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# **Unconventional Interest Rate Corridor and the Monetary Transmission: Evidence from Turkey**

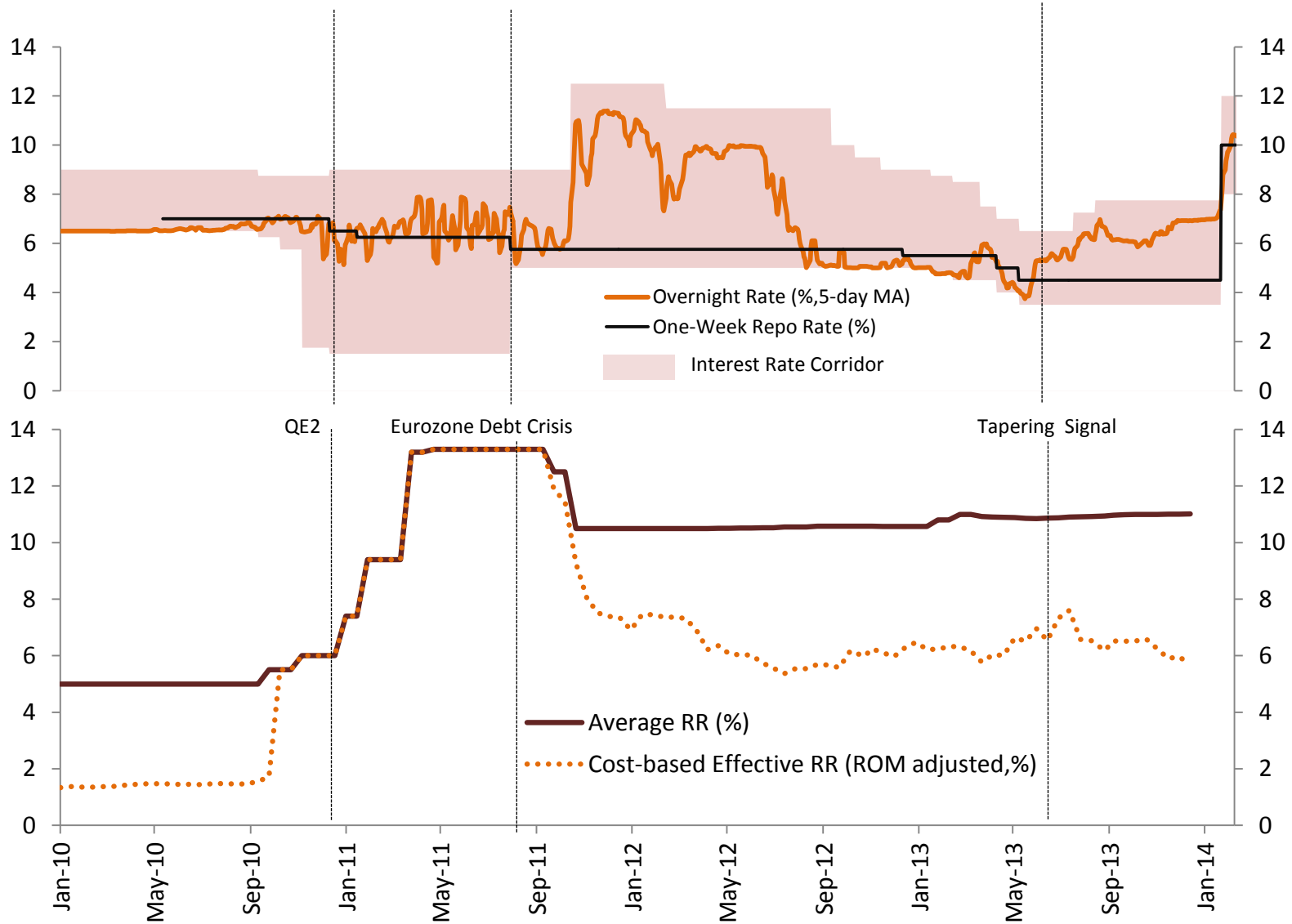
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The views expressed in this presentation are those of the authors and are not necessarily reflective of views at the Central Bank of Turkey.

- The GFC necessitated the use of unconventional monetary policy.
- QE in advanced economies → Capital flows into EMEs → Financial stability risks → Quantitative tightening (QT)
- For example, under a single instrument (short -term interest rate) regime, consider the two options during capital inflows:
  - $i \uparrow$  → currency appreciation → wider CA deficit, higher risk of sudden stop
  - $i \downarrow$  → overheating → higher inflation
- Trade-off between financial stability and price stability
- Multiple instruments are needed.

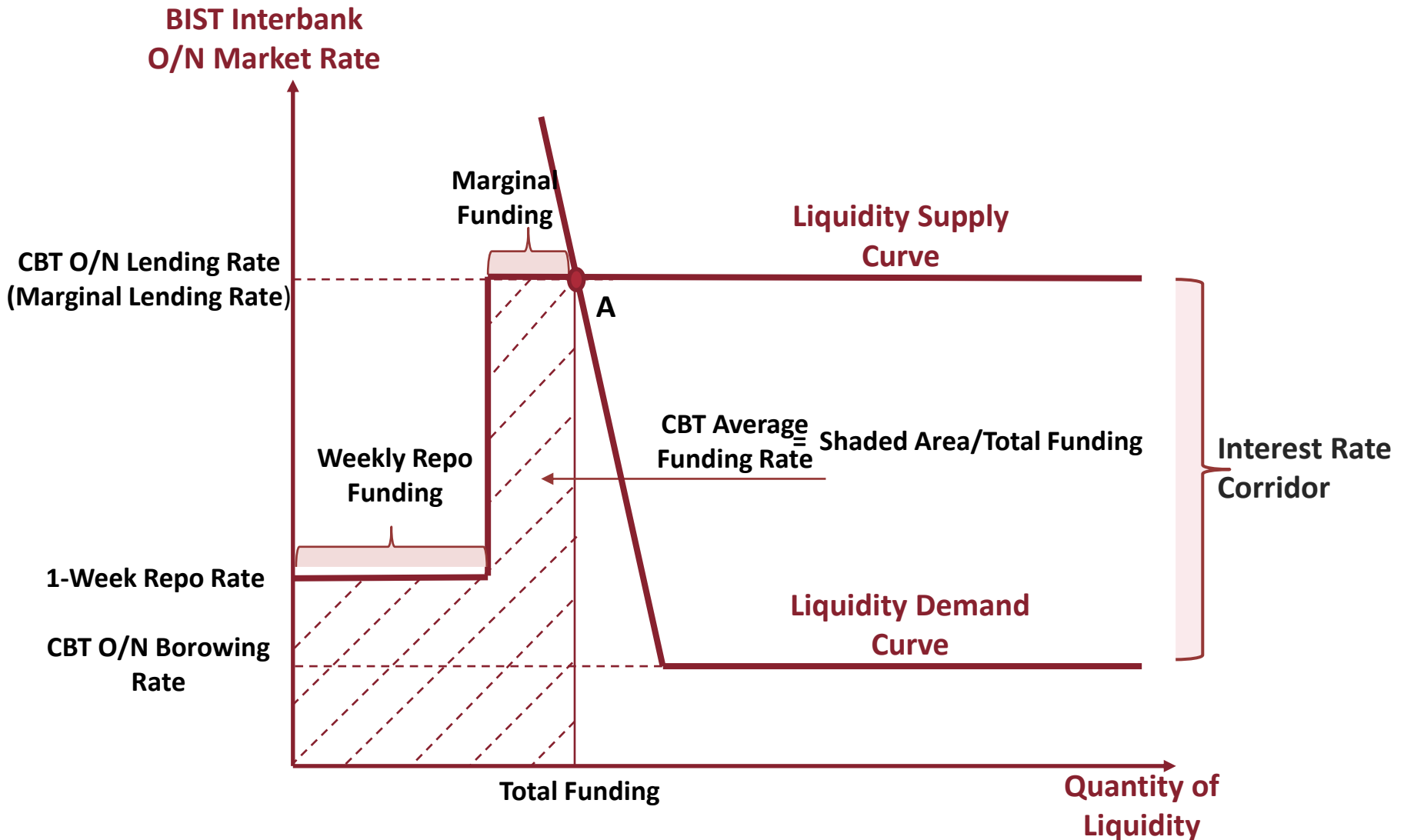
# Multiple Instruments: Interest Rate Corridor and Reserve Requirements

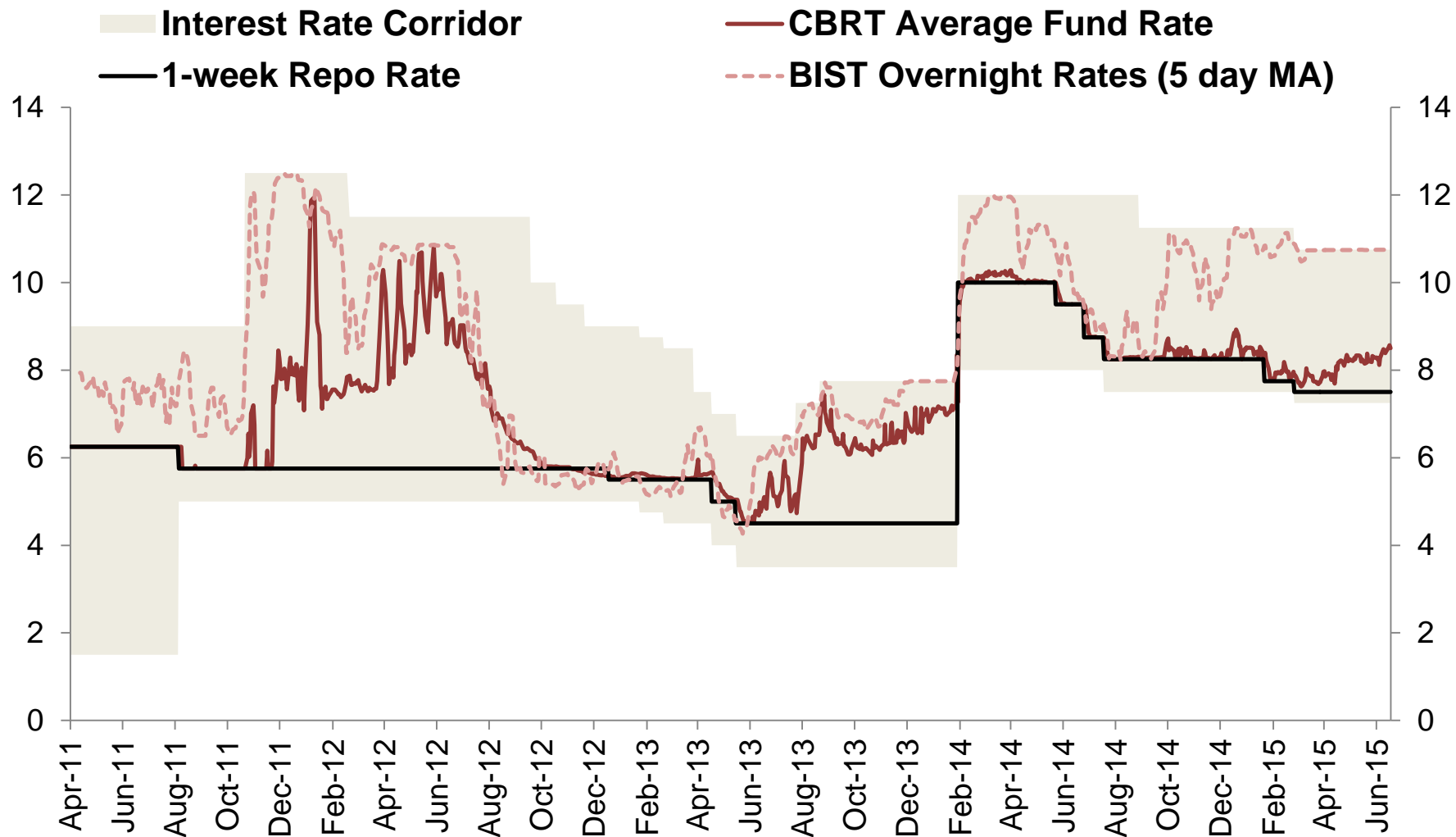


- Examine the relationship between short term rates (policy and market rates) and bank interest rates in a system of multiple instruments.
- Which short-term rate is more relevant in pricing of banks' rates on loan and deposits?
- Are responses to change in policy rates symmetric?
- Does short-term funding composition matter in response to policy decisions?

- Earlier literature / pre-GFC: Policy rate is a reasonable proxy for the cost of short-term funding in financial system.
  - Bernanke and Blinder (1988), Bernanke (1993), Cottarelli and Kourelis (1994), De Bondt (2002), ECB (2009), Banerjee et al. (2013).
- During heightened market distress: Short-term market rates may diverge notably from the policy rate, relationship between policy rates and loan/deposit rates changes
  - Illes et al (2015), Gambacorta et al (2014), Karagiannis et al (2010), Darracq Paries et al (2014)
- Our contribution: Provide evidence from an emerging economy with intended consequence of unconventional corridor - divergence between policy vs. market rate

# How Short-term Rates are Set? Operational Framework





## 1. Official rates

- a. Funding rates (O/N and 1-week repo)
- b. Borrowing rates (O/N)

## 2. Effective rates

- a. Average funding rate

$$\text{AFR} = (1-w \text{ repo funding} * \text{Repo rate} + \text{O/N funding} * \text{Funding rate}) / \text{Total funding}$$

- b. O/N interbank market rate

## ➤ Monetary policy stance?

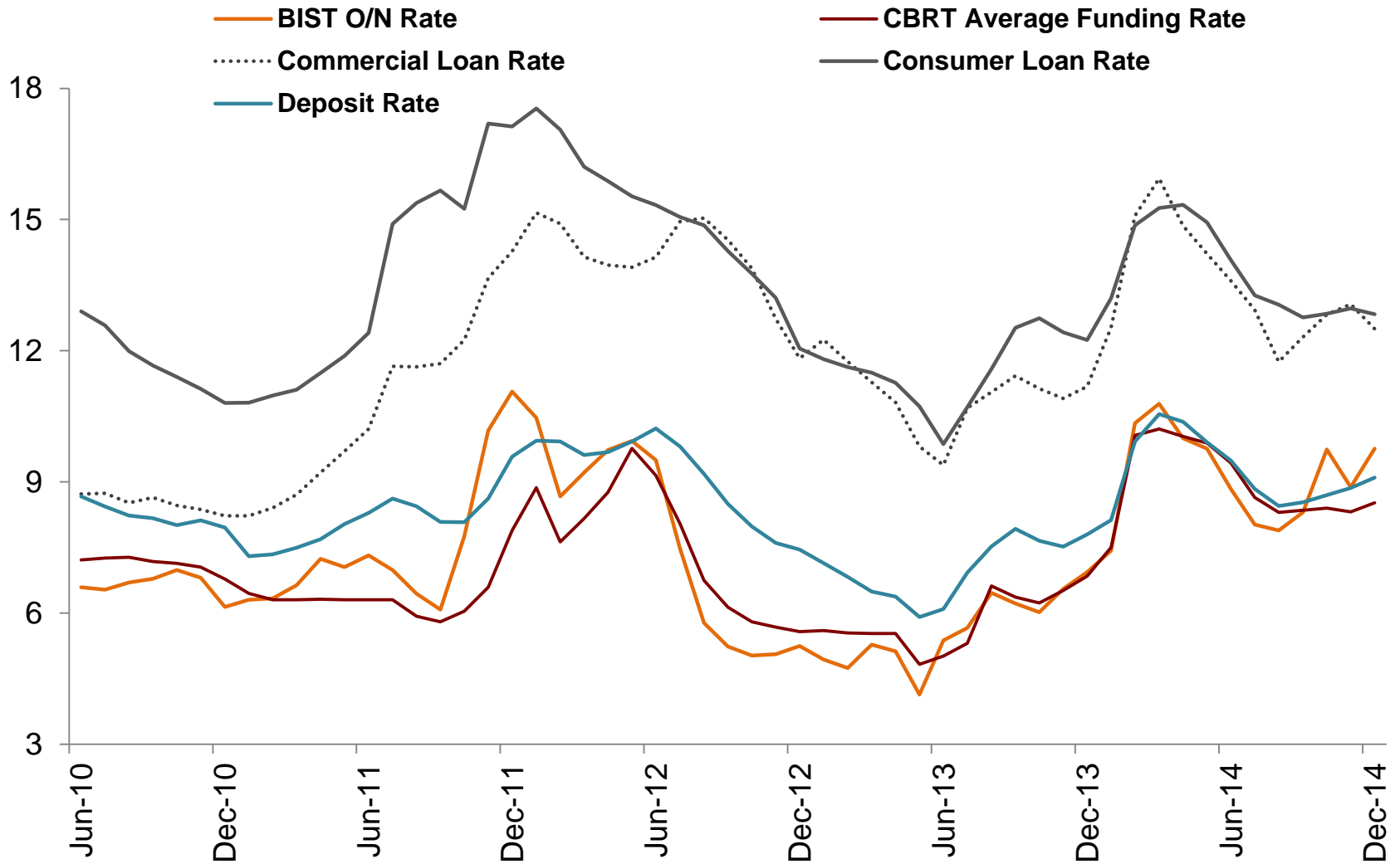
- Implied by the interaction of the short term interest rates and the liquidity policy



- Bank level data from June 2010 to December 2014
  - 19 deposit banks that cover 90 percent share of total deposit and lending
- *Flow data on deposit and loan interest rates*
- Loan rates:
  - Commercial loans -- shorter maturity with re-adjustable interest rates
  - Consumer loans -- longer maturities (avg. about 5 years) and fixed interest rates
- Deposit rates
  - Major source of funding
  - Average maturity < 3 months

**Table 1: Descriptive Statistics**

|                                  | Original<br>Frequency | Conversion       | Obs. | Mean   | Standard Dev. |
|----------------------------------|-----------------------|------------------|------|--------|---------------|
| <b>Bank level variables</b>      |                       |                  |      |        |               |
| Corporate loan rate              | Weekly                | Average, Level   | 1045 | 12.45  | 3.033         |
| Consumer loan rate               | Weekly                | Average, Level   | 1045 | 13.81  | 2.697         |
| Deposit rate                     | Weekly                | Average, Level   | 1045 | 8.686  | 1.411         |
| Reserve requirement rate         | Bi-weekly             | Average, Level   | 1045 | 6.552  | 3.099         |
| <b>Short term interest rates</b> |                       |                  |      |        |               |
| Weekly repo rate                 | Daily                 | Average, Level   | 55   | 6.433  | 1.509         |
| Average funding rate             | Daily                 | Average, Level   | 55   | 7.168  | 1.435         |
| Marginal funding rate            | Daily                 | Average, Level   | 55   | 9.825  | 1.745         |
| BIST O/N rate                    | Daily                 | Average, Level   | 55   | 7.352  | 1.826         |
| BIST O/N rate-CBRT funding rate  | Daily                 | Average, Level   | 55   | 0.183  | 0.917         |
| <b>Macro indicators</b>          |                       |                  |      |        |               |
| Economic sentiment               | Monthly               | Monthly change   | 55   | -0.44  | 5.62          |
| US dollar                        | Daily                 | Monthly % change | 55   | 2.143  | 4.711         |
| EMBI Turkey                      | Daily                 | Monthly change   | 55   | -0.606 | 26.26         |
| Inflation                        | Monthly               | Level            | 55   | 7.628  | 1.504         |
| Non-farm unemployment rate       | Monthly               | Monthly change   | 55   | -0.024 | 0.255         |
| Consumer confidence index        | Monthly               | Monthly change   | 55   | -0.396 | 6.381         |



## Baseline model

$$i_{it} = \beta_0 + \mu_i + \beta_1 i_{i,t-1} + \beta_2 PR_t + \beta_3 RR_{i,t}^c + \beta_4 X_t + \varepsilon_{it}$$

$i_{it}$  : corporate rate, consumer rate or deposit rate

$PR_t$  : short-term rates (1-week repo rate, average funding rate, marginal funding rate, BIST O/N)

$RR_{i,t}^c$  : effective reserve requirement rate

$X_t$  : vector of control variables such as the exchange rate, inflation, sentiments etc.

- Estimation method: Generalized method of moments
  - One-step system GMM, limiting the number of instruments
- Check robustness with FE (within effect), IV, Kiviet-correction

**Table 2: Corporate Loan Rates**

|                                | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Corporate <sub>t-1</sub>       | 0.888***<br>(0.036)  | 0.869***<br>(0.039)  | 0.859***<br>(0.037)  | 0.822***<br>(0.035)  | 0.827***<br>(0.031)  | 0.842***<br>(0.028)  |
| 1-week repo rate <sub>t</sub>  | 0.122***<br>(0.027)  |                      |                      |                      | 0.012<br>(0.044)     |                      |
| MFR <sub>t</sub>               |                      | 0.180***<br>(0.040)  |                      |                      | 0.069<br>(0.059)     |                      |
| AFR <sub>t</sub>               |                      |                      | 0.214***<br>(0.036)  |                      | 0.128**<br>(0.057)   | 0.183***<br>(0.031)  |
| BIST o/n <sub>t</sub>          |                      |                      |                      | 0.233***<br>(0.035)  |                      |                      |
| BIST-AFR <sub>t</sub>          |                      |                      |                      |                      | 0.278***<br>(0.082)  | 0.304***<br>(0.066)  |
| RR <sup>c</sup> <sub>i,t</sub> | 0.065***<br>(0.014)  | 0.041***<br>(0.013)  | 0.064***<br>(0.014)  | 0.037***<br>(0.014)  | 0.022*<br>(0.013)    | 0.023*<br>(0.012)    |
| Inflation <sub>t-1</sub>       | 0.091**<br>(0.046)   | 0.003<br>(0.045)     | 0.023<br>(0.044)     | 0.004<br>(0.046)     | -0.004<br>(0.048)    | 0.001<br>(0.044)     |
| Δ EMBI-Turkey <sub>t-1</sub>   | 0.004*<br>(0.002)    | 0.005**<br>(0.002)   | 0.004*<br>(0.002)    | 0.004**<br>(0.002)   | 0.005**<br>(0.002)   | 0.005**<br>(0.002)   |
| Δ USD <sub>t-1</sub>           | 0.040***<br>(0.013)  | 0.031**<br>(0.014)   | 0.036***<br>(0.014)  | 0.024*<br>(0.013)    | 0.019<br>(0.013)     | 0.019<br>(0.014)     |
| Δ Outlook <sub>t-1</sub>       | -0.036***<br>(0.008) | -0.033***<br>(0.009) | -0.035***<br>(0.009) | -0.035***<br>(0.008) | -0.034***<br>(0.008) | -0.036***<br>(0.008) |
| Constant                       | -0.569*<br>(0.329)   | -0.464*<br>(0.279)   | -0.412<br>(0.306)    | 0.214<br>(0.305)     | 0.309<br>(0.334)     | 0.435<br>(0.329)     |
| Obs.                           | 1,045                | 1,045                | 1,045                | 1,045                | 1,045                | 1,045                |
| Number of Banks                | 19                   | 19                   | 19                   | 19                   | 19                   | 19                   |
| <i>Robustness test</i>         |                      |                      |                      |                      |                      |                      |
| AR(2) test statistic           | -0.147               | -0.185               | -0.209               | 0.0182               | 0.0524               | 0.0594               |
| p value of AR(2)               | 0.883                | 0.854                | 0.834                | 0.985                | 0.958                | 0.953                |
| Hansen J statistic             | 10.86                | 13.38                | 10.85                | 13.42                | 12.07                | 15.32                |
| p value of Hansen statistic    | 0.145                | 0.146                | 0.145                | 0.0625               | 0.280                | 0.121                |

# Robustness Checks: Corporate Loan Rates

Table A2: Corporate Loan Rate -- Comparing Different Estimation Methods

|   | FE                   | LSDV-Kiviet Correction | GMM                  | IV                   |
|---|----------------------|------------------------|----------------------|----------------------|
|   | (1)                  | (2)                    | (3)                  | (4)                  |
| Corporate Loan Rate <sub>i,t-1</sub>            | 0.833***<br>(0.020)  | 0.856***<br>(0.017)    | 0.842***<br>(0.028)  | 0.813***<br>(0.023)  |
| CBRT Average Funding Rate <sub>t</sub>          | 0.196***<br>(0.026)  | 0.183***<br>(0.032)    | 0.183***<br>(0.031)  | 0.204***<br>(0.030)  |
| BIST O/N Rate-CBRT Avr. Fund. Rate <sub>t</sub> | 0.236***<br>(0.055)  | 0.225***<br>(0.060)    | 0.304***<br>(0.066)  | 0.234***<br>(0.057)  |
| Reserve Req. Rate <sub>i,t</sub>                | 0.037***<br>(0.012)  | 0.028*<br>(0.015)      | 0.023*<br>(0.012)    | 0.042***<br>(0.012)  |
| Inflation <sub>t-1</sub>                        | 0.002<br>(0.040)     | -0.011<br>(0.035)      | 0.001<br>(0.044)     | 0.019<br>(0.031)     |
| Δ EMBI_Turkey <sub>t-1</sub>                    | 0.002<br>(0.002)     | 0.003<br>(0.002)       | 0.005**<br>(0.002)   | 0.002<br>(0.002)     |
| Δ USD/TL <sub>t-1</sub>                         | 0.035***<br>(0.010)  | 0.034***<br>(0.010)    | 0.019<br>(0.014)     | 0.038***<br>(0.011)  |
| Δ Economic Sentiment <sub>t-1</sub>             | -0.046***<br>(0.007) | -0.046***<br>(0.007)   | -0.036***<br>(0.008) | -0.044***<br>(0.007) |
| Observations                                    | 1,045                | 1,045                  | 1,045                | 1,045                |

Notes: Robust standard errors (clustered at the bank level) are reported. The symbols \*, \*\*, and \*\*\* represent significance levels of 10%, 5%, and 1% respectively.

Table 3: Consumer Loan Rates

|                                | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Consumer <sub>t-1</sub>        | 0.935***<br>(0.040)  | 0.961***<br>(0.058)  | 0.900***<br>(0.045)  | 0.843***<br>(0.044)  | 0.850***<br>(0.046)  |
| 1-week repo rate <sub>t</sub>  | -0.016<br>(0.031)    |                      |                      |                      |                      |
| MFR <sub>t</sub>               |                      | -0.052<br>(0.061)    |                      |                      |                      |
| AFR <sub>t</sub>               |                      |                      | 0.074***<br>(0.041)  |                      | 0.084**<br>(0.041)   |
| BIST o/n <sub>t</sub>          |                      |                      |                      | 0.131***<br>(0.030)  |                      |
| BIST-AFR <sub>t</sub>          |                      |                      |                      |                      | 0.218***<br>(0.043)  |
| RR <sup>c</sup> <sub>i,t</sub> | 0.078***<br>(0.016)  | 0.078***<br>(0.013)  | 0.091***<br>(0.017)  | 0.0.85***<br>(0.016) | 0.066***<br>(0.017)  |
| Inflation <sub>t-1</sub>       | 0.029<br>(0.036)     | 0.045**<br>(0.023)   | 0.036<br>(0.028)     | 0.029<br>(0.027)     | 0.019<br>(0.028)     |
| ΔEMBI-Turkey <sub>t-1</sub>    | -0.000<br>(0.001)    | -0.001<br>(0.001)    | -0.001<br>(0.001)    | -0.001<br>(0.001)    | -0.002<br>(0.001)    |
| ΔUSD <sub>t-1</sub>            | 0.036***<br>(0.010)  | 0.034***<br>(0.010)  | 0.037***<br>(0.010)  | 0.039***<br>(0.009)  | 0.0.38***<br>(0.010) |
| ΔNon-agr. Empl. <sub>t-1</sub> | 0.341***<br>(0.087)  | 0.285***<br>(0.099)  | 0.252***<br>(0.088)  | 0.240***<br>(0.088)  | 0.250***<br>(0.087)  |
| ΔConsumer Conf. <sub>t-1</sub> | -0.022***<br>(0.006) | -0.022***<br>(0.006) | -0.022***<br>(0.006) | -0.022***<br>(0.006) | -0.022***<br>(0.006) |
| Sabit                          | 0.199<br>(0.200)     | 0.134<br>(0.199)     | -0.082<br>(0.215)    | 0.363<br>(0.315)     | 0.795***<br>(0.211)  |
| Obs.                           | 1,045                | 1,045                | 1,045                | 1,045                | 1,045                |
| Number of Banks                | 19                   | 19                   | 19                   | 19                   | 19                   |
| <i>Robustness test</i>         |                      |                      |                      |                      |                      |
| AR(2) test statistic           | -0.664               | -0.688               | -0.813               | -0.900               | -0.910               |
| p value of AR(2)               | 0.507                | 0.492                | 0.416                | 0.368                | 0.363                |
| Hansen J statistic             | 13.04                | 14.95                | 16.33                | 16.84                | 15.64                |
| p value of Hansen statistic    | 0.291                | 0.185                | 0.129                | 0.113                | 0.155                |

**Table 3: Deposit Rates**

|                                | (1)                  | (2)                  | (3)                 | (4)                 | (5)                 | (6)                 |
|--------------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|
| Deposit <sub>t-1</sub>         | 0.800***<br>(0.010)  | 0.765***<br>(0.011)  | 0.587***<br>(0.021) | 0.666***<br>(0.015) | 0.595***<br>(0.022) | 0.597***<br>(0.021) |
| 1-week repo rate <sub>t</sub>  | 0.141***<br>(0.010)  |                      |                     |                     | -0.025<br>(0.018)   |                     |
| MFR <sub>t</sub>               |                      | 0.149***<br>(0.011)  |                     |                     | 0.015<br>(0.014)    |                     |
| AFR <sub>t</sub>               |                      |                      | 0.376***<br>(0.023) |                     | 0.357***<br>(0.026) | 0.347***<br>(0.022) |
| BIST o/n <sub>t</sub>          |                      |                      |                     | 0.263***<br>(0.013) |                     |                     |
| BIST-AFR <sub>t</sub>          |                      |                      |                     |                     | 0.163***<br>(0.022) | 0.172***<br>(0.019) |
| RR <sup>c</sup> <sub>i,t</sub> | 0.047***<br>(0.005)  | 0.025***<br>(0.005)  | 0.062***<br>(0.009) | 0.014**<br>(0.006)  | 0.034***<br>(0.009) | 0.036***<br>(0.009) |
| Inflation <sub>t-1</sub>       | 0.138***<br>(0.010)  | 0.081***<br>(0.009)  | 0.079***<br>(0.013) | 0.051***<br>(0.011) | 0.051***<br>(0.010) | 0.061***<br>(0.013) |
| ΔEMBI-Turkey <sub>t-1</sub>    | 0.003***<br>(0.000)  | 0.004***<br>(0.000)  | 0.002***<br>(0.000) | 0.003***<br>(0.000) | 0.003***<br>(0.000) | 0.003***<br>(0.000) |
| ΔUSD <sub>t-1</sub>            | 0.035***<br>(0.003)  | 0.028***<br>(0.003)  | 0.028***<br>(0.003) | 0.015***<br>(0.003) | 0.018***<br>(0.003) | 0.019***<br>(0.003) |
| Sabit                          | -0.599***<br>(0.098) | -0.248***<br>(0.088) | -0.164<br>(0.149)   | 0.465***<br>(0.121) | 0.297*<br>(0.154)   | 0.255<br>(0.164)    |
| Obs.                           | 1,045                | 1,045                | 1,045               | 1,045               | 1,045               | 1,045               |
| Number of Banks                | 19                   | 19                   | 19                  | 19                  | 19                  | 19                  |
| <i>Robustness test</i>         |                      |                      |                     |                     |                     |                     |
| AR(2) test statistic           | -1.873               | -1.834               | 0.110               | 0.0517              | 0.465               | 0.476               |
| p value of AR(2)               | 0.0610               | 0.0666               | 0.912               | 0.959               | 0.642               | 0.634               |
| Hansen J statistic             | 18.48                | 18.11                | 17.38               | 18.44               | 16.53               | 17.54               |
| p value of Hansen statistic    | 0.102                | 0.112                | 0.136               | 0.103               | 0.168               | 0.130               |



|                               | $\Delta BIST\ o/n > 0$ |                     | $\Delta BIST\ o/n < 0$ |                     | $\Delta AFR > 0$    |                     | $\Delta AFR < 0$    |                     |
|-------------------------------|------------------------|---------------------|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <b>A: Corporate Loan Rate</b> |                        |                     |                        |                     |                     |                     |                     |                     |
|                               | (1)                    | (2)                 | (3)                    | (4)                 | (5)                 | (6)                 | (7)                 | (8)                 |
| $AFR_t$                       |                        | 0.359***<br>(0.062) |                        | 0.084<br>(0.051)    | 0.475***<br>(0.086) | 0.463***<br>(0.089) | 0.256***<br>(0.093) | 0.180*<br>(0.092)   |
| $BIST\ o/n_t$                 | 0.385***<br>(0.031)    |                     | 0.168***<br>(0.042)    |                     |                     |                     |                     |                     |
| $BIST-AFR_t$                  |                        | 0.415***<br>(0.065) |                        | 0.336***<br>(0.077) |                     | 0.453***<br>(0.074) |                     | 0.272***<br>(0.095) |
| $RR^c_{i,t}$                  | 0.041*<br>(0.021)      | 0.033*<br>(0.019)   | 0.035*<br>(0.019)      | 0.011<br>(0.023)    | 0.135***<br>(0.028) | 0.042<br>(0.030)    | 0.094**<br>(0.037)  | 0.061*<br>(0.037)   |
| <b>B: Consumer Loan Rate</b>  |                        |                     |                        |                     |                     |                     |                     |                     |
|                               | (1)                    | (2)                 | (3)                    | (4)                 | (5)                 | (6)                 | (7)                 | (8)                 |
| $AFR_t$                       |                        | 0.198**<br>(0.081)  |                        | 0.109<br>(0.078)    | 0.262***<br>(0.082) | 0.342***<br>(0.090) | 0.248***<br>(0.085) | 0.177**<br>(0.089)  |
| $BIST\ o/n_t$                 | 0.245***<br>(0.064)    |                     | 0.154***<br>(0.043)    |                     |                     |                     |                     |                     |
| $BIST-AFR_t$                  |                        | 0.307***<br>(0.069) |                        | 0.234***<br>(0.057) |                     | 0.412***<br>(0.074) |                     | 0.187**<br>(0.075)  |
| $RR^c_{i,t}$                  | 0.080***<br>(0.029)    | 0.064**<br>(0.031)  | 0.133***<br>(0.039)    | 0.114**<br>(0.056)  | 0.150***<br>(0.036) | 0.114***<br>(0.038) | 0.184***<br>(0.070) | 0.139*<br>(0.074)   |
| <b>C: Deposit Rate</b>        |                        |                     |                        |                     |                     |                     |                     |                     |
|                               | (1)                    | (2)                 | (3)                    | (4)                 | (5)                 | (6)                 | (7)                 | (8)                 |
| $AFR_t$                       |                        | 0.375***<br>(0.017) |                        | 0.319***<br>(0.031) | 0.403***<br>(0.025) | 0.348***<br>(0.019) | 0.443***<br>(0.022) | 0.360***<br>(0.026) |
| $BIST\ o/n_t$                 | 0.279***<br>(0.012)    |                     | 0.296***<br>(0.014)    |                     |                     |                     |                     |                     |
| $BIST-AFR_t$                  |                        | 0.186***<br>(0.020) |                        | 0.244***<br>(0.033) |                     | 0.220***<br>(0.023) |                     | 0.189***<br>(0.034) |
| $RR^c_{i,t}$                  | -0.010<br>(0.007)      | 0.018**<br>(0.009)  | 0.031***<br>(0.008)    | 0.037***<br>(0.012) | 0.051***<br>(0.010) | -0.003<br>(0.010)   | 0.072***<br>(0.011) | 0.047***<br>(0.011) |

# Does Short-term Funding Position Matter?

|                                | BIST Borrowing/Deposit<br>-High- | BIST Borrowing/Deposit<br>-Low- |
|--------------------------------|----------------------------------|---------------------------------|
| <b>A: Commercial Loan Rate</b> |                                  |                                 |
|                                | (1)                              | (2)                             |
| Corporate <sub>i,t-1</sub>     | 0.787***<br>(0.033)              | 0.822***<br>(0.059)             |
| AFR <sub>t</sub>               | 0.183***<br>(0.058)              | 0.219***<br>(0.052)             |
| BIST-AFR <sub>t</sub>          | 0.298***<br>(0.103)              | 0.297***<br>(0.083)             |
| RR <sup>c</sup> <sub>i,t</sub> | 0.037***<br>(0.010)              | -0.002<br>(0.029)               |
| <b>B: Consumer Loan Rate</b>   |                                  |                                 |
|                                | (1)                              | (2)                             |
| Consumer <sub>i,t-1</sub>      | 0.898***<br>(0.077)              | 0.959***<br>(0.063)             |
| AFR <sub>t</sub>               | 0.067<br>(0.078)                 | 0.005<br>(0.051)                |
| BIST-AFR <sub>t</sub>          | 0.190**<br>(0.076)               | 0.126*<br>(0.069)               |
| RR <sup>c</sup> <sub>i,t</sub> | 0.055***<br>(0.013)              | 0.039<br>(0.028)                |
| <b>C: Deposit Rate</b>         |                                  |                                 |
|                                | (1)                              | (2)                             |
| Deposit <sub>i,t-1</sub>       | 0.585***<br>(0.022)              | 0.555***<br>(0.054)             |
| AFR <sub>t</sub>               | 0.360***<br>(0.027)              | 0.365***<br>(0.050)             |
| BIST-AFR <sub>t</sub>          | 0.165***<br>(0.026)              | 0.200***<br>(0.036)             |
| RR <sup>c</sup> <sub>i,t</sub> | 0.032***<br>(0.009)              | 0.028*<br>(0.016)               |

- The monetary policy stance implied by the interaction of short term interest rates with the liquidity composition can be represented by:
  - (i) BIST o/n Interbank Rate
  - (ii) CBT average funding rate.
- Both indicators have direct impact on the broad funding costs of the banking system, therefore playing significant role in the monetary transmission mechanism.
- How the policy stance is evaluated if effective rates diverge from official rates?
  - In such case, money market rates is the key for MTM.
  - “Actions speak louder than words”
- Heterogeneity exists across lending and deposit rate pricing, depending on the direction of policy rates and funding needs.