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The Corporate Real Effects of CIP Deviations*

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Abstract

We show corporate real effects from Covered Interest Parity (CIP) deviations, exploiting administrative data from Norway as well as CIP deviation shocks. Banks with access to U.S. money markets strongly increase short-term USD funding in response to CIP deviations. This, in turn, leads to higher credit to non-financial firms. The increase in credit is robust to firm-time fixed effects, suggesting that it is supply-driven. Moreover, firms receiving additional credit also pay lower interest rates. These loan-level results translate into an increase in firm-level bank debt and total debt. However, corporate real effects are weaker. Despite strong effects on corporate sales (firm output), affected firms (i.e., with higher credit availability) increase their fixed assets completely driven by an increase in financial fixed assets, not through investment in real assets. Further, more affected firms pay out more dividends to shareholders.

Keywords: CIP deviations, bank lending channel, global banks

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1 Introduction

Covered Interest Parity (CIP) is a central condition in international finance, postulating that interest rates should be equal across currencies after accounting for the price of hedging exchange rate risk through an FX swap contract. Since the Global Financial Crisis (GFC) in 2008 there have been sizable deviations from CIP across a wide range of markets and currency pairs. For highly rated global banks with access to U.S. money markets, the cost of exchanging USD into domestic currency with the exchange rate risk fully hedged has been lower than borrowing local currency directly (Du, Tepper, and Verdelhan, 2018; Rime, Schrimpf, and Syrstad, 2022), creating a funding cost advantage for such banks. The breakdown of CIP has been dubbed as "one of the most significant developments in global financial markets" (Du, Tepper, and Verdelhan, 2018). At the same time, a significant part of global banks' transactions is financed by USD-denominated unsecured short-term credit. Indeed, the USD liabilities of non-U.S. banking institutions have grown rapidly since the early 2000s, and are currently estimated at above $10 trillion based on data from the Bank for International Settlements (BIS).[1]

The sizeable exposure of global banks to USD-denominated liabilities implies that CIP deviations, by changing the relative attractiveness of funding and investments across currencies, could affect global banks' balance sheets, thereby loans to firms and investment outcomes. Despite the importance of CIP deviations, there is scant evidence on the real effects of CIP, in particular to non-financial corporations.

In this paper we aim to fill this gap. We show corporate real effects from Covered Interest Parity (CIP) deviations using administrative data from Norway and exploiting CIP deviation shocks. We begin the analysis by studying how CIP deviations affect bank funding structure. We show that positive CIP deviations induce banks with access to U.S. money markets (the "affected" banks) to raise more short-term funding abroad, increasing the share of short-term foreign funding to the overall balance sheet by about 4.2 - 5 percentage points. This, in turn, leads to higher credit to non-financial firms, with weaker economic effects as banks hoard part of the extra funding as central bank deposits.

The higher credit is supply-driven, as we control for firm-time fixed effects, and we find larger

[1] A large part of this borrowing activity is then transferred as loans to customers in local currency. See Ivashina, Scharfstein, and Stein (2015) for more details on the role of dollar-denominated financial intermediation.

credit volumes but lower loan interest rates for affected firms (i.e., those with higher pre-shock funding from banks with access to US funds). More loans translate into more firm-level bank debt and total debt. However, corporate real effects are weaker. Despite strong effects on corporate sales (firm output), more affected firms (i.e., with higher credit availability) increase their fixed assets but this is completely driven by an increase in financial fixed assets, not through investment in real assets. Further, more affected firms pay out more dividends to shareholders. Our results underscore an unexplored credit reallocation channel of short-term funding shocks. We show that the credit reallocation is driven by carry trade or as a precautionary measure by firms with more volatile and presumably less diversified revenue streams.

Identifying the effects from CIP deviations on credit and the wider economy is empirically challenging, because the funding structure of banks is endogenous to the composition of their assets, investors' preferences, funding costs, and to the overall economic environment. To overcome this challenge we combine granular administrative datasets with an arguably exogenous shock: a decrease in the cost of direct USD funding in U.S. wholesale funding markets during the Eurozone crisis. Unlike euro area banks, globally active Scandinavian banks in Norway were not affected by the dry-up in USD funding, and instead experienced a large funding cost advantage compared to domestic banks in Norway. The implicit cost of raising NOK through USD borrowing at its peak generated a 140 basis points reduction compared to domestic funding, after accounting for hedging costs. These sizable CIP deviations were happening in global markets and were orthogonal to the Norwegian banking sector. Moreover, supporting our identification is the fact that the set of banks borrowing abroad was relatively constant over our sample period, allowing us to compare the outcomes of the affected globally oriented banks with other Norwegian banks not in a position to take advantage of the CIP deviations. Finally, while in most of the analysis we focus around the Eurozone crisis, during which CIP deviations were more pronounced, we show that global banks' response to CIP deviations in increasing short-term USD borrowing extends to other periods as well.

We combine data from three main sources. First, we use supervisory bank-level data on balance sheet and income statement items to analyze the impact of CIP deviations on bank funding and asset allocation. Second, we use loan-level data from Norwegian tax authorities to establish the impact of CIP deviations on loans to Norwegian firms. Importantly, these data cover the universe of all loans between banks and firms in Norway, allowing us to look at the impact on the population of firms. Third, we use granular firm-level data to trace out the impact of CIP deviations on both financial investments and the real sector. Specifically, the firm-level data contain detailed information on all of the components of fixed assets, including physical capital (PP&E), financial fixed assets, either corporate debt or equity. In addition to these three data-sources, we use bank-level data from Bloomberg to compute CIP deviations on short-term unsecured debt issued by Scandinavian banks operating in the Norwegian market.

We first document that affected banks increase the share of *total* foreign currency funding to total assets by approximately 5 percentage points in response to the increase in CIP deviations. On the asset side, affected banks increase firm lending by approximately 2 percentage points relative to total assets. Banks also increase liquid asset holdings, such as deposits at other central banks, by approximately 1 percentage point relative to total assets. Figure 1 decomposes the effect of the increase in FX funding on corporate lending and assets at central banks, the other primary asset that banks acquired with new borrowing.

–Insert Figure 1–

At the loan-level, we perform analysis using the entire sample, as well as restrict attention to the sample of firms borrowing from both an affected and a non-affected bank. In the latter case, following Khwaja and Mian (2008) and using only within firm-year variation, we find that credit growth is 6 percentage points higher and interest rates 1.46 percentage points lower on loans from affected banks. This is consistent with an increase in corporate credit supply by affected banks to their firms.

Next, we explore how firms used the increased credit, saturating the specifications with industry-year fixed effects to control for confounding industry-year level shocks. We show that firms borrowing from affected banks have a 0.44 percentage points higher growth in fixed assets compared to other firms, and a 0.81 percentage points higher growth in sales. We find that the increase in fixed assets is coming from increased holdings of fixed *financial* assets (by 0.28 percentage points). By breaking down fixed financial assets into firms' equity holdings of other companies or holding of their debt, we further find that the majority of the effect on fixed financial assets is driven by the latter. Furthermore, affected firms increase sales by 1 percent in 2011, and an additional 3 percent in 2022. Finally, the increased credit also results in higher wages and dividends, in line with existing work documenting higher dividends following increase in debt (Cooper and Lambertides, 2018).

We then shift our focus to examine the heterogeneous responses among different firms. The decision to borrow in order to invest in liquid financial assets is considered an optimal portfolio choice when firms are confronted with uncertainty (Xiao, 2022). Favara, Gao, and Giannetti (2021) documents that a crucial factor behind credit reallocation is the motive for precautionary savings. According to this, we would expect firms with fluctuating earnings or less diversified earning streams to amass more liquid financial assets (Riddick and Whited, 2009). Consistent with this, we find that firms with higher sales growth volatility or firms that are smaller have a larger propensity to gather fixed financial assets, which aligns with the notion of the precautionary savings motive. These proxies for the precautionary savings motive of firms are the only firm characteristics - across a wide range of variables - that explain firms investment into fixed financial assets.

Our work contributes to recent work on CIP deviations in financial markets. A growing body of literature has established the existence of CIP deviations (Mancini-Griffoli and Ranaldo, 2011; Du, Tepper, and Verdelhan, 2018). These deviations have been consistently different from zero since the crisis, are on average large, yet highly volatile at the same time (Du, Tepper, and Verdelhan, 2018). CIP deviations can occur in equilibrium (Ivashina, Scharfstein, and Stein, 2015; Duffie, 2017), and number of studies have examined the underlying reasons for CIP deviations, including (Avdjiev, Du, Koch, and Shin, 2019; Borio, Iqbal, McCauley, McGuire, and Sushko, 2018; Cenedese, Della Corte, and Wang, 2021; Cerruti and Zhou, 2023; Correa, Du, and Liao, 2020; Dedola, Georgiadis, Grab, and Mehl, 2021; Du, Hebert, and Huber, 2022; Du, Tepper, and Verdelhan, 2018; Ivashina, Scharfstein, and Stein, 2015; Liao, 2020; Puriya and Brauning, 2020; Ranciere and Tornell, 2016; Rime, Schrimpf, and Syrstad, 2022). Unlike traditional explanations of the failure of the law of one price (Garleanu and Pedersen, 2011), most of these explanations are based on bank balance sheet constraints. Other explanations include regulation (Du, Tepper, and Verdelhan, 2018), market segmentation (Rime, Schrimpf, and Syrstad, 2022), arbitrage limits (Ivashina, Scharfstein, and Stein, 2015), and swap market imperfections (Liao, 2020).

Ivashina, Scharfstein, and Stein (2015) and Brauning and Ivashina (2017) focus on the dollar's central role in international financial markets. During the same time period that we examine, Ivashina, Scharfstein, and Stein (2015) document how U.S. money market funds withdrew lending from Euro-area banks. Our paper documents that money market funds increased lending to non Euro-area banks with high creditworthiness. Using the latter as a source of quasi exogenous variation, we focus on corporate real effects stemming from the lending activity of the affected global banks.

Our work is also related to studies on borrower-level effects of currency compositions in a setting with limited hedging (Alfaro, Calani, and Varela, 2021; Keller, 2023). In these studies, CIP deviations influence the choice of currency by borrowers. Keller (2023) shows how banks' attempt to arbitrage deviations in a certain currency reduced lending in that currency due to its scarcity. While these papers focus on explaining the persistence of the post-crisis CIP-deviations and arbitrage activities by banks, none of them studies corporate real effects of such deviations. We take CIP deviations as given and demonstrate they have implications beyond arbitrage activities and borrower-level currency implications.

We focus on firm-level real implications of CIP deviations - a funding source that is unstable owing to short maturities (Norges Bank Financial Stability Report, 2018). High volatility in their magnitude amplifies uncertainty about future refinancing through this channel. We demonstrate that while they have small effects on long-term physical capital, they have real effects in form of increase in sales and payroll expenses by directly affected firms, as well as more liquid financial investments in other firms.

The rest of the paper is organised as follows: Section 2 describes the fundamentals of the CIP deviations. Section 3 and 4 describe data and methodology. Section 5 and 6 present micro- and macro-level results. Section 7 provides a policy discussion, while Section 8 concludes.

2 CIP deviations

CIP is a central condition in finance, postulating that interest rates should be equal across currencies after accounting for the price of hedging exchange rate risk through an FX swap contract. For example, a bank with access to money markets around the globe can choose to obtain funding across a range of currencies. Suppose a Scandinavian bank needs to obtain NOK for a period of 3-months. It can either obtain it in USD and enter an FX swap contract to hedge the exchange rate risk, or resort to direct funding in NOK. Letting F denote the FX forward price (USD/NOK), S the FX spot price, $i_\$$ the unsecured funding cost in foreign currency (USD) and i_d the funding cost in domestic currency (NOK), the CIP conditions states that:

$$\underbrace{\frac{F}{S}(1+i_{\$})}_{\text{Funding cost in foreign currency (USD), hedged for exchange rate risk}} = \underbrace{(1+i_d)}_{\text{Funding cost in domestic currency (NOK)}} \tag{1}$$

If CIP does not hold, global lenders will obtain funds in the cheaper currency and enter an FX-swap contract to convert this funding to the currency of interest. Such lenders are then able to raise funds in the chosen currency at a lower price, and on better terms than their peers without access to foreign markets.

During the European Sovereign debt crisis, European banks were constrained in terms of U.S short-term funding (Ivashina, Scharfstein, and Stein, 2015) and faced high direct funding costs in USD. The shock affected primarily euro area banks due to the large holdings of European government debt and their exposure to the break-up risk of the euro currency. Scandinavian banks and those from other *safe-haven* countries did not experience such punitive funding conditions in US money markets. However, due to the general uncertainty in financial markets and largely heterogeneous access to USD funding, large deviations from CIP appeared across several currency pairs.

Generally, the Eurozone crisis increased the demand for USD. Higher demand for USD affects the FX swap market by reducing the synthetic NOK rate for a given USD rate, and equivalently increases the synthetic USD rate for a given NOK rate.[2] Often, such periods also correspond to difficulties and higher costs of raising short-term funding in USD. However, the globally oriented banks operating in the Norwegian market (mainly large Scandinavian banks) experienced no change in the terms and conditions in US money markets leading to a substantial funding cost advantage compared to banks without access to short-term money markets in USD. Hence, globally oriented Scandinavian banks could access short-term money markets in USD to obtain cheaper funding compared to borrowing directly in NOK after hedging the FX risk. Figure 2 illustrates this, by comparing the funding cost in NOK for hedged-USD funding with the cost faced by banks borrowing directly in NOK for contracts with 3-month maturity.[3] At the height, the funding cost advantage

[2]The synthetic NOK rate is the sum of the USD rate and the forward premium (in percentage points) in the FX swap market.

[3]Note that CIP deviations were present the whole sample period. However, in this paper we exploit the large change

reached about 140 bps. Such cost advantages were also present against other currencies, notably CAD, JPY, CHF, AUD.

–Insert Figure 2–

As an approximation, equation 1 can be written in log form as:

$$\underbrace{1+(i_{\$})}_{\text{USD funding cost}} + \underbrace{(f-s)}_{\text{FX-swap implicit interest rate differential}} = \underbrace{1+(i_d)}_{\text{NOK funding cost}} \tag{2}$$

Figure 3 decomposes the 3-month CIP deviations for the USD/NOK pair in the elements spelled out in equation 2. The blue area shows the evolution of the 3-month USD funding rate ($i_{\$}$) faced by Scandinavian banks in the US money markets. The red area is the corresponding evolution of the 3-month FX hedging cost measured in per cent. This is essentially the forward premium (F/S) from equation 1 and can be interpreted as the interest rate differential priced in the FX derivative market to compensate for the actual interest rate differential between NOK and USD. Since the interest rate in Norway was higher than the interest rate in USD, the cost of hedging the FX risk should represent this interest rate differential. If CIP holds perfectly, the sum of the USD-rate and the hedging cost should equal the NOK-rate (i_d) represented by the green line (also 3-month maturity). The difference between the NOK-rate and the sum of the USD-rate and hedging cost is the CIP deviation. As can be gleaned from figure 3 the USD funding cost remained relatively stable from mid 2011 until end of 2012, while the hedging cost in the FX swap market fell despite little change in the direct NOK-rate. This contributed to a widening of CIP deviations stemming mainly from the pricing in the FX derivative market rather than from the cost of wholesale funding in US money markets. In the beginning of 2012, the NOK rate fell due to lower interest rate expectations and the CIP deviations gradually started to move towards levels seen in 2010 and the beginning of 2011. Figure 3 substantiates that it was primarily the FX market dislocation that caused the CIP deviation to widen in 2011/2012.

in the CIP deviations and employ a difference-in-difference identification strategy based on the abrupt movement in CIP deviations.

–Insert Figure 3 –

Not all banks in the Norwegian market could exploit this cost-advantage. As we discuss in Section 3, the Norwegian banking system comprises of a small number of highly rated and globally oriented commercial banks with access to the U.S. commercial paper market. The remaining banks are relatively small domestic savings banks with no such access. Although the small domestic banks are typically not rated by the main international credit agencies required to get access to the U.S. commercial paper market, they have a low level of complexity and high capital base. This implies that these banks are comparable to the highly rated global banks in terms of credit quality. Access to U.S. money markets is effectively available only for large banks for two main reasons: first, money market funds require that at least one of the main rating agencies have a rating for the bank. Second, fixed costs make it worthwhile to issue commercial paper only if the amount raised is large. Thus, the funding cost advantage documented in Figure 2 affected only a subset of the banks, which we refer to as ”affected” banks.

CIP deviations are not confined to the special case studied in this paper. As clearly illustrated in (Du, Tepper, and Verdelhan, 2018) and (Rime, Schrimpf, and Syrstad, 2022) over the past decade CIP deviations have been the rule, rather than the exception. The episodes were also observed outside crisis times, as well as across a range of currency pairs. Although we do not have detailed loan level data from other currencies, we observe CIP deviations exist outside Norway. In Figure 6 in the Appendix, we show the case for Canada during tranquil financial conditions, when we observe an increase in CIP deviations between USD and CAD. The evidence is based on granular CD issuance data in USD, that Canadian banks increased their issuance of short-term debt in USD to exploit the cost advantage. This increase in short-term USD-denominated funding suggests that Canadian banks exploited the funding cost advantage in the same manner as Scandinavian banks active in the Norwegian market in our study.

3 Data

In this section, we discuss the data used in our analysis as well as provide summary statistics of the final sample.

3.1 Description of data sources

We construct our measure of CIP deviations by calculating the synthetic 3-month NOK rate based on Scandinavian banks' funding rate in the commercial paper market in USD. We use the commercial paper rate for high quality banks reported by the Federal Reserve. To ensure that this is an accurate proxy for our sample, we compare this rate to the individual commercial paper rate for two of the largest banks active in the Norwegian market quoted on Bloomberg. By adding the 3-month forward premium (in percentage points) in the FX swap market we get the synthetic NOK rate. We obtain the FX spot exchange rate, the forward points and the number of trading days from Bloomberg. The CIP deviation is the synthetic 3-month NOK rate minus the 3-month local interbank rate – the Nibor (Norwegian Interbank Offered Rate). The 3-month Nibor is a proxy for the domestic short term funding costs.[4]

To investigate the impact of CIP deviations on bank lending (both at the bank- and loan-level) and real economic outcomes, we proceed by using data from three main sources: (1) a supervisory bank-level dataset, a (2) an administrative loan-level dataset and (3) a firm-level dataset from a credit rating agency. Our bank data are obtained from several bank reports available at Norges Bank at a quarterly frequency.

Our loan-level information comes from an administrative dataset obtained from the Norwegian tax authorities. For tax reasons, all banks report all accounts on their books by the end of the year. A unit of observation in this data is therefore loan information between a bank and a firm as of the year-end. The dataset contains firm and bank identifiers, as well as the outstanding loan balance and the interest paid over the calendar year. This data allows us to investigate how exposure to CIP deviations potentially affect the pricing and supply of corporate credit.

Finally, our firm-level data consists of information on the end-of-year financial statements for all Norwegian private and public limited liability companies for our sample period. Norwegian companies are required to have an authorized auditor, and must file their annual financial statements after each accounting year. The accounting database includes the profit and loss account, the balance sheet, industry information and legal form. Importantly, this data includes more granular information than what is typically available. we are able to break down fixed assets into its subcomponents: physical capital, firm-to-firm lending and holdings of other firms' equity.

[4] As a robustness we compare Nibor to the actual commercial paper issuance in NOK and find that these are comparable.

3.2 Sample selection and data construction

We work with a subset of the combined three data sources. The subset is chosen based on two sets of criteria. First, we restrict our attention to borrowers with positive debt, assets, sales and capital. Second, in the firm-level regressions we winsorize the dependent variable at the 5th and 95th percentiles. In the case where firms have multiple loans at a specific bank, we aggregate our loan-level data to the relationship×year level. Due to our focus on the period of large CIP deviations, our final sample runs from 2009q1 to 2012q4.

3.3 Summary statistics

In this section, we show summary statistics at the bank-level. We show separate summary statistics for affected vs. other banks. We classify banks as affected if by the end of 2010 they had issued commercial paper in a foreign currency. All other domestic banks are classified as other banks.

–Insert Table 1–

Table 1 shows summary statistics at the bank-level and (aggregate) CIP funding deviation. The average CIP funding deviation is 49 bps, when we average commercial paper issuance at the quarterly level. That is, issuing funding abroad in an average quarter is 49 bps cheaper than issuing funding in NOK (with a standard deviation of 38 bps) after accounting for hedging costs. Approximately 19% of the total liabilities of affected banks are short-term foreign funding, with a standard deviation of 10%. The table also compares affected and other banks across several key ratios. Affected banks have slightly higher equity ratios, more liquid assets and are somewhat larger compared to other banks.

4 Methodology

A natural empirical strategy to isolate the effects of CIP deviations is to compare outcomes for affected banks with other domestic Norwegian banks. During the fall of 2011, the Eurozone-crisis escalated rapidly. As shown in Figure 2, this led to a substantial decrease in the funding cost in foreign currency markets for Norwegian banks compared to the domestic ones. By the summer of 2012, most of the cost advantage had receded to pre-2011 levels. In our main analysis, we therefore focus on how the increase in CIP funding advantage during 2011 and 2012 affected bank behavior.

Our empirical approach consists of comparing bank-, loan- and firm-level outcomes for affected banks vs. other banks. We treat 2011 and 2012 as the ”post” period and 2009 and 2010 as the ”pre” period.

Identification In our empirical strategy, we rely on standard parallel trends assumption.

- The outcomes considered at the bank- and loan-level would have been similar for affected and other banks in the absence of the CIP-shock.
- The outcomes considered at the firm-level would have been similar for treated and control firms in the absence of the CIP-shock.

There are at least two main threats to these identifying assumptions. The first threat is that outcomes can be systematically different for different types of banks at the bank- and loan-level, and systematically different for treated and control firms at the firm-level. This can arise for instance if affected banks over the time-period considered have different business models compared to other banks giving rise to differential corporate credit growth. We address this by adopting a dynamic approach, where we explicitly test for differences between the two groups of banks also prior to the shock.

Our second main threat to identification is that, even if different groups of banks and firms are similar prior to the shock, they may be hit by unobserved confounding shocks during the treatment period. For instance, this can be the case if treated firms are more likely to be exporting firms, and thereby be more affected by the slowdown in the Eurozone economy.

We adopt two strategies to rule out confounding shocks. First, at the loan-level we adopt an approach a la Khwaja and Mian (2008), effectively only using variation within firm-year. Second, at the firm-level we only use within-industry×year variation, which ensures that we compare outcomes for relatively similar firms borrowing from different types of banks. In the rest of this section, we explicitly outline our identification strategy at the different levels of the analysis.

Bank-level At the bank-level, we estimate the following equation

$$\Delta Y_{b,t} = \alpha_b + \sum_{\tau} \delta_\tau \mathbf{1}_{t=\tau} + \sum_{\tau} \gamma_\tau \left(D_b \times \mathbf{1}_{t=\tau}\right) + \sum_{\tau} \eta_\tau \left(X_b \times \mathbf{1}_{t=\tau}\right) + \epsilon_{b,t} \tag{3}$$

where b refers to bank and t to time. The outcome variable $\Delta Y_{b,t}$ denotes the change in either foreign currency denominated short-term funding or the change in log(corporate loans). The treatment indicator D_b is equal to 1 if a bank has positive short-term foreign funding in 2011q2. X_b is a vector including the equity to assets ratio, log(assets) and liquidity to total assets, all of which is measured in 2011q2.

Loan-level At the loan-level, we estimate

$$\Delta Y_{b,f,t} = \alpha_b + \alpha_{f,t} + \gamma \left(\mathbf{1}_{t=2011 \cup t=2012} \times D_b\right) + \epsilon_{b,f,t} \tag{4}$$

where b refers to bank, f refers to firm, and t to time. The main outcome variable is growth at the loan-level. We saturate our specification with bank fixed effects. In addition, we include firm×year fixed effects captured by $\alpha_{f,t}$ for the subsample of loans at firms that borrow from multiple banks (Khwaja and Mian, 2008). This subsample constitutes roughly 10% of the sample of loans.

Firm-level At the firm-level, we estimate

$$\Delta Y_{f,t} = \alpha_f + \gamma \left(\mathbf{1}_{t=2011 \cup t=2012} \times D_b\right) + \mathbf{X_{f,t}} + \epsilon_{f,t} \tag{5}$$

where $\Delta Y_{f,t}$ is chosen from a broad set of firm balance sheet and income statement variables. To control for confounding factors, we include firm-year level controls $\mathbf{X_{f,t}}$. The firm-year level controls comprise of a year-industry FE, allowing us to hold factors affecting industries fixed.

5 Empirical Analysis

We start by investigating the impact of the shock on the growth in short-term foreign funding and overall corporate credit for affected banks, and show that both variables increase at the time of the shock.

5.1 Bank-level analysis

We move on to estimate equation 3 using the share of foreign funding to total assets as the dependent variable. For each period, we estimate the difference in *total* foreign funding to total assets for different types of banks.The time-varying differences, along with the confidence intervals, between the two groups are shown in Figure 4.

–Insert Figure 4

The evolution is relatively flat for both groups of banks prior to 2011q3. In 2011q3 however, there is a substantial increase in the level of foreign funding for affected banks which persists throughout the remainder of the sample. The third quarter of 2011 corresponds to the beginning of the escalation of the Eurozone crisis, and the time period during which the CIP deviations started to become especially pronounced (Figure 2.) Overall, the timing is consistent with the funding cost advantage leading to increased foreign borrowing by the affected banks.

Conditional on a type fixed effect (i.e. affected or domestic bank), the fraction of foreign funding to total assets evolves relatively similarly for both types of banks for all periods considered, except the third and fourth quarters of 2011 where there is a sizable and significant increase in foreign funding for affected banks. The difference is large: in 2011q3 and 2011q4, foreign funding relative to total assets is approximately 5 percentage points higher for affected banks. Once the shock reverts and the commercial paper matures, the FX ratio reverts towards pre-treatment levels. Overall, Figures **??** and 4 are consistent with CIP deviations leading the affected banks to increase their borrowing in short-term foreign funding.

Table 2 further shows that our results hold more generally, not only during the Eurozone crisis. In particular, once we rerun the model for the entire sample and interact CIP deviation with bank treatment dummy, our results indicate that a 1 percentage point increase in CIP deviations, increases the foreign funding ratio with 4.2 percentage points and the corporate lending ratio with 1.7 percentage points.

Next, we examine what happens to the corporate credit share at the bank-level. In Figure 5, we show the time-varying differences in the share of corporate loans to total assets for both groups of banks.

–Insert Figure 5

There are no significant differences in the corporate credit share between the two groups of banks prior to the shock. After the shock, there is an increase in corporate credit for affected banks. For 2011q4, the difference in corporate credit relative to total assets between the two types of banks is approximately 2 percentage points (statistically significant), while the increase in q3 is not as robust. This is consistent with the relative increase in foreign funding documented in Figure 4, which translated into higher credit supplied to corporations, seemingly with a slight delay. Figure 1 decomposes the effect of the increase in FX funding on corporate lending and assets at central banks, the other primary asset that banks acquired with new borrowing. As we show, there is an uptick in assets at central banks in 2011q4 and 2012q1 which potentially explains why the corporate lending share reverts to zero. Moreover, this uptick in liquid assets highlight that despite a seemingly increased maturity mismatch due to the increase in short-term funding and (more) long-term credit, banks partially insured against increased rollover risk by holding more liquid assets. The extent to which banks insure against increased reliance on short-term funding is important for understanding the normative aspects of our findings. We revisit this issue in Section 6.

A potential challenge to our bank-level analysis is that the difference in corporate credit growth between the two types of banks may be driven by other factors, such as confounding demand shocks. We therefore proceed to investigate whether the observed increase in corporate credit at the bank-level is also present at the loan-level by controlling for time-varying factors affecting credit demand.

5.2 Loan-level analysis

In this section, we explore whether the observed increase in corporate credit is present at the loan-level. Using loan-level data allows us to further substantiate that we are identifying a credit supply expansion by (1) investigating both quantity and price responses and (2) controlling for firm-specific factors. Our baseline loan-level results are given in Table 3.

–Insert Table 3–

Starting with column (1), loan-level credit growth is approximately 3.2 percentage points higher in loans from affected banks compared to other banks. The economic magnitude is relatively large. Specifically, the unconditional mean credit growth is - 6.8 percentage points. In columns (2) and (3), we restrict attention to the sample of firms borrowing from more than one bank, and where at least one of those banks is affected. This represents approximately 10 percentage points of our sample. In column (2), we run our baseline regression *without* firm× year fixed effects, whereas the results from our preferred specification with firm×year fixed effects is given in column (3). The results in column (3) indicate that credit growth within a firm is approximately 6 percentage points higher at affected banks. Again, compared to a mean credit growth of -10.5 percentage points, these results suggest that there is a sizable expansion in credit at the loan-level for firms borrowing from banks responding to CIP deviations compared to other banks.[5]

In Table 4 we repeat the estimation using the change in interest paid relative to outstanding debt as dependent variable. Consistent with a credit supply rather than credit demand shock, there is a significant decline in loan-level interest rates once we control for firm-specific factors in Column (3).

–Insert Table 4–

In sum, the findings suggest that affected banks expand the supply of credit due to CIP deviations by increasing credit volumes at lower rates.

5.3 Firm-level analysis

In the previous sections we showed that the increase in CIP deviations translated into higher FX funding ratios and more corporate lending. Next, we examine the impact of CIP deviations at the firm-level.

It is ex-ante unclear whether the shock will bring about real changes on the firm's asset side, for instance a higher capital growth partly funded by the increase in leverage, or whether firms use lower funding costs to substitute for more expensive sources of external financing or to increase

[5]The relative increase in coefficient estimate from column (2) to (3) is consistent with firms borrowing from affected banks having lower demand for credit compared to other firms in the post-period. The coefficients in column (2) and (3) are, however, not statistically significantly different from each other.

payouts. We therefore start by looking at a wide-range of firm outcomes, comparing firms linked to at least one affected bank with other firms.

–Insert Table 5–

In Table 5, we provide evidence of how treated firms adjust their capital structure in response to the shock. Importantly, we find that firms increase their leverage. While there is a statistically insignificant effect on equity (column 2), firms expand their overall debt (column 3). This finding is important, as it suggests that cheaper loans from affected banks do not merely substitute other forms of credit. The increase in total debt is associated with an increase in bank debt (column 4).

Next, we investigate whether the increase in borrowing has implications for firm production and other related outcomes. The results are reported in Table 6.

–Insert Table 6–

Column (1) shows the results from a regression using log(sales) as a dependent variable. There is a positive and statistically significant effect on sales for treated firms. The magnitudes are large: the estimated impact is 0.81 percentage points, compared to the unconditional mean of 2.7 percentage points.

In order to provide a back-of-the-envelope estimate of the CIP shock on aggregate capital, we aggregate our estimates in Table 6 using lagged sales as weights. Our analysis implicitly relies on two assumptions (see for instance Chodorow-Reich (2014)): there are no general equilibrium effects; and in the absence of the shock, sales would have had a growth rate equal to the average growth rate of control firms. Armed with these assumptions, we can use the average growth in outcomes for the control banks and aggregate across our estimates in Table 6 and 8 excluding the estimated treatment effects to obtain an estimate of the counterfactual sales growth in absence of the CIP shock. The results of our aggregation exercise are shown in Table 7:

–Insert Table 7–

Both in 2011 and 2012, the growth in sales is substantially higher as compared to our aggregated series in the counterfactual case. Specifically, the sales growth is 1% higher in 2011 *due to* the CIP shock and 3% higher in 2012. This suggests that the CIP shock not only translated into a relatively large increase in domestic lending, but also into a substantial increase in firm sales at the aggregate level.

In column (2), we show that there is a positive and statistical effect on the change in wages (0.45 percentage points). In column (3), we show a statistically significant impact on the growth in fixed assets (0.44 percentage points). Fixed assets include PP&E as well as long-term financial assets with maturity over 12 months. The effect is larger than the mean growth in fixed assets. In column (4), we do not find a similar impact on current assets. Therefore, the expansion in credit that comes from increased *short-term* funding at banks translates mostly into *long-term* investment at the firm-level.

Explaining the effect on fixed assets

Next, we exploit the granularity of our firm-level data to examine the type of fixed assets that firms invest in. In our database, fixed assets consist of three sub-components: fixed financial assets, capital and intangible assets. The overall impact of the credit supply expansion on the real economy is likely to depend substantially on whether firms allocate surplus funds to financial investments, whether they invest in intangible assets or direct the funds to more capital growth. In Table 8, we focus on the different components of fixed assets.

–Insert Table 8–

In Column (1), we reproduce Column (6) from Table 6. Columns (2)-(3) report the results from using the different subcategories of fixed assets as outcome variables. In column (2), we show that there is a positive and statistically significant impact on fixed financial assets, with nearly 0.28 percentage points higher growth for affected firms. This comprises of investment in other companies and credit provided to other firms. In contrast, column (3) suggests that there is no significant effect on capital growth.

Given the sizeable effect on fixed financial assets, in Table 9 we further decompose financial assets into equity holdings of other companies and credit (excluding trade credit) granted to other firms. We find that firms significantly expand credit provided to other firms as highlighted by column (3). We refer to this as the "credit reallocation channel" of bank credit shocks. This increase in bonds is associated with an increase in return on assets (column 4). All in all, these results suggest that the increased credit by banks due to CIP deviations induces affected firms to engage in a carry trade where they reallocate funds to other firms in form of credit, earning a spread which materializes in significantly higher profitability.

–Insert Table 9–

Drivers of credit reallocation

Finally, we investigate why firms respond to an increase in credit supply by increasing their credit to other firms, either in the form of loans or bonds. Our proposed explanations center around a channel of precautionary savings. Due to volatile sales growth and undiversified income streams, some firms might be incentivized to acquire bonds for precautionary reasons once financing these bonds become cheaper (Opler, Pinkowitz, Stulz, and Williamson, 1999; Gao, Harford, and Li, 2013; Riddick and Whited, 2009). We use two proxies for capturing such motives, namely firm size and the volatility of sales growth. Firms that are bigger (and likely to have more diversified income streams, e.g. Crouzet and Mehrotra (2020)) and/or have lower sales growth volatility are less likely to have a strong precautionary motive.

Precuationary motives might not be the only reason to invest in bonds. For instance, firms with low investment opportunities, or firms with a lot of exposure to foreign markets, might respond differentially to the CIP-induced credit supply expansion compared to other firms. We therefore consider proxies for these, as well as other important firm characteristics, when exploring whether the increase in bonds is driven by a particular subset of firms.

Table 10 reports the results. Across a wide range of firm characteristics, we find that only the proxies for precautionary motives explain whether firms increase fixed financial assets in response to the CIP-induced credit supply expansion. Specifically, firms that are smaller or have more volatile sales growth, significantly increase their bond holdings compared to other firms borrowing from the same, global bank. For instance, the increase on bond holdings decline by 0.5 percentage points per 1 million NOK increase in assets. Alternatively, firms with a 1 standard deviation lower sales growth volatility have a 2.7 percentage point lower growth in bond holdings.

We take this - combined with the fact that all of the other firm characteristics lack explanatory power - as evidence consistent with precautionary motives being the key driver of the observed increase in fixed financial assets.

–Insert Table 10–

6 Policy implications

Our paper has implications for policy analysis. We have documented how CIP deviations lead to an expansion in short-term foreign funding for banks issuing commercial paper in foreign currencies. Such short-term foreign funding represents high refinancing risk, especially due to the fact that in general, as well as in our setting in particular, short-term funding consists of *unsecured* commercial paper and certificate of deposits. Precisely due to its unsecured nature, this type of funding is likely to dry up in bad times, as it happened in the Great Financial Crisis, and during the European sovereign debt crisis. Norwegian policymakers, too, have expressed their concern regarding the matter:

"This funding comprises short-term paper and deposits from money market funds and large companies. Deposits can be withdrawn quickly and are not considered stable. Short-term money market funding is considered unstable owing to short maturities."(Norges Bank Financial Stability Report, 2018).

Despite CIP deviations being orthogonal to monetary policy, it has implications for monetary authorities. Even though banks partially insure against refinancing risk by increasing deposits at central banks, their private incentives to borrow short-term following positive CIP deviations may lead individual banks to be under-insured. This is because banks do not fully internalize potential fire-sales costs to which their maturity transformation activities will lead (Stein, 2012). In a crisis, the only way for banks to honor their short-term debt would be to sell their long-term assets at fire-sale prices. The potential for such fire sales may give rise to a negative externality. Thus, unregulated banks may engage in excessive short-term borrowing leaving the financial system overly vulnerable to costly crises. However, if banks' short-term liabilities are subject to reserve requirements, the monetary policy can be used as a mechanism: the central bank can contract or inject reserves into the system, effectively changing the amount available for lending. Therefore, policymakers are better off expanding regulation (e.g. reserve requirement, or haircut) on such short-term facilities. This is especially true when there is no other direct impact on the schedule of foreign funding availability, such as pricing which can be altered only for local borrowing.

Thus, the short-term nature of our shock puts it apart from academic and policy discussions on longer-term refinancing. For instance, the 2011 European Central Bank's (ECB) long-term refinancing operations (LTRO) allowed participating banks to get unlimited funding with long-term (three-year) maturity at similar conditions as in case of the short-term borrowing (the same interest rate, pool of eligible securities and haircut policy). At the time of the ECB policy decision, euro area banks were relying on short-term debt and were largely exposed to rollover risk. The rationale of the LTRO policy was to support bank investment by ensuring stable funding for a long horizon and reducing uncertainty about refinancing. While this may imply that short-term financing may not have credit or, more importantly, real implications, we show that it does to a considerable extent, but that it has further implication on credit reallocation not captured by traditional variables in real effects studies. Therefore, a topic of further interest that we encourage others to analyze, is to quantify the total impact, as well as understand whether short-term versus long-term funding shocks work differently for firm-level capital generation as opposed to capital reallocation.[6]

7 Conclusion

In this paper, we take an empirical approach to investigate the impact of a shock to short-term funding in a subset of banks operating in Norway during the European sovereign debt crisis of 2011. During this event, the affected banks could benefit from their access to USD-denominated debt markets due to positive CIP deviations: they could obtain favourable funding terms in USD as compared to other Norwegian banks that only had access to domestic funding. The asymmetric nature of this shock gives us the opportunity to examine how a shock to short-term funding, that is

[6] Along these lines, Berg, Streitz, and Wedow (2020) study the implications of credit shocks differentiating between organic (increase in real economic activity) and inorganic (M&A activity) growth of firms.

unrelated to domestic monetary policy, affects lending behaviour of banks, and the resulting impact on firm-level credit and asset acquisitions. By making use of detailed bank-, loan- and firm-level datasets, we quantify the effects of the shock in the cross-section of firms in the economy. The completeness of our data allows us to control for firm demand by employing a granular set of fixed effects.

We find that firms that borrowed from affected banks benefited from an expansion in credit, that is also less expensive. We show that despite the short-term nature of the shock, the increased funding was used to boost both investments in fixed financial assets, primarily through the purchase of bonds issued by other firms. This credit reallocation channel acted as a source of further profits, in the form of additional interest income. Both of these effects are sizeable in magnitude and important for quantifying the total impact of credit shocks on the aggregate economy.

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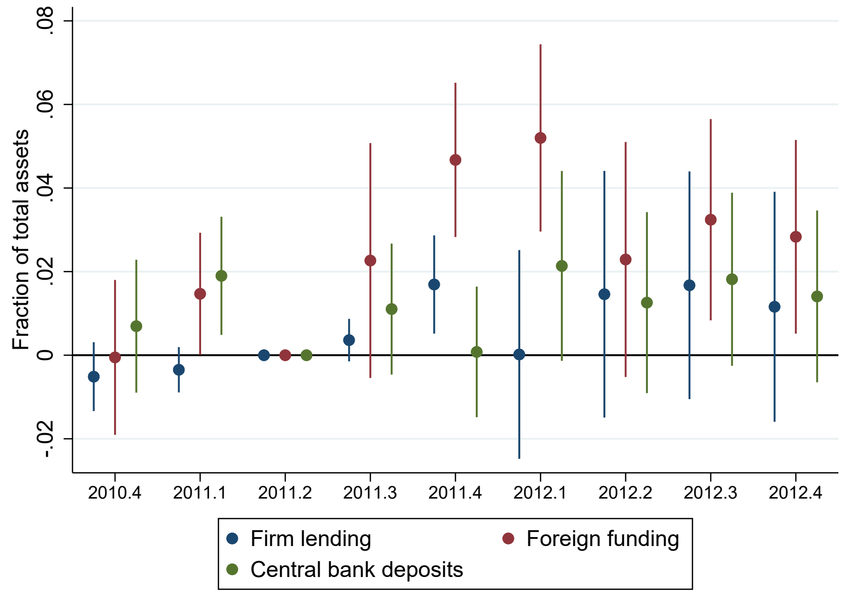
8 Figures and Tables

Figure 1: **Decomposition of the effect of CIP deviations on bank outcomes**

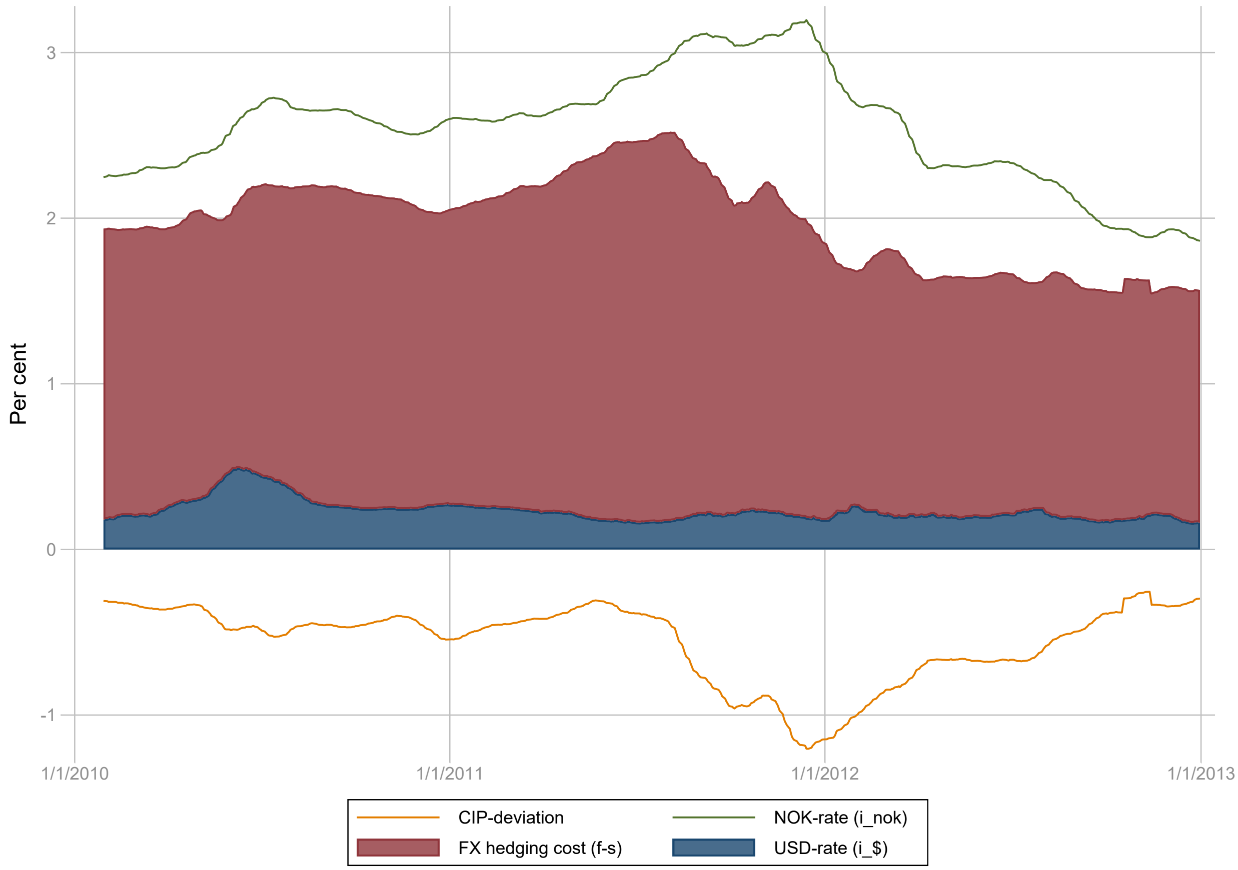


Notes: This figure shows the coefficient estimates from estimating equation 3, using the corporate lending share, foreign funding share and the share of assets at central banks as dependent variables, respectively.

Figure 2: **CIP funding deviations with 3-month maturity between USD and NOK**

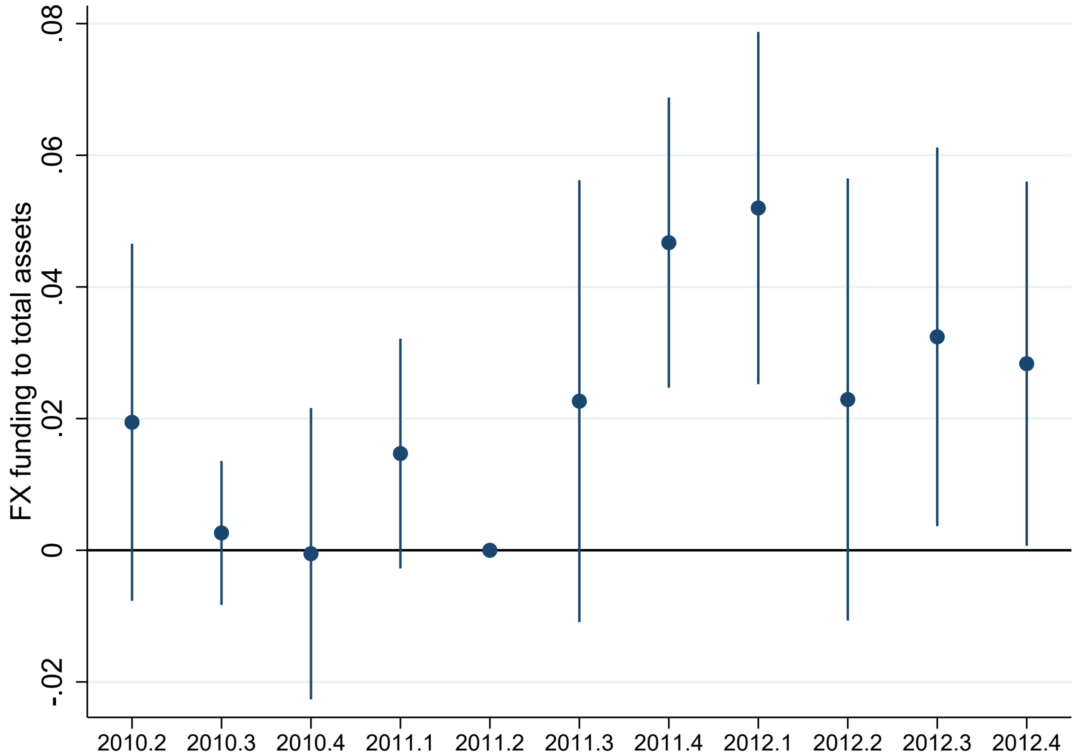
Notes: This figure depicts the CIP funding deviations for banks with access to 3-month unsecured funding in USD. The CIP deviation is defined as 3-month interbank rate in Norway (NIBOR) minus the FX-swap implied rate in NOK from the 3-month CP rate in USD for highly rated banks. A negative value indicates cheaper USD hedged funding as compared to domestic borrowing in NOK. Data source: Bloomberg.

Figure 3: **Decomposing the CIP-deviations**



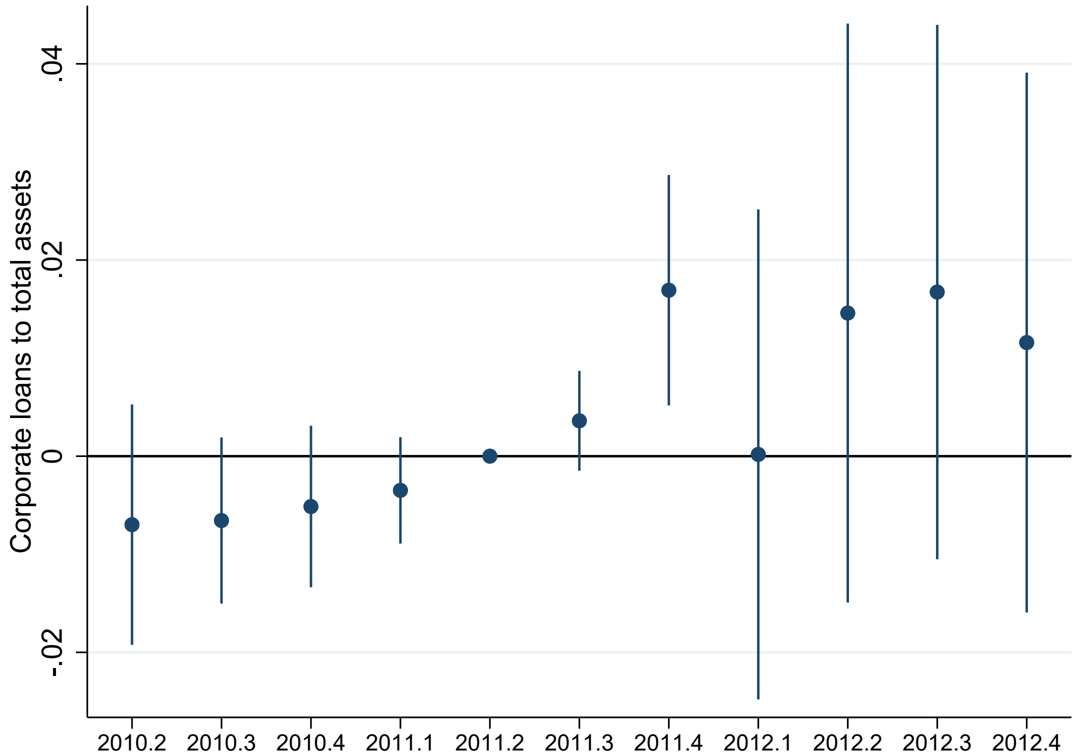
Notes: This figure decomposes the CIP deviation in the NOK/USD foreign exchange cross. It illustrates the development in the various components - the USD-rate, the hedging cost that is equal to the forward premium and the direct NOK-rate. The implicit NOK-rate faced by high-quality Scandinavian banks stems from borrowing in USD and hedging the FX risk, and is the sum of the USD-rate and the forward premium. The difference between the implicit NOK- rate and the direct NOK-rate equals the CIP deviation. The data is calculated as rolling 1-month averages to increase visibility. Sample period is from January 2010 to December 2013. Data source: Bloomberg.

Figure 4: **Relative growth in foreign funding (affected banks)**



Notes: This figure shows the estimated γ_τ from equation (3) using the foreign funding relative to total assets as outcome variable. Dots indicate point estimates and vertical lines are the associated 95% confidence interval. All coefficients are plotted relative to 2011q2.

Figure 5: **Relative growth in corporate lending (affected banks)**



Notes: This figure shows the estimated γ_τ from equation (3) using corporate loans to total assets as dependent variable. Dots indicate point estimates and vertical lines are the associated 95% confidence interval. All coefficients are plotted relative to 2011q2.

Table 1: **Summary statistics, bank-level**

	(1)		(2)		
	Other banks		**affected**		**Difference**
	Mean	Std. dev	Mean	Std. dev	
CIP funding deviation			-0.49	0.38	
Short-term foreign fund ratio			0.19	0.10	
Equity / Assets	0.04	0.02	0.06	0.04	-0.011***
Deposits / Assets	0.62	0.13	0.62	0.22	0.005
Central bank deposits / Assets	0.03	0.08	0.02	0.04	0.01
Corporate loans / Assets	0.21	0.08	0.19	0.11	0.02
Log(Assets)	10.99	1.28	11.77	1.81	-0.78**
Observations	117		23		

Notes: This table report summary statistics at the bank-level. All values based on end of 2010 balance-sheet statement. Summary statistics are computed for banks active in international short-term funding market (column (2)) and other banks (column (1)). *** indicates $p < 0.01$ and ** indicates $p < 0.05$, where p is the p-value on a test of equality across groups.

Table 2: **Panel regression of CIP deviations and bank balance sheet outcomes**

	(1) Foreign funding to total assets	(2) Corporate loans to total assets
$CIP_t \times D_b$	0.042*	0.017**
	(0.007)	(0.008)
N	1470	1522
R-squared	0.942	0.948
Mean of dependent variable	0.0214	0.217
Bank FE	Yes	Yes
Year FE	Yes	Yes

Notes: Sample period runs from 2009q1 to 2012q4. Column (1) considers the foreign funding to total assets as dependent variable. Column (2) considers corporate loans to total assets as dependent variable. Standard errors clustered at the bank-level. * p<0.1, ** p<0.05, ***p<0.01.

Table 3: **Loan-level results**

	(1) Credit growth	(2) Credit growth	(3) Credit growth
D_b×Post	0.0321**	0.0402	0.0605**
	(0.0127)	(0.0282)	(0.0305)
N	162315	15745	15745
R-squared	0.00356	0.0108	0.484
Mean of dependent variable	-0.0687	-0.105	-0.105
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
Firm-Year	No	No	Yes
Sample	All	Multiple banks	Multiple banks

Notes: This table contains the results from estimating equation (4) using loan-level credit growth as outcome variable. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise. Column (1) considers the full sample. Columns (2) and (3) consider only firms borrowing from at least one affected and one internationally non-active bank. Dependent variables are truncated at the 5th and 95th percentile. Standard errors two-way clustered at the bank and firm level.

Table 4: **Loan-level results, interest rates**

	(1)	(2)	(3)
	Δ interest rate	Δ interest rate	Δ interest rate
$D_b \times$Post	0.00184	-0.00802	-0.0146**
	(0.00216)	(0.00615)	(0.00640)
N	143605	12383	12383
R-squared	0.0852	0.0790	0.502
Mean of dependent variable	0.000420	0.00134	0.00134
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
Firm-Year	No	No	Yes
Sample	All	Multiple banks	Multiple banks

Notes: This table contains the results from estimating equation (4) using imputed interest rates as outcome variable. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise. Column (1) considers the full sample. Columns (2) and (3) consider only firms borrowing from at least one affected and one internationally non-active bank. Dependent variables are truncated at the 5th and 95th percentile. Standard errors two-way clustered at the bank and firm level.

Table 5: **Firm-level results**

	(1) $\Delta \log$(Dividends)	(2) $\Delta \log$(Equity)	(3) $\Delta \log$(Total debt)	(4) Growth in bank debt
$\text{Post}_t \times D_b$	0.00481**	0.00588	0.00924*	0.0193**
	(0.00228)	(0.00386)	(0.00512)	(0.00974)
N	126017	126017	126017	126017
Mean of dependent variable	0.0312	0.0576	0.0447	-0.0614
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
R-squared	0.314	0.378	0.273	0.319

Notes: This table contains the results from estimating equation (5) using different firm outcomes as dependent variable across columns. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise. Dependent variables are truncated at the 5th and 95th percentile. Standard errors are two-way clustered at the bank and firm level.

Table 6: **Further firm-level results**

	(1)	(2)	(3)	(4)
	Δ log(Sales)	Δ log(Wages)	Δ log(Fixed Assets)	Δ log(Current Assets)
$\text{Post}_t \times D_b$	0.00808***	0.00456**	0.00440*	-0.00180
	(0.00201)	(0.00184)	(0.00247)	(0.00538)
N	126017	126017	126017	126017
Mean of dependent variable	0.0267	0.0309	0.00327	0.0299
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
R-squared	0.355	0.382	0.356	0.272

Notes: This table contains the results from estimating equation (5) using different firm outcomes as dependent variable across columns. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise. Dependent variables are truncated at the 5th and 95th percentile. Standard errors are two-way clustered at the bank and firm level.

Table 7: **Actual and counterfactual sales**

Year	Actual	Counterfactual
2011	0.1044	0.0927
2012	0.0328	0.0061

Notes: This table contains counterfactual aggregate sales and credit growth. Counterfactual growth measures are computed based on the procedure in section 5.3.

Table 8: **Firm-level results, decomposing the effect on fixed assets**

	(1)	(2)	(3)
	$\Delta\log$(Fixed Assets)	$\Delta\log$(Fixed Financial Assets)	$\Delta\log$(Capital)
$\text{Post}_t \times D_b$	0.00440*	0.00286**	0.000575
	(0.00247)	(0.00112)	(0.00294)
N	126017	126017	126017
Mean of dependent variable	0.00327	0.00544	-0.0204
Firm FE	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes
R-squared	0.356	0.341	0.379

Notes: Fixed assets include financial assets with maturity over 12 months, capital growth and intangibles. Financial assets are investments in other companies and lending to other companies (including bond holdings). Capital growth is PP&E. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise. Dependent variables are truncated at the 5th and 95th percentile. Standard errors two-way clustered at the bank and firm level.

Table 9: **Firm-level results, decomposing the effect on fixed assets**

	(1)	(2)	(3)	(4)
	Δ log(Fixed Financial Assets)	Δ log(Investments)	Δ log(Bonds)	Δ RoA
$\text{Post}_t \times D_b$	0.00286**	0.00488	0.00235**	0.00159*
	(0.00112)	(0.00494)	(0.00116)	(0.000918)
N	126017	126017	126017	126017
Mean of dependent variable	0.00544	0.00837	-0.00934	-0.00195
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
R-squared	0.341	0.285	0.342	0.209

Notes: Investments are defined as the total value of equity holdings in other companies. Post = 1 for 2011, 2012 and 2013, and zero otherwise. Standard errors two-way clustered at the bank and firm level. Dependent variables are truncated at the 5th and 95th percentile.* p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2012). Post = 1 for 2011 and 2012, and zero otherwise.

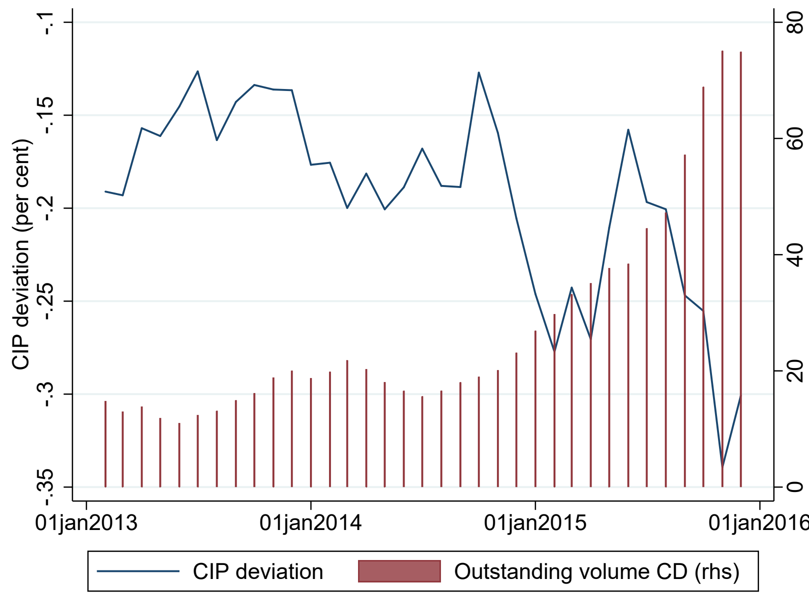
Table 10: **Firm-level credit reallocation I**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)	Δ log(Bonds)
$\text{Post}_t \times D_b$	0.00179*	0.00181*	0.00265	0.00119	0.00557*	0.00144	0.00205*	-0.000705
	(0.00101)	(0.00101)	(0.00186)	(0.00134)	(0.00303)	(0.00103)	(0.00106)	(0.00129)
$\text{Post}_t \times D_b \times$ Asset (mill NOK)$_{f,2010}$		-0.00489**						
		(0.00244)						
$\text{Post}_t \times D_b \times$Equity/Assets$_{f,2010}$			-0.00337					
			(0.00576)					
$\text{Post}_t \times D_b \times$Cash/Assets$_{f,2010}$				0.00283				
				(0.00437)				
$\text{Post}_t \times D_b \times$Top rating$_{f,2010}$					-0.00449			
					(0.00352)			
$\text{Post}_t \times D_b \times$Exporter$_{f,2010}$						0.0115		
						(0.00728)		
$\text{Post}_t \times D_b \times$Profit/Assets$_{f,2010}$							-0.000526	
							(0.000415)	
$\text{Post}_t \times D_b \times$SD(Sales growth)$_{f,2010}$								0.0274***
								(0.00991)
N	126017	120804	120797	126017	120804	120804	114321	126017
Mean of dependent variable	-0.00934	-0.00961	-0.00961	-0.00934	-0.00961	-0.00961	-0.00989	-0.00934
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Post = 1 for 2011, 2012 and 2013, and zero otherwise. * p<0.1, ** p<0.05, ***p<0.01. Mean and standard deviations are taken over the full sample period (2009 - 2013). Dependent variables are truncated at the 5th and 95th percentile. Standard errors two-way clustered at the bank and firm level.

A Additional figures and tables

Figure 6: **CIP funding deviations USD/CAD**



Notes: This figure shows the evolution of CIP funding deviations between USD and CAD (blue line, left axis) and the outstanding volume of USD funding (red bars, right axis). The CIP deviations (blue) are calculated as the difference between the implicit 3-month interest rate in CAD based on USD after hedging the exchange rate risk in the FX swap market and the direct 3-month interest rate on financial commercial paper issued in CAD. Negative numbers imply that it is cheaper to borrow in USD and use the FX swap market to convert the proceeds to CAD than issuing directly in CAD. The commercial paper rate in USD is based on the Federal Reserves financial commercial paper rate for high quality banks, while the corresponding commercial paper rate in CAD is based on data from Bank of Canada for high quality financial issuance in CAD. The outstanding volume of USD denominated Certificates of Deposits (red bars) is based on issuance level data obtained from Bloomberg. Certificates of Deposits are similar to commercial papers, but can only be issued by banks. Data source: Bloomberg.