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What Drives Sectoral Differences in Currency Derivative Usage in a Small Open Economy? Evidence from Supervisory Data

Zuzana Gric, Jan Janků, and Simona Malovaná *

Abstract

Using a sample of nearly 980,000 new derivative transactions from about 1,700 unique institutions, we explore sectoral differences in currency derivatives usage in the Czech financial sector from 2020 to 2022. We find that larger financial institutions, institutions that are part of complex financial groups, and institutions with higher foreign exposure are more likely to engage in currency derivative transactions. Contrary to other studies, we find that financially stable institutions use currency derivatives more frequently, reflecting the long-term stability of the Czech financial system. However, the significance of key characteristics varies across financial segments. Banks are less sensitive to changes in leverage, while liquidity is crucial for investment funds.

Abstrakt

Na vzorku téměř 980 000 derivátových transakcí z přibližně 1 700 různých institucí zkoumáme sektorové rozdíly ve využívání měnových derivátů v českém finančním sektoru od roku 2020 do roku 2022. Zjišťujeme, že pravděpodobnost vstupu do transakcí s měnovými deriváty je vyšší u větších finančních institucí, institucí, které jsou součástí komplexních finančních skupin, a institucí s většími zahraničními expozicemi. Na rozdíl od jiných studií docházíme k závěru, že finančně stabilní instituce používají měnové deriváty častěji, což odráží dlouhodobou stabilitu českého finančního systému. Význam klíčových charakteristik se však v jednotlivých finančních segmentech liší. Banky jsou méně citlivé na změny v zadlužení, zatímco pro investiční fondy je zásadní likvidita.

JEL Codes: F30, G15, G23, G32.
Keywords: Currency derivatives, EMIR, FX derivatives, GLEIF, market-based finance.

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1. Introduction

Different financial institutions can use derivatives for different purposes, from risk hedging or raising additional funding to pure speculation on asset price movements. The underlying motives for entering the derivatives market and making active use of derivatives over time are thus strongly connected to institutions' characteristics and financial positions. As such, understanding the business models and choices these institutions make is critical for monitoring them and making informed policy decisions. In an environment of high uncertainty and volatility in the financial markets, the need to understand such behavior is all the stronger, given that using derivatives can be both an effective tool for managing and mitigating risks and a risk amplifier.

Until recently, the unavailability of detailed data on institutions' OTC derivative transactions made it difficult for researchers to explore this subject comprehensively. A number of empirical studies have used the new database arising from reporting under the European Markets Infrastructure Regulation (EMIR),[1] which was formalized at the EU level in late 2012. The majority of these studies, however, focus on a single, usually large, economy and a single (financial) segment. As such, there is a missing strand of literature exploring the use of derivatives in smaller economies and comparing differences in the behavior of specific financial sectors.

In this paper, we fill that gap and provide evidence on the factors that affect the use of currency derivatives in a small open economy, namely, the Czech Republic. On top of that, we provide a valuable insight into the incentives of various financial sectors (banks, investment funds, insurance companies, pension funds, securities dealers, and other financial intermediaries), showing that their behavior does indeed differ. We work with EMIR trade-state data between October 2020 and December 2022, which provides information about all outstanding transactions as of a given date. We employ a rather unique approach to filtering the data compared to similar studies – for each derivative transaction, we keep the data only on its first occurrence, mimicking trade activity data (the "transaction-flow" approach). Given that 95% of these derivative transactions in the Czech Republic are currency derivatives, our empirical analysis focuses solely on them. Our sample comprises nearly 980,000 new derivative transactions executed by around 1,700 unique institutions, 865 of which are domestic financial institutions. For each of these financial institutions, we use confidential supervisory information on its financial position. This allows us to gain greater insight into institutions' decisions and to get a better understanding of the potential vulnerabilities to financial stability.

We estimate both the extensive and intensive margins, showing which factors influence the probability of a financial institution entering into a derivative transaction and the notional amount (i.e., the face value) of such a transaction. We provide empirical evidence that larger financial institutions, financial institutions that are part of financial groups, and institutions with higher foreign exposure are more likely to use currency derivative transactions. Beyond that, we show that the complexity of the financial group also plays a significant role, with financial institutions that are part of a financial group with more family members being more likely to use derivative transactions. Due to economies of scale, large and more complex institutions and groups can afford to have a risk management program that takes care of derivative transactions (Schiozer and Saito, 2009; Allayannis and Ofek, 2001). All these effects also hold in specifications where we look at individual contract types – forwards, swaps, and options – separately.

[1] Regulation (EU) 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

In the intensive margin estimation, we show that larger, more complex, and more liquid financial institutions are more likely not only to use derivative transactions, but also to use them in greater notional amounts. The overall results remain qualitatively similar when we focus only on intragroup transactions, although the effects are generally weaker. This suggests that the effects originating in the family group account for only part of the intensive margin effects.

In contrast to some recent papers (Bartram et al., 2009; Cici and Palacios, 2015; Fiedor and Killeen, 2021), we show that more stable (less indebted and more liquid) financial institutions are more likely to use currency derivative transactions. The Czech financial system is characterized by long-term financial stability, hence the motive for more vulnerable institutions to hedge themselves against increased risk may play a limited role. Given the low interest rate environment that was characteristic of part of the period analyzed, more stable financial institutions may have been motivated to enter the derivatives market to a greater extent, possibly to achieve a higher return on their available funds.

The significance of key characteristics varies among financial sectors, with some being more critical to certain sectors than others. Banks seem to be less sensitive to changes in their leverage, reflecting their solid capital position and their business model focused on lending to the private non-financial sector. Unlike other studies, we do not observe incentives for less capitalized banks to make extensive use of derivatives for hedging purposes or even to circumvent the regulations. In the case of investment funds, it appears that liquidity plays a prominent role in the use of derivatives. In contrast to other institutions, less liquid investment funds tend to be more likely to use derivatives, reflecting their business model, their generally higher sensitivity to financial distress, and their ability to use derivative transactions as leverage under conditions of low liquidity.

We contribute to the existing literature in multiple ways. First, we expand the research that uses transaction-level data from the EMIR database. Only a limited number of studies have delved into the derivatives market in Europe using this detailed dataset. In its approach and the data used, our work closely aligns with Fiedor and Killeen (2021), who study financial vehicle corporations in Ireland using transaction-level EMIR data, identifying factors such as the size of the financial institution and its inter-institutional relationships that might influence the use of derivatives. Benatti and Napolitano (2019) use the EMIR data to investigate how the demographic and financial characteristics of firms determine their engagement with derivatives markets in Europe. More recently, Jukonis (2022) employs the EMIR data to assess market risk from leveraged derivative exposures, while Ghio et al. (2023) examine derivative margin calls, emphasizing the volatility in money market funds' flows and the liquidity needs of investors.

Second, we enrich the existing body of research on the factors affecting the use of derivatives, encompassing a diverse array of entities, countries, asset classes, and methodologies (as summarized in Table 1). The prevailing belief is that the decision to use derivatives is informed by a cost-benefit analysis, with the benefits of these financial instruments needing to surpass the associated costs to be considered valuable (Nance et al., 1993). While some studies examine broad panels of countries (Bartram et al., 2009; Bartram, 2019; Benatti and Napolitano, 2019; Bias et al., 2021), most focus on individual countries, such as Ireland (Fiedor and Killeen, 2021), Italy (Infante et al., 2020), the USA (Allayannis and Ofek, 2001; Ashraf et al., 2007; Cici and Palacios, 2015; Ghosh, 2017), and Taiwan (Shu and Chen, 2003). Moreover, a majority of the studies target a single type of financial or non-financial institution, for example, financial vehicle corporations (Fiedor and Killeen, 2021), banks (Infante et al., 2020), mutual funds (Cici and Palacios, 2015), and non-financial corporations

(Bartram et al., 2009). Unlike the prior research, our findings offer broad conclusions relevant to all financial institutions and also underscore the distinct characteristics of each institution type.

Table 1: Selected Papers on Determinants of Derivative Transactions

Publication	Region	Sector	Underlying asset class
Fiedor and Killeen (2021)	IE	FVCs	CO, CR, CU, EQ, IR, OT
Bias et al. (2021)	EU	UCITS funds	CO, CR, CU, EQ, IR, OT
Infante et al. (2020)	IT	Banks	CO, CR, CU, EQ, IR
Bartram (2019)	47 countries	NFCs	CO, CR, CU, EQ, IR
Benatti and Napolitano (2019)	EA	NFCs	CO, CR, CU, EQ, IR
Ghosh (2017)	USA	Banks	CU, IR
Cici and Palacios (2015)	USA	Mutual funds	EQ options
Rossi (2013)	BR	NFCs (publicly traded)	CU
Bartram et al. (2009)	50 countries	NFCs	CO, CU, EQ
Schiozer and Saito (2009)	AR, BR, CL, MX	NFSs	CU
Ashraf et al. (2007)	USA	Banks	CR
Shu and Chen (2003)	TW	NFCs (publicly traded)	CO, CU, IR
Allayannis and Ofek (2001)	USA	NFCs (from S&P 500)	CU

Note: Underlying asset class of derivatives used in the primary study analysis: CO – commodity, CR – credit, CU – currency, EQ – equity, IR – interest rate, OT – other.

Third, we contribute to the literature on derivatives markets in small open economies, where the market is composed predominantly of currency derivatives. This distinguishes our work from many existing studies. Among those which are loosely related, Bartram et al. (2009) analyze derivative transactions in a panel of 50 countries, including some with less developed financial markets, focusing on the derivative activity of non-financial corporations. They suggest that non-financial firms with higher leverage, shorter debt maturity, lower interest coverage, and reduced liquidity are more inclined to use derivatives for financial risk management. In a similar vein, Shu and Chen (2003) explore derivatives usage among firms listed on the Taiwan Stock Exchange and pinpoint firm size, the long-term debt ratio, industry, and the export ratio as key determinants. This supports the "capability-willingness hypothesis" that larger firms – particularly those with elevated financial risk in their debt structures – are more inclined to use derivatives. As for currency derivatives, the literature attests to their capacity to boost risk-adjusted profits (Ghosh, 2017). Such derivatives often serve firms that have restricted financing avenues (Géczy et al., 1997) and are even employed by non-international firms (lacking foreign exchange exposure) for both hedging and speculative purposes (Bartram, 2019).

2. Data and Hypotheses

As of 2022, the Czech financial sector accounted for about 166% of GDP and was primarily bank-based, with banks making up almost 80% of its total assets. Investment funds came in second with less than 8%, followed by insurance companies and pension funds with around 5% each. Although the Czech non-banking sector is relatively small compared to large financial centers, it has seen rapid growth in recent years. For example, domestic investment funds have expanded by 400% over the last ten years, one of the fastest rates of growth in the EU.[2] Insurance companies and pension funds have grown at a lower but steady rate.

[2] The comparison is based on data from the European Central Bank.

Uncovering the factors that drive the use of derivative transactions by financial institutions is a crucial step in understanding the financial market. To shed light on this issue, we gather information on derivative transactions as well as financial data on Czech financial institutions reporting to the Czech National Bank (CNB). This includes institutions from all financial sectors and both institutions that engage in derivative transactions and those that do not. We combine the two datasets using the Legal Entity Identifier (LEI) to create institution-level panel data on a monthly basis. Next, we describe the data in more detail and formulate testable hypotheses.

2.1 Derivative Transactions

We collect end-of-the-week trade-state data on the derivative transactions entered into by Czech financial institutions between October 2020 and December 2022[3] and recorded in trade repositories under the European Market Infrastructure Regulation (EMIR). The Czech derivatives market is dominated by currency transactions (accounting for 95% of the total), with interest rate derivatives (3%) and other asset-class derivatives being in the minority (see Table A2 in the appendix). Henceforth, our study centers solely on *currency* derivative transactions in which domestic (Czech) financial institutions form at least one of the counterparties to the contract.

To make the data suitable for analysis, we perform several adjustments. First, the data undergo a thorough cleaning process in accordance with the criteria outlined in Abad et al. (2016) (for more information, please refer to Appendix A). Second, to ensure that our analysis reflects current activity and avoids duplicates even though we use weekly trade-state snapshots of outstanding transactions, we apply specific filtration – we only focus on *new* transactions. This means that we only consider the first record of each transaction in the consecutive end-of-the-week state reports (STA).[4] Finally, we aggregate the data across institutions, so that the resulting data set contains information about the monthly number of currency transactions, the sum of the notional, the average maturity, and so on. These statistics are then mapped to our second data set, the panel data of Czech financial institutions and their balance sheet characteristics.[5]

By using and filtering consecutive trade-state reports, we attempt to mimic the structure of the trade activity data. We argue that trade-state reports are less erroneous than the most granular trade activity data and that their use is more established due to existing guidelines on how to clean it (Abad et al., 2016). We are aware of the limitations arising from the use of data of lower granularity. For example, we are not able to analyze speculative vs. hedging motives of domestic firms when using derivatives, a topic which has been addressed by other authors (De Oliveira and Novaes, 2007; Rossi, 2013; Bartram, 2019).

[3] Unfortunately, due to the large quantity of data and associated storage requirements, we are unable to provide a wider analysis of the historical data. The CNB only keeps about six months' worth of data available on a rolling basis and we initiated the data gathering in March 2021.

[4] Filtering the data based on action type, which provides information about the status of each transaction – whether it is *new*, modified, canceled, etc. – is not feasible when one is working with multiple data snapshots. To ensure consistency, residual intraday and intraweek transactions which were both entered into and cleared within a single day or a single week are not included in our sample. This is because the raw data contains Friday (end-of-the-week) intraday transactions as well as Friday intraweek transactions, for example, those that are entered into within a week and cleared on Friday the same week. Intraday and intraweek transactions for other days of the week are not part of the end-of-the-week snapshot.

[5] Fiedor and Killeen (2021) employed a similar strategy but used lower-frequency (quarterly) data and concentrated on only one type of financial institution. Benatti and Napolitano (2019) and Bias et al. (2021) opted for a different procedure and mapped the aggregated balance sheet data to the derivatives' transaction data rather than the other way around.

Table 2 shows an overview of the derivative transactions and financial institutions that are part of the analysis. We divided the financial institutions into five categories: banks (including credit unions and excluding foreign branches), insurance companies and pension funds, investment funds, securities dealers, and other financial institutions (such as payment companies and other financial intermediaries). Domestic financial institutions may enter into derivative transactions with other domestic financial institutions, domestic non-financial firms, or foreign financial or non-financial entities. Our dataset comprises 865 domestic financial institutions, with nearly three-quarters being investment funds. Out of the banks, insurance companies, and pension funds, more than half actively use derivatives. These institutions are also more likely to belong to a larger financial group, with 52% of banks and 63% of insurance companies and pension funds being members of one. Investment funds and securities dealers lag behind in terms of the share of institutions using derivatives, each at around 29%. As for the derivatives data, we work with more than 978,000 individual new transactions (about 36,200 per month). Banks lead in terms of both the number and the notional amount of these transactions, with 53% and 63% of the total, respectively.

Table 2: Currency Derivative Transactions of Czech Financial Institutions

	Total	Banks	IC&PF	IF	Dealers	Other
Financial institutions						
Total number	865	33	99	623	41	69
of which (share in %):						
Has LEI	81.5	87.9	82.8	83.3	65.9	69.6
Derivative users	39.4	69.7	47.5	39.0	26.8	24.6
With direct parent	34.3	51.5	62.6	28.9	29.3	37.7
Currency derivatives						
Total number	978,154	524,509	7,558	26,198	406,761	13,128
Monthly average	36,228	19,426	280	970	15,065	486
of which (share in %):						
Intragroup transactions	16.2	29.7	4.7	0.3	0.6	0.5
Currency forwards	34.7	46.4	37.7	47.8	16.7	94.8
Currency swaps	50.6	26.2	62.3	51.9	83.2	5.2
Currency options	14.6	27.1	0.0	0.0	0.1	0.0
Total notional amount (CZK bn)	95,049	70,051	2,116	8,891	8,263	5,728
Monthly average (CZK bn)	3,520	2,595	78	329	306	212
of which (share in %):						
Intragroup transactions	31.9	57.9	1.3	0.1	6.2	1.9
Currency forwards	35.3	30.9	25.8	32.9	33.0	99.9
Currency swaps	58.8	61.4	74.2	66.0	66.2	0.1
Currency options	5.5	7.5	0.0	0.1	0.0	0.0

Note: The table shows the number of domestic financial institutions employed in the analysis and the number and notional of the currency derivative transactions, including the distribution of these statistics by different characteristics. Intragroup transactions are derivative transactions that took place within a financial group (where the parent and subsidiary are identified). The data are from October 2020 to December 2022.

Although the share of derivative users in the total number of financial institutions may seem low, in terms of total assets it represents the majority of the market (see Table A4 in the appendix). This implies that it is mainly larger and more systemically important financial institutions that engage in derivative transactions. Banks using derivatives account for a staggering 80% of all bank assets. This trend continues with other balance sheet items, such as liquid assets, financial assets, foreign assets, and debt, where the proportion of banks using derivatives is either comparable to or

surpasses the proportion based on total assets. Additionally, insurance companies, pension funds, and investment funds using derivatives hold a significant share of their market as well, with roughly half of the sector's total assets.

The majority of derivative transactions occur between banks and non-financial firms, as depicted in Table 3 (Panel A). This makes sense in the context of the Czech Republic being a small open economy, where firms often turn to derivatives to mitigate currency movements and banks provide this service. Due to the Czech economy's strong ties with the Eurozone, to which the majority of Czech exports are directed, CZK/EUR currency derivatives are dominant. The CZK/USD currency pair comes second, since many globally traded commodities are denominated in dollars (see Figure A3 in the appendix).[6] To balance out the risk exposure, banks typically engage in offsetting derivative transactions with other customers. However, when it comes to the overall notional amount, banks' exposure to non-financial firms is lower than their exposure to domestic financial institutions and foreign entities (both financial and non-financial firms), as shown in Table 3 (Panel B). Beyond providing risk management services to clients, banks and non-bank financial institutions also employ derivatives to manage the risks in their own trading activities, as well as in their more traditional borrowing and lending activities.

Table 3: Currency Derivative Transactions by Counterparty Sector

(A) Number of currency derivative transactions and counterparties (in parentheses)

	Total	Banks	IC & PF	IF	Dealers	Other
Czech financial institutions	90,901 (328)	52,473 (23)	6,792 (44)	22,649 (236)	7,771 (10)	1,216 (15)
Banks	51,368 (322)	13,088 (20)	6,792 (44)	22,613 (233)	7,661 (10)	1,214 (15)
IC & PF	6,792 (5)	6,792 (5)	0 (0)	0 (0)	0 (0)	0 (0)
IF	23,015 (10)	22,973 (7)	0 (0)	0 (0)	42 (3)	0 (0)
SD	7,699 (13)	7661 (8)	0 (0)	36 (4)	0 (0)	2 (1)
Other	2,027 (9)	1,959 (7)	0 (0)	0 (0)	68 (2)	0 (0)
Czech non-financial firms	327,995 (16)	313,320 (10)	0 (0)	0 (0)	14,675 (6)	0 (0)
Foreign firms	219,171 (149)	194,627 (16)	1,198 (13)	5,088 (104)	5,942 (8)	12,316 (8)

(B) Notional amount (in CZK bn)

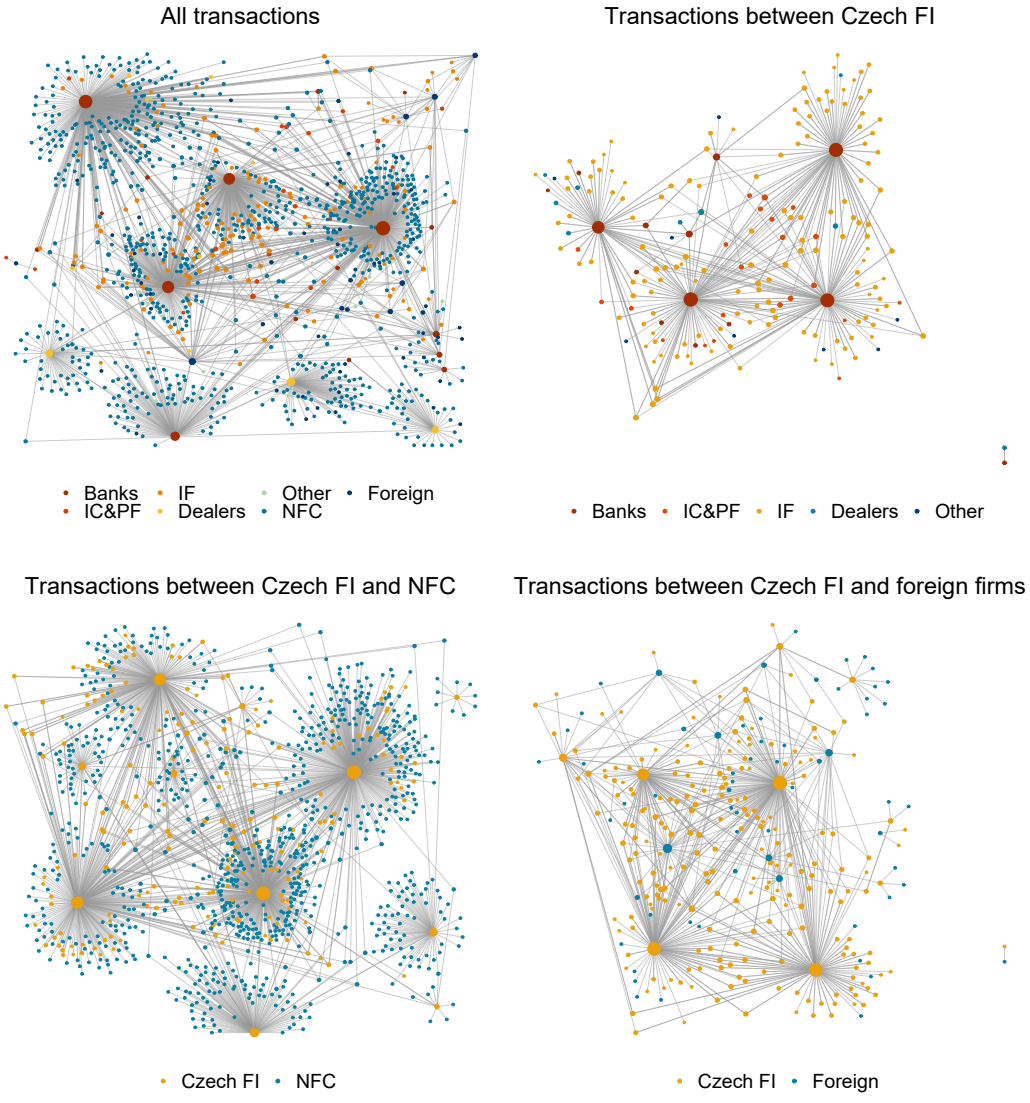
	Total	Banks	IC & PF	IF	Dealers	Other
Czech financial institutions	32,707	20,703	2,063	8,193	1,623	124
Banks	20,683	8,870	2,063	8,194	1,432	124
IC & PF	2,063	2,063	0	0	0	0
IF	8,200	8,200	0	0	0	0
SD	1,432	1,432	0	0	0	0
Other	329	138	0	0	191	0
Czech non-financial firms	14,521	12,219	0	0	2,303	0
Foreign firms	62,807	50,651	205	2,198	4,029	5,723

Note: The tables should be read row-wise. For instance, Czech non-financial firms engage in 327,995 derivative transactions provided by 16 financial institutions, of which 10 are banks and 6 are securities dealers.

[6] The high openness of the Czech economy is shown by its trade share (exports + imports). As of 2022, the trade share of Czech Republic was 143% of GDP, one of the highest in the European Union. Around 88% of Czech exports go to other EU member states; of this, 32% is exported to the Czech Republic's largest trading partner, Germany. At the firm level, in 2019, 75.7% of Czech medium-sized firms were exporting, which is the highest share in the CEE region (WorldBank, 2019)

Figure 1 shows how interconnected the derivatives market is. Each node represents a financial institution or non-financial firm, with the size of the node proportional to the number of transactions each institution engages in. The figure is divided into four parts, each highlighting a different segment of the derivatives market. The network shows that the derivatives market is dominated by a small group of key players: five banks and three securities dealers. Various measures of network centrality, such as degree, betweenness, and page rank, give similar information, identifying five to six important players in the network (see Figure A2 in the appendix). These financial institutions all offer their services to non-financial firms to some degree (bottom left panel) and some of them also engage in derivatives with foreign entities (bottom right panel).

Figure 1: Networks of New Currency Derivative Transactions – Number of Transactions

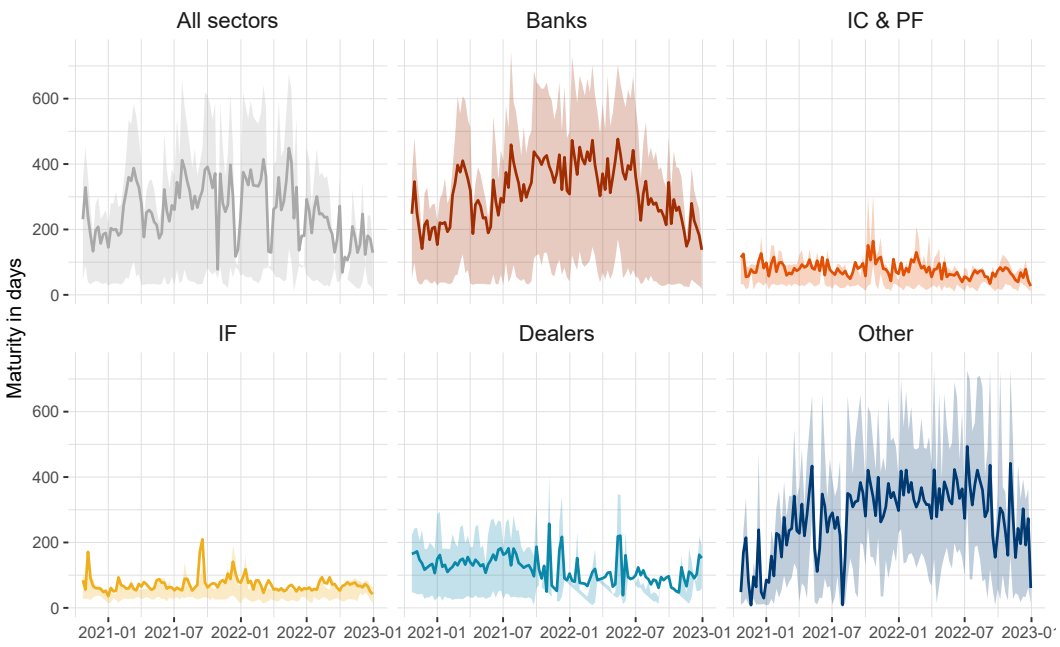


Note: The size of the nodes is proportional to the number of adjacent edges (number of transactions). NFC stands for non-financial corporations, Czech FI for Czech financial institutions, and foreign for foreign entities. Due to the large amount of relationship nodes in the overall dataset, we created the networks with a subset of one month – December 2021. The network graphs for the other months are similar.

When it comes to transactions solely between domestic financial institutions, they are primarily linked to four key banks. If we adjust the size of the nodes to reflect the gross notional amount instead of the number of transactions, the number of key players increases and their relative dominance shifts slightly (as shown in Figure A1 in the appendix). Additionally, a few key foreign entities become more prominent, showcasing the substantial notional amount of derivatives between banks and foreign entities depicted in Table 3. Some of these foreign counterparties are the parent companies of the domestic financial institutions.

Figure 2 displays the maturity (in days) of currency derivative transactions for different types of financial institutions, while Figure 3 shows the frequency distribution of derivative transactions for these institutions. Banks engage in derivatives that have the longest maturities but lower notionals. Conversely, investment funds typically deal with very short maturities and high notionals. This suggests that banks might lean toward providing long-term hedging (e.g., for non-financial companies), while investment funds could be motivated by both hedging and speculative motives, as evidenced by high notional volumes traded with short maturities. The trading strategies of investment funds with derivatives appear to be riskier for financial stability. Short-maturity derivatives can cause rapid market turnovers, leading to potential liquidity issues if many participants exit at once.[7] High notional values, when combined with leverage, can result in substantial losses from minor market moves. The frequent renewal requirements of short-term positions introduce roll-over risks, potentially leading to forced trades or defaults.

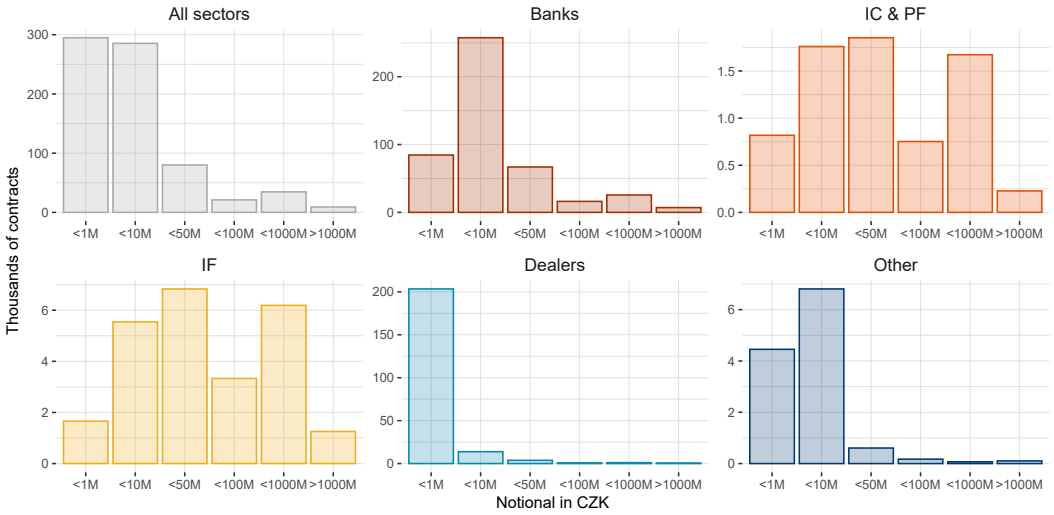
Figure 2: Average Maturity Across Sectors



Note: Solid lines represent the average maturity through the individual data snapshots and the shaded area depicts the corresponding interval between the 0.25 and 0.75 quantiles. The first panel shows all the derivative transactions where at least one of the counterparties is a Czech financial firm. The other panels only include derivatives where at least one of the counterparties is represented by the given (Czech) financial sector.

[7] Similarly, in the case of debt maturities, the liquidity risk effect of short maturity on leverage is significantly negative (Johnson, 2003), which is consistent with the models by Diamond (1991, 1993).

Figure 3: Frequency Distribution of Notional Across Sectors



Figures A4 and A5 in the appendix provide an expanded description of the Czech derivatives market. Figure A4 illustrates the dynamics of the average notional across sectors, while Figure A5 portrays the dynamics of the average number of contracts across institutions. Figure A4 reveals that in terms of notional values, investment funds, insurance companies, pension funds, and – for a brief period in 2021 – securities dealers, dominate the market. However, when examining the average number of transactions across the financial sector, Figure A5 indicates that the average Czech bank engages in approximately 300 transactions per month, in contrast to the average investment fund, which undertakes just three transactions per month. This is consistent with the observation that Czech banks frequently arrange derivative transactions, albeit with smaller notional values, particularly for non-financial corporations. As for investment funds, their use of derivative transactions is more restrained. In fact, 61% of these funds do not engage in such transactions at all, which reduces the overall average for the sector. Notably, securities dealers typically engage in a minimal number of currency derivative transactions for the majority of the period under consideration, though there are specific intervals marked by a significant surge in their transaction volumes.

2.2 Firm-level Determinants of Derivative Transactions, and Hypotheses

We gather balance sheet data on all 865 Czech financial institutions from the CNB's supervisory database. To match the derivative transactions data set, we concentrate on the period between October 2020 and December 2022 and align all the variables to monthly frequency.[8] Our data sources allow us to delve into various characteristics of financial institutions, including their size, leverage, liquidity, profitability, and foreign exposure. We use metrics such as the logarithm of total assets, the debt-to-asset ratio, return on assets (ROA), return on equity (ROE),[9] and the ratio of foreign assets to total assets. Additionally, we collect each firm's legal entity identifier (LEI), if available, and use it to map information on their organizational structure employing relationship

[8] Our data are of various frequencies, including monthly data for banks and pension funds, and quarterly data for the rest of the financial system. Before the analysis, we interpolate all the data to a monthly basis and annualize the profit and loss statement data.

[9] Additionally, as an alternative measure of profitability, we consider the inverse of the interest coverage ratio (the annualized return after taxes divided by interest expenses).

records from GLEIF.[10] This database provides information on the ownership relations between individual LEIs. Specifically, legal entities that have an LEI report their "direct accounting consolidating parent" as well as their "ultimate accounting consolidating parent."

We provide a comprehensive list of all firm-level variables and their construction in Table A3 and summary statistics in Table A5 in the appendix. Below, we outline our expectations for the relationship between each variable and derivative transactions and formulate testable hypotheses.[11]

Hypothesis 1. Larger financial institutions, financial institutions that are part of complex financial groups, and institutions with higher foreign exposure are more likely to use currency derivative transactions.

The existing literature largely agrees that the size of a financial or non-financial institution is one of the most critical determinants of whether it uses derivatives (Fiedor and Killeen, 2021; Infante et al., 2020; Minton et al., 2009; Ashraf et al., 2007). Beyond that, some studies have found that the complexity of the financial group also plays a significant role. For example, Fiedor and Killeen (2021) show that special purpose vehicles in Ireland that are active on international capital markets or sponsored by banks and non-bank financial institutions are more likely to use derivatives. Infante et al. (2020) then find that for Italian banks, being a part of a banking group positively affects banks' use of derivatives. Hau et al. (2021) show that transaction costs systematically vary with measures of client sophistication. Less sophisticated clients experience additional costs when trading with their counterparties, leading to a reduced frequency of using derivative contracts. Similarly, Duffie et al. (2005) state that less sophisticated clients with worse access to alternative dealers and weaker bargaining power pay higher prices for the same contract. Due to economies of scale, large and more complex institutions and groups can afford to have a risk management program that takes care of derivative transactions (Schiozer and Saito, 2009; Allayannis and Ofek, 2001).

To test this hypothesis in the Czech financial system, we examine several key variables. Along with a variable for the institution's size, we use a binary variable $HasDP_{i,t}$ which equals one if the financial institution is part of a larger group, i.e., has a direct parent company. Next, we define a variable $FamilyCount_{i,t}$ to account for the complexity of such financial groups. This variable is calculated as the logarithm of the number of institutions in the family plus one. On top of economies of scale, larger financial groups may be more likely to use derivatives simply because they engage in intragroup derivative transactions. Finally, we explore the impact of an institution's foreign exposure by studying the relationship between derivative use and the institution's share of foreign assets in total assets.

Hypothesis 2. In generally stable financial systems, institutions that exhibit financial stability (are less vulnerable) are more likely to engage in currency derivative transactions.

The literature often mentions that financially vulnerable companies may engage in derivative transactions to a greater extent as a means of mitigating risk exposure, i.e., hedging their high-risk

[10] `https://www.gleif.org`. In the case of investment funds, we use the LEIs of their managing companies to map the relationship data.

[11] We also considered the use of macro-control determinants for derivative transactions, including short-term (3M) interbank interest rates, interest rate spreads, interest rate differentials (CZK x EUR), exchange rate deviations, and various measures of uncertainty, including the VSTOXX index, the attention index using Google Trends data, and confidence indices. However, they proved to be statistically insignificant. This might be due to our focus on a relatively short time frame, while these macro-variables tend to capture long-term trends in derivative transactions. Nevertheless, in our model, we account for the heterogeneity in derivatives over time using monthly fixed effects.

exposures (Bartram et al., 2009; Cici and Palacios, 2015; Fiedor and Killeen, 2021). However, the long-term stability of the Czech financial system suggests that this motive may play a somewhat minor role.[12] Rather, we expect more stable financial institutions to be more likely to participate in the derivatives market with the intention of enhancing returns on available funds. This hypothesis is further substantiated by the observed growth of financial markets and the low interest rate environment prevalent during a significant portion of the period analyzed. Speculation on an increase/decrease in the value of the currency may thus outweigh the motive of hedging against exchange rate risk, especially in the case of (non-bank) financial institutions with larger trading portfolios.

Concerning specific institutional characteristics, we expect financial institutions with lower leverage and profitability and higher liquidity to be more likely to use derivatives. Less indebted and more liquid institutions will have more funds they can decide to use in derivative transactions, for example, to speculate on currency movements. In line with this reasoning, less profitable institutions will be more likely to enter the derivatives market to generate an additional return.

Our hypothesis contradicts the prevailing view in the literature, which highlights the relationship between financial vulnerability and higher usage of derivatives. Previous studies, such as Fiedor and Killeen (2021), Thornton and Di Tommaso (2018), and Minton et al. (2009), have found that financial institutions with higher levels of debt (or lower levels of equity) are more likely to use derivatives. Additionally, Benatti and Napolitano (2019) found that non-financial firms that use derivatives are financially stable but less liquid than firms that do not. Fiedor and Killeen (2021) then indeed argue that the relationship between an institution's profitability and derivative use should be negative. Nevertheless, for a different reason, less profitable institutions are expected to face financial distress and thus manage their risk and cash flow volatility through derivatives. However, in the context of a stable financial system such as the Czech one, these relationships cannot be expected to be significant, as we mentioned above. This, of course, does not mean that the identified relationships do not exist in other countries and other financial systems, where there may be a higher percentage of vulnerable institutions.

Hypothesis 3. The influence of the aforementioned factors on the use of derivative transactions varies among different types of financial institutions.

The existing literature often focuses solely on a single type of financial institution, without comparing multiple types of institutions (Fiedor and Killeen, 2021; Infante et al., 2020; Cici and Palacios, 2015). However, the determinants of derivative transaction usage are likely to vary across financial institutions due to differences in business models and regulation. Banks may focus mainly on managing derivative transactions for non-financial corporations, whereas investment funds may use currency derivatives for speculation. Furthermore, financial institutions that are subject to stricter regulation may turn to derivatives to protect their credit risk exposures and reduce the related capital requirements (Aldasoro and Barth, 2017). Meanwhile, institutions dealing with highly volatile assets may require more hedging, while those with less risky investments may have a greater inclination to enter the derivatives market for a higher return.

[12] The Czech financial sector has shown sufficient stability for several years, even in international comparison. Banks – the basis of the financial system – are sound, well-capitalized, and profitable over the long term. The capital position of the banking sector remains robust, thanks in part to capital buffers and capital surpluses in excess of the regulatory requirements (CNB, 2022).

3. Determinants of Currency Derivatives

We now turn to estimating the impact of various factors on financial institutions' choice of whether to use derivatives. Considering first the extensive margin, we find that institutions' size, family structure, leverage, liquidity, and profitability significantly affect the probability of using derivatives. Additionally, we show that the role of the individual factors differs markedly between financial segments. In terms of intensive margin effects, we find that some of these factors influence the average notional amount of derivative transactions as well.

3.1 Extensive Margin: Probability of Using Currency Derivatives

We estimate the extensive margin effects of the selected factors according to the probit model in equation (1). That is, we estimate the impact of institution-level characteristics on the probability of using currency derivatives on a sample of all Czech financial institutions.

$$Pr(Entered\ into\ currency\ derivative\ transaction_{i,t} = 1)_{i,t} = \Phi(\alpha + X_{i,t-1} + \delta_t + \gamma_s + \varepsilon_{i,t}) \quad (1)$$

The dependent variable $Entered\ into\ currency\ derivative\ transaction_{i,t}$ is a binary indicator variable equal to one if financial institution i uses currency derivative transactions in month t. Monthly fixed effects are captured by δ_t. In addition, we use fixed effects for the different financial sectors (banks, insurance and pension funds, investment funds, and other financial institutions) γ_s in the regressions with all financial sectors. $X_{i,t-1}$ represents a vector of institution-level characteristics.

Table 4 reports the regression results. The first two columns store the baseline results with four primary characteristics: size, debt-to-asset ratio, liquidity ratio, and a dummy variable *Has DP*, which indicates whether a financial institution has a direct parent company. The two columns differ in terms of time fixed effects. The next two columns (3) and (4) examine the impact of additional institution-level characteristics, such as profitability and the density of the organizational structure in which the institution operates.

The observed patterns align with the existing literature, showing that larger, more complex, and internationally active institutions are more likely to use derivatives (*Hypothesis 1*). Quantitatively, a 1% increase in total assets translates to a 8.2% higher probability of using currency derivatives, while financial institutions with a direct parent abroad have a 14.7% higher likelihood of using currency derivatives. We further investigate the role of the organizational structure in which the company operates by replacing variable *Has DP* with variable *Family count*, representing the number of institutions in the family (column 4). The results show that the density of the family structure matters for the institution's participation in the derivatives market. That is, a 1% increase in the number of family members increases the likelihood of the firm using derivatives by 2.6%. According to some studies, large companies can afford to have a risk management program that handles derivative transactions due to economies of scale. Moreover, if a firm is part of a group, the probability of it using a derivative transaction may increase simply because some derivative transactions occur within the group. We test this hypothesis in the following subsection, examining the intensive margin effects for intragroup transactions.

Next, our results show that more stable financial institutions with higher liquidity are more likely to participate in the derivatives market, suggesting that they have more room to maneuver to engage in derivatives trades (*Hypothesis 2*). Specifically, a 1 percentage point (pp) increase in the liquidity ratio means that financial institutions are about 30% more likely to use currency derivatives. The effect of leverage is also found to be substantial, indicating that a 1 pp decrease in

leverage increases the likelihood of executing a currency derivative transaction in the given month by about 33%. Next, we observe that higher profitability reduces the likelihood that the institution will engage in derivative transactions. In quantitative terms, a 1 pp increase in profitability leads to a 7% lower probability of using currency derivatives.[13] This result supports our initial intuition that less profitable institutions will have a stronger incentive to participate in the derivatives market to generate a higher return (in exchange for higher risk), speculating on currency movements. This interpretation is plausible considering the generally high stability and low vulnerability of the Czech financial system. In a more vulnerable financial system, institutions with low profitability may be motivated to use derivatives to hedge the volatility of their cash flows, i.e., to prevent potential financial distress (Fiedor and Killeen, 2021). We support our findings in an alternative specification where we look only at specific contract types – currency forwards, swaps, and options. The results are qualitatively and quantitatively similar (see Table B1 in the appendix). Due to a lower number of observations with the dependent variable equal to 1 for some derivative types, some coefficients lose statistical significance, although the direction of the effect remains the same.

Table 4: Average Marginal Effects – All Financial Institutions

Dependent variable: Pr(Entered into currency derivative transaction = 1)				
	(1)	(2)	(3)	(4)
$Size_{t-1}$	0.082***	0.082***	0.097***	0.082***
	(0.002)	(0.002)	(0.002)	(0.002)
$Debt\text{-}to\text{-}assets_{t-1}$	-0.329***	-0.329***	-0.271***	-0.319***
	(0.013)	(0.013)	(0.019)	(0.014)
$Liquidity_{t-1}$	0.303***	0.304***	0.253***	0.302***
	(0.016)	(0.016)	(0.024)	(0.016)
Has DP	0.147***	0.147***	0.033***	
	(0.006)	(0.006)	(0.009)	
$Profitability_{t-1}$			-0.070***	
			(0.007)	
$Family\ Count_{t-1}$				0.026***
				(0.001)
Observations	20,055	20,055	11,046	20,055
Y = 1	5,961	5,961	4,566	5,961
Log-likelihood	-9,796	-9,786	-5,992	-9,942
AIC	19,609	19,643	12,055	19,954
Group FE	Y	Y	Y	Y
Time FE	N	Y	Y	Y

Note: The table reports the average marginal effects of the probit model regression. "Y = 1" indicates the number of observations with the dependent variable equal to 1. Standard errors are reported in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

As a next step, we distinguish between different sectors of the Czech financial system: banks, insurance and pension companies, investment funds, securities dealers, and other financial institutions (*Hypothesis 3*). We estimate the baseline model extended for two variables, profitability and the ratio of foreign exposures to total assets. The second variable can only be used in the regression for banks and retail investment funds[14] due to data availability. We show the complete results in Table 5.

[13] We used other proxy variables for profitability, such as the inverse of the interest coverage ratio (calculated as the ratio of returns after tax to interest expense). The results remain qualitatively similar.

[14] Retail funds as established under Czech law in Part Seven of Act No. 240/2013 Coll., on Management Companies and Investment Funds.

The impact of firm size and profitability is generally consistent across financial sectors. We continue to observe that larger, less leveraged, and less profitable institutions are more likely to use derivatives. Nevertheless, these two factors are more important for some sectors than for others. For instance, size is not as strong a determinant of derivative use for investment funds, particularly retail investment funds, as it is for banks. This may be due to the relatively similar sizes of investment funds. While some banks differ by a factor of 10×10^5 in terms of their assets (denominated in CZK), investment funds differ only by a factor of 7×10^2. Furthermore, the size of a fund may not serve as an accurate measure of its complexity and sophistication. Some of the large Czech funds engage in relatively straightforward investment strategies, primarily focusing on holding Czech government bonds and CZK repos or term accounts. Conversely, smaller hedge funds catering to risk-seeking investors may involve themselves in speculative activities that entail complex option strategies and currency exchange operations.

The impact of liquidity, leverage, and complexity of family structure is less consistent across sectors. In the case of leverage, we find a mixed message across sectors and model specifications. For instance, a higher debt-to-assets ratio reduces the probability of insurance companies, pension funds, and investment funds using derivatives, but we do not find any such effect for banks. Regarding banks, the weaker role of leverage in the probability of derivatives use could be due to their generally high capitalization. The existing literature suggests that banks can be motivated to engage in derivative transactions to circumvent the regulations (Adrian and Ashcraft, 2012; Acharya et al., 2013). Some recent studies then argue that less capitalized banks are more incentivized to use derivatives such as CDS to protect their credit risk exposures and to lower the related capital requirements (Aldasoro and Barth, 2017). As of the date of this analysis, the Czech banking sector is well capitalized and these types of incentives may thus play a limited role. Moreover, as indicated above, Czech banks engage in a significant number of derivative transactions with non-financial corporations, potentially managing these currency derivatives on their behalf. As a result, the bank's own leverage might have diminished significance. Therefore, the speculative motive of derivative use is also most likely limited among Czech banks and may be more of an issue among other financial institutions/segments. As such, we would not expect (and do not observe) either a positive or a negative significant effect of bank leverage.

In the case of liquidity, we find the opposite effect on the probability of investment funds and (exclusively) retail investment funds using derivatives, when controlling for foreign exposure: higher liquidity reduces the probability. This may simply point to a different business model and overall strategy of derivative use or to higher sensitivity of this sector to financial distress. First, investment funds can employ derivatives to enhance their leverage and achieve exposures without holding any cash (with the exception of FX swaps). Consequently, less liquid investment funds may be more inclined to use derivative transactions to amplify their leverage and, subsequently, their profitability (speculative motive). Second, if we go back to the literature, we would expect more vulnerable institutions to use derivatives more. In the data section, we highlighted that investment funds' derivative transactions typically involve large notional amounts with short maturities, making them more risky. While liquidity is not a significant issue for Czech banks, insurance companies, and pension funds, it can be for (open-ended) investment funds. Investment funds operate with less liquidity and often hold assets traded in global markets. Concerns about a sudden correction in equity or bond prices in global markets may lead investors to exit investment funds, which may affect the funds' liquidity position. In very adverse circumstances, investment funds could be forced to sell off certain assets, which could trigger or exacerbate a decline in their

prices. Investment funds with lower liquidity may thus be more likely to hedge against risk (hedging motive) (CNB, 2022).[15]

Table 5: Average Marginal Effects – Breakdown by Financial Sectors

Dependent variable: Pr(Entered into currency derivative transaction = 1)								
	(1) Banks	(2) Banks (excl. CU)	(3) IC&PF	(4) IF	(5) IF (retail only)	(6) Dealers	(7) Other	(8) Other (PC only)
$Size_{t-1}$	0.141***	0.213***	0.118***	0.069***	0.04***	0.132***	0.029***	0.115***
	(0.008)	(0.020)	(0.006)	(0.003)	(0.005)	(0.009)	(0.005)	(0.011)
$Debt\text{-}to\text{-}assets_{t-1}$	0.288	0.707	-0.411***	-0.526***	-0.425***	-0.125*	0.033	-0.693***
	(0.278)	(0.556)	(0.026)	(0.075)	(0.072)	(0.053)	(0.020)	(0.064)
$Liquidity_{t-1}$	0.827***	0.725***	0.285***	-0.123**	-0.489***	0.246***	0.286***	0.539***
	(0.049)	(0.059)	(0.077)	(0.047)	(0.061)	(0.043)	(0.029)	(0.058)
Has DP	-0.206***	-0.176***	-0.010	0.039***	0.016	0.0120	0.042**	0.198***
	(0.031)	(0.036)	(0.019)	(0.011)	(0.014)	(0.026)	(0.015)	(0.037)
$Profitability_{t-1}$	-0.396***	-0.736**	-0.006	-0.160***	-0.171***	-0.179***		-0.174***
	(0.108)	(0.232)	(0.011)	(0.013)	(0.027)	(0.022)		(0.041)
$Foreign\ Exposure_{t-1}$		0.485***			0.110***			
		(0.098)			(0.024)			
Observations	736	548	2,485	6,470	4,903	873	1,651	482
Y = 1	417	387	819	2,986	2,832	237	141	107
Log-likelihood	-230	-165	-1,291	-3,712	-3,067	-214	-386	-170
AIC	524	395	2,645	7,488	6,200	492	833	404
Group FE	N	N	N	N	N	N	N	N
Time FE	Y	Y	Y	Y	Y	Y	Y	Y

Note: The table reports the average marginal effects of the probit model regression. Each specification employs a different sample of financial institutions. CU stands for credit unions and PC for payment companies. "Y = 1" indicates the number of observations with the dependent variable equal to 1. Retail investment funds are funds as established under Part Seven of Act No. 240/2013 Coll., on Management Companies and Investment Funds. Standard errors are reported in parentheses. *** p < 0.001, ** p < 0.01, * p < 0.05.

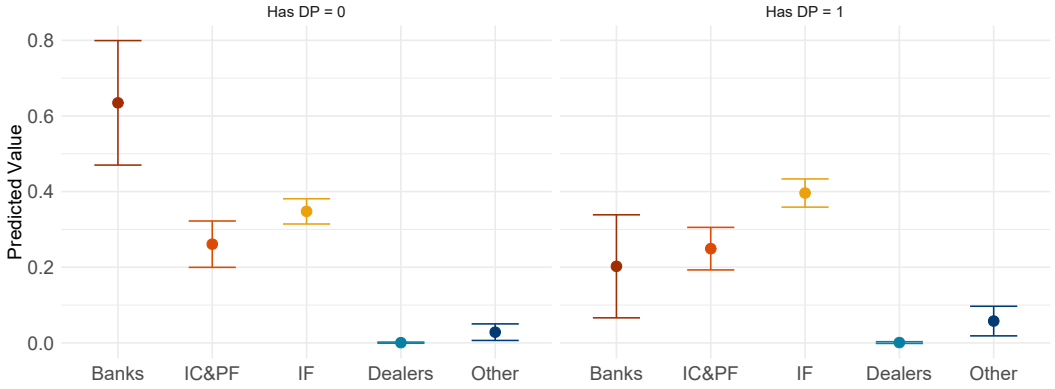
As for the family structure, we find the opposite effect on the probability of banks using derivatives: having a direct parent and a more dense family structure reduces the probability. Figure 4 depicts the predicted probabilities of using currency derivatives for different financial sectors, showing that banks are more likely to use derivative transactions if they do not have a direct parent, whereas, for example, investment funds are more likely to use them if they do. We discussed above the various reasons why a more complex family structure can increase the probability of derivative use. However, the existence of a direct parent may also reduce the need to procure derivative transactions. These derivative transactions can be managed by the parent institution and settled with the subsidiary outside the derivatives market. In the case of the Czech banking sector, we do not have exact data, but anecdotal evidence suggests that banks differ in their risk management strategies (i.e., managing derivative transactions individually or on a group basis).

[15] The low-yield environment which the Czech Republic experienced in part of the period under review may also have reinforced the incentive of non-bank financial institutions to allocate their investment portfolios to riskier and potentially less liquid assets to an increased extent, further increasing their sensitivity to a possible correction in financial markets (CNB, 2021). Hodula et al. (2022) show that retail investors tend to respond dramatically to bad performance during less tranquil times, such as liquidity shortages and extreme events like the COVID-19 outbreak. They also show that investors respond more dramatically when investing in funds that hold less liquid assets, which may lead such funds to hedge more.

Additionally, when a bank has a direct parent company, and particularly if that parent company is a foreign bank, it may have access to a wider range of funding sources and expertise in managing risk, which can reduce the need for derivative transactions. For example, if a foreign bank is the parent company of a domestic bank, the domestic bank may have access to the foreign parent company's balance sheet.

The impact of higher foreign exposure is consistent with the intuition that the probability of using currency derivatives increases with an increasing share of foreign assets in total assets. Institutions with a high share of foreign assets need to hedge against foreign exchange risk. Data on foreign exposures are only available for banks and retail investors' funds, which is why they only appear in some of the regressions. In all these regressions, the results are qualitatively similar.

Figure 4: Probability of Entering into Currency Derivative Transaction – Family Structure



Note: The figure depicts the predicted probabilities of currency derivative use for specifications (1), (3), (4), (6), and (7) in Table 5 when *Has DP* is equal to zero (left) or one (right). Error bars correspond to 95% confidence intervals.

3.2 Intensive Margin: Notional of Derivative Transactions

We define the intensive margin effects as the response of the notional of derivative transactions to a similar set of firm-level characteristics. In contrast to the extensive margin analysis, we only consider those financial institutions which have engaged in at least one currency derivative transaction. The regression is specified in equation (2), where the dependent variable is the natural logarithm of the sum of the notional of the currency derivative transactions entered into by financial institution i in month t. As before, monthly fixed effects are captured by δ_t and financial sector fixed effects by γ_s. Vector $X_{i,t-1}$ represents firm-level variables.

$$log(Notional\ of\ currency\ derivatives_{i,t}) = \alpha + \beta X_{i,t-1} + \delta_t + \gamma_s + \varepsilon_{i,t} \tag{2}$$

The intensive margin results are reported in Table 6 and in Table B2 in the appendix. The former shows the response of the *total* notional of currency derivatives, while the latter only contains the notional of *intragroup* currency derivatives. Focusing on the intensive margin effects enables us to examine *intragroup* derivatives separately, a distinction not feasible in the extensive margin analysis.

For most firm-level variables, the direction of effect and statistical significance remain the same as in the case of the extensive margin. Larger, less leveraged, and more liquid financial institutions are more likely not only to use derivative transactions, but also to use them in greater notional amounts.

Table 6: Regression Results for Notional of Currency Derivatives

Dependent variable: log(Notional of currency derivatives)				
	(1)	(2)	(3)	(4)
$Size_{t-1}$	0.879***	0.881***	0.869***	0.890***
	(0.018)	(0.018)	(0.020)	(0.019)
$Debt\text{-}to\text{-}assets_{t-1}$	−0.453***	−0.452***	−0.743***	−0.514***
	(0.154)	(0.153)	(0.172)	(0.156)
$Liquidity_{t-1}$	1.004***	0.968***	0.342	0.976***
	(0.175)	(0.175)	(0.224)	(0.175)
Has DP	−0.275***	−0.276***	−0.077	−0.121
	(0.053)	(0.053)	(0.060)	(0.091)
$Profitability_{t-1}$			−0.139**	
			(0.064)	
$Family\ Count_{t-1}$				−0.046**
				(0.022)
Observations	5,908	5,908	4,528	5,908
R^2	0.990	0.990	0.991	0.990
Adjusted R^2	0.990	0.990	0.991	0.990
Group FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y

Note: The table reports the results of the panel data regression in eq. (2). The dependent variable is winsorized at 1% from both sides. Standard errors, clustered at the level of financial segments, are reported in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Specifically, a 1% increase in firm size translates to about a 0.88% increase in the notional amount of currency derivative transactions. Regarding the complexity of the family structure, having a direct parent reduces the average notional of currency derivatives by about 27.5%. In a similar vein, an increase in the number of institutions within the group (or family) reduces the notional amount of derivative transactions. To complete the picture, based on the extensive margin findings, the presence of a direct parent increases the likelihood of a firm engaging in derivative transactions. Yet, when firms have a direct parent, or as the size of the family group expands, the notional value of these derivatives tends to be comparatively smaller.

As for liquidity, a 1 pp increase in the liquidity ratio nearly doubles the average notional value of the currency derivative transactions. Lower leverage increases the institution's notional amounts on the derivatives market. In terms of profitability, we find a similar negative impact on the probability of derivatives use and the notional of currency derivative transactions. Higher profitability reduces the notional volume of currency derivative transactions.

The overall results remain qualitatively similar when we focus solely on intragroup transactions, though the effect of liquidity is not statistically significant. This could be due to the relatively low number of observations stemming from the limited number of *intragroup* derivative transactions in our sample. Moreover, *intragroup* derivative transactions might be motivated primarily by internal accounting, risk management, or capital allocation reasons, rather than by hedging/speculative or pure trading motives (EY, 2018). Also, within a group structure, there is often an internal capital market and liquidity might be redistributed within the group, reducing the reliance on external liquidity. As a result, the availability of liquidity might not play as significant a role in these transactions as it does in the broader market.

Regarding family relationships, the effect of family count turns around. That is, a 10% increase in the number of family relationships increases the notional amount by about 4%. This observation may align with our previous understanding of the role of liquidity in *intragroup* derivative transactions. Larger families, comprising more subsidiaries or branches, could engage in increased *intragroup* derivative transactions as a mechanism for managing liquidity and cash flows within the group, transferring funds, and optimizing capital allocation. This could account for the reversal in the sign of the family count effect, demonstrating a positive impact of larger families on the notional value of *intragroup* currency derivative transactions.

4. Conclusions

The literature to date has only very lightly explored the determining factors of the derivative transactions of non-banking institutions, despite considerable advances in data availability and the significant role played by derivatives markets in the financial system. There is an even larger gap in the literature regarding the comparison of the behavior of different types of financial institutions. This paper sheds light on the drivers of activity on the Czech derivatives market, tracking nearly 980,000 new derivative transactions between October 2020 and December 2022 from 865 domestic financial institutions. We center our attention on the sectoral differences between financial institutions, showing that the significance of key characteristics varies among financial sectors, with some being more critical to certain sectors than others.

We present evidence indicating that larger financial institutions, institutions that are part of complex financial groups, and institutions with higher foreign exposure are more likely to engage in derivative transactions. Our findings differ from some previous studies in that we show that more stable financial institutions (those with less debt and greater liquidity) engage in derivative transactions more frequently. This is likely due to the long-term financial stability of the Czech financial system, which reduces the need for more vulnerable institutions to hedge against risk.

Furthermore, banks were found to be less sensitive to changes in their leverage. This may be due to their strong capital position and their focus on lending to the private non-financial sector. Unlike some previous studies, we did not observe less capitalized banks using derivatives extensively for hedging or to circumvent the regulations. With regard to investment funds, the results indicate that liquidity is a key factor in their derivative use, with less liquid funds being more likely to use derivatives, reflecting their sensitivity to financial distress.

In terms of policy implications, regulators should be mindful that financial institutions in stable financial systems may use derivatives as a means of generating profits in addition to using them as a risk hedging tool. While this approach can be effective in the short term, it can be detrimental in the event of an unforeseen financial shock. By taking a balanced approach and implementing sound risk management practices when trading in derivatives markets, financial institutions can both increase their resilience and safeguard their long-term profitability in volatile market conditions.

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Appendix A: Additional Information on Data

A.1 Data Cleaning and Adjustments

In our data processing and cleaning procedure, we closely follow Abad et al. (2016). We perform several steps to obtain data suitable for descriptive and empirical analysis from the raw trade-state data reported by trade repositories (TRs). This procedure primarily discards all observations that are unreliable, insufficient, duplicated, or even completely erroneous. The following steps are performed for each end-of-the-week snapshot of outstanding derivative transactions (trade-state data).

First, we drop observations with missing notional values and with implausible gross notional values (greater than CZK 250 bn and lower than CZK 25,000). Second, we drop duplicated trades with the same reporting counterparties and trade ID. Third, we identify pairs of "mirror trades," which refer to the same trade but from the perspective of each counterparty. These trades have the same trade ID and the reporting counterparties are exactly the opposite. We proceed to identify inconsistent transactions and duplicates of the data sample. First, we identify "obvious duplicates" – observations which have exactly the same reporting counterparties and trade ID. From each of these duplicates we keep only one observation and drop the rest. We perform an internal consistency check of those mirror entries in such a way that we compare mirror entries and their respective notional amounts, maturity dates, asset classes, and contract types. We drop those observations that show different characteristics mentioned above. This internal consistency check ensures that the same transactions are consistent across the sample.

A.2 Data Description and Summary Statistics

Table A1: Derivatives Market in Europe and World

	Total	Commodities	Credit	Currency	Equity	Interest Rate
Panel A: World						
Total notional (CZK tn)	12,639	46	187	2,117	154	10,129
% share	100	0.4	1.5	16.8	1.2	80.1
Top instrument	IRS	forw&swap	CDS	forw&swap	forw&swap	IRS
Panel B: European Union						
Total notional (CZK tn)	6,425	53	158	843	290	5,082
% share	100	1	2	13	4	79
Top instrument	swap	futr	swap	forw	optn	swap
Total no. contracts (mn)	24	3	0	7	10	4
% share	100	11	1	30	41	16
Top instrument	CFD	CFD	swap	forw	optn	swap

Note: The table shows snapshots of outstanding derivative transactions in the second half of 2020 (Panel A) and as of December 11th, 2020 (Panel B). The total notionals in Panels A and B are calculated with the use of the CNB exchange rate as of December 11th, 2020. IRS – interest rate swap, CDS – credit default swap. CFD – contract for difference, futr – futures, forw – forward, optn – option.
Source: BIS Statistical Warehouse, ESMA (2021).

Table A2: Basic Overview of Derivative Transactions per Asset Class – Overall Dataset

	Commodities	Currency	Equity	Interest rate	Credit
Number of transactions (share in %)	1.8	95.0	0.2	3.0	0
Notional in CZK (share in %)	0.7	83.9	0.2	15.2	0

Note: The underlying data cover the overall data set after cleaning and adjustments as described in Appendix A.1 and spanning between October 2020 and December 2022.

Table A3: Variable Description

Variable	Description	Source
Institution-level variables		
Size	Natural logarithm of total assets	CNB
Debt-to-assets	Ratio of total debt to total assets, where total debt is calculated as total assets minus equity	CNB
Liquidity	Ratio of liquid assets to total assets, where liquid assets consist of high-quality liquid assets Level 1 (HQLA L1 according to Regulation (EU) No 575/2013 of the European Parliament and of the Council) in case of banks and cash on hand or cash deposited with central bank and other demand deposits in case of all other sectors (data on HQLA L1 are not available for sectors other than banks)	CNB
Profitability	Annualized after tax return on assets (ROA) in case of investment funds and annualized after tax return on equity (ROE) in case of all other financial sectors (equity data cannot be obtained for investment funds)	CNB
Foreign exposure	Ratio of foreign assets to total assets, where foreign assets are assets held in currencies other than CZK	CNB
Has DP	Binary indicator (dummy variable) equal to 1 if institution has direct parent company and 0 otherwise (time-invariant variable)	CNB, GLEIF
Family count	Natural logarithm of number of institutions in same organizational structure plus one (time-invariant variable)	CNB, GLEIF
Entered into currency derivative transaction	Binary indicator (dummy variable) equal to 1 if institution engaged in any new currency derivatives contract in given month and 0 otherwise	EMIR
Notional of currency derivatives	Sum of notional in CZK of new currency derivative transactions entered into by given firm in given month	EMIR
Notional of intragroup currency derivatives	Sum of notional in CZK of new *intragroup* currency derivative transactions entered into by given firm in given month, where *intragroup* transaction is defined as transaction with counterparty which is within firm's organizational structure	EMIR, GLEIF

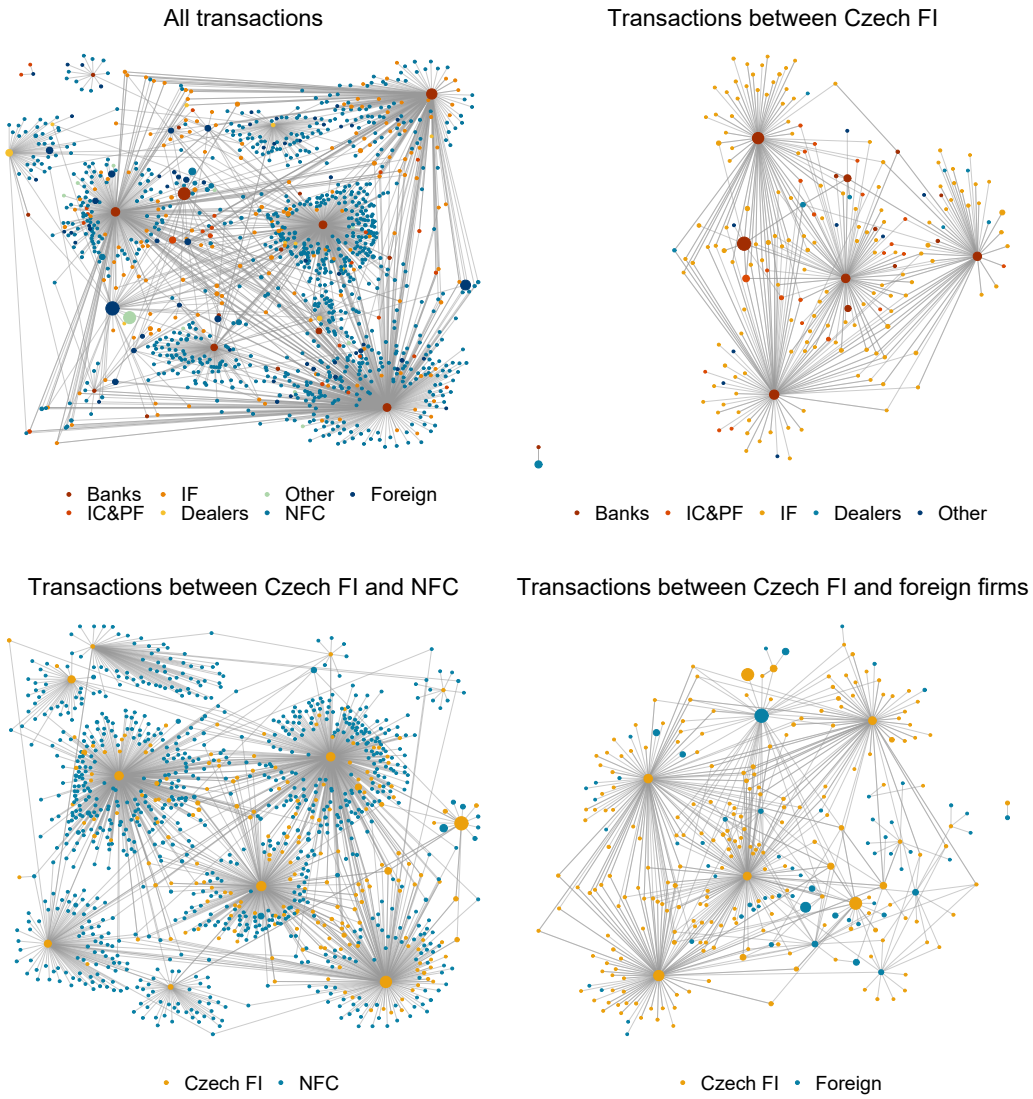
Note: CNB – Czech National Bank internal databases; EMIR – reporting under the European Markets Infrastructure Regulation; GLEIF – Global Legal Entity Identifier Foundation data. Selected variables (debt-to-assets, liquidity, profitability, and notional of currency derivatives) are winsorized at 1% from each side.

Table A4: Share of Financial Institutions Using Currency Derivatives in Their Sector (%)

	Banks	IC & PF	IF	Dealers	Other
Share of assets	97.8	73.7	70.0	88.1	37.7
Share of liquid assets	99.2	61.5	78.0	83.2	55.2
Share of financial assets	97.9	73.8	86.8	91.1	2.9
Share of foreign assets	100.0	-	88.9	-	-
Share of debt	97.8	73.1	48.5	89.2	25.0

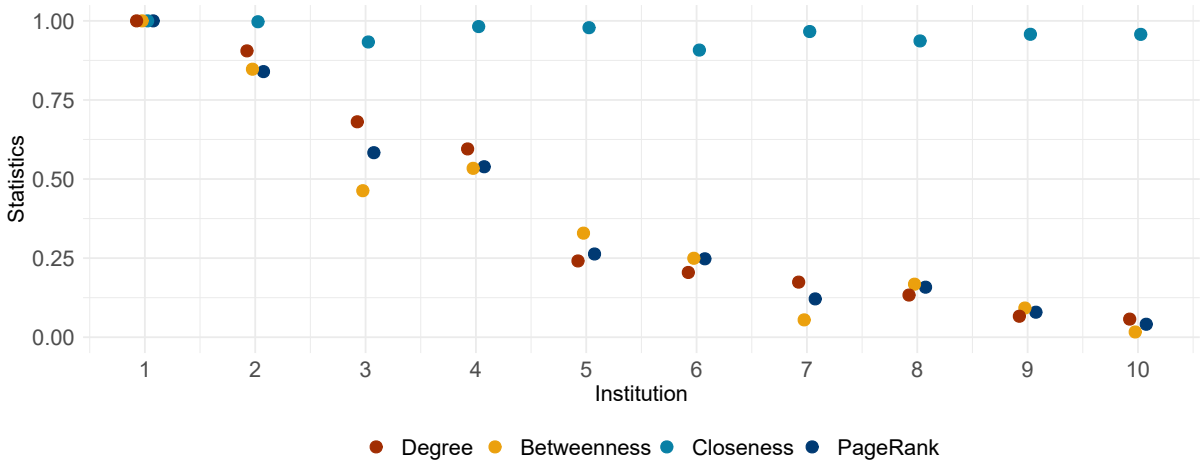
Note: The percentages in the table should be read separately and not added together. For example, the first cell shows the assets of banks using currency derivatives as a percentage of the assets of all banks. Data on foreign assets are not available for insurance companies, pension funds, securities dealers, and other financial institutions.

Figure A1: Networks of New Currency Derivative Transactions – Notional Amount



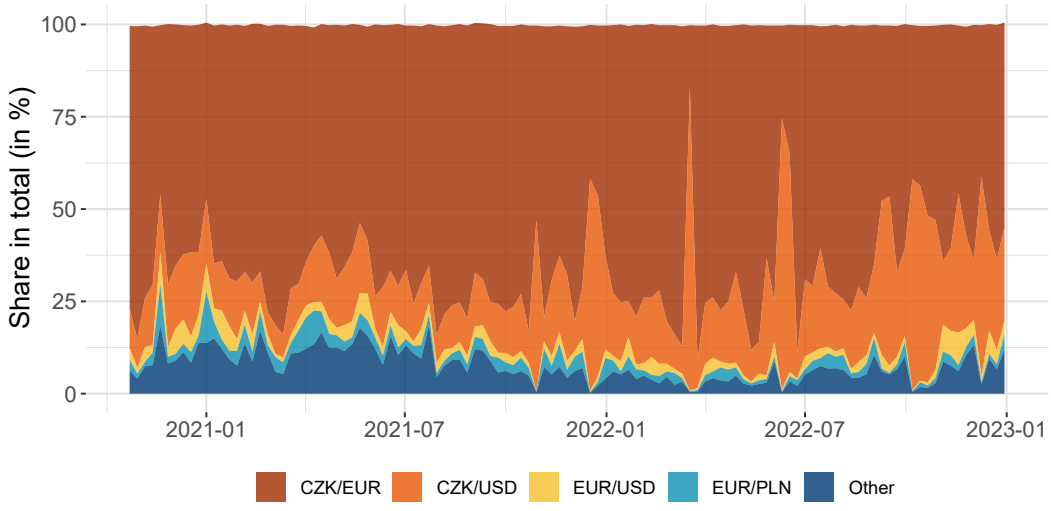
Note: The size of the nodes is proportional to the gross notional amount. NFC stands for non-financial corporations, Czech FI for Czech financial institutions, and foreign for foreign entities. Due to the large amount of relationship nodes in the overall dataset, we created the networks with a subset of one month – December 2021. The network graphs for other months are similar.

Figure A2: Network Centrality Measures



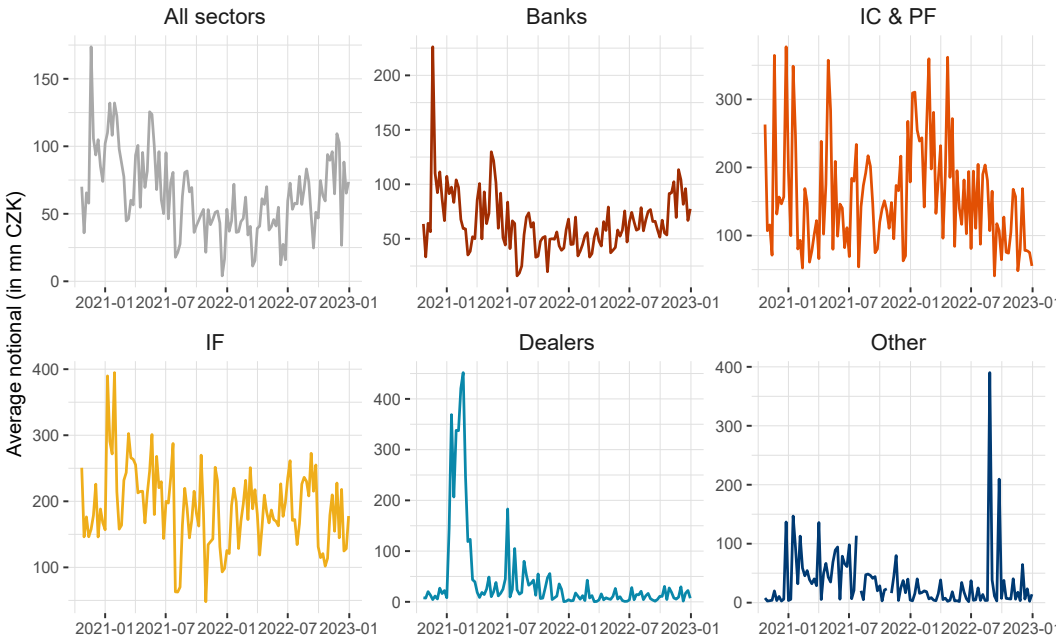
Note: The figure presents standardized network centrality statistics for the ten financial institutions (nodes) with the highest centrality. In contrast to Figure 1, we employ the full data set of currency derivative transactions to calculate the measures. Each centrality statistic is divided by its maximum for ease of comparison. Degree centrality measures the number of connections that a node (i.e., an institution) has in the network. Nodes with high degree centrality are often important players in the network. Betweenness centrality measures the extent to which a node lies on the shortest paths between other nodes in the network. Nodes with high betweenness centrality are often important for facilitating transactions between other nodes. Closeness centrality measures the average distance between a node and all other nodes in the network. Nodes with high closeness centrality are often able to quickly transmit information or resources to other nodes in the network. PageRank is a variant of degree centrality that also takes into account the importance of the nodes that are connected to a given node. Nodes with high PageRank scores are often connected to other important nodes in the network.

Figure A3: Dynamics of Major Underlying Benchmarks



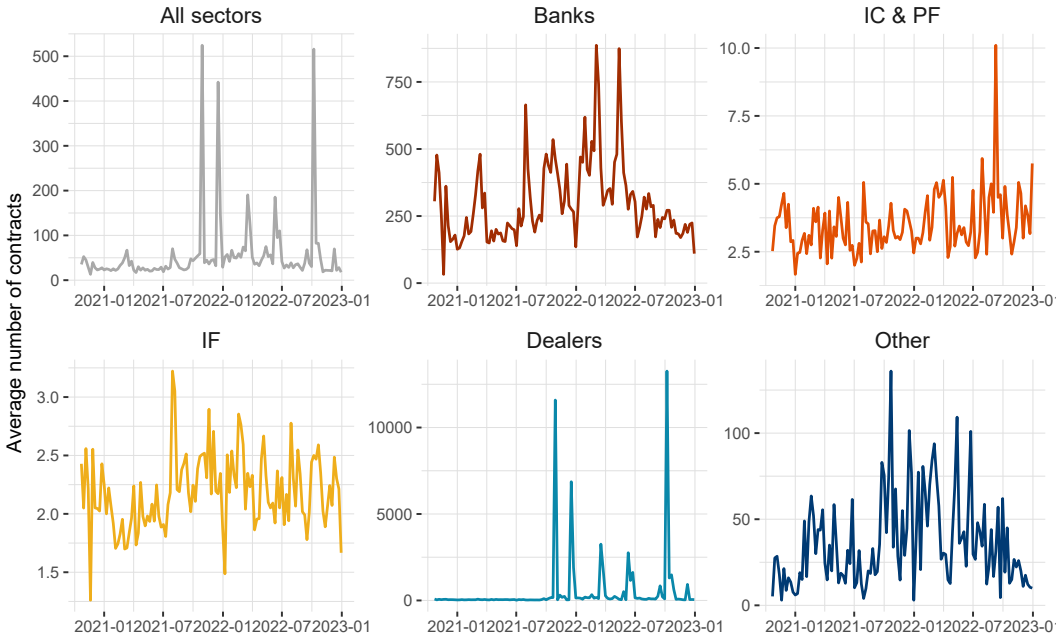
Note: Underlying benchmarks CZK/EUR, CZK/USD, EUR/USD, and EUR/PLN have shares that exceed 1% of the total on average. The average shares of all the other underlying currency pairs are less than 1% in the period of observations.

Figure A4: Dynamics of Average Notional Across Sectors



Note: The figure depicts the average notional of currency derivatives contracts in individual sectors in CZK million. The data on the notional are winsorized at 1% from each side prior to taking means.

Figure A5: Dynamics of Average Number of Contracts Across Sectors



Note: The figure depicts the average number of currency derivatives contracts across the individual firms in the sectors.

Table A5: Summary Statistics of Financial Variables

	Currency derivative users					Currency derivative non-users				
Type	No. obs.	No. firms	Mean	Median	SD	No. obs.	No. firms	Mean	Median	SD
Size										
Total	8668	341	21.21	20.96	2.07	11662	517	19.37	19.7	2.67
Banks	555	23	25.69	25.75	1.72	233	9	21.55	21.52	2.74
IC&PF	1188	47	22.15	22	2.05	1326	51	20.8	20.66	1.82
IF	6225	243	20.64	20.6	1.46	8204	375	18.96	19.4	2.46
Dealers	277	11	21.03	21.15	1.29	611	30	16.47	17.46	3.49
Other	423	17	21.12	21.45	2.46	1288	52	21.43	21.58	1.7
Debt-to-asset ratio (winsorized at 1%)										
Total	8648	341	0.18	0.02	0.32	11550	514	0.28	0.05	0.46
Banks	555	23	0.91	0.92	0.04	233	9	0.67	0.81	0.34
IC&PF	1188	47	0.33	0.04	0.41	1325	51	0.6	0.58	0.5
IF	6205	243	0.05	0.01	0.14	8137	373	0.2	0.03	0.38
Dealers	277	11	0.8	0.85	0.16	611	30	0.8	0.55	0.79
Other	423	17	0.29	0.01	0.35	1244	51	0.14	0	0.28
Liquidity ratio (winsorized at 1%)										
Total	8612	341	0.13	0.06	0.2	11511	513	0.16	0.04	0.28
Banks	516	23	0.38	0.35	0.2	210	9	0.14	0.08	0.17
IC&PF	1188	47	0.06	0.03	0.11	1322	51	0.13	0.06	0.18
IF	6208	243	0.1	0.06	0.14	8130	372	0.14	0.03	0.27
Dealers	277	11	0.61	0.68	0.28	611	30	0.6	0.64	0.34
Other	423	17	0.28	0	0.39	1238	51	0.08	0	0.23
Profitability (winsorized at 1%)										
Total	6150	331	0.12	0.02	0.61	4990	434	0.45	0.11	1.07
Banks	559	23	0.08	0.08	0.15	236	10	0.04	0.03	0.09
IC&PF	1184	47	0.22	0.03	0.79	1305	52	0.41	0.11	1.07
IF	3914	242	0.08	0	0.61	2558	332	0.52	0.08	1.15
Dealers	277	11	0.17	0.3	0.39	596	28	0.58	0.38	1.02
Other	216	8	0.2	0.19	0.27	295	12	0.07	0.05	0.5
Foreign exposures										
Total	4085	160	0.37	0.25	0.36	1511	60	0.36	0	0.42
Banks	523	21	0.15	0.1	0.19	81	3	0	0	0
IF	3562	139	0.4	0.34	0.37	1430	57	0.38	0	0.43
Has direct parent										
Total	9207	341	0.57	1	0.5	14148	524	0.2	0	0.4
Banks	621	23	0.65	1	0.48	270	10	0.2	0	0.4
IC&PF	1269	47	0.64	1	0.48	1404	52	0.62	1	0.49
IF	6561	243	0.54	1	0.5	10260	380	0.13	0	0.34
Dealers	297	11	0.73	1	0.45	810	30	0.13	0	0.34
Other	459	17	0.53	1	0.5	1404	52	0.33	0	0.47
Family count										
Total	9207	341	1.99	1.39	2.13	14148	524	0.54	0	1.45
Banks	621	23	2.41	2.89	2.17	270	10	0.53	0	1.27
IC&PF	1269	47	2.38	1.39	2.47	1404	52	2.05	0	2.51
IF	6561	243	1.88	1.1	2.06	10260	380	0.23	0	0.88
Dealers	297	11	2.13	2.08	1.72	810	30	0.28	0	0.92
Other	459	17	1.84	1.39	2.05	1404	52	1.49	0	2.09

Note: The table presents summary statistics for all the financial institutions entering the analysis. Banks include regular banks (excluding foreign branches) and credit unions, IC&PF are insurance companies and pension funds, IF are investment funds, Dealers are securities dealers, and Other represent other financial institutions, such as payment companies and other financial intermediaries.

Appendix B: Additional Results

Table B1: Regression Results for Different Contract Types

Dependent variable: Pr(Entered into currency derivative transaction of type $X = 1$)						
	(1) FORW	(2) FORW	(3) SWAP	(4) SWAP	(5) OPTN	(6) OPTN
$Size_{t-1}$	0.071***	0.089***	0.066***	0.080***	0.005***	0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)	(0.001)
$Debt\text{-}to\text{-}asset_{t-1}$	-0.195***	-0.140***	-0.318***	-0.247***	-0.005	-0.039***
	(0.012)	(0.018)	(0.013)	(0.019)	(0.009)	(0.010)
$Liquidity_{t-1}$	0.139***	0.052*	0.245***	0.281***	0.005*	0.008*
	(0.015)	(0.025)	(0.015)	(0.024)	(0.002)	(0.004)
Has DP	0.044***	0.039***	0.112***	0.018*	0.002	0.003
	(0.005)	(0.008)	(0.005)	(0.008)	(0.001)	(0.002)
$Profitability_{t-1}$		-0.044***		-0.074***		0.008***
		(0.007)		(0.008)		(0.001)
Group FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	20,055	11,046	20,055	11,046	20,055	11,046
Y = 1	3,978	3,127	4,474	3,528	153	151
Log-likelihood	-8,314	-5,343	-8,656	-5,747	-244	-188
AIC	16,699	10,757	17,381	11,567	558	449

Note: The table reports the average marginal effects of a probit model regression similar to eq. (1). The individual pairs of specifications employ different dependent variables. Specifications (1) and (2) employ a dummy variable equal to 1 if institution i entered into a currency derivative of type forward (FORW) in month t, and 0 otherwise. Specifications (3) and (4) consider swaps (SWAP) and specifications (5) and (6) consider options (OPTN). "Y = 1" indicates the number of observations with the dependent variable equal to 1. Standard errors are reported in parentheses. *** p < 0.001, ** p < 0.01, * p < 0.05.

Table B2: Regression Results for Notional of Intragroup Currency Derivatives

Dependent variable: log(Notional of intragroup currency derivatives)				
	(1)	(2)	(3)	(4)
$Size_{t-1}$	0.917***	0.925***	0.959***	0.714***
	(0.091)	(0.092)	(0.094)	(0.099)
$Debt\text{-}to\text{-}assets_{t-1}$	−4.744***	−4.673***	−4.627***	−1.680
	(1.293)	(1.325)	(1.335)	(1.412)
$Liquidity_{t-1}$	−0.609	−0.595	0.023	1.480
	(0.989)	(1.012)	(1.054)	(1.062)
$Profitability_{t-1}$			−1.433**	
			(0.686)	
$Family\ count_{t-1}$				0.405***
				(0.080)
Group FE	Y	Y	Y	Y
Time FE	N	Y	Y	Y
Observations	401	401	381	401
R^2	0.990	0.990	0.991	0.991
Adjusted R^2	0.990	0.990	0.990	0.990

Note: The table reports the results of the panel data regression in eq. (2) with the sum of the CZK notional of the intragroup currency derivatives entered into by firm i in month t as the dependent variable. Standard errors, clustered at the level of financial segments, are reported in parentheses. *** p < 0.001, ** p < 0.01, * p < 0.05.

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