Central Bank Interventions, Demand for Collateral, and Sovereign Borrowing Costs

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22 July 2015
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Disclaimer: The opinions expressed are those of the authors and do not necessarily reflect the views of Banco de Portugal or of the Eurosystem.
Papers

▶ “Central Bank Interventions, Demand for Collateral, and Sovereign Borrowing Costs”
  ▶ We analyze the vLTRO intervention, its impact on the demand and supply of Portuguese govt bonds
  ▶ Working paper

▶ “The Portuguese Banking System during the Sovereign Debt Crisis”
  ▶ We describe the evolution of the balance sheets of PT banks in 2005-2014
  ▶ To be released in July as part of “BdP Economic Studies”
Research Question

Unconventional Monetary Policy and the Macroeconomy

- December 2011: ECB announced 3-Year LTRO
- Collateralized lending to banks $\rightarrow$ sovereign yields

- Our laboratory: Portugal
  - Unprecedented intervention: more than €1 tn
  - Peripheral country under sovereign stress
  - Bank-based financial system
  - Unique dataset from Banco de Portugal
Banks purchased Portuguese govt debt after the 3Y-LTRO announcement, before the allotment
  ▶ Pledge them at the ECB, collateral trade
  ▶ Purchased mostly short-term bonds

Equilibrium effects
  ▶ Sovereign yield curve steepens
  ▶ Strategic behavior: debt agency takes advantage of the steepening to resume issuance of ST bonds
LITERATURE REVIEW
Four Strands of Literature

1. Linkages between sovereign and financial sector

2. Transmission of monetary policy through banks

3. Sovereign Debt Management

4. Coordination of fiscal and monetary policy
OUTLINE

1. The 3Y-LTRO
   - Two stylized facts
2. Simple theoretical framework to
   - Rationalize these two facts
   - Yield three additional empirical implications
3. Empirical tests
   - Alternative explanations
ECB Regular Open Market Operations
Two Types of Repo: MRO and LTRO

- OMO conducted through repurchase agreements
  - Cash loans in exchange for collateral (w./ haircut)
  - Contrast with US-style market-based operations

- Regular open market operations
  - MROs: one-week maturity
    $\approx 75\%$ overall liquidity provided
  - LTROs: three-month maturity
    occasionally extended during the crisis up to one-year
ECB Non Standard Open Market Operations
The 3-Year Long Term Refinancing Operation (vLTRO)

- vLTROs announcement
- vLTRO1 allotment
- vLTRO2 allotment

8Dec11  21Dec11  29Feb12

- Very attractive loans for banks
  - Cheap (≈ 1%)
  - Long Term (3Y)
- Little time between announcement and first allotment
**Two Stylized Facts**

**Fact 1:** Positive net uptake only in the second allotment
**Two Stylized Facts**

**Fact 2:** Increase in govt bond holdings in the intra-allotment period

![Graph showing increase in govt bond holdings](image_url)
THE "COLLATERAL TRADE"

$t = 0$, bank targets liquidity buffer and can borrow from the ECB
The “Collateral Trade”

$t = 1$, bank repays ECB and earns return on collateral

- Profit, $€10 \times [R^{coll} - (1 - h)R^{LTRO}]$

- Cash on hand: $€10 \times (1 - h)$
**The “Collateral Trade”**

$t = 0$, bank targets a liquidity buffer and can choose collateral maturity

![Diagram showing the collateral trade](attachment:image.png)
The “Collateral Trade”

$t = 1$, bank needs to repay LTRO

\[ \€10(1 - h) \times R^{LTRO} \]

\[ \€10(1 - h) \times R^{LTRO} \]
THE “Collateral Trade”

$t = 1$, long-term bonds subject to liquidity risk

Profit ST: $\frac{10}{q_0^S} - \frac{(1 - h)R^{LTRO}}{q_0^S}$

Profit LT: $\frac{q_L^L}{q_0^L} - \frac{(1 - h)R^{LTRO}}{q_0^L}$

Cash on hand: $\frac{10}{(1 - h)}$
THREE ADDITIONAL EMPIRICAL IMPLICATIONS

1. Banks tapping 3y-LTRO prefer ST bonds
   ▶ Collateral trade, liquidity risk management

2. Yield curve steepens

3. Debt Agency reacts?
   ▶ More issuance during the intra-allotment period
   ▶ Public debt is financed with ST bonds
Data

Granular Bank- and Security-Level Dataset

Two proprietary datasets from Banco de Portugal

- Monetary and Financial Statistics (MFS)
  - Balance sheets for all reporting institutions (82 banks + 10 savings institutions + 13 money market funds)

  "lending with maturity 1Y to French households in Oct07"

- Sistema integrado de estatísticas de títulos (SIET)
  - ISIN-level data for all holdings of domestic govt debt by financial institutions (606 entities: banks, mutual funds, pension funds, ...)

  "holdings of PTPBTYGE0017 by BES in Oct07"
**LINKING THE TWO STYLIZED FACTS**

**Fact 1:** Banks are at the collateral constraint and simply rollover LTRO1
**Linking the Two Stylized Facts**

**Fact 2:** Banks buy govt bonds to pledge them as collateral at LTRO2

\[
\Delta \text{Total ECB Borrowing}_i = \alpha + \beta_1 \Delta \text{Govt}_i^{PT} + \beta_2 X_i + \epsilon_i
\]
**Linking the Two Stylized Facts**

**Fact 2:** Banks buy govt bonds to pledge them as collateral at LTRO2

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\Delta \text{Total ECB Borrowing}_i = \alpha + \beta_1 \Delta \text{Govt}^{PT}_i + \beta_2 X_i + \epsilon_i
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Bank \( i \), cross-section
**LINKING THE TWO STYLIZED FACTS**

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Bank \(i\), cross-section

- \(\Delta \text{Total ECB Borrowing}_i\) - change between (Feb12-Mar12)
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Bank \(i\), cross-section

- \(\Delta \text{Total ECB Borrowing}_i\) - change between (Feb12-Mar12)
- \(\Delta \text{Govt}^{PT}_i\): change in PT govt bond portfolio quantities (Dec11-Feb12)
LINKING THE TWO STYLIZED FACTS

Fact 2: Banks buy govt bonds to pledge them as collateral at LTRO2

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Bank \( i \), cross-section

- \( \Delta \text{Total ECB Borrowing}_i \): change between (Feb12-Mar12)
- \( \Delta \text{Govt}^{PT}_i \): change in PT govt bond portfolio quantities (Dec11-Feb12)
- \( X_i \): Controls: other measures of collateral, price changes for PT govt bonds (Dec11-Feb12)

(all quantities divided by assets)
**LINKING THE TWO STYLIZED FACTS**

**Fact 2:** Banks buy govt bonds to pledge them as collateral at LTRO2

\[
\Delta \text{Total ECB Borrowing}_i = \alpha + \beta_1 \Delta \text{Govt}^{PT}_i + \beta_2 X_i + \epsilon_i
\]

<table>
<thead>
<tr>
<th>(\Delta \text{Govt}^{PT}_i)</th>
<th>0.175</th>
<th>0.195***</th>
<th>0.346***</th>
<th>0.235***</th>
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<tbody>
<tr>
<td></td>
<td>(0.209)</td>
<td>(0.0651)</td>
<td>(0.0641)</td>
<td>(0.0631)</td>
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</tbody>
</table>

Price controls

| Price controls | ✓ | ✓ | ✓ | ✓ | ✓ |

Other collateral

| Other collateral | ✓ | ✓ |

| \(N\) | 71 | 37 | 71 | 37 |
| adj. \(R^2\) | 0.037 | 0.664 | 0.911 | 0.706 |
#1 **HIGH DEMAND FOR ST SECURITIES**

\[
\frac{\text{Hold}_{i,j,t}}{\text{Amount Outstanding}_{j,t}} = \beta vLTRO_t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]
#1 **High Demand for ST Securities**

\[
\frac{\text{Hold}_{i,j,t}}{\text{Amount Outstanding}_{j,t}} = \beta \text{vLTRO}_t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}
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Entity \( i \), ISIN \( j \), month \( t \)
#1 High Demand for ST Securities

$$\frac{\text{Hold}_{i,j,t}}{\text{Amount Outstanding}_{j,t}} = \beta vLTRO_t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}$$

Entity $i$, ISIN $j$, month $t$

- $\text{Hold}_{i,j,t}$: holdings of ISIN $j$ by bank $i$ in month $t$, face value
#1 High Demand for ST Securities

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- \(\text{vLTRO}_t\): time dummy equal to 1 after December 2011
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- \( \text{Short-Term}_j \): bond dummy equal to 1 if expiration date \( \leq \) February 2015

Controls: double interactions, fixed effects

Sample excludes all bonds issued after the announcement.
#1 High Demand for ST Securities

\[
\text{Hold}_{i,j,t} / \text{Amount Outstanding}_{j,t} = \beta v_{\text{LTRO}} t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}
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Entity \( i \), ISIN \( j \), month \( t \)

- \( \text{Hold}_{i,j,t} \): holdings of ISIN \( j \) by bank \( i \) in month \( t \), face value
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#1 HIGH DEMAND FOR ST SECURITIES

\[
\text{Hold}_{i,j,t} = \beta vLTRO_t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]

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<thead>
<tr>
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<th>All Bonds</th>
<th>No Issuance After Dec2011</th>
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<tbody>
<tr>
<td>(vLTRO_t \times \text{Short}_j \times \text{Access}_i)</td>
<td>0.00224***</td>
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<tr>
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<td>(vLTRO_t \times \text{Short}_j)</td>
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<td></td>
<td>(0.000117)</td>
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<tr>
<td>(vLTRO_t \times \text{Access}_i)</td>
<td>0.000181***</td>
<td>0.000191***</td>
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<tr>
<td></td>
<td>(0.0000526)</td>
<td>(0.0000529)</td>
</tr>
<tr>
<td>(\text{Short}_j \times \text{Access}_i)</td>
<td>0.00315***</td>
<td>0.00316***</td>
</tr>
<tr>
<td></td>
<td>(0.000391)</td>
<td>(0.000393)</td>
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<table>
<thead>
<tr>
<th>Feature</th>
<th>All Bonds</th>
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<tr>
<td>ISIN FE</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Entity FE</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>(N)</td>
<td>259,272</td>
<td>242,589</td>
</tr>
<tr>
<td>adj. (R^2)</td>
<td>0.126</td>
<td>0.127</td>
</tr>
</tbody>
</table>

Sample excludes all bonds issued after the announcement.
#1 High Demand for ST Securities

![Graph showing the percentage of outstanding securities for different access conditions over time.](image)

- **Short Access**
- **Long Access**
- **Short No Access**
- **Long No Access**

The graph illustrates the percentage of outstanding securities for all ISINs, face value, from 2011m12 to 2012m2, showing a high demand for specific securities conditions.
#1 High Demand for ST Securities

*Intensity* should matter for the collateral trade.
#1 High Demand for ST Securities

Intensity should matter for the collateral trade.

\[
\frac{\text{Hold}_{i,j,t}}{\text{Amt Outst}_{j,t}} = \beta \times vLTRO_t \times \text{Short-Term}_j \times \text{Intensity}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]

where

\[
\text{Intensity}_i = \frac{vLTRO \text{ Borrowing}_i}{\text{Assets}_i}
\]
#1 High Demand for ST Securities

*Intensity* should matter for the collateral trade.

\[
\frac{\text{Hold}_{i,j,t}}{\text{Amt Outst}_{j,t}} = \beta \times \nu\text{LTRO}_t \times \text{Short-Term}_j \times \text{Intensity}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]

where

\[
\text{Intensity}_i = \frac{\nu\text{LTRO Borrowing}_i}{\text{Assets}_i}
\]

- Intensity is endogenous
#1 High Demand for ST Securities

*Intensity* should matter for the collateral trade.

\[
\frac{\text{Hold}_{i,j,t}}{\text{Amt Outst}_{j,t}} = \beta \times v\text{LTRO}_t \times \text{Short-Term}_j \times \text{Intensity}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]

where

\[
\text{Intensity}_i = \frac{v\text{LTRO Borrowing}_i}{\text{Assets}_i}
\]

- Intensity is endogenous
- \(v\text{LTRO}\) mostly rollover
#1 High Demand for ST Securities

*Intensity* should matter for the collateral trade.

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where

\[
\text{Intensity}_i = \frac{vLTRO \text{ Borrowing}_i}{\text{Assets}_i}
\]

- Intensity is endogenous
- vLTRO mostly rollover
- IV: ECB borrowing *before* beginning of the sample
#1 High Demand for ST Securities

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\frac{\text{Hold}_{i,j,t}}{\text{Amt Outst}_{j,t}} = \beta \times vLTRO_t \times \text{Short-Term}_j \times \text{Intensity}_i + X_{i,j,t} + \epsilon_{i,j,t}
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</thead>
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<td>(vLTRO_t \times \text{Short}_j \times \text{Intensity}_i)</td>
<td>0.0261***</td>
<td>0.0261***</td>
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<tr>
<td></td>
<td>(0.00252)</td>
<td>(0.00256)</td>
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<tr>
<td>(vLTRO_t \times \text{Short}_j)</td>
<td>0.000102**</td>
<td>0.000101**</td>
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<tr>
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<td>(0.0000403)</td>
<td>(0.0000409)</td>
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<td>(vLTRO_t \times \text{Intensity}_i)</td>
<td>0.00597***</td>
<td>0.00597***</td>
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<td>(0.00108)</td>
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<td>(–)</td>
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<tr>
<td>(F) stat</td>
<td>98.26</td>
<td>105.7</td>
</tr>
</tbody>
</table>
#2 Yield Curve Steepens

PT Yield curve – before and after vLTRO

Maturity, Years

%
#3 Government Debt Agency seems to React

Government Bond Issuance: Volume and Maturity
ALTERNATIVE HYPOTHESES

Low net uptakes in the 1st Allotment

Were banks really collateral constrained?
- Collateral buffers
  - Banks have collateral buffer targets
  - Similar to a collateral constraint
- Window dressing for end-year annual reports
  - Similar to collateral buffers
  - Compatible with our analysis
- Stigma
  - Popular explanation
  - Ruled out by large gross uptakes
  - Banks self-reported uptakes
EXTERNAL VALIDITY

Italy and Spain

[Graphs showing interest rates for Italy and Spain over different maturities.]
UNCONVENTIONAL MONETARY POLICY
Collateralized Lending vs. Quantitative Easing

▶ vLTRO

▶ QE
Unconventional Monetary Policy
Collateralized Lending vs. Quantitative Easing

- vLTRO
  - relies on indirect purchases of ST debt

- QE
  - relies on direct purchases of LT debt
Unconventional Monetary Policy
Collateralized Lending vs. Quantitative Easing

▶ vLTRO
  ▶ relies on indirect purchases of ST debt
  ▶ yield curve steepens

▶ QE
  ▶ relies on direct purchases of LT debt
  ▶ yield curve flattens
Unconventional Monetary Policy
Collateralized Lending vs. Quantitative Easing

▶ **vLTRO**
  ▶ relies on *indirect* purchases of *ST* debt
  ▶ yield curve *steepens*
  ▶ govt strategically reacts by *shortening* the maturity of public debt

▶ **QE**
  ▶ relies on *direct* purchases of *LT* debt
  ▶ yield curve *flattens*
  ▶ govt strategically reacts by *increasing* the maturity of public debt
Unconventional Monetary Policy
Collateralized Lending vs. Quantitative Easing

▶ vLTRO
  ▶ relies on indirect purchases of ST debt
  ▶ yield curve steepens
  ▶ govt strategically reacts by shortening the maturity of public debt
  ▶ banks reduce maturity mismatch by increasing liability maturity (asset maturity also ↓)

▶ QE
  ▶ relies on direct purchases of LT debt
  ▶ yield curve flattens
  ▶ govt strategically reacts by increasing the maturity of public debt
  ▶ banks reduce maturity mismatch by decreasing asset maturity
CONCLUSION

- vLTRO boosted bank demand for domestic sovereign debt
- Liquidity risk channel generated preference for shorter-term bonds
- Implications for the management of
  - Yield curve
  - Maturity of sovereign debt
  - Bank risk-taking and financial stability