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TLTRO Spillovers Outside the Euro Area

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TLTRO Spillovers Outside the Euro Area
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ABSTRACT: We examine spillovers from ECB's TLTROs on European countries outside the euro area. Using individual banks' balance sheet data, we find that TLTROs lowered funding and lending rates for foreign-owned subsidiaries, especially in emerging market economies. We also find an increase in profitability among foreign subsidiaries and no effects on solvency risk. The effects are sizable--every €1 billion in exposure to TLTROs via parent banks is associated with 0.2 bps reduction in deposit rates and 0.4 bps reduction in lending rates of foreign subsidiaries. This underscores the need to factor euro area monetary policies into policy settings outside the euro area.

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Introduction

Euro area multinational banks play a significant role in the banking systems of countries outside the euro area, in particular in Europe's CESEE region. The share of euro-area owned subsidiaries in total banking sector assets in these countries can be quite large, ranging from as high as nearly 80 percent in the Czech Republic to around 40 percent in Hungary (Figure 1). This sizable presence of euro-area owned subsidiaries opens up a potential pathway for euro area monetary policy—in particular, policies with banks as the intended transmission channel—to have spillover effects on banks, and thus on the wider domestic economy, outside the euro area.

One such recent policy is ECB's Targeted Longer-Term Refinancing Operations (TLTRO) operations. The TLTRO program was aimed specifically at increasing bank lending, by offering access to central bank term funding at favorable conditions, conditional on the amount of banks' lending to the real economy (albeit with specific design differences across TLTRO I, II and III). The amount of bank funding provided under TLTRO was larger than under any of the preceding refinancing operations—though notably with a different purpose than preceding refinancing operations—with the outstanding amount peaking at €2.2 trillion as of 2021 Q3 (see Appendix A for further details of the operations).

From a policy perspective, such spillovers could serve to either amplify or to dampen domestic cyclical conditions in the host country of the subsidiary bank, and thus either add, or reduce the burden on domestic economic policies. Indeed, in a recent paper on this issue, Arčabić, Panovska, and Tica (2024) find that business cycle synchronization across European countries can be highly variable, although it increased during COVID-19; and there is relatively little similarity in terms of business cycle amplitudes between core countries and periphery and non-euro area countries. For countries outside the euro area, this type of heterogeneity could imply that spillovers from ECB policies could be procyclical at certain points of time.

In addition, the vast injection of bank funding in TLTROs could also have financial stability effects and structural effects in the financial system of the host countries if there are spillovers. While the presence of foreign banks overall has been found to have beneficial effects on the financial system,¹ there could be potentially unwelcome effects in the current context. Increased pressure on profitability due to favorable funding conditions for foreign banks could drive domestic banks towards a riskier asset profile. Access to cheaper finance for foreign subsidiaries could undercut domestic banks, reducing their profitability and their market share—indeed this is already relevant in many non-euro countries of Europe with large foreign bank presence. Resulting stress among domestic banks in such conditions may also test relatively weaker financial safety nets outside the euro area.

¹ An extensive literature has noted the beneficial effects of multinational banks in host countries, for example by not withdrawing credit in bad time (Rosengren and Peek (2000)), enhancing the competitiveness of domestic banks (Claessens, Demirguc-Kunt, and Huizinga (2001)), and improving the allocation of credit among firms (Gianetti and Ongena (2009)).

With this motivation, we investigate the impact of TLTRO on selected bank balance sheet indicators, including funding costs, lending rates, profitability, and the risk profiles. We employ two approaches: (i) a difference-in-difference approach in which foreign-owned subsidiaries of parent banks from the euro area constitute the treatment group, and domestic banks in the host market are the control; and (ii) an OLS approach treating TLTRO funding as a continuous variable.

To summarize our main findings, we find that foreign-owned subsidiaries of euro-area banks operating in non-euro-area countries experienced lower funding costs (deposit rates) and lower lending rates as compared to domestic banks in those countries. We also observe statistically significant improvements in profitability among the foreign-owned subsidiaries, while we do not observe significant effects on risk.

In what follows, Section 2 relates our paper to the literature, Section 3 discusses the spillover channels and our main hypotheses, Section 4 lays out the details of the methodology, Section 5 discusses the data and presents some key stylized facts, Section 6 presents the main results, and Section 7 concludes.

Literature Review

This paper is linked to several strands in the literature. It most directly addresses the literature on the impact of ECB's unconventional monetary policies (UMPs), including transmission to non- euro-area countries. Among these, a few studies have focused on the financial market impact of ECB's asset purchase programs introduced since the onset of financial markets strains around the GFC. Marcel Fratzscher and Straub (2016) find that ECB's VLTRO, SMP, and OMT programs instituted over 2007–2012 lifted equity markets in the euro area and globally, and lowered bond yields in the euro area periphery, but did not have a significant impact on global sovereign yields, and did not trigger sizable portfolio flows. Georgiadis and Gräß (2016) find some similar financial effects from the announcement of ECB's 2015 Asset Purchase Programme (APP), namely a boost to euro area and global equity prices. They also find that the APP announcement led to a sizeable depreciation in the euro area exchange rate. Notably they find evidence of spillovers; while the impact on euro area bond yields was limited, the impact on bond yields in non- euro area EU and central and eastern European countries was much larger. Indeed, Falagiarda et al. (2015) focus on spillovers from the announcement of UMPs between 2007–2015 on selected non- euro area countries (the Czech Republic, Hungary, Poland, and Romania), and find that the announcements are associated with strong declines in sovereign bond yields (except in Hungary). Overall, the findings from the literature on ECBs APPs suggest the UMPs implemented by the ECB can have meaningful financial market spillovers outside the euro area.

With respect to the TLTRO instrument, the literature mainly focuses on the domestic impact within euro area countries, in particular on bank credit supply and interest rates. It commonly employs a difference-in-difference estimation strategy using proprietary loan level data. Benetton and Fantino (2018) use transaction level data in a sample of Italian banks over 2014–2015 and find that treated banks offered lower loan interest rates to the same firm than control banks and that higher concentration reduces this pass-through. Afonso and Sousa-Leite (2020) use bank-wise data over 2014–2018 to investigate the impact of TLTRO I and II

on credit supply and interest rates in the euro area and in Portugal.² They find that euro area banks that accessed TLTRO funding increased credit supply to the real economy. Further, in Portugal, banks that accessed TLTRO funding lowered loan interest rates. Andreeva and García-Posada (2021) use ECB's Bank Lending Survey data for 130 banks from 13 euro area countries over 2014–2017 and find that TL-TRO uptake had an easing effect on margins on loans to relatively safe borrowers. Laine (2021) finds that TLTRO II funding enhanced non-financial corporate lending by treated banks, and the effect was proportional to the amount of TLTRO II funding. With regard to TLTRO III, Castillo et al. (2022) examine balance sheet aggregates of Spanish banks and find that TLTRO III supported continued lending. Silva et al. (2021) focus on the channels of transmission and find that TLTRO III funding increased the stock of eligible loans (targeting channel), and the stock of ineligible loans (profitability channel). Barmeier, Falath, Kiššová and Lojschavá (2023) find that TLTRO III had increased bank lending and lowered bank lending rates in Slovakia, whereas the evidence on profitability was inconclusive. Overall, these papers suggest that TLTRO operations had significant real effects on lending volumes and lending rates in euro area countries. Notably, our focus on the *spillover* effects from TLTROs thus helps fill an important gap in the literature on the impact of TLTROs.

This paper also links with an extensive literature on multinational banking and its effects on financial stability, in particular to the international transmission of liquidity shocks. Reliance on external capital markets can directly reduce bank funding in the presence of shocks. In addition, multinational banks actively allocate funds across their member institutions, which can reduce funding to and lending by subsidiaries. (Cetorelli and Goldberg (2012), Ongena et al. (2015)). de Haas and van Lelyveld (2010) find evidence that there are sizable internal capital markets in multinational banking groups, through which parents manage credit growth in the subsidiary. This connects subsidiary performance to the conditions of the parent bank. Moreover, the presence of internal capital markets is a key pathway connecting TLTRO funding to lending by foreign bank subsidiaries in non-euro area countries. In relation to Europe, the literature has dealt with issues including the expansion of foreign currency lending in emerging Europe Brown and de Haas (2012), and lending by international banks and subsidiaries during the global financial crisis (GFC) (de Haas and van Horen (2012), de Haas and van Lelyveld (2014)), and the role of cross-border institutional arrangements such as the Vienna Initiative in supporting credit during the GFC (Haas et al. (2015)).

Finally, this paper also connects with the literature on business cycle alignment in Europe. This matters for the operations of banks – de Haas and van Lelyveld (2006) examine whether foreign and domestic banks react differently to business cycles (and banking crises), and find that home country conditions matter for lending in the host country. In addition, the state of the business cycle in the *host* country would also matter from a policy perspective, as spillovers from (in this case) euro area policies could be either pro- or countercyclical in the host country, noting that “the EU is not a homogeneous entity in terms of business cycle synchronization”, with significant differences between the core and the non-core countries (Arčabić, Panovska, and Tica (2024)).

² See Appendix A for details of TLTRO I, II, and III.

Identification Issues

In this section we discuss key issues related to identification of the spillovers from TLTROs. It may be useful to describe the two main effects we would expect to see starting with a large funding shock that increases the volume of available funding and lowers the cost of funding for a parent multinational bank. First, there may be an effect on the funding costs of the subsidiary banks as funds available through internal capital markets within the banking group may provide a cheaper substitute to domestic deposit funding. We would thus anticipate a reduction in foreign subsidiaries' deposit rates. Second, as the total demand for domestic deposits is now lower, deposit costs for domestic banks may decline as well. We may think of the first effect as a direct effect through the foreign subsidiaries, and the second as an indirect effect through general equilibrium effects on domestic banks, leading to an overall decline in deposit rates in the banking sector.

For lending rates, in the simplest case we may assume that changes in funding costs fully pass through to lending rates due to competition. Banks would thus lower lending rates in similar magnitude as the changes in their funding costs. The initial shock thus leads to an overall loosening of financial conditions in the host country. With regard to profitability, the net effect on banks' net interest margins would depend on the relative changes in deposit and lending rates, which will depend on general equilibrium dynamics, and we therefore do not have a prior on the direction or size of this effect.

The actual changes in banks' interest rates and profitability may vary between domestic and foreign banks depending on a number of factors. For instance, (i) we may observe no TLTRO effects if there is no internal capital market channel between the foreign parent and its host country subsidiary, (ii) the banks may choose to keep deposit rates high due to fear of losing deposits as the cheaper funding would eventually run out once the TLTRO programs end, (iii) changes in deposit rates may not translate to changes in lending rates due to market imperfections. These factors would vary across countries, and could lead to there being significant differences in the impact of TLTROs on foreign subsidiaries relative to domestic banks.

With this in mind, it is useful to clarify the scope of this paper. In this study, we only try to establish whether there is a spillover effect, and how large it is. We do not provide direct evidence of the existence of an internal capital market in multinational banking groups which we posit as a key pathway for the spillover; and we do not interpret our findings as evidence of market imperfections. While we note that there may be both direct and indirect effects that affect respectively foreign subsidiaries and domestic banks, we proceed as if the domestic banks are a valid control group (see Section 4 below on Methodology for details) in the difference-in-difference exercises. There are two points to emphasize here. First, to the extent that domestic banks are "contaminated" as a control group via the indirect effect, the difference-in-difference effects we find would be underestimated (as long as the domestic banks also react in the same way as foreign subsidiaries in response to the decline in funding costs). Second, it is worth noting that to the extent domestic banks also react to changes in funding costs for the foreign subsidiaries, this would only amplify the spillover effect of TLTROs as compared to if there were only direct effects via the foreign subsidiaries, which is

relevant from a policy perspective, and aligns with the focus of this paper, which is to assess whether there are monetary policy spillovers in non-euro area countries as a whole.

One final point worth emphasizing is that while making causal inference about TLTRO effects within the euro area is subject to some concerns about endogeneity (e.g., in strategic take-up of TLTRO by banks), causal inference is more plausible for the non-euro area countries in Europe, since the design of the policy was based in lending within the euro area, and not based on local economic conditions. In particular, there would be less reason to believe that euro area multinational banks engaged in TLTRO financing with a view to affecting their operations outside the euro area through their subsidiaries. Further, any indirect effects of such a policy on domestic banks in the non-euro area country would even less likely be subject to endogeneity concerns.

Methodology

To estimate the effect of TLTRO exposure on different outcomes, first we use a difference-in-differences approach, by comparing banks that were exposed to TLTRO through their parent company in the euro area with domestic banks that were not exposed, before and after the introduction of TLTRO. This implies estimating the following model:

$$Y_{t,i} = \beta_0 + \beta_1 DT + \beta_2 Dafter + \beta_3 DT \cdot Dafter + u_{i,t} \quad (1)$$

where $Y_{t,i}$ is the outcome variable, DT is a dummy variable that takes value 1 for the treated and zero otherwise, and $Dafter$ is a dummy variable that takes value 1 for the treatment period and 0 otherwise. The treatment period is 2014–22. Hence β_3 , the coefficient for the interaction term between the treated dummy and the treatment period dummy, is the average treatment effect on the treated, i.e., the effect of TLTRO exposure on outcomes. Second, to gauge the effect of different levels of TLTRO exposure on outcomes, we estimate the following regressions:

$$Y_{t,i} = \alpha_0 + \alpha_1 TLTRO_{i,t} + \alpha_2 X_{i,t} + v_{i,t} \quad (2)$$

where $Y_{t,i}$ is the outcome variable, $TLTRO_{i,t}$ is the exposure of bank i at time t to parent-country TLTRO³, and $X_{i,t}$ is a set of control variables including macroeconomic indicators of the host country (output gap, host country short term interest rates), and parent bank characteristics (asset size, deposits to liabilities and loans to assets). We also use different combinations of country and parent country fixed effects. In one specification, we use bank and time fixed effects. This Two-Way Fixed Effects (TWFE) specification would be the continuous treatment version of the difference in difference regression before. Third, we estimate the difference in the effect of TLTRO exposure on banks in emerging markets and

³ We use two different measures of TLTRO exposure. One is the total TLTRO take up of the parent country at time t . In the second measure we weigh the total TLTRO take up of the parent country by the share of parent bank assets in total parent country assets. This is a proxy for individual parent TLTRO exposure since we do not have bank-by-bank TLTRO take-up data, and it assumes TLTRO take-up is proportional to parent bank size.

advanced economies. We will refer to this as “destination effects”. We thus run the following regression:

$$Y_{t,i} = \theta_0 + \theta_1 TLTRO_{i,t} + \theta_2 X_{i,t} + \theta_3 EM + \theta_4 EM \times TLTRO_{i,t} + e_{i,t} \quad (3)$$

where we added a dummy variable EM for emerging markets, and its interaction term with TLTRO exposure. Similarly, we estimate the difference in the effect of TLTRO exposure stemming from parent banks in core euro area countries versus periphery euro area countries. We will refer to this as “source effects”. We thus run the following regression:

$$Y_{t,i} = \eta_0 + \eta_1 TLTRO_{i,t} + \eta_2 X_{i,t} + \eta_3 Periphery + \eta_4 Periphery \times TLTRO_{i,t} + \epsilon_{i,t} \quad (4)$$

where we added a dummy variable Periphery, and its interaction term with TLTRO exposure.

Data

The main data source for this study is the Fitch Connect database of worldwide bank balance sheets, at annual frequency. The Fitch dataset has good coverage of European banks once the data have been appropriately treated (Thibaut and Le Mathias 2015). Following the principles outlined in that paper, we undertake a number of steps in preparing the data (see Appendix B). The final estimation dataset consists of an unbalanced panel of 1167 banks over 2006–2022 located in 19 non-euro area European countries. These include Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Czech Republic, Denmark, Hungary, Moldova, Montenegro, North Macedonia, Norway, Poland, Romania, Russian Federation, Serbia, Sweden, Türkiye, Ukraine, and the United Kingdom. Of the 1167 banks, 1048 banks are domestic banks in the non-euro area country, and 119 are subsidiaries of parent banks located in the euro area. The dataset includes 21 parent countries of the 119 subsidiary banks. Five countries (Austria, Germany, France, Italy, and Netherlands) account for 73 subsidiaries. This is important, as some of these countries, in particular Italy, France, and Germany, had sizable uptake of TLTROs (see Appendix C). The original Fitch dataset does not have a full set of information on the parent bank and parent country of each foreign subsidiary bank. In these instances, information on the parent bank and parent country was added manually from online information. As data on the bank-wise uptake of TLTRO in the euro area are not publicly available, we take country level TLTRO uptake data from Eurostat. In addition, we incorporate macroeconomic controls in our regressions to capture the effect of cyclical conditions and domestic policy settings that might confound the impact of TLTROs. For example, deposit and lending rates may vary with the setting of domestic policy rates, obscuring the effect of TLTROs. In addition, bank profits may rise or fall depending on domestic cyclical conditions in addition to responding to interest rates via net interest margins. To control for these factors, we include data on short-term interest rates and on the output gap in the host country, taken from the IMF WEO database.

Key descriptive statistics describing the pre- and post-TLTRO balance sheet indicators of domestic banks and foreign subsidiaries are shown in Table 1 below. Our main dependent variables of interest include deposit rates, lending rates, profitability, and risk. We take deposit

rates, lending rates, and operating ROA directly from the Fitch database. We measure risk with the bank z-score, which measures banks' buffers given by $(ROA + \text{equity/assets})$ divided by the standard deviation of the ROA, to give a sense of how robust capital is to shocks to income.

In Table 1, we see that deposit rates for both sets of banks declined in the post TLTRO (2014 onwards) period. On average across all countries and banks, we see a decline of 235 basis points in deposit rates of foreign subsidiaries, and a 178 basis point drop for domestic banks. The decline in lending rates is similar to the decline in funding costs; for foreign subsidiaries the drop is on average 234 basis points, and for domestic banks 170 basis points. This suggests that interest margins overall tended to remain stable, although this is averaging across the sample and there may be differences in the cross-section. In addition, we find that profitability for foreign subsidiaries, measured by ROA, increased by nearly 40 basis points, whereas it remained nearly unchanged for domestic banks.

Results

Difference in Differences

The results in Table 2 show that exposure to TLTROs through euro area parents of foreign subsidiaries is associated with decreased deposit and lending rates, and higher profitability among foreign subsidiaries relative to their domestic counterparts. These results suggest that the impact of TLTRO funding on foreign subsidiaries was on average larger than the impact on the funding costs of domestic banks, allowing the former to improve their profitability despite also reducing their lending rates (by more than domestic banks). This suggests there may also be effects on non-interest income such that profitability increased for foreign subsidiaries (we leave the exploration of the sources of variation in profitability for future work). Finally, we note also that the results do not show a significant impact of TLTROs on risk.

In terms of magnitude, TLTRO exposure of foreign subsidiaries is associated with a 25bps decrease in deposit rates, a 54 bps decrease in lending rates, and a 0.36 percent increase in ROA. All these results are significant at the 5 percent confidence level.

Effect of the Intensity of TLTRO Exposure

In addition to the difference-in-difference estimates, we also estimate OLS regressions with TLTRO exposure as a continuous variable, which allows us to gauge the effects of intensity of TLTRO exposure. The results in Tables 3 and 4 show a negative and significant relationship between TLTRO exposure and the deposit and lending rates observed in the host country banks. Although the combined effect of lower lending and deposit rates results in a negative and statistically significant impact on net interest margins, results for ROA in Table 5 show increased profits overall, indicating a subsidization of lower lending rates through TLTRO itself, and/or a positive impact on non-interest income. We find no significant effect on risk, per Table 6.

In terms of the size of the effects, \$1 billion worth of TLTRO take-up in the parent country is associated with a reduction of 0.2 bps in deposit rates and 0.4 bps in lending rates in the most stringent specification (Column (2)). The fact that the reduction in lending rates is higher than that of deposit rates is likely due to the fact that TLTRO funds are much cheaper than deposits as a source of funding, so the substitution of some deposits for these funds creates room for foreign subsidiaries to cut lending rates by more than a one-to-one cut in deposit rates.

Overall, considering the total TLTRO take-up of many euro area countries, which at its peak reached over \$400 billion for Germany, France, and Italy, and over \$2 trillion in total at peak, these effects are economically significant. Similar results are obtained using the asset weighted TLTRO exposure of the parent bank in terms of sign of the effect, with a larger estimated magnitude of the effect. Using this measure of TLTRO exposure however somewhat diminishes the significance of the results, with the TWFE coefficient dropping out of 5% significance. This is likely because subsidiary bank fixed effects are likely correlated with the characteristics of each subsidiary's parent, including parent size, which is used in computing the dependent variable.

On profitability, the results show that for \$1 billion of TLTRO exposure, foreign branches of euro area banks exhibit higher ROAs by around 0.2bps, although the significance of this result varies by specification. The results using the asset weighted TLTRO exposure are again in line with the unweighted TLTRO measure in terms of sign, and slightly larger in terms of magnitude.

Turning to "destination effects", TLTRO exposure of parent banks on lending and deposit rates appears to be significantly stronger in emerging markets than advanced economies, although this difference is muted for profitability and risk. On "source" effects, however, the interaction term for parent banks in euro area periphery countries is not statistically significant for any of the variables of interest, leading us to reject the hypothesis that there are source effects in TLTRO spillovers.

Conclusions and Policy Implications

Targeted Longer-Term Refinancing Operations (TLTRO) are tools used by the European Central Bank (ECB) to increase lending to businesses and households in the euro area by offering banks favorable borrowing conditions. While much of the literature on the international spillovers of ECB monetary policy has focused on asset purchases, less attention has been given to the effects of these term lending operations.

In this paper, we exploit the cross-sectional variation in exposure to TLTRO by non-euro area countries through subsidiaries of euro area banks that operate in those markets. This approach allows us to investigate how TLTRO influenced banking systems outside the euro area. Due to data constraints, we are unable to use the actual take-up of TLTRO by parent banks and are guided by the total take-up in the parent bank's country. Our findings reveal that larger exposure to TLTROs is associated with lower deposit rates, lower lending rates,

and higher profitability for the foreign subsidiaries of euro area banks, relative to the domestic banks in the host country outside the euro area. This suggests these spillovers outside the euro area contributed to a loosening in financial conditions.

From a policy perspective, given that the economic cycles in countries outside the euro area may not be synchronized with that of the euro area (or may differ in magnitude), spillovers from euro area monetary policy operations could expose these countries to unwanted monetary loosening or tightening. On the other hand, such spillovers could also play a stabilizing role and create additional space for domestic policy if cyclical conditions align the aims of policies in the two regions. In either case, spillovers would have an impact on the calibration of domestic policies outside the eurozone.

Secondly, while we do not explore the issues in this paper, we note that these spillovers could potentially also have financial stability and structural effects on the banking system as foreign-owned subsidiaries may become more competitive than domestic banks, potentially reshaping the local financial landscape. Policymakers would also need to be aware of these potential effects.

Table 1: Means of Key Variables

	Domestic Banks	Foreign subsidiaries	p-value
Before TLTRO			
Deposit rate (%)	3.70	4.08	.00
Loan rate	7.79	8.58	.00
ROA (%)	0.70	0.56	.20
Z-score	3.35	3.04	.00
Total assets (USD 000s)	5978	6073	.92
Gross loans (USD 000s)	3392	3832	.37
Loan-to-asset ratio (%)	65.01	62.42	.00
Liquid assets to total assets (%)	19.82	20.71	.17
Deposits-to-liabilities ratio (%)	76.41	64.13	.00
After TLTRO			
Deposit rate (%)	1.92	1.73	.03
Loan rate	6.09	6.24	.37
ROA (%)	0.72	0.95	.01
Z-score	3.32	2.97	.00
Total assets (USD 000s)	7212	7317	.92
Gross loans (USD 000s)	3909	4445	.31
Loan-to-asset ratio (%)	60.25	57.77	.00
Liquid assets to total assets (%)	22.13	20.02	.00
Deposits-to-liabilities ratio (%)	84.72	76.89	.00

Table 2: Results: Difference in Differences

VARIABLES	(1) Lending rates	(2) Deposit rates	(3) Profitability	(4) Risk
tltoi = 1	-2.096*** (0.092)	-1.498*** (0.043)	0.024 (0.051)	-0.044** (0.019)
(last) treated = 1	0.731*** (0.188)	0.153* (0.088)	-0.136 (0.104)	-0.314*** (0.039)
1.tltoi#1.treated	-0.544** (0.256)	-0.246** (0.120)	0.364** (0.142)	-0.027 (0.053)
Constant	8.400*** (0.066)	3.454*** (0.031)	0.704*** (0.036)	7.943*** (0.014)
Observations	9,939	9,939	9,939	9,931
R-squared	0.062	0.129	0.001	0.016

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Effect of TLTRO on Deposit Rates

VARIABLES	Total TLTRO of parent country				Weighted TLTRO exposure of parent bank			
	(1) OLS	(2) TWFE	(3) OLS	(4) OLS	(5) OLS	(6) TWFE	(7) OLS	(8) OLS
TLTRO	-0.005*** (0.001)	-0.002** (0.001)	-0.003** (0.002)	-0.006*** (0.001)	-0.031*** (0.004)	-0.013* (0.007)	0.009 (0.008)	-0.022** (0.011)
Output gap	0.053*** (0.007)	-0.064*** (0.014)	0.067*** (0.008)	0.050*** (0.009)	0.054*** (0.007)	-0.063*** (0.014)	0.067*** (0.008)	0.051*** (0.009)
S/T rate	0.044*** (0.008)	0.007 (0.011)	0.080*** (0.005)	0.083*** (0.006)	0.046*** (0.008)	0.007 (0.011)	0.081*** (0.005)	0.082*** (0.006)
Asset size	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Deposits to liabilities	-0.039*** (0.002)	-0.018*** (0.004)	-0.033*** (0.001)	-0.045*** (0.001)	-0.039*** (0.002)	-0.018*** (0.004)	-0.033*** (0.001)	-0.044*** (0.001)
Loans to assets	0.023*** (0.002)	0.006 (0.004)	0.022*** (0.001)	-0.007*** (0.002)	0.023*** (0.002)	0.006 (0.004)	0.022*** (0.001)	-0.007*** (0.002)
Emerging markets			2.834*** (0.052)				2.843*** (0.052)	
EM x TLTRO			-0.006*** (0.002)				-0.011*** (0.001)	
Periphery				-0.389** (0.154)				-0.374** (0.155)
Periphery x TLTRO				0.002 (0.002)				-0.001 (0.002)
Constant	4.395*** (0.208)	3.767*** (0.450)	2.589*** (0.150)	6.682*** (0.151)	4.435*** (0.208)	3.788*** (0.449)	2.566*** (0.149)	6.631*** (0.151)
Observations	8,840	8,840	8,942	8,942	8,840	8,840	8,942	8,942
R-squared	0.740	0.802	0.349	0.129	0.739	0.802	0.349	0.126
Bank FE	YES	YES	NO	NO	YES	YES	NO	NO
Time FE	NO	YES	NO	NO	NO	YES	NO	NO
Country FE	YES	NO	NO	NO	YES	NO	NO	NO
Parent Country FE	YES	NO	NO	NO	YES	NO	NO	NO

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: In columns (1) to (4), TLTRO denotes the total TLTRO take up of the parent country. In columns (5) to (8), TLTRO denotes the total TLTRO take up of the parent country, weighted by the share of parent bank assets to total parent country assets. The output gap is defined per the IMF WEO. S/T rate refers to the short-term interest rate of the host country per WEO. Emerging markets include Albania, Bulgaria, Bosnia and Herzegovina, Belarus, Hungary, Moldova, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Türkiye and Ukraine. Periphery EA countries include Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain. For the TWFE specification, standard errors are clustered at the bank level.

Table 4: Effect of TLTRO on Lending Rates

VARIABLES	Total TLTRO of parent country				Weighted TLTRO exposure of parent bank			
	(1) OLS	(2) TWFE	(3) OLS	(4) OLS	(5) OLS	(6) TWFE	(7) OLS	(8) OLS
TLTRO	-0.007*** (0.001)	-0.004*** (0.001)	-0.004* (0.002)	-0.006*** (0.002)	-0.032*** (0.005)	-0.009 (0.007)	-0.035*** (0.012)	-0.045*** (0.017)
Output gap	0.067*** (0.008)	-0.071*** (0.017)	0.078*** (0.012)	0.045*** (0.015)	0.069*** (0.008)	-0.070*** (0.017)	0.078*** (0.012)	0.046*** (0.015)
S/T rate	0.086*** (0.009)	0.036*** (0.013)	0.064*** (0.008)	0.067*** (0.010)	0.090*** (0.009)	0.036*** (0.013)	0.064*** (0.008)	0.066*** (0.010)
Asset size	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Deposits to liabilities	-0.021*** (0.002)	0.012** (0.005)	-0.011*** (0.002)	-0.033*** (0.002)	-0.023*** (0.002)	0.010** (0.005)	-0.011*** (0.002)	-0.032*** (0.002)
Loans to assets	0.026*** (0.002)	0.002 (0.005)	-0.005** (0.002)	-0.061*** (0.003)	0.027*** (0.003)	0.002 (0.005)	-0.005** (0.002)	-0.061*** (0.003)
Emerging markets			5.443*** (0.079)				5.446*** (0.078)	
EM x TLTRO			-0.011*** (0.003)				-0.012*** (0.002)	
Periphery				-0.240 (0.252)				-0.235 (0.252)
Periphery x TLTRO				-0.005* (0.003)				-0.003 (0.003)
Constant	7.173*** (0.257)	6.067*** (0.569)	5.911*** (0.228)	13.716*** (0.247)	7.258*** (0.258)	6.137*** (0.570)	5.901*** (0.227)	13.686*** (0.247)
Observations	8,840	8,840	8,942	8,942	8,840	8,840	8,942	8,942
R-squared	0.849	0.896	0.411	0.095	0.847	0.896	0.411	0.094
Bank FE	YES	YES	NO	NO	YES	YES	NO	NO
Time FE	NO	YES	NO	NO	NO	YES	NO	NO
Country FE	YES	NO	NO	NO	YES	NO	NO	NO
Parent Country FE	YES	NO	NO	NO	YES	NO	NO	NO

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: In columns (1) to (4), TLTRO denotes the total TLTRO take up of the parent country. In columns (5) to (8), TLTRO denotes the total TLTRO take up of the parent country, weighted by the share of parent bank assets to total parent country assets. The output gap is defined per the IMF WEO. S/T rate refers to the short-term interest rate of the host country per WEO. Emerging markets include Albania, Bulgaria, Bosnia and Herzegovina, Belarus, Hungary, Moldova, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Türkiye and Ukraine. Periphery EA countries include Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain. For the TWFE specification, standard errors are clustered at the bank level.

Table 5: Effect of TLTRO on Profitability

VARIABLES	Total TLTRO of parent country				Weighted TLTRO exposure of parent bank			
	(1) OLS	(2) TWFE	(3) OLS	(4) OLS	(5) OLS	(6) TWFE	(7) OLS	(8) OLS
TLTRO	0.003*** (0.001)	0.002* (0.001)	0.001 (0.002)	0.002*** (0.001)	0.019*** (0.005)	0.014* (0.007)	-0.008 (0.008)	0.016* (0.009)
Output gap	0.095*** (0.008)	0.077*** (0.022)	0.079*** (0.008)	0.078*** (0.008)	0.095*** (0.008)	0.077*** (0.022)	0.079*** (0.008)	0.078*** (0.008)
S/T rate	0.040*** (0.009)	0.060*** (0.013)	-0.046*** (0.005)	-0.045*** (0.005)	0.039*** (0.009)	0.059*** (0.013)	-0.046*** (0.005)	-0.045*** (0.005)
Asset size	-0.000 (0.000)	-0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)
Deposits to liabilities	0.012*** (0.002)	0.009* (0.005)	0.008*** (0.001)	0.007*** (0.001)	0.012*** (0.002)	0.009* (0.005)	0.008*** (0.001)	0.007*** (0.001)
Loans to assets	0.015*** (0.002)	0.018*** (0.005)	0.012*** (0.001)	0.011*** (0.001)	0.015*** (0.002)	0.018*** (0.005)	0.012*** (0.001)	0.011*** (0.001)
Emerging markets			0.119** (0.051)				0.115** (0.051)	
EM x TLTRO			0.000 (0.002)				0.002** (0.001)	
Periphery				-0.285** (0.132)				-0.289** (0.132)
Periphery x TLTRO				-0.002 (0.001)				-0.002 (0.002)
Constant	-1.193*** (0.250)	-1.242*** (0.459)	-0.591*** (0.148)	-0.400*** (0.129)	-1.211*** (0.250)	-1.255*** (0.459)	-0.581*** (0.148)	-0.384*** (0.129)
Observations	8,840	8,840	8,942	8,942	8,840	8,840	8,942	8,942
R-squared	0.445	0.460	0.034	0.035	0.445	0.460	0.034	0.034
Bank FE	YES	YES	NO	NO	YES	YES	NO	NO
Time FE	NO	YES	NO	NO	NO	YES	NO	NO
Country FE	YES	NO	NO	NO	YES	NO	NO	NO
Parent Country FE	YES	NO	NO	NO	YES	NO	NO	NO

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: In columns (1) to (4), TLTRO denotes the total TLTRO take up of the parent country. In columns (5) to (8), TLTRO denotes the total TLTRO take up of the parent country, weighted by the share of parent bank assets to total parent country assets. The output gap is defined per the IMF WEO. S/T rate refers to the short-term interest rate of the host country per WEO. Emerging markets include Albania, Bulgaria, Bosnia and Herzegovina, Belarus, Hungary, Moldova, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Türkiye and Ukraine. Periphery EA countries include Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain. For the TWFE specification, standard errors are clustered at the bank level.

Table 6: Effect of TLTRO on Risk

VARIABLES	Total TLTRO of parent country				Weighted TLTRO exposure of parent bank			
	(1) OLS	(2) TWFE	(3) OLS	(4) OLS	(5) OLS	(6) TWFE	(7) OLS	(8) OLS
TLTRO	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.000)	0.002 (0.002)	-0.001 (0.004)	-0.007** (0.003)	-0.006 (0.004)
Output gap	0.020*** (0.003)	0.006 (0.007)	0.002 (0.003)	0.004 (0.003)	0.020*** (0.003)	0.006 (0.007)	0.002 (0.003)	0.004 (0.003)
S/T rate	-0.010*** (0.003)	-0.001 (0.005)	0.007*** (0.002)	0.008*** (0.002)	-0.010*** (0.003)	-0.001 (0.005)	0.007*** (0.002)	0.008*** (0.002)
Asset size	-0.000 (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)
Deposits to liabilities	-0.007*** (0.001)	-0.007*** (0.002)	0.000 (0.000)	0.001*** (0.000)	-0.007*** (0.001)	-0.007*** (0.002)	0.000 (0.000)	0.001*** (0.000)
Loans to assets	0.008*** (0.001)	0.009*** (0.002)	0.004*** (0.001)	0.008*** (0.001)	0.008*** (0.001)	0.009*** (0.002)	0.004*** (0.001)	0.008*** (0.001)
Emerging markets			-0.395*** (0.020)				-0.396*** (0.020)	
EM x TLTRO			-0.001 (0.001)				-0.000 (0.000)	
Periphery				-0.405*** (0.053)				-0.405*** (0.053)
Periphery x TLTRO				-0.000 (0.001)				0.000 (0.001)
Constant	3.413*** (0.086)	3.275*** (0.181)	3.274*** (0.058)	2.741*** (0.052)	3.411*** (0.086)	3.277*** (0.181)	3.277*** (0.058)	2.739*** (0.052)
Observations	8,830	8,830	8,932	8,932	8,830	8,830	8,932	8,932
R-squared	0.586	0.606	0.072	0.038	0.586	0.606	0.072	0.038
Bank FE	YES	YES	NO	NO	YES	YES	NO	NO
Time FE	NO	YES	NO	NO	NO	YES	NO	NO
Country FE	YES	NO	NO	NO	YES	NO	NO	NO
Parent Country FE	YES	NO	NO	NO	YES	NO	NO	NO

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: In columns (1) to (4), TLTRO denotes the total TLTRO take up of the parent country. In columns (5) to (8), TLTRO denotes the total TLTRO take up of the parent country, weighted by the share of parent bank assets to total parent country assets. The output gap is defined per the IMF WEO. S/T rate refers to the short-term interest rate of the host country per WEO. Emerging markets include Albania, Bulgaria, Bosnia and Herzegovina, Belarus, Hungary, Moldova, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Türkiye and Ukraine. Periphery EA countries include Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain. For the TWFE specification, standard errors are clustered at the bank level.

Appendix A.TLTRO Operations

The Table below summarizes the main operational details of the TLTRO I, II, and III operations. Notably, cross-border group formation was possible under the rules including if banks were in a parent-subsidiary relationship. The target area for the operations was loans within the euro area. The stock of eligible loans against which financing could be availed range from 7 percent to 30 percent as of certain cut-off dates. The terms of the financing varied between TLTROs.

TLTRO Program	Dates of Operation	Rules Governing Group Formation	Rules Governing Eligible Loans	Borrowing Limits	Lending Terms
TLTRO I	Sep 2014 - Jun 2016	Entities could form groups within a single Member State or across borders, but only if they had a parent-subsidiary relationship or were part of the same institutional protection scheme.	Loans to non-financial corporations and households (excluding mortgages) in the euro area.	Initial borrowing limit of 7% of the stock of eligible loans as of April 30, 2014. Subsequent borrowing could be up to three times the net lending in the reference period.	Fixed rate equal to the MRO rate prevailing at the time of allotment plus a fixed spread of 10 basis points.
TLTRO II	Jun 2016 - Mar 2017	Same as TLTRO I, with additional provisions allowing newly formed groups to participate if they met certain criteria.	Same as TLTRO I, but with the reference period for net lending being from Feb 1, 2016, to Jan 31, 2018.	Up to 30% of the stock of eligible loans as of Jan 31, 2016.	Initial rate equal to the MRO rate, with potential reduction to the DFR depending on lending performance.
TLTRO III	Sep 2019 - Mar 2021	Similar to TLTRO I and II, with additional flexibility for certain cross-border group formations.	Expanded to include loans to SMEs, with specific adjustments for agricultural loans and loans to self-employed individuals.	Up to 10% of the stock of eligible loans as of Mar 31, 2019, per operation, with potential additional borrowing based on net lending.	Rate equal to the average rate applied in the Eurosystem's main refinancing operations over the life of the respective TLTRO III operation, with potential reduction to the DFR plus 50 basis points depending on lending performance.

Appendix B. Fitch Data

The following steps were taken to prepare the Fitch Connect data used in this paper, which mainly consist of removing multiple duplicate observations for the same bank-year observation.

1. We confined the market sectors of firms in Fitch Connect to banks while excluding other institutions, e.g., central banks. More specifically, we only included the following market sectors: 'Banks,' 'Credit Union,' 'Other Banks,' 'Retail & Consumer Banks,' 'Universal Commercial Banks,' 'Trading & Investment Banks,' 'Wholesale Commercial Banks,' 'Development Banks.'
2. We excluded inflation-adjusted balance sheets.
3. We only included annual balance sheets and income statement. For most banks, the fiscal year ends in December. Therefore, we identified the year of each balance sheet according to the following rule: if the fiscal year ends in the second half of the calendar year, the year of the balance sheet in question is the same as the fiscal year; conversely, if the fiscal year ends in the first half of the calendar year, the year of a balance sheet is the fiscal year minus one.
4. When multiple balance sheets exist for one year, we only kept consolidated balance sheets when available. Otherwise, we used unconsolidated balance sheets.
5. We dropped balance sheets with statement types of 'Estimated,' 'Forecast,' 'Preliminary,' 'Partial' or 'Pro-forma' when the balance sheets are annual.
6. Some banks release multiple balance sheets each year following different accounting practices. In these cases, we selected IFRS, if available, or Local GAAP otherwise. For some banks, there are multiple balance sheets each year which are neither IFRS nor Local GAAP. In such cases, we only kept the balance sheet with the accounting system that is most frequently used by the same bank.
7. Some banks release multiple balance sheets with different fiscal year-end dates within a year (the definition of the year of a balance sheet is defined in step 3). In those cases, we only kept the balance sheets which have the latest fiscal year end-dates within the year.
8. Some banks release multiple balance sheets with different 'Audited/Qualified.'
9. 'Flag' within a year. We kept the balance sheets with the highest level.
10. 'Audited/Qualified Flag' within the year (the highest level corresponds to 'Unqualified opinion').
11. For some bank-year level observations, there are multiple balance sheets with different 'Fitch Nickname,' which uniquely identify a bank's statements with the same type of disclosure, including accounting system, consolidation, inflation adjusted currency, consolidation level etc. We picked the 'Fitch Nickname' that is most frequently used among the 'Fitch Nicknames'

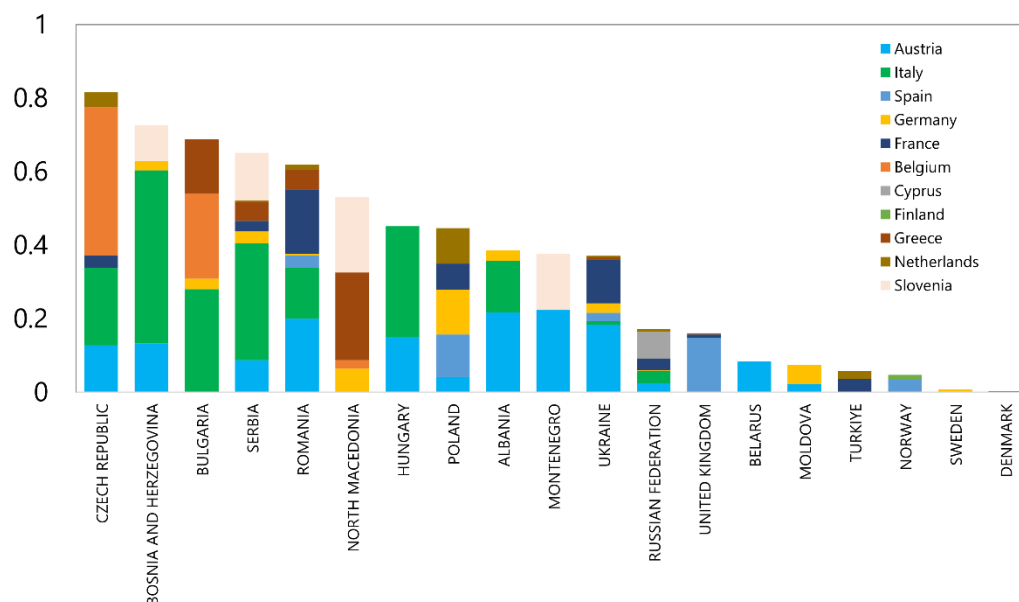
available in the latest observation of a bank. In years with multiple balance sheets for a bank, we only kept the reserved 'Fitch Nickname' if available.

12. For some bank-year level observations, there are multiple balance sheets but no balance sheets with the reserved 'Fitch Nickname.' In those cases, we only kept the 'Fitch Nicknames' that are most frequently used among all 'Fitch Nicknames' available in that year.

Appendix C. Charts

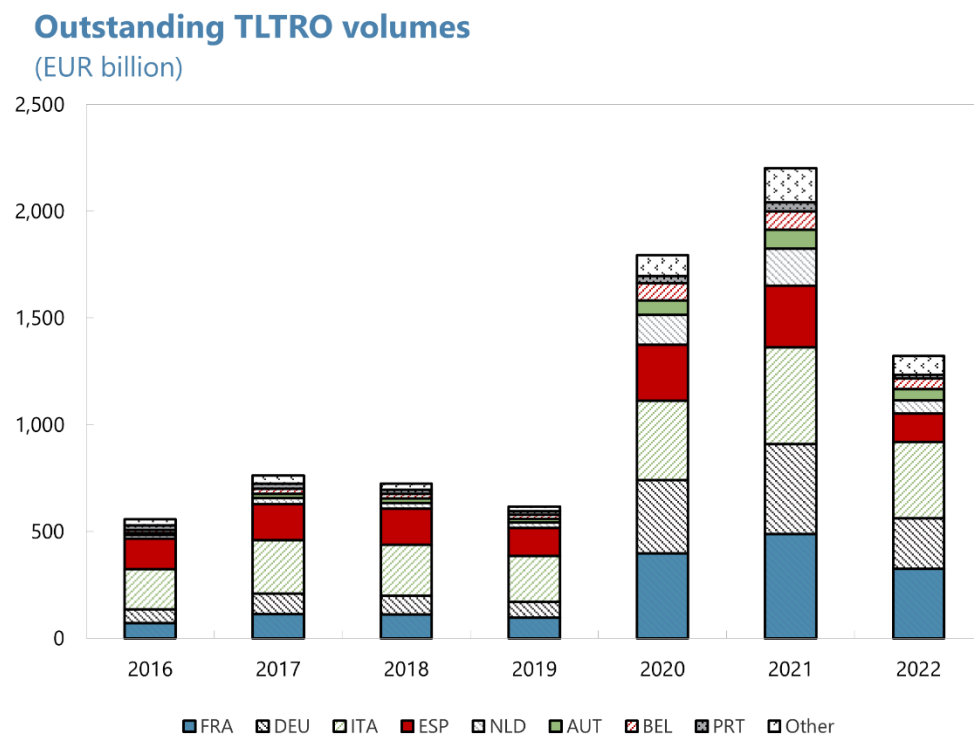
Figure 1. Euro Area-owned Subsidiaries' Share in Banks' Assets Outside Euro Area

Euro area-owned subsidiaries' share in banks' assets outside euro area



Source: Fitch Connect database, and authors' calculations.

Figure 2. Outstanding TLTRO Volumes



Source: HAVER Analytics

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