Drain, Baby, Drain: Term Deposits, Reserves and Interbank Rates

Day Ahead Conference - Federal Reserve Bank of Chicago

Morten L. Bech and Spence Hilton[1]

BIS and FRBNY

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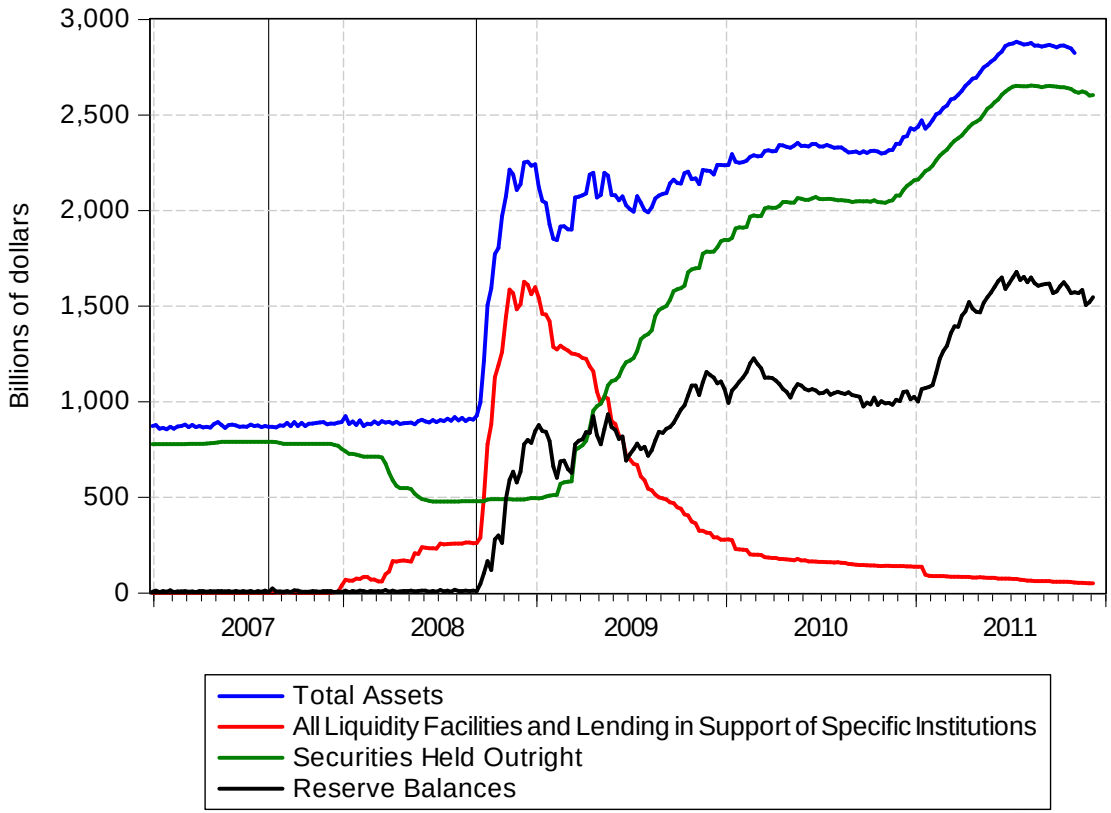
[1] The views expressed in this paper are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of New York, the Federal Reserve System or Bank for International Settlements

Reserves balances have exploded in the U.S.

- Driven by liquidty support, QE1, change in reinvestment policy and QE2
- Exit: Might need to drain in order to get better control over the federal funds rate e.g. Bech and Klee (2011)



How to drain?

- Shrink balance sheet
  - Sell assets
    - Long term goal: All treausury balance sheet
- Change composition of balance sheet
  - Reverse repos
    - Counterparties: Primary dealers, MMMFs, DIs or GSEs
  - **Term deposits**
    - Deposits that cannot be withdrawn for a period of time (penalties)
    - Key funding source for commercial banks but not CBs
  - Other
    - SFP (US Treasury), reserve requirements

Game Plan

- Overview of Central Bank Term Deposit Facilities
  - Design
  - Results
- Flavor of our model
  - Standard demand for reserves model in corridor system
  - Add credit risk
  - Add Term Deposit Facility
- Vaildate model using Reserve Bank of Australia data
- Conclusion

Term Deposits and Central Banking

- 2004 IMF survey of CB tools:
  - Use of overnight deposit facilities increasing
  - Term deposits only used by a few CBs (emerging or developing)
- Now! Term deposits are in vogue among central banks
  - Sep. 24, 2008: Reserve Bank of Australia
    - Sterilize impact of longer term repo transactions
    - Keep cash rate at target. Discontinued March 2009
  - Dec. 28, 2008: Federal Reserve announcement
    - Exit strategy tool, only small-scale auctions so far
  - May, 17, 2010: European Central Bank
    - Narrow objective: Sterilize impact of Securities Markets Program
  - August 31, 2010: Bank of Korea
    - Market-Friendly Monetary Stabilization Accounts
    - "non-residents' increased investment in domestic securities"

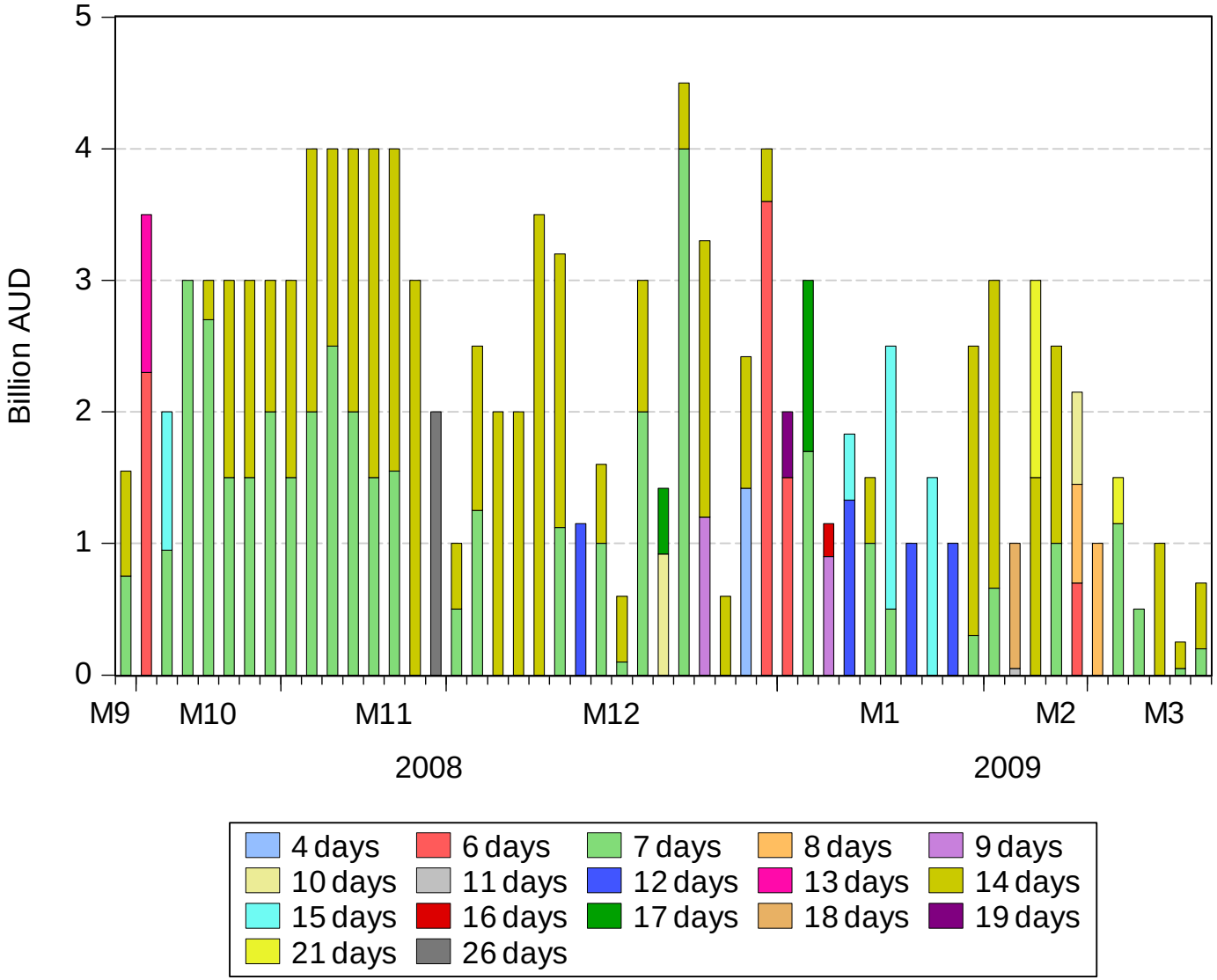
Key Features of Term Deposit Facilities

	RBA	FED	ECB	BoK
Announcement	Sep. 24, 2008	Dec. 28 2008	May 17, 2010	Aug. 31, 2010
Operational	Sep. 29, 2008	Jun. 14, 2010	May 18, 2010	Oct. 11, 2010
Auction Type	Discrimatory	Uniform	Discrimatory	Uniform
Bid measure	Spread to target	Rate	Rate	Rate
Max. bid rate	Discretion	Primary Credit	MRO rate	Discretion
Noncomp. bids	No	Yes	No	No
Max bid amount	100%	25%	100%	Discretion
Duration	$\leq$26 days	$\leq$84 days	1 week	28 days
Amount	$\leq$5.5B AUD	$\leq$\$5B	Equal to SMP	$\leq$\$1.5T KRW
Settlement	T+1	T+3	T+1	T+0
Intraday credit	No	Collateral	Collateral	No
Callable	Penalty	No	No	Discretion

Notes: Based on observations as of Mar. 8, 2011, SMP = Securities Market Program

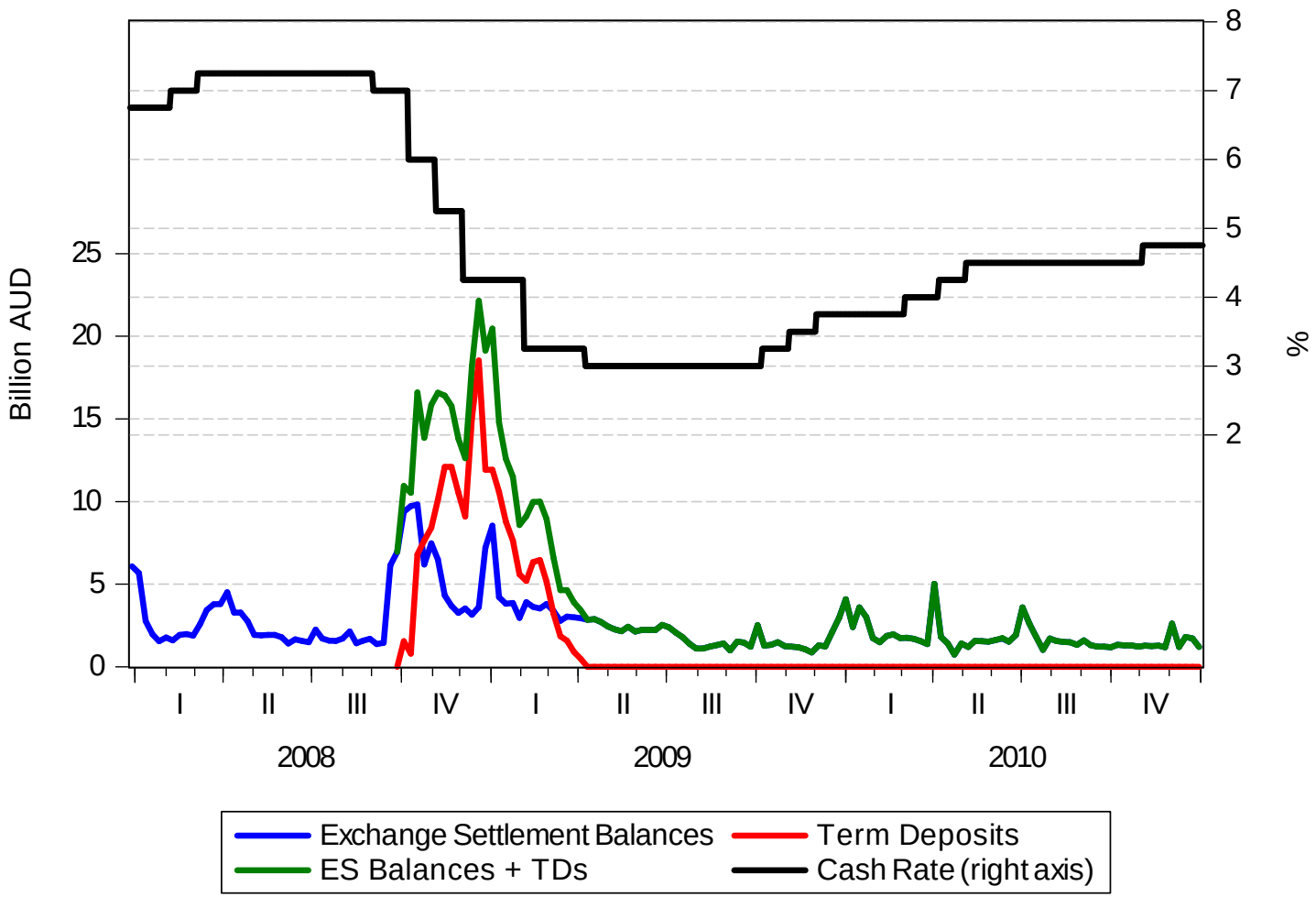
MRO = Marginal Refinancing Operations

Term Deposits Collected by the RBA



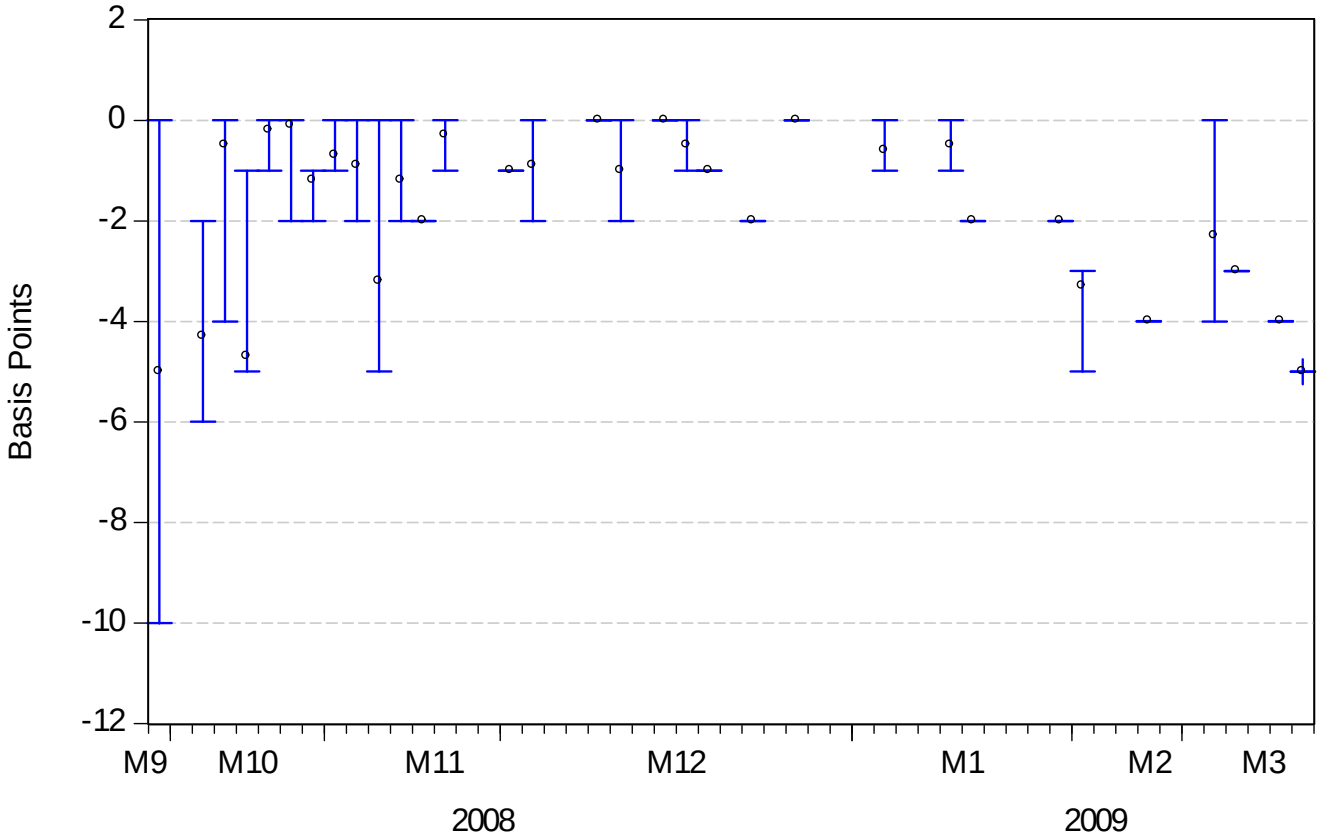
RBA: Settlement Balances, Term Deposits and Cash Rate

Weekly data



RBA: High, Low and Weighted Avg. Spread to Target

7-day Auctions



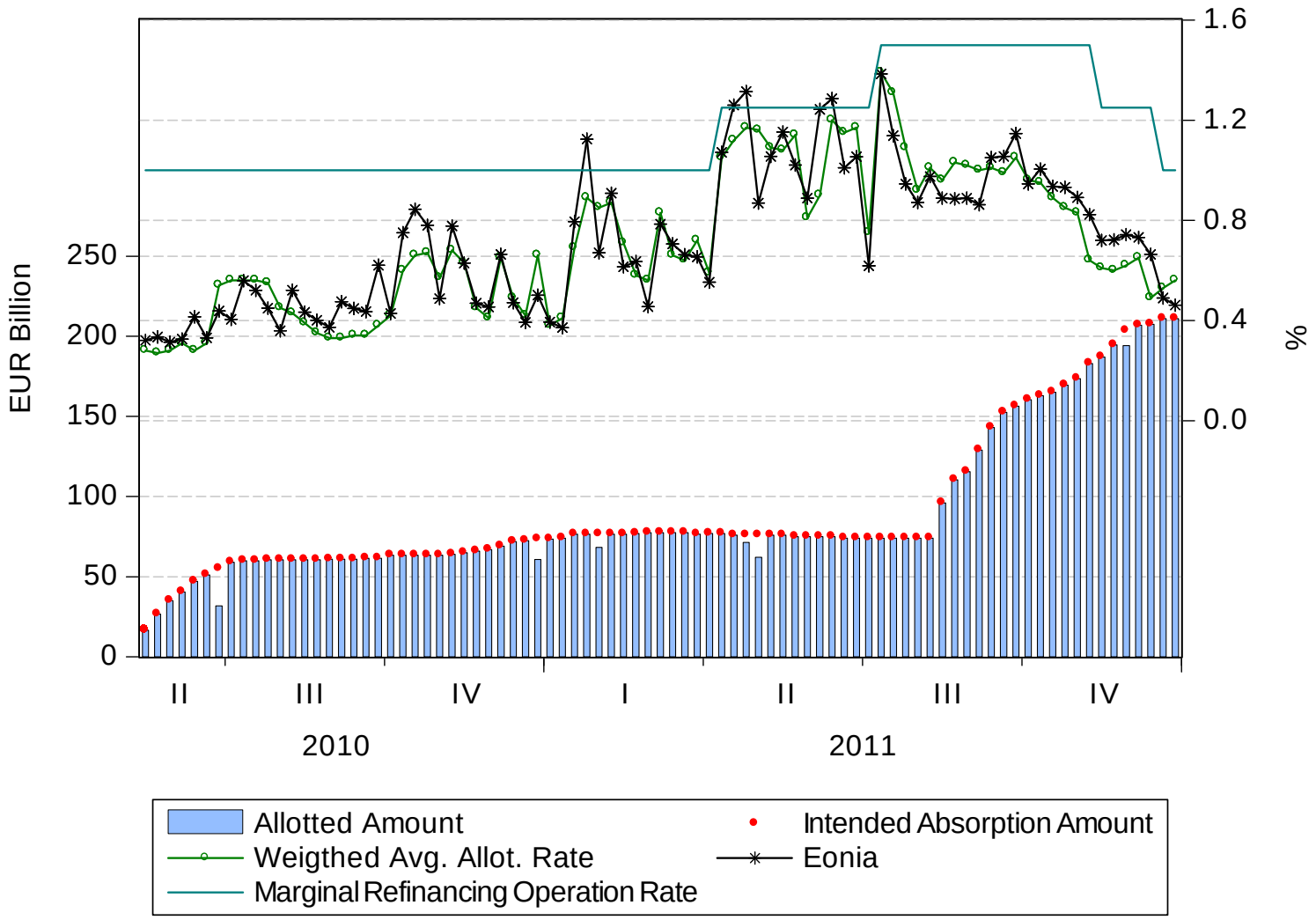
Federal Reserve - Small-scale Offerings

Auction Date	Term	Competitive. Amount Offered	Non-Comp. Amount Awarded	Bid to Cover	Stop Out Rate
2010	Days	$Billions	$Millions	Ratio	%
Jun. 14	14	1	152	6.14	0.270
Jun. 28	28	2	121	5.57	0.270
Jul. 12	84	2	199	3.70	0.310
Oct. 4	28	5	113	2.72	0.269
Nov. 29	28	5	113	2.93	0.260
2011					
Feb. 7	28	5	70	2.52	0.260
Apr. 4	28	5	81	2.20	0.260
May 31	28	5	87	2.17	0.259
Jul. 25	28	5	88	1.26	0.280
Sep. 19	28	5	77	2.41	0.265

Source: Federal Reserve

ECB Term Deposits

1 week



Modeling Strategy

- Take standard demand for reserves model in a corridor system
  - Woodford (2001), Whitesell (2006) and Ennis and Keister (2008)
- Add credit risk (fit financial crisis)
- Assume an expanded central bank balance sheet
- Add one period auction based "term" deposit facility (TDF)
- Only in paper
  - Add multiple periods [soon!]
  - Look at standing TDF

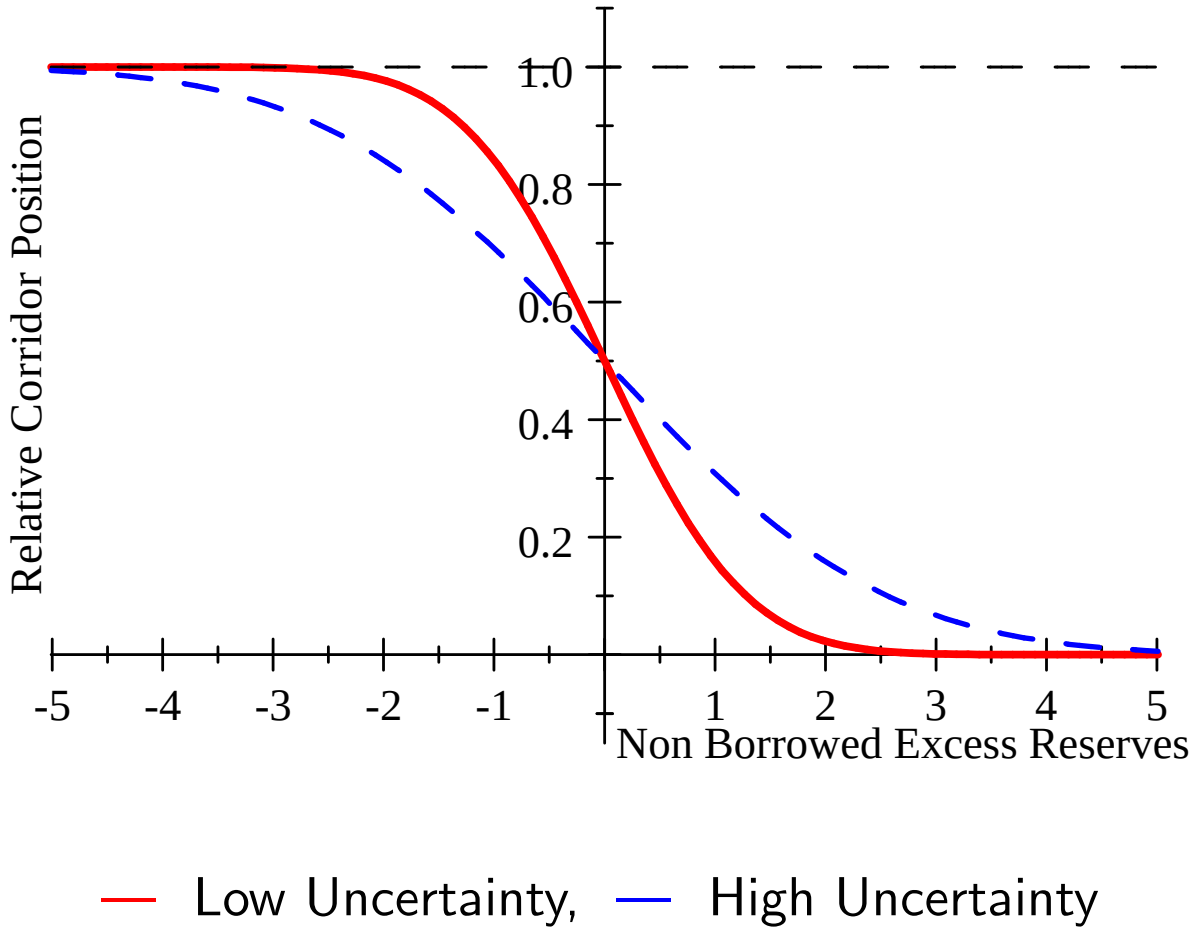
Standard Model - Poole (1968)

- End of day balance: $B_i = R_i + \varepsilon_i$ payment shock, $\varepsilon_i \sim F_i$
- Expected Profit: $E[\Pi_i(R_i)] = E[r_{ior} B_i 1_{B_i>0} + r_{dw} B_i 1_{B_i<0} - \rho R_i]$
  - 1_x is the indicator function, ρ is the interbank rate.
- Key first order condition

$$\tilde{\rho} = \frac{\rho - r_{ior}}{r_{dw} - r_{ior}} = F_i(-R_i^*)$$

- Woodford (2001): "*the demand for [excess reserves is] a function of the location of the overnight rate relative to the [central bank] lending rate and [central bank] deposit rate, but independent of the absolute level of any of these interest rates*".

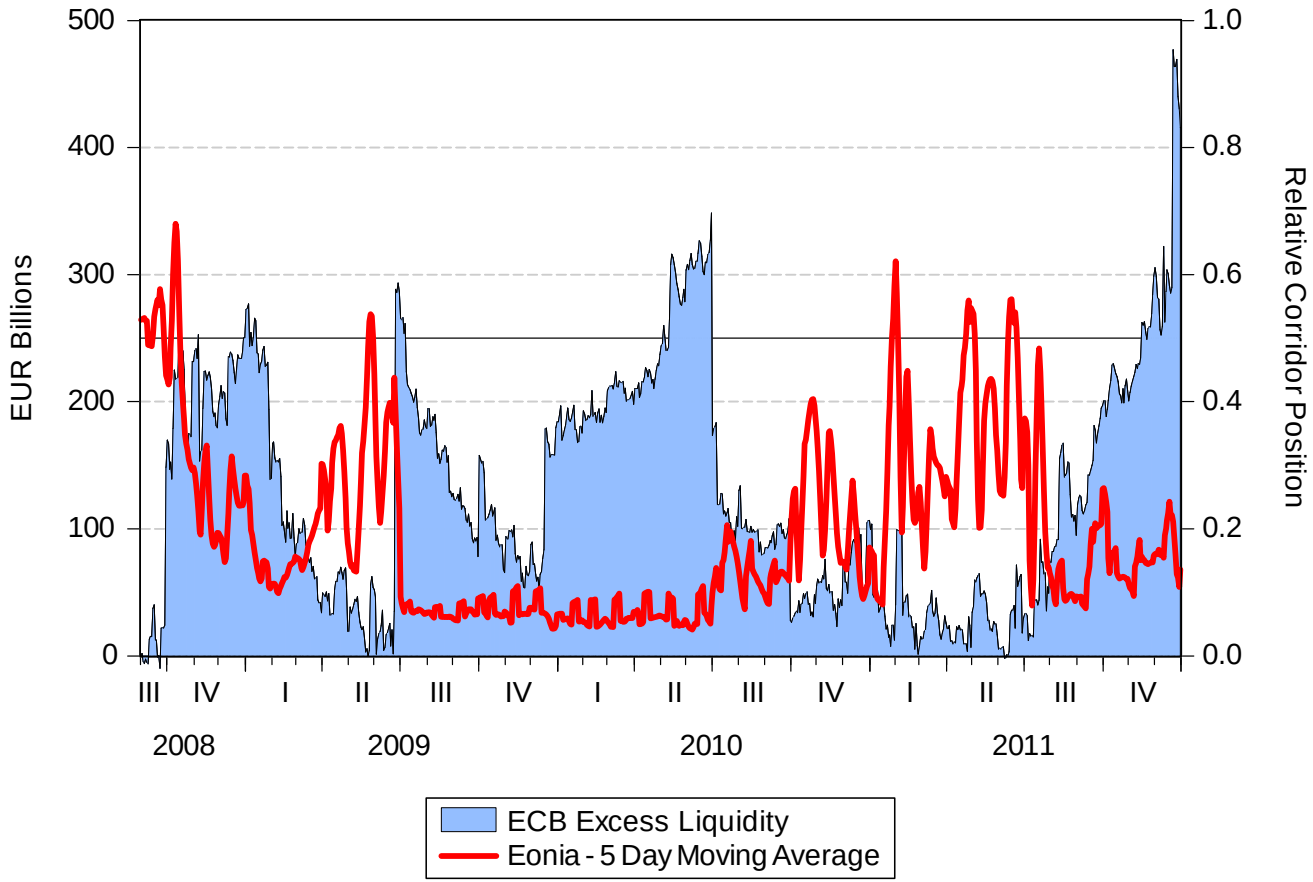
Demand Curve for Reserves (Gaussian - Whitesell 2006)



- CB can pin down interbank rate by supplying $R^S = R^T + v$ via OMOs
- The inverse demand curve for reserves flattens as the uncertainty

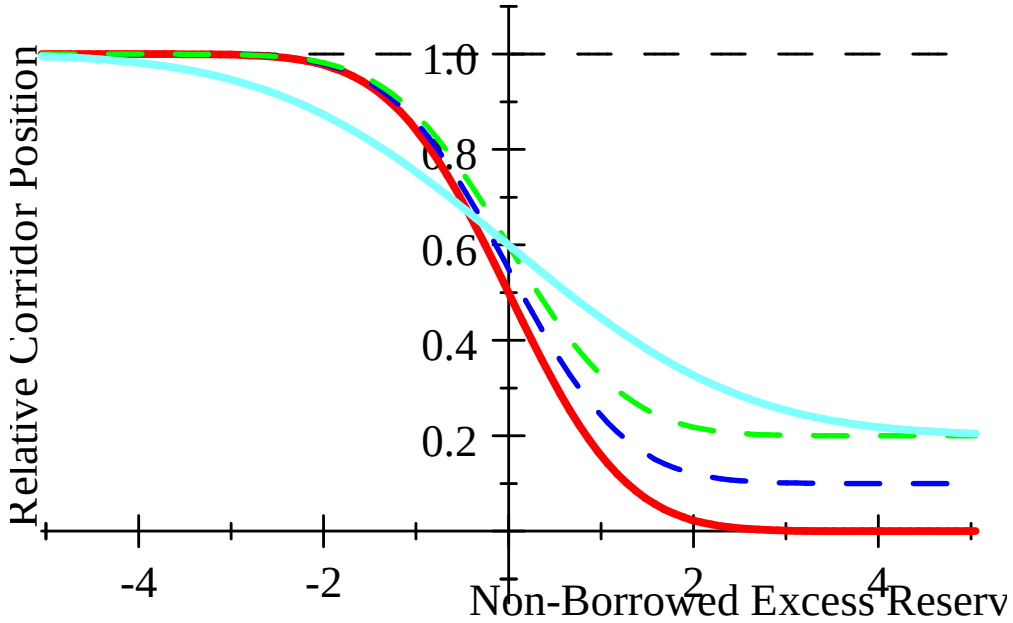
How Crazy is the Model? ECB

- Excess liquidity vs. relative corridor position



Adding Credit Risk

Debelle (2008): "*[I]n August 2007, as banks became ... less confident of the credit profile of their counterparties, the inter-bank borrowing markets became quite tight ... the demand curve for ES balances* **shifted out**"



No credit risk Low credit risk High credit risk

ECB Empirics

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$\tilde{\rho}_t = (1 + e^{-z_t})^{-1} + u_t$	Eonia Relative Corridor Position	
$z_t = \beta_0 + \beta_1 x_{1t} + \ldots$	Daily	Weekly
Constant	-1.986	-2.200
	(0.290)	(0.398)
Excess Reserves	-0.006**	-0.006**
	(0.001)	(0.001)
CDS/Corridor Width	0.012**	0.014*
	(0.004)	(0.005)
End of MP	0.662**	0.323**
	(0.111)	(0.115)
Observations	590	121
Adjusted R^2	0.35	0.36

Notes: Newey-West standard errors in parentheses, MP: Maintenance Period
** and * denotes significance at the 5% and 10% level, respectively

Adding an Auction Based Term Deposit Facility

- Set up
  - Assume an expanded CB Balance sheet
  - Banks hold $\bar{Q}_i$ in CB liabilities. To start with $R_i = \bar{Q}_i$
  - CB decides to drain D via a TDF. $R^S = \bar{Q} - D$
  - Term = intraday and overnight
  - Auctions conducted and settled at 9:00 am
- Auction mechanism
  - Reverse auction: CB is the buyer, banks are sellers
  - Object is the right to supply funds to CB
- The object is divisible and bidders are capacity constrained
  - If $D > \max Q_i$ then at least two banks will have to provide funds

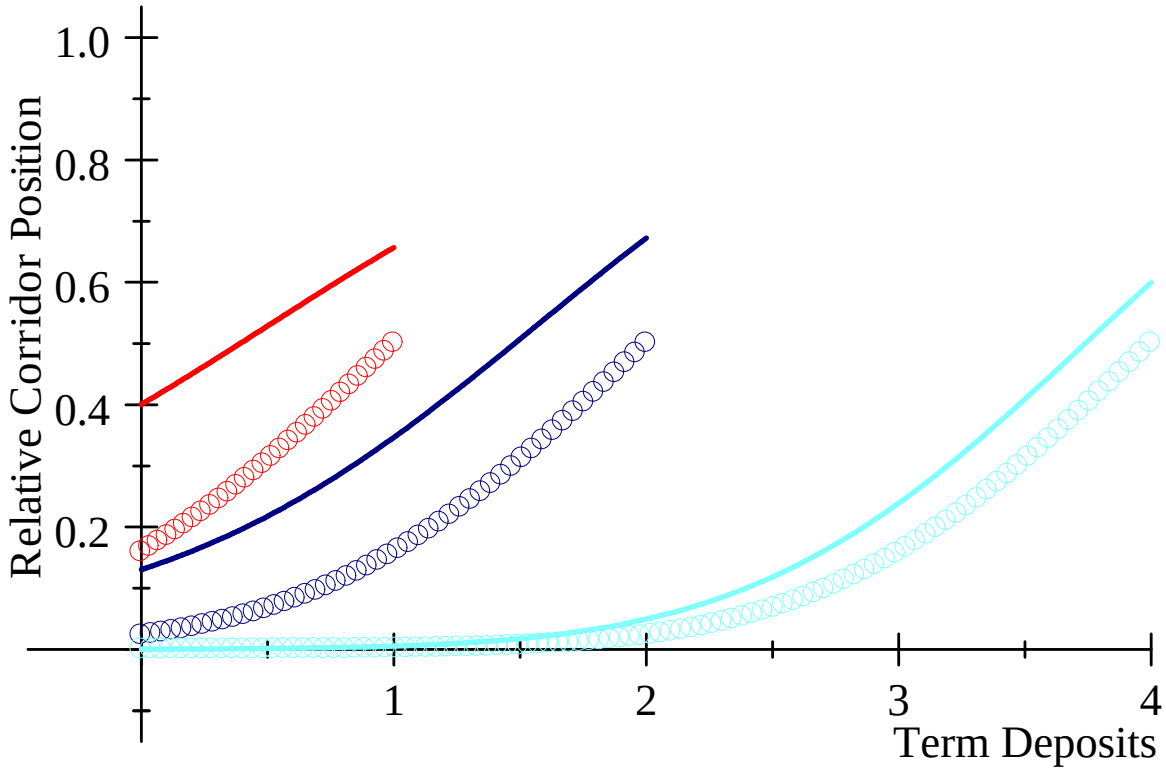
Auction Based Term Deposit Facility

- Banks submit bids in the form of cost schedules $\hat{C}_i(D_i)$.
  - D_i can not be used to off set payment shocks, $\hat{C}_i' \geq 0$.
- Central bank seeks to drain D at least cost, $\min \Sigma a_i D_i$
  - Design of auction important (ignore here)
- Look at full information case (best case for CB)
  - Banks submit true cost schedules $C_i^{true}(D_i)$
  - Banks get no surplus, i.e., $E[\Pi_i(D_i)] - E[\Pi_i(0)] = 0 \Rightarrow$

$$(a_{i,\min} - \rho(R^S))D_i = -(r_{dw} - r_{ior}) \int_{-\bar{Q}_i}^{D_i - \bar{Q}_i} \varepsilon_i f(\varepsilon_i) d\varepsilon_i$$

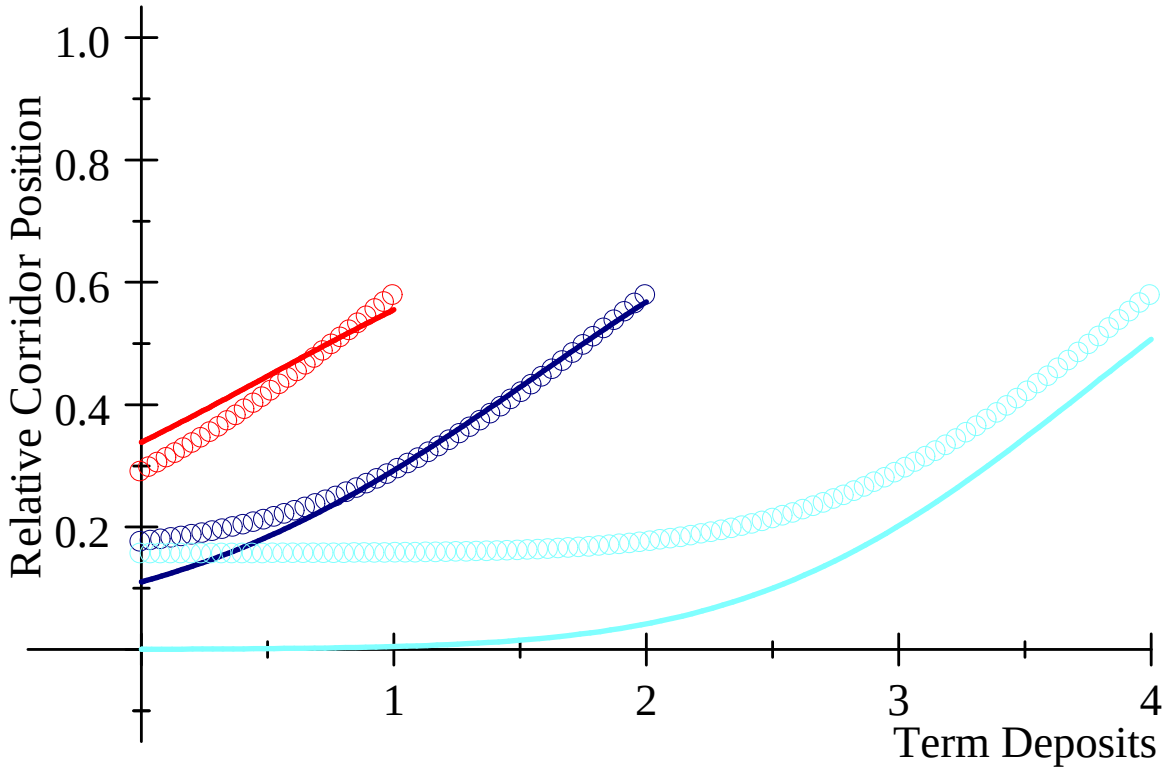
  - Result: Every (identical) bank
    - supply the same amount, $D_i = \frac{1}{n} D$
    - gets paid the same $a_{i,\min} = a_{\min}$
- Private information $\Rightarrow$ Shading of bids, $\hat{C}_i(D_i) \neq C_i^{true}(D_i)$ $\Rightarrow a_i > a_{\min}$

Term Deposits and Min. Auction Rate (No Credit Risk)



$\tilde{a}_{\min} = -$ and $\tilde{\rho} = \circ$, Colors: $\bar{Q}$=1, $\bar{Q}$=2 and $\bar{Q}$=4

Term Deposits and Minimum Auction Rate (Credit Risk)



$\tilde{a}_{\min} = -$ and $\tilde{\rho} = \circ$, Colors: $\bar{Q}$=1, $\bar{Q}$=2 and $\bar{Q}$=4

RBA Term Deposit Auction Pricing

	Spread to Target (basis points)		
	Lowest Accepted	Weighted Average	Highest Accepted
Constant	-4.702**	-0.723	1.793*
	(1.141)	(0.761)	(1.006)
Duration	0.067*	0.075**	0.038
- days	(0.036)	(0.029)	(0.024)
Average ANZ and NAB CDS	-0.016**	-0.023**	-0.022**
- basis points, day of auction	(0.006)	(0.006)	(0.008)
TDs/(TDs+ES Balances)	6.795**	2.821**	0.329
- week of auction	(1.030)	(0.814)	(1.532)
Observations	95	95	95
Adjusted R^2	0.41	0.25	0.13

Notes: Newey-West standard errors in parentheses,
** and * denotes significance at the 5% and 10% level, respectively

Conclusion

- The limited data on TDs auctions consistent with model
  - The more the CB drains the more the CB has to pay (per dollar)
  - Longer term more expensive
  - Credit risk important
- Are lessons valid for the Federal Reserve's Exit? Yes, but ...
  - The purposes of other CBs different in scale and scope
    - Fed's operations potentially different orders of magnitude
  - Model does not include non-DIs
    - Reverse repos with MMMF, dealers or GSEs
  - No GSEs in interbank market (Bech and Klee, forthcoming CR/JME)
- Other CBs' TDFs have some interesting features
  - Callable, spread to target, no limits, discretion, quick settlement
- Caution: ECB and BoK have not always drained desired amount