The (Unintended?) Consequences of the Largest Liquidity Injection Ever

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NYU

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LBS

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Real and Financial Externalities of Non-Traditional Monetary Policy Tools

The opinions expressed are those of the authors and do not necessarily reflect the views of Bank of Portugal or of the Eurosystem.
Research Question

- Unintended consequences of central bank liquidity provisions/lender-of-last-resort interventions
  ▶ Credit supply contraction in bad times
  ▶ Borrowers affected (cannot easily switch lenders)
  ▶ Central bank liquidity increase bank credit supply

- The intervention
  ▶ European Central Bank Dec11 intervention (LTRO)
  ▶ Largest liquidity provision in history: > 1.6$ tn
  ▶ Turning point of the Eurozone crisis
  ▶ Goal: “support bank lending and money market activity”

- Our laboratory is the Portuguese financial system
  ▶ Peripheral country under sovereign stress
  ▶ Bank-based financial system
  ▶ Unique dataset from the Portuguese Central Bank
- Banks purchased Portuguese govt debt after the LTRO announcement, *before* the allotment
  - Pledge them at the ECB, collateral trade
  - Purchased mostly short-term bonds

- Equilibrium effects
  - Sovereign yield curve steepens
  - Debt agency takes advantage of the steepening to resume issuance

- Main result: LTRO boosted demand for public debt
  - Short-Term: 12 to 17 p.p. of amounts outstanding
  - Long-Term: 1 to 2 p.p. of amounts outstanding
Relation to Literature

1) **Sovereign-bank risk feedback loops**

2) **Transmission of central bank liquidity**

3) **Banking sector demand for domestic sovereign debt**

4) **Interaction of fiscal and monetary policy during crises**
   Greenwood et al. (2014), Greenwood et al. (2015)
Outline

1) Two Stylized Facts
2) Our Story
3) Empirical Findings
4) Discussion
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The LTRO

- Announced in December 2011 at the peak of Euro crisis
- Unlimited provision of collateralized cash loans
  - 3-year maturity
  - many assets eligible, govt bonds security pledged the most
  - ∼ 1% rate for all banks, but haircut is security-specific
  - Two allotment dates
The LTRO

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Intra-allotment period

<table>
<thead>
<tr>
<th>Announcement</th>
<th>$1^{st}$ allotment (LTRO1)</th>
<th>$2^{nd}$ allotment (LTRO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8Dec2011</td>
<td>21Dec2011</td>
<td>29Feb2012</td>
</tr>
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</table>
The LTRO

- Announced in December 2011 at the peak of Euro crisis
- Unlimited provision of collateralized cash loans
  ▶ 3-year maturity
  ▶ many assets eligible, govt bonds security pledged the most
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- Attractive compared to private market
  ▶ Haircuts and rate favorable compared to private market
  ▶ 800 eurozone banks tapped for > 1.6$ trillion
    (> 2/3 total uptake by GIIPS banks)
Data

Proprietary data from the Bank of Portugal

1) *All* financial institutions
   - Security-level holdings of domestic government bonds
   - > 98% holdings matched with Bloomberg
   - 606 entities (e.g., insurance companies, hedge funds)

2) Commercial banks
   - 82 commercial banks
   - Standard balance sheet characteristics
1. Banks Buy Govt Bonds Between Announcement and Allotment

Domestic Government Bond Holdings

- Access to ECB
- No Access to ECB

<table>
<thead>
<tr>
<th>Year</th>
<th>Access to ECB</th>
<th>No Access to ECB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011m6</td>
<td></td>
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</tr>
<tr>
<td>2011m12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012m3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012m6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Banks Increase *Total* Borrowing at ECB
Outline

1) Two Stylized Facts
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4) Discussion
The “Collateral Trade”

- Banks seek to minimize funding liquidity risk
  ▶ External borrowing is costly (as in Dec 2011)
  ▶ Insurance motives induce banks to hold liquid reserves vs. high yield assets, (e.g., govt debt)
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  ▶ External borrowing is costly (as in Dec 2011)
  ▶ Insurance motives induce banks to hold liquid reserves vs. high yield assets, (e.g., govt debt)

- “Collateral Trade”
  ▶ Use cash reserves to purchase high yield govt debt
  ▶ Use ECB funding facilities to replenish cash reserves
  ▶ Risk diminished buying maturity shorter than loan
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- Why LTRO?
  ▶ Normal times: ECB funding is too short-term
  ▶ Longer-term ECB funding makes this trade safer for all assets with shorter maturity
Anecdotal Evidence

Banco Carregosa Annual Report, 2012:

[Carregosa] invested essentially in short-term deposits with other financial institutions and in Portuguese public debt, in most cases, with maturities up to 2015. Stable financial sources were used with the Clients’ 2 to 3 year term deposits and transforming the short-term financing with the ECB into 3 years (…)
Four Empirical Implications

1) Bank buy-and-pledge
2) LTRO $\Rightarrow$ ↑ demand for short-term bonds
3) Yield curve steepens
4) Debt agency reacts
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1) Banks Buy-and-Pledge

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

<table>
<thead>
<tr>
<th></th>
<th>(\Delta \text{Govt}^{PT}_i)</th>
<th>(0.369^{***})</th>
<th>(0.241^{***})</th>
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<tr>
<td></td>
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<td>((0.064))</td>
<td>((0.067))</td>
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<tr>
<td>Price controls</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Other collateral</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Sample</td>
<td>Full</td>
<td>Domestic</td>
<td></td>
</tr>
<tr>
<td>(N)</td>
<td>71</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>adj. (R^2)</td>
<td>0.915</td>
<td>0.699</td>
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</table>
2) LTRO ⇒ ↑ Demand for Short-Term Govt Bonds

- Explore three sources of variation
  ▶ *Time*: Before and after announcement
  ▶ *Entity*: Banks with access to ECB vs. no access
  ▶ *Security*: Maturity < LTRO vs. longer term

- Triple difference approach

- **Our Goal**: Show that institutions with *Access* purchased more *Short-Term* securities *after* the announcement.

\[
\frac{\text{GovPT}_{i,j,t}}{\text{Amount Outstanding}_{j,t}} = \beta_{\text{LTRO}} t \times \text{Short-Term}_j \times \text{Access}_i + X_{i,j,t} + \epsilon_{i,j,t}
\]

Institution *i*, security *j*, month *t*
2) LTRO ⇒ ↑ Demand for Short-Term Govt Bonds

<table>
<thead>
<tr>
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<th>All Bonds</th>
<th>No Issuance After Dec2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTRO&lt;sub&gt;t&lt;/sub&gt; × Short&lt;sub&gt;j&lt;/sub&gt; × Access&lt;sub&gt;i&lt;/sub&gt;</td>
<td>0.00220***</td>
<td>0.00018**</td>
</tr>
<tr>
<td></td>
<td>(0.00005)</td>
<td>(0.00006)</td>
</tr>
<tr>
<td>LTRO&lt;sub&gt;t&lt;/sub&gt; × Short&lt;sub&gt;j&lt;/sub&gt;</td>
<td>-0.00006</td>
<td>0.00016</td>
</tr>
<tr>
<td></td>
<td>(0.00011)</td>
<td>(0.00014)</td>
</tr>
<tr>
<td>LTRO&lt;sub&gt;t&lt;/sub&gt; × Access&lt;sub&gt;i&lt;/sub&gt;</td>
<td>0.00029***</td>
<td>0.00029***</td>
</tr>
<tr>
<td></td>
<td>(0.00006)</td>
<td>(0.00006)</td>
</tr>
<tr>
<td>Short&lt;sub&gt;j&lt;/sub&gt; × Access&lt;sub&gt;i&lt;/sub&gt;</td>
<td>0.00353***</td>
<td>0.00353***</td>
</tr>
<tr>
<td></td>
<td>(0.00039)</td>
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</thead>
<tbody>
<tr>
<td>Period FE</td>
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<td>✓</td>
<td></td>
</tr>
<tr>
<td>Security FE</td>
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<td></td>
</tr>
<tr>
<td>Entity FE</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>259,272</td>
<td>242,589</td>
<td></td>
</tr>
<tr>
<td>adj. R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.126</td>
<td>0.127</td>
<td></td>
</tr>
</tbody>
</table>

Sample: +- 6 months around announcement, June 2011 - May 2012. SE clustered at investor sector.
3) Yield Curve Steepens

PT Yield curve – before and after vLTRO

Maturity, Years

%
4) Public Debt Issuance Volume
Public Debt Maturing Volume

Public Debt Maturing Amount

Amount Maturing (billion euros)

2010m6 2010m12 2011m6 2011m12 2012m6 2012m12 2013m6 2013m12
Outline

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Who Engages in the Collateral Trade the Most?

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Below Median</th>
<th>Above Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets</td>
<td>billion Euro</td>
<td>16.10</td>
<td>12.96</td>
</tr>
<tr>
<td>Cash Reserves</td>
<td>% Assets</td>
<td>0.36%</td>
<td>0.24%</td>
</tr>
<tr>
<td>Leverage</td>
<td>A/E</td>
<td>20.53</td>
<td>11.25</td>
</tr>
<tr>
<td>Securities</td>
<td>% Assets</td>
<td>17.47%</td>
<td>21.11%</td>
</tr>
<tr>
<td>Total Govt Bonds</td>
<td>% Assets</td>
<td>8.11%</td>
<td>4.46%</td>
</tr>
<tr>
<td>Dom Govt Bonds</td>
<td>% Assets</td>
<td>7.80%</td>
<td>3.56%</td>
</tr>
<tr>
<td>IIGS Govt Bonds</td>
<td>% Assets</td>
<td>0.17%</td>
<td>0.79%</td>
</tr>
<tr>
<td>Lending</td>
<td>% Assets</td>
<td>70.76%</td>
<td>67.52%</td>
</tr>
<tr>
<td>Lending to HH</td>
<td>% Assets</td>
<td>18.63%</td>
<td>20.34%</td>
</tr>
<tr>
<td>Lending to Firms</td>
<td>% Assets</td>
<td>13.22%</td>
<td>16.97%</td>
</tr>
<tr>
<td>Lending to MFIs</td>
<td>% Assets</td>
<td>24.27%</td>
<td>17.24%</td>
</tr>
<tr>
<td>Deposits</td>
<td>% Assets</td>
<td>84.76%</td>
<td>73.57%</td>
</tr>
<tr>
<td>ST Funding</td>
<td>% Assets</td>
<td>72.41%</td>
<td>59.48%</td>
</tr>
</tbody>
</table>
Why Not Use LTRO1?

Bank Behavior at LTRO1

Change Short-Term ECB Borrowing / Assets vs. LTRO1 Uptake / Assets

Two outliers are excluded from the scatter plot, but still included in the regression line.
Why Domestic Government Bonds?

- Why government bonds?
  ▶ Euro denominated government bonds have a zero capital requirement

- Why domestic government bonds?
  ▶ Moral Suasion
  ▶ Risk-shifting
  ▶ Financial entanglement
Final Thoughts

LTRO and QE are identical in most macro models but...

- LTRO

- QE
Final Thoughts

LTRO and QE are identical in most macro models but...

- LTRO
  - relies on indirect purchases of ST debt

- QE
  - relies on direct purchases of LT debt
Final Thoughts

LTRO and QE are identical in most macro models but...

- LTRO
  - relies on indirect purchases of ST debt
  - yield curve steepens

- QE
  - relies on direct purchases of LT debt
  - yield curve flattens
Final Thoughts

LTRO and QE are identical in most macro models but...

- **LTRO**
  - relies on *indirect* purchases of ST debt
  - yield curve *steepens*
  - govt reacts by *shortening* the maturity of public debt

- **QE**
  - relies on *direct* purchases of LT debt
  - yield curve *flattens*
  - govt reacts by *increasing* the maturity of public debt
Thank you
A Simple Model of the “Collateral Trade”
Model Setup

- Agents: government, (domestic) banks, intl investors
- Three dates: \( t = 0, t = 1, t = 2 \)
Model Setup

- Agents: government, (domestic) banks, intl investors
- Three dates: $t = 0$, $t = 1$, $t = 2$

\[
\begin{align*}
&t = 0 \\
&\quad \circ \text{ Govt issues ST and LT debt} \\
&\quad \circ \text{ Banks choose portfolio} \\
&t = 1 \\
&\quad \circ \text{ Govt repays ST debt} \\
&\quad \circ \text{ Secondary markets open} \\
&\quad \circ \text{ Banks may access funding markets} \\
&t = 2 \\
&\quad \circ \text{ Govt repays LT debt} \\
&\quad \circ \text{ Payoffs realized}
\end{align*}
\]
Banks Choose at $t = 0$ and Obtain Utility at $t = 2$

$$U = E_0[\pi_2]$$
Banks Choose at $t = 0$ and Obtain Utility at $t = 2$

$$\mathcal{U} = \mathbb{E}_0[\pi_2]$$

- At $t = 2$, profits from LT govt bonds and (costly) storage

$$\pi_2 = b'_L + d\{1_{d \geq 0} + k1_{d < 0}\}$$
Banks Choose at \( t = 0 \) and Obtain Utility at \( t = 2 \)

\[
\mathcal{U} = \mathbb{E}_0[\pi_2]
\]

- At \( t = 2 \), profits from LT govt bonds and (costly) storage

\[
\pi_2 = b'_L + d\{1_{d \geq 0} + k1_{d < 0}\}
\]

- At \( t = 1 \), rebalance LT bonds, ST bonds mature

\[
q_1b'_L + d = W_1
\]

\[
W_1 = b_s + q_1b_L + c - R\epsilon
\]

- At \( t = 0 \), choose ST/LT bonds and borrow from ECB

\[
W_0 + \epsilon = q_s b_s + q_L b_L + c
\]

\[
\epsilon \leq (1 - h_L)q_L b_L + (1 - h_S)q_s b_S
\]
Banks Choose at $t = 0$ and Obtain Utility at $t = 2$

$$U = \mathbb{E}_0[\pi_2]$$

- At $t = 2$, profits from LT govt bonds and (costly) storage
$$\pi_2 = b'_L + d\{1_{d\geq0} + k1_{d<0}\}$$

- At $t = 1$, rebalance LT bonds, ST bonds mature
$$q_1b'_L + d = W_1$$
$$W_1 = b_s + q_1b_L + c - R\varepsilon$$

- At $t = 0$, choose ST/LT bonds and borrow from ECB
$$w_0 + \varepsilon = q_s b_s + q_L b_L + c$$
$$\varepsilon \leq (1 - h_L)q_L b_L + (1 - h_S)q_S b_S$$
International Investors, Government and Equilibrium

- International Investors
  ▶ Risk-neutral, deep pocketed traders
  ▶ Operate at $t = 1$ in the LT bond market
  ▶ Willing to purchase any amount (perfectly elastic demand)
  ▶ Uncertainty regarding their outside option
    Unique source of uncertainty in the model

$$a \sim F \text{ on } [q_1, \bar{q}_1] \Rightarrow \text{purchase if } q_1 \leq a$$

- Government/Treasury
  ▶ Wants to issue $B$ at $t = 0$
  ▶ Exogenous (for the moment) fraction $\gamma$ using ST bonds

**Equilibrium:** Prices $(q_S, q_L)$, bank policies $(b_L, b_S, c, \infty, b'_L(q_1), d(q_1))$ such that agents maximize and all markets clear
IV Approach
2) High Demand for ST Securities (IV)

Intensity should also matter for the collateral trade.

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

where

\[
\text{Intensity}_i = \frac{\text{LTRO Borrowing}_i}{\text{Assets}_i}
\]
2) High Demand for ST Securities (IV)

Intensity should also matter for the collateral trade.

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

where

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

- Intensity is endogenous
- Exploit the fact that a significant component of LTRO is rollover
- IV: ECB borrowing before the announcement
2) High Demand for ST Securities (IV)

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

<table>
<thead>
<tr>
<th></th>
<th>All Bonds</th>
<th>No Issuance After Dec2011</th>
</tr>
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<tbody>
<tr>
<td>(\text{LTRO}_t \times \text{Short}_j \times \text{Intensity}_i)</td>
<td>0.0370***</td>
<td>0.0140***</td>
</tr>
<tr>
<td></td>
<td>(0.0012)</td>
<td>(0.0010)</td>
</tr>
<tr>
<td>(\text{LTRO}_t \times \text{Short}_j)</td>
<td>0.0000295</td>
<td>0.000120</td>
</tr>
<tr>
<td></td>
<td>(0.0000446)</td>
<td>(0.0000982)</td>
</tr>
<tr>
<td>(\text{LTRO}_t \times \text{Intensity}_i)</td>
<td>-0.0240***</td>
<td>-0.0080***</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>(\text{Short}_j \times \text{Intensity}_i)</td>
<td>0.0252***</td>
<td>0.0511***</td>
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<tr>
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<td>(0.0029)</td>
<td>(0.0001)</td>
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