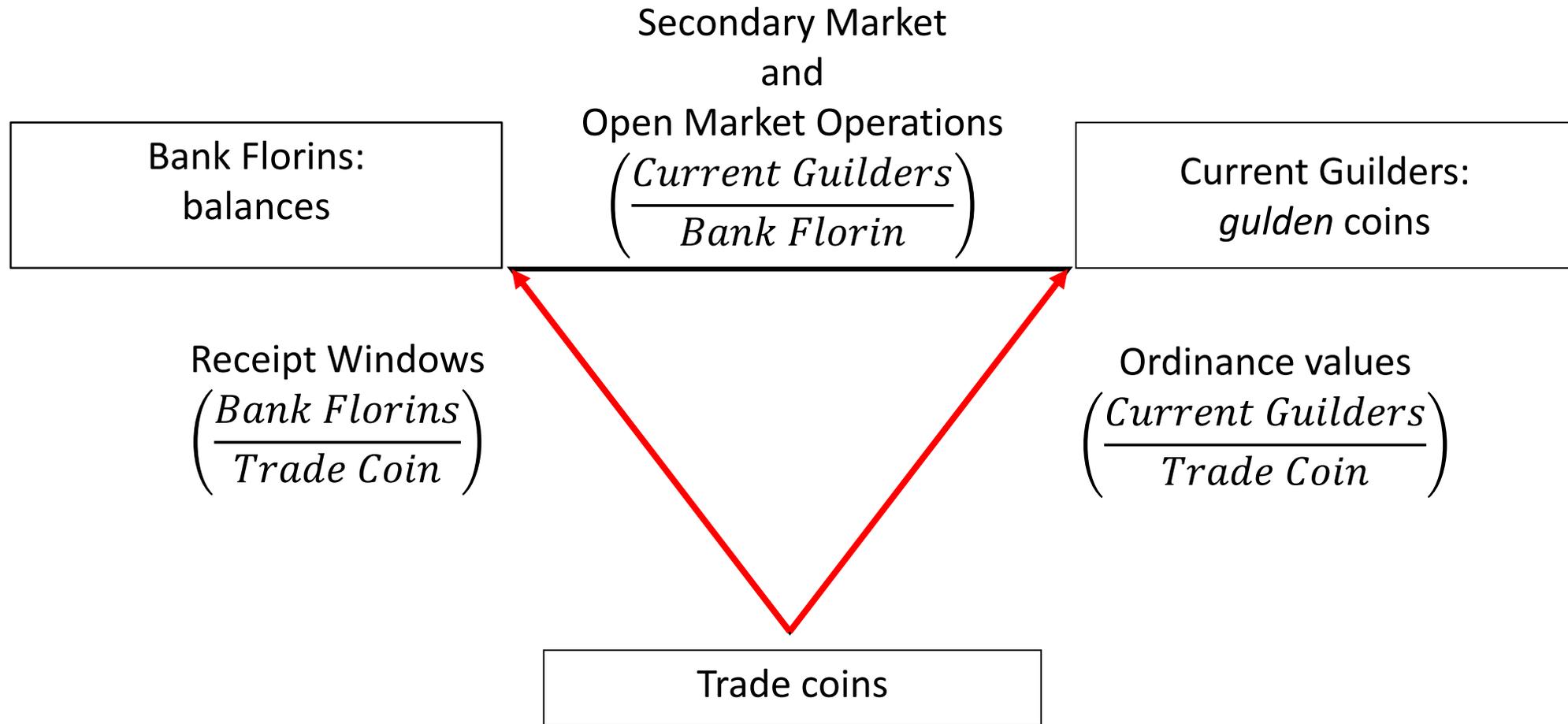
# Figure 2. Agio



# Figure 4. Market agio, 1736:1 to 1791:12



# Figure 2. Implicit agio



# Anchor

- The implicit agio for a Dutch silver coin was around 4 to 5 percent.
- The Bank's implicit policy goal was agio stability (-> price stability; inflation  $\approx 0$ ) around this anchor.
- High agios have stronger anchoring incentives than do low agios.
  - When high (>5%), receipt values approached zero.
  - When low (<4%), receipts insure holders against declining agios.

# Recap

- The agio was stable and on target over long periods of time.
- The agio was never off-target on the *high* side for an extended period.
- The agio was off-target on the *low* side when market funding was extreme:
  - the Seven Years War.
  - the Fourth Anglo-Dutch War.

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# I. The Seven Years War: 1756-1763

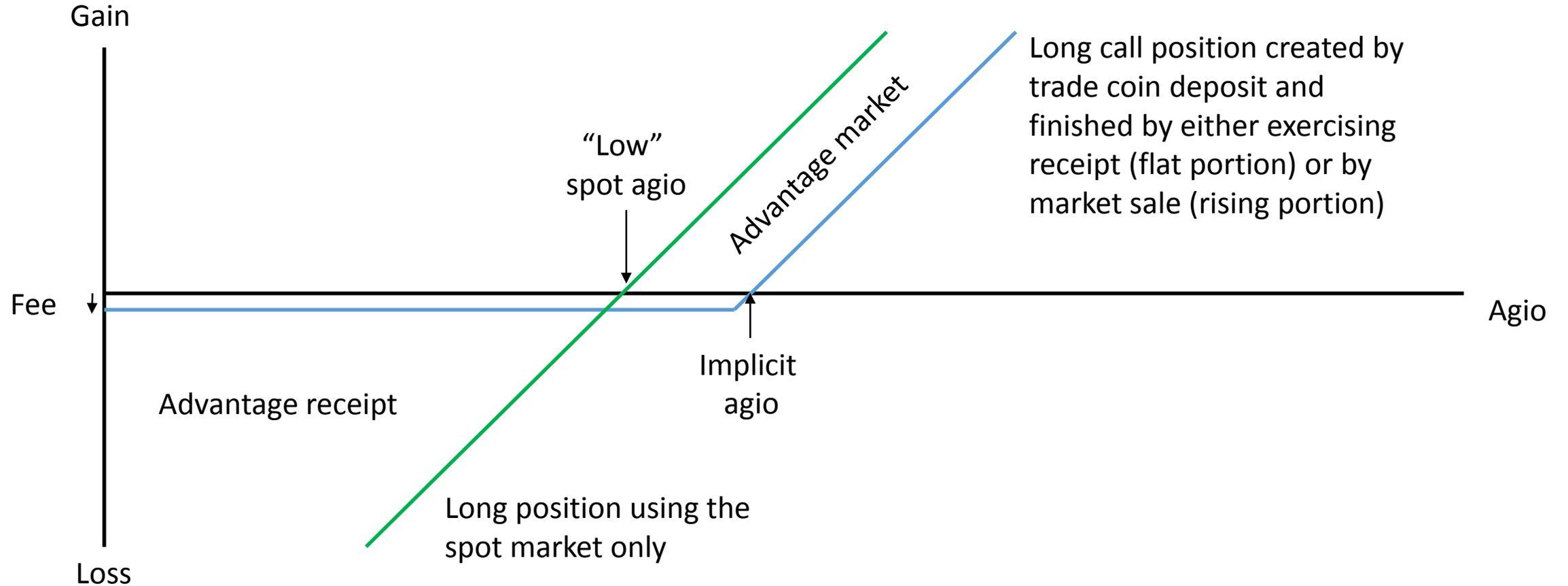
*Foreign exchange speculation weakened the bank florin.*

- Expectation of declining bank florin creates FOREX opportunity.
- Receipt options insulates FOREX from domestic (agio) decline.

Results:

- Agio persists below target, yet a massive 25 million florin inflow (10% of Dutch GDP, \$1.8 trillion today).
- Limited collateral constrains sales (tightening).
- Credit bubble ends with Crisis of 1763.

# Figure 5. Spot versus receipt



## II. The Fourth Anglo-Dutch War: 1780-1784

*Receipts lose credibility.*

- Bank's largest debtor, Dutch East India Company, falls into non-performance
- A recapitalization effort comes a decade late and is insufficient in size.

Results:

- Markets abandon the Bank via "shadow" run: 15 million florin contraction (6% of GDP, \$1.1 trillion today).
- Agio falls into long-term decline.
- Again, limited collateral constrains sales (tightening).

# III. Bimetallic shocks

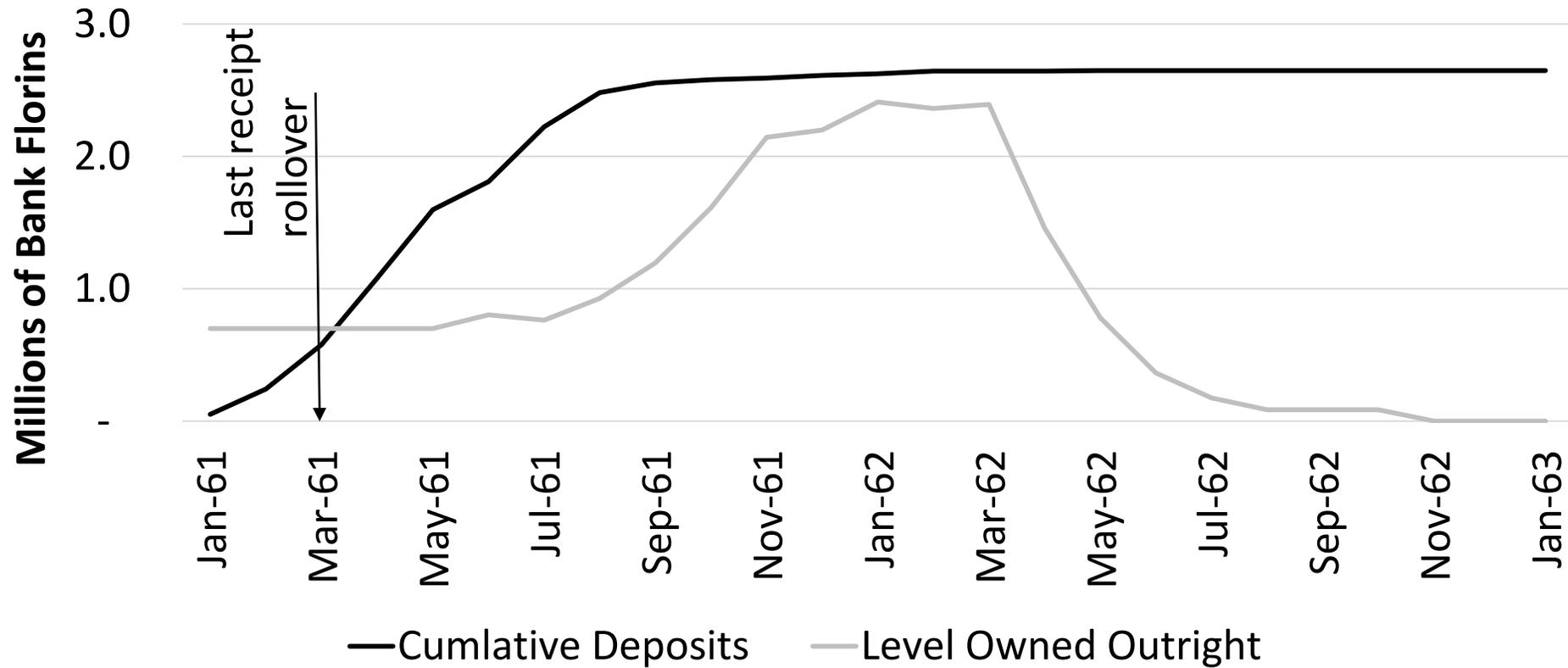
*Sudden declines in the price of gold.*

- Implicit agio of gold coins falls.

Results:

- Surge of gold deposits at the Bank.
- Abandonment of gold receipts.
- Open market sales of gold: 14 million florin (\$1 trillion today).

# Figure 6. Gold *dukaten* at the Bank, 1761-2



# Recap

The Bank was unable to restore targets when

- Low agios made the anchor weak.
- A lack of collateral constrained sales.

The Bank was able to retain targets when

- It had the collateral to sterilize inflows.

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# Time series

Market rates in percent, monthly levels

1. Agio
2. Return on bills (money market)

Components of Bank money in bank florins, monthly levels

3. Cumulative net deposits
4. Cumulative net purchases
5. Cumulative net loans to Dutch East India Company (VOC)
6. Collateral owned outright.

# Intervention regimes

***Tightening***: the Bank purchases (net) 25,000 bank florins or more that month.

***Easing***: the Bank sells (net) 25,000 bank florins or more that month.

***No intervention***: neither Easing nor Tightening.

# Table 2. Multinomial logit of transition probabilities: maximum likelihood coefficients (t-statistics)

Current month's regime	Explanatory variable	Next month's regime			
		Tightening (Sales)		Easing (Purchases)	
No intervention	Constant	-1.87	(-1.62)	.646	(.425)
	Agio < 3.7%	<b>-.180</b>	(-.346)	<b>-1.52</b>	(-1.85)
	Agio > 4.8%	<b>-.856*</b>	(-2.01)	<b>0.859</b>	(1.92)
	Bill rate	-.252*	(-2.32)	-.00504	(-.0464)
	Bill rate (-1)	.229*	(1.97)	-.0209	(-.143)
	VOC Loans	-.0632	(-.130)	.427	(-.617)
	VOC (-1)	.00587	(.0119)	-.406	(.674)
	Deposits	.118	(.424)	-.463	(-1.52)
	Deposits (-1)	-.161	(-.577)	.348	(1.32)
	Metal stock	<b>0.278**</b>	(2.58)	<b>-.313**</b>	(-3.10)

Pseudo-  $R^2 = .159$ ;

(Two) asterisks denote significance at the 5% (1%) level

# Lack of collateral

Construct counterfactual scenarios over two policy-failure intervals.

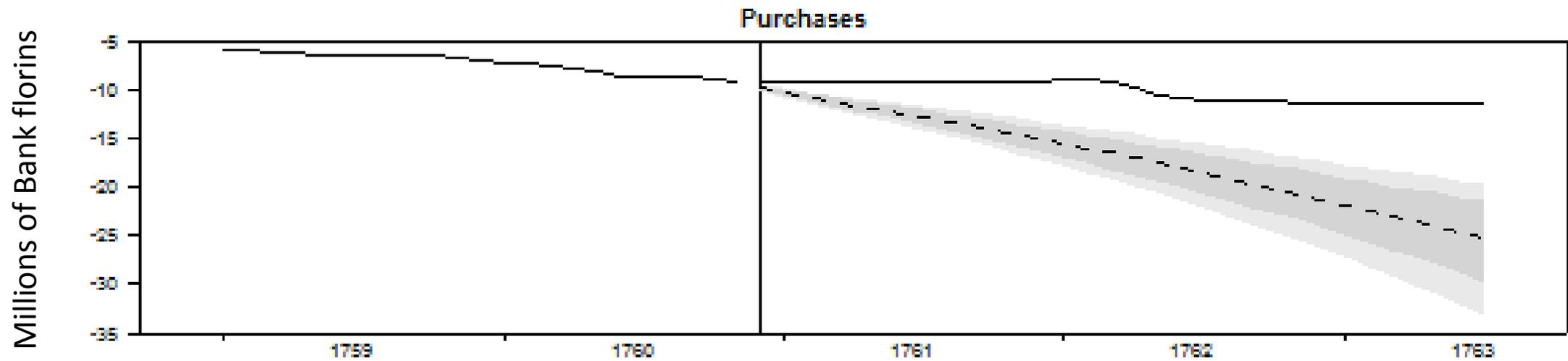
## 1. Estimated in-sample VAR

- Estimating each of the three intervention regimes: Tightening, Easing, No Intervention.
- Regimes are observable.

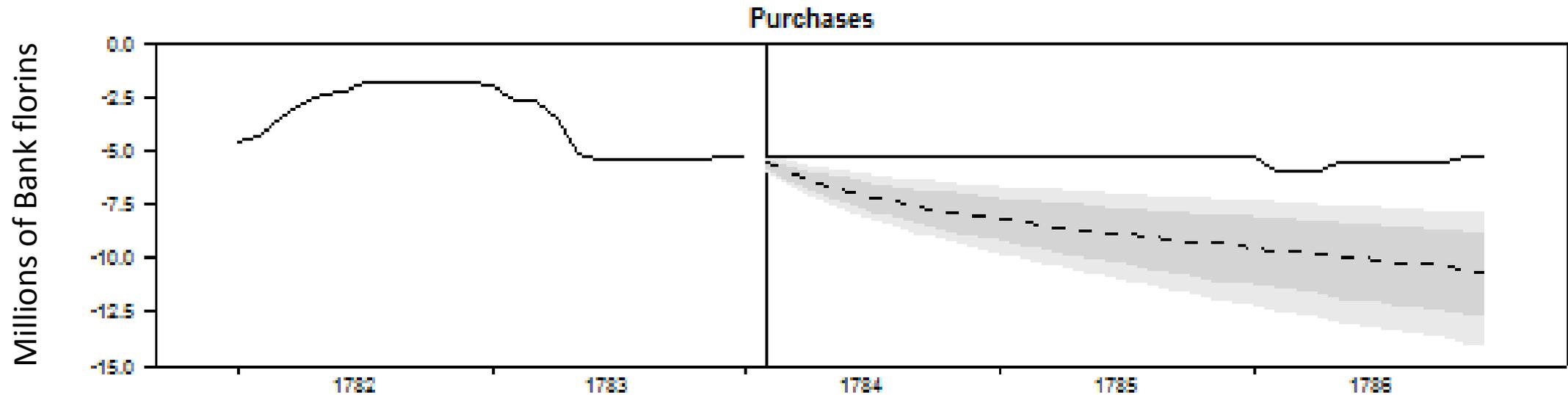
## 2. Construct out-of-sample forecasts

- Apply the “tightening” VAR model to the two policy failures.
- Constrain the path of deposits to match their end-of-interval levels.

# Figure 7. Conditional forecast versus actual series, 1760:12-1763:7



# Figure 8. Conditional forecast versus actual series, 1784:2-1786:12



# Recap

- Quantitative management: low collateral levels prompted purchases, and high levels prompted sales.
- A high agio increased the chance of an easing regime, but a low agio did *not* increase the chance of tightening.
- Collateral constraints were substantial during periods of policy failure.

# Conclusions

- Under permazero, the Bank managed a stable agio and a stable monetary stock over long periods.
- Open market operations assisted stabilization, but tightening (sales) could be critically constrained by a lack of collateral.
- Design mattered:
  - Low-rate standing facilities created an anchor but led to volatile levels of market funding.
  - Receipts attracted market funding but weakened the anchor when agios were low.
  - Amsterdam's persistent collection of seigniorage depleted the Bank's collateral.

# Lessons

- Permazero is not that easy to pull off, even in the 18<sup>th</sup> century.
- To manage, the Bank engaged in extensive, sometimes massive operations. Bank policy was successful when able to do this and unsuccessful when unable.
- Permazero policy bitter-sweet.
  - The good: low rates attract “hot money.”
  - The bad: volatile funding requires management that can fail.

# Bottom line

Policy failed because the Bank of Amsterdam did not anticipate the scale of open market operations required for stabilization.

# Questions?





# Figure 7. Cumulative balances from net purchases and net deposits, 1736:1-1792:1

