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Monitoring complex financial instruments in banks' balance sheets

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Monitoring Complex Financial Instruments in Banks' Balance Sheets

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Monitoring Complex Financial Instruments in Banks' Balance Sheets



Supporting Banking Union scrutiny

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Monitoring Complex Financial Instruments in Banks' Balance Sheets

Abstract

European banks have substantial investments in assets that are measured without directly observable market prices (mark-to-model). Financial disclosures of these value estimates lack standardization and are hard to compare across banks. These comparability concerns are concentrated in large European banks that extensively rely on level 3 estimates with the most unobservable inputs. Although the relevant balance sheet positions only represent a small fraction of these large banks' total assets (2.9%), their value equals a significant fraction of core equity tier 1 (48.9%). Incorrect valuations thus have a potential to impact financial stability. 85% of these bank assets are under direct ECB supervision. Prudential regulation requires value adjustments that are apt to shield capital against valuation risk. Yet, stringent enforcement is critical for achieving this objective.

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LIST OF ABBREVIATIONS

CAP50	Basel Framework: Definition of Capital, Chapter 50 (“Prudent Valuation Guidance”)
CET1	Common Equity Tier 1
DCF	Discounted Cash Flow
ECB	European Central Bank
GAAP	Generally Accepted Accounting Principles
IFRS	International Financial Reporting Standards
NCA	National Competent Authority
OCI	Other Comprehensive Income
P&L	Profit & Loss Statement
PVA	Prudential Valuation Adjustment

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EXECUTIVE SUMMARY

European banks have substantial investments in assets that are measured on a mark-to-model basis without directly observable market prices. These assets represent 6.5% of total assets and 118.0% of CET1 on average. However, the most significant share of these assets (more than 85%) is attributable to level 2 fair values. These level 2 fair values rely on observable and verifiable inputs, e.g., market interest rates or credit spreads. Against this background, evidence suggests that investors perceive the level 2 fair values as being as reliable as level 1 mark-to-market fair values. Comparability is a concern for level 3 fair values and evidence shows that many banks are using their discretion in estimating these fair values opportunistically. Yet, the use of level 3 fair values is not widespread in the European banking industry. For the median bank, the level 3 fair values represent 6.4% of CET1. Therefore, comparability concerns are confined to a small subset of European banks that extensively rely on these level 3 estimates.

International rules require fairly extensive disclosures when banks are using level 3 fair value estimates. These disclosures include both qualitative information about the valuation models and quantitative information about the inputs in these models. Compliance with disclosure rules is generally diverse. For a representative sample of IFRS-adopting banks from Germany, we show that only about half of the banks provide fully detailed disclosures in accordance with IFRS 13. Other banks refer to a lack of materiality of their level 3 fair values and avoid a similar level of detail.

IFRS 13 does not prescribe a specific reporting template. Therefore, the reporting formats of our sample banks vary widely. It becomes evident that banks are using different valuation models and, especially, different inputs into these models when estimating level 3 fair values for the same class of instrument. This divergence of estimation procedures reduces the comparability of level 3 fair values. The lack of standardization in the disclosures also fails to provide users of financial statement information with the opportunity to infer whether the different inputs are due to fundamental differences in the level 3 portfolios (and, thus, economically justified) or due to different assumptions and estimates in the internal generation of level 3 fair values for highly similar assets.

Prudential regulation is taking the valuation risk inherent to banks' use of unobservable inputs into level 2 and level 3 fair values into account. Under the framework of the Basel Committee on Banking Supervision, chapter CAP50 regulates the prudent valuation of assets measured at fair value and requires prudential valuation adjustments. Specific adjustments have to be made for less liquid assets and those for which marking-to-model is used (i.e., levels 2 and 3 according to the IFRS fair value hierarchy). Standardized disclosure templates are embedded in banks' Pillar 3 reports and make these adjustments transparent and relatively easy to compare.

Level 2 and level 3 fair values play a minor role on the balance sheets of banks outside the ECB's direct supervision. This is for at least three reasons. First, many of these banks do not adopt IFRS at all. Second, by definition, the magnitude of their portfolios is systematically smaller. Third, the relative fraction of their investments in assets that require a level 2 or level 3 valuation also tends to be lower. Public data suggests that 84.5% of all level 2 and level 3 fair value estimates in the Eurozone are made by banks that are under direct ECB supervision.

1. BANKS' APPLICATION OF THE FAIR VALUE HIERARCHY

1.1. The Magnitude of Investments in Level 2 and Level 3 Assets

Under applicable accounting rules (International Financial Reporting Standard [IFRS] no. 9), banks have to measure their financial instruments at fair value mainly in four instances. First, they are obliged to apply fair value accounting to all instruments that are held for trading. By default, this category comprises all financial derivatives that are not designated as part of a hedge relationship. Changes in these fair values are always reported in profit or loss (P&L). Second, they are also obliged to measure their equity investments at fair value, with value changes being shown in either P&L or other comprehensive income (OCI). Third, fair value measurement is required for all complex debt instruments that do not solely yield payments of principal or interest (e.g., because of embedded derivatives). These fair value changes also go through P&L. Fourth, banks have the right to use fair value as the measurement base for all other assets and liabilities if this choice reduces potential accounting mismatches (e.g., a credit derivative that is used as a hedging instrument for a specific loan portfolio can be measured at fair value).

When applying fair value accounting, banks have to estimate values in accordance with IFRS no. 13. The estimation follows a fair value hierarchy with three different levels (see Box 1 for the exact definition of these levels). Whenever available, banks are required to use quoted prices from active markets (level 1). These level 1 fair values are most relevant for many instruments held from banks' trading books. Historically, approximately 55% of all fair values on bank balance sheets are attributable to level 1 (Becker et al., 2021, section 4.3). Banks are only allowed to use other, less verifiable input for their fair value estimation if there is no active market for the asset or liability. These inputs come from other observable market prices (level 2), e.g., for similar instruments on other markets and, to a lesser extent, from valuation models that are relying on internal management estimates only (level 3). These latter level 3 fair values represent a fairly low share of all fair value positions on banks' balance sheets (in most years less than 10%, see Becker et al., 2021, section 4.3).

Despite this background of uniform accounting rules, there is substantial heterogeneity in banks' reporting practice that the aggregate numbers tend to conceal. The variation comes from two different sources. First, banks differ in their business models. The use of fair values is most pronounced in banks with large trading portfolios and significant investments in complex banking book products other than standard loans. Second, banks make different use of the accounting choices for financial instruments in the banking book. While they tend to use the fair value option for a fairly small fraction of assets only (approximately 3% of assets; see Fiechter and Novotny-Farkas, 2017), some banks are using the option extensively for almost their entire loan portfolio (Becker et al., 2021). The heterogeneous application of fair value accounting results in substantial variation in the levels of fair value estimates across banks. Table 1 summarizes the distribution of fair value levels for a sample of European banks.

Box 1: The definition of the fair value hierarchy

When using fair values for accounting valuation, international accounting standards require banks to disclose their use of the three different levels of fair value measurement (the ‘fair value hierarchy’). IFRS 13 provides the definition of the three levels:

Level 1 (“mark-to-market”): Level 1 inputs are quoted prices in active markets for identical assets or liabilities that the entity can access at the measurement date. A quoted price in such an active market shall be used without adjustment to measure fair value whenever available.

Level 2 (“mark-to-model”): Level 2 inputs are inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly. Examples are quoted prices for similar assets or liabilities in active markets, quoted prices for identical or similar assets or liabilities in inactive markets, other observable market rates such as interest rates or credit spreads.

Level 3 (“mark-to-model”): Level 3 inputs are unobservable inputs for the asset or liability. Unobservable inputs shall be used in situations in which there is little, if any, market activity for the asset or liability. The fair value measurement objective remains the same, i.e., an exit price from the perspective of the market participant that holds the asset or owes the liability. Therefore, unobservable inputs shall reflect the assumptions that market participants would use when pricing the asset or liability, including assumptions about risk.

Source: International Accounting Standards Board, IFRS 13.

Table 1 presents the descriptive statistics for this analysis. We examine a comprehensive sample of 251 banks from the Eurozone over the time period from 2015 to 2021. The sample includes banks of different size (with total assets ranging from €41m at the first percentile to €1,326,235m at the 99th percentile, and CET1 ranging from €6m to €52,376m) and from all Eurozone countries. On average, level 2 and level 3 assets make up 44.9% of these banks’ fair values. This fraction is equivalent to 6.5% of total assets and 118.0% of CET1. These fractions are somewhat lower than the ones reported by the ECB¹, mainly because our sample includes more smaller banks where fair values play a less significant role. The data underscores that level 2 fair values, for which verifiable market input must exist, dominate the observed magnitudes. The least verifiable level 3 fair values alone only represent a minor share of total assets (1.2%) and CET1 (18.2%).

It also becomes evident that reporting practice is very diverse and that a few banks that heavily rely on level 3 fair values are driving the average values upwards. At the 25th percentile, the banks in our sample report an insignificant magnitude of level 3 fair values (0.1% of total assets and 1.5% of CET1). At the median, the ratios are 0.4% for total assets and 6.4% for CET1. Even at the 75th percentile, there is a modest use of level 3 fair values (1.1% of total assets and 18.9% of CET1). It is only for about 10% of the banks above the 90th percentile – i.e. the largest institutions in our sample – that the magnitude of level 3 fair values comprises a significant fraction of total assets and, thus, a critical portion of CET1 (up to 198.7% at the 99th percentile). These differences are not necessarily the outcome of inconsistent enforcement or auditing of accounting standards, they rather arise from the fundamental differences in business models and the application of permissible accounting choices.

¹ The ECB Supervision Newsletter from May 2021 reports a ratio of 518% for CET1. See https://www.bankingsupervision.europa.eu/press/publications/newsletter/2021/html/ssm.nl210519_5.en.html.

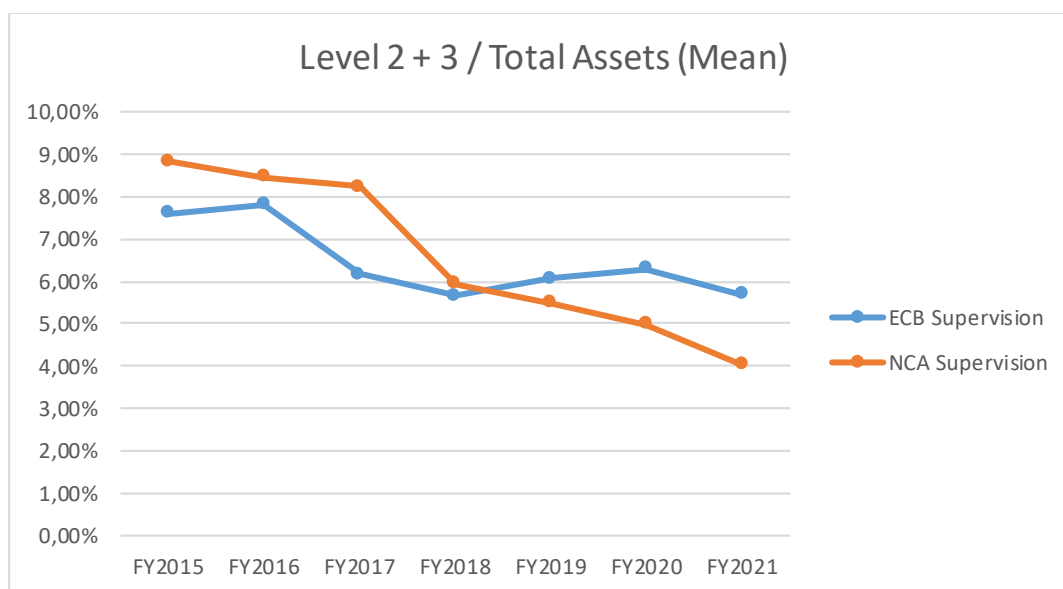
Table 1: Level 2 and Level 3 Fair Value Measurement by Eurozone banks

	Mean	Median	P1	P25	P75	P90	P99
Total Assets (in €m)	57,624	2,171	41	545	16,051	76,514	1,326,235
CET1 (in €m)	2,922	180	6	52	1,263	5,798	52,376
Level 3 / Total Fair Value	11.2%	3.0%	0.0%	0.7%	11.2%	33.4%	97.4%
Level 2 + 3 / Total Fair Value	44.9%	40.1%	0.6%	17.7%	70.8%	91.1%	100.0%
Level 3 / Total Assets	1.2%	0.4%	0.0%	0.1%	1.1%	2.9%	18.4%
Level 2 + 3 / Total Assets	6.5%	4.0%	0.0%	1.5%	8.8%	15.3%	38.7%
Level 3 / CET1	18.2%	6.4%	0.0%	1.2%	18.9%	48.9%	198.7%
Level 2 + 3 / CET1	118.0%	58.9%	0.3%	23.5%	125.7%	296.0%	825.2%

Source: S&P Capital IQ Pro. The table presents statistics for 251 IFRS-reporting banks from Eurozone countries. All data represent average values for financial years from 2015 to 2021.

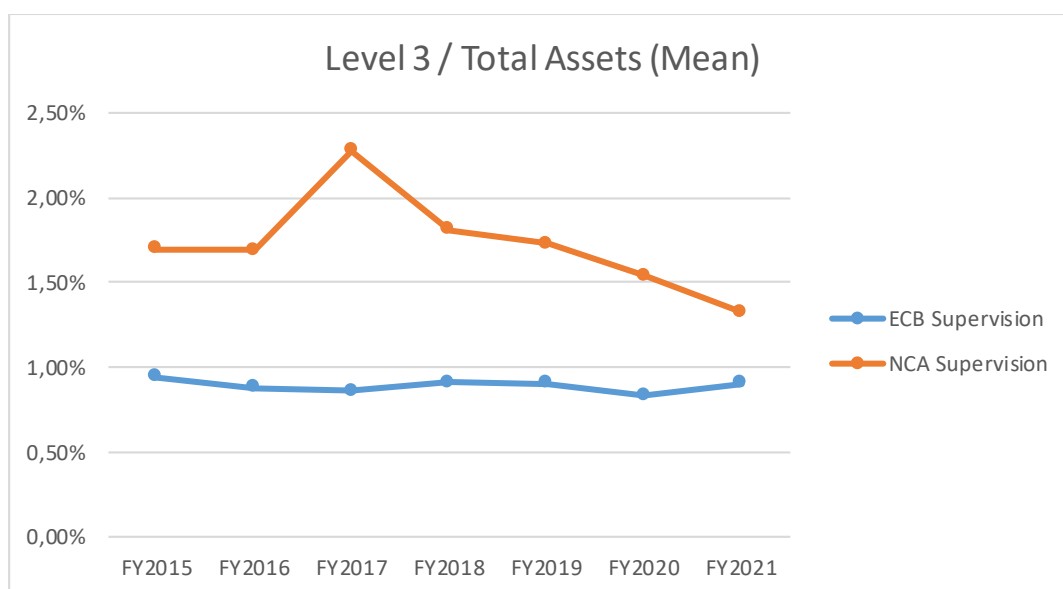
In addition to the aggregate average over all periods, Figure 1 presents a time-series graph of the magnitude of banks' level 2 and 3 fair values with separate trends for banks under the direct supervision of the European Central Bank (ECB) and under national supervision. Figure 2 is presenting the same time series for level 3 fair values only. If anything, the trend is declining until 2021 and there is no indication that the use of level 2 and 3 fair values is becoming more widespread in recent years (and especially not after the adoption of IFRS 9 in 2018).

Figure 1: Time Series of Level 2 and Level 3 Fair Values (2015-2021)



Source: S&P Capital IQ Pro. The table presents statistics for 251 IFRS-reporting banks from Eurozone countries. The graph shows the average share of level 2 plus level 3 assets in banks’ total assets for financial years from 2015 to 2021. The blue line describes banks under direct supervision of the ECB. The orange line describes banks under the supervision of national competent authorities.

Figure 2: Time Series of Level 3 Fair Values (2015-2021)



Source: S&P Capital IQ Pro. The table presents statistics for 251 IFRS-reporting banks from Eurozone countries. The graph shows the average share of level 3 assets in banks’ total assets for financial years from 2015 to 2021. The blue line describes banks under direct supervision of the ECB. The orange line describes banks under the supervision of national competent authorities.

1.2. Evidence on the Market Perception and Comparability of Level 2 and Level 3 Assets

While the enormous differences in the reported magnitude of level 2 and level 3 fair values across banks cannot be interpreted as reporting opportunism and, thus, a lack of comparability, there is a growing stream of academic studies examining market reactions to banks' presentation of level 2 and level 3 fair values. The market reactions will at least indirectly reveal the market perception of the comparability of the reported values. The literature can be classified in three different streams.

First, several studies examine the value relevance of level 2 and level 3 fair values on the balance sheet, i.e., the relationship between these book values and the market pricing of the bank's shares. The evidence is relatively robust and indicates that (i) there is hardly any valuation discount for level 2 fair values (compared with level 1 mark-to-market values), but that (ii) investors discount the reported level 3 fair values by approximately 30-40% (Song et al., 2010; Goh et al., 2015; Chung et al., 2017). The discount is particularly pronounced if the underlying asset is opaque, such as mortgage-backed securities (Huizinga and Laeven, 2010). Further results suggest that investors do not use level 3 fair value gains in the pricing of bank shares (Goh et al., 2015) and that the price discount for level 3 assets is accompanied by a higher cost of capital for the institution (Riedl and Serafeim, 2011). Taken together, this evidence suggests that investors view level 2 fair values as comparable with fully observable level 1 estimates. The uncertainty about asset values is really confined to level 3 fair values.

Second, studies like Black et al. (2022) directly examine the comparability of fair value estimates by assessing the correlations of fair value gains and losses between banks with similar fair value portfolios. The idea is that banks with similar characteristics of their asset portfolios should report similar gains or losses when estimating their fair values. The results show that the correlation is lowest if banks have the highest share of level 3 fair value estimates (and especially investments in opaque mortgage-backed securities). The result is largely consistent with the discount that investors are considering in their pricing of level 3 assets.

Third, there are cross-sectional differences in management's opportunistic use of valuation discretion. One stream of literature studies manager incentives and bank characteristics that help explain the reliability of level 3 fair value estimates. For example, Hanley et al. (2018) use security-level disclosures by insurance companies to benchmark the level 3 fair value estimates of a security with the industry-wide consensus estimate for this same security. The results suggest that typical reporting incentives like potential capital shortfalls help explain upward biases in managers' level 3 estimates. Hodder et al. (2010) find similar results for the very specific setting of fair value estimates for employee stock options. This literature suggests that the valuation risk tends to be highest in ailing banks that have the strongest incentives to appear financially healthier than they are.

We note that most of this evidence comes from data for US banks and the US capital market. However, accounting research has shown that, at least for the banking sector, these findings on the capital market perception of bank investments can plausibly be generalized to the European environment (e.g., Becker et al., 2021; Fiechter and Novotny-Farkas, 2017).

2. BANK DISCLOSURES OF LEVEL 2 AND LEVEL 3 FINANCIAL INSTRUMENTS

2.1. Disclosure Regulation

International accounting rules require very specific disclosures for level 2 and level 3 fair values. IFRS no. 13 (“Fair Value Measurement”) includes most of these requirements, which we summarize in Box 2.

Most of these disclosure rules relate to the use of level 3 fair values because information asymmetries are most pronounced for the valuation processes and valuation inputs that underlie these measurements. However, prior literature has also documented that the compliance of international banks with disclosure rules is very diverse, and especially so when it comes to disclosures about fair values (Bischof et al., 2022). Therefore, we will present evidence on the compliance of European banks with the disclosure requirements for level 3 fair values (section 2.2.). IFRS 13 also lacks standardized reporting templates and more detailed guidance on how to organize the disclosures of level 3 fair values on an instrument-by-instrument basis. Therefore, even if enforcement and compliance with the disclosure rules was perfect, a fairly high diversity of reporting formats would persist and be consistent with the disclosure standard. We assess the diversity of the resulting reporting practices and its implications for the comparability of level 3 disclosures across banks (section 2.3.).

Box 2: Disclosure requirements for Level 2 and Level 3 financial instruments

IFRS 13 requires additional disclosures when banks are employing level 2 or level 3 fair values.

In particular, banks shall disclose information “that helps users of its financial statements assess both of the following:

(a) for assets and liabilities that are measured at fair value (...), the valuation techniques and inputs used to develop those measurements.

(b) for recurring fair value measurements using significant unobservable inputs (Level 3), the effect of the measurements on profit or loss or other comprehensive income for the period.” (paragraph 91)

The required disclosures are supposed to describe (paragraph 93)

- the level of the fair value hierarchy within which the fair value measurements are categorized (Level 1, 2 or 3),
- for fair value measurements categorized within Level 2 and Level 3 of the fair value hierarchy, a description of the valuation technique(s) and the inputs used in the fair value measurement, changes in that valuation technique, and the reason(s) for making the change.

In addition, banks have to provide specific disclosures only for those fair value measurements categorized within level 3 (paragraph 93):

- quantitative information about the significant unobservable inputs used in the fair value measurement, and, for recurring fair value measures, a reconciliation from the opening balances to the closing balances,
- the amount included in profit or loss that is attributable to the change in unrealized gains or losses,
- a description of the valuation processes used by the entity,
- a narrative description of the sensitivity of the fair value measurement to changes in unobservable inputs if a change in those inputs to a different amount might result in a significantly higher or lower fair value measurement,
- the effect of potential changes in unobservable inputs,
- the highest and best use of the asset if that use differs from its current use.

Source: International Accounting Standards Board, IFRS 13.

2.2. Compliance with Disclosure Requirements

To examine the compliance with the disclosure requirements for level 3 fair values, we collect the financial reports of a representative sample of 22 IFRS-adopting banks from Germany. We systematically screen their financial statements for the years 2017, 2019, and 2021 to identify all disclosures related to level 3 fair values. For each report, we document whether the disclosures on level 3 fair values include information on (i) the valuation technique used for each asset or liability measured at level 3, (ii) the main observable and unobservable inputs into the valuation models, and (iii) the quantitative ranges of these parameters. This self-constructed disclosure score summarizes the key

requirements from IFRS 13, para. 93. In Table 2 below, we provide an overview of the sample banks included in our analysis. For each institute we report the level 2 and 3 fair values as a ratio of total fair values.

Table 2: Sample of 22 IFRS-adopting banks from Germany to examine the compliance with the disclosure requirements for level 3 fair values

Bank	Total Assets (in €bn)	Level 2 Fair Values / Total Fair Values	Level 3 Fair Values / Total Fair Values
Deutsche Bank	1,323,993	81.4%	4.8%
DZ Bank	627,273	46.6%	11.3%
KfW Group	550,962	7.1%	87.3%
Commerzbank	473,044	66.9%	4.4%
UniCredit Bank	312,112	63.0%	2.1%
LBBW	282,344	54.1%	38.9%
Bayerische Landesbank	266,554	10.3%	84.2%
Helaba	212,341	52.7%	4.3%
Deutsche Kreditbank	134,946	3.9%	93.3%
NordLB	114,663	16.7%	75.4%
DekaBank	88,865	43.6%	38.5%
Bausparkasse Schwaebisch Hall	85,371	0.0%	0.2%
Wuestenrot & Wuerttembergische	75,213	92.0%	6.6%
Volkswagen Bank	67,253	0.9%	74.8%
Deutsche Pfandbriefbank	58,402	62.5%	10.9%
Aareal Bank	48,728	27.7%	11.0%
Hamburg Commercial Bank	30,271	34.8%	58.8%
Comdirect Bank AG	29,759	98.1%	0.8%
HSBC Trinkaus & Burkhardt	29,467	83.6%	0.2%
Investitionsbank Berlin	19,485	35.4%	64.4%
ProCredit	8,216	25.2%	73.4%
ODDO BHF	7,110	2.5%	52.9%

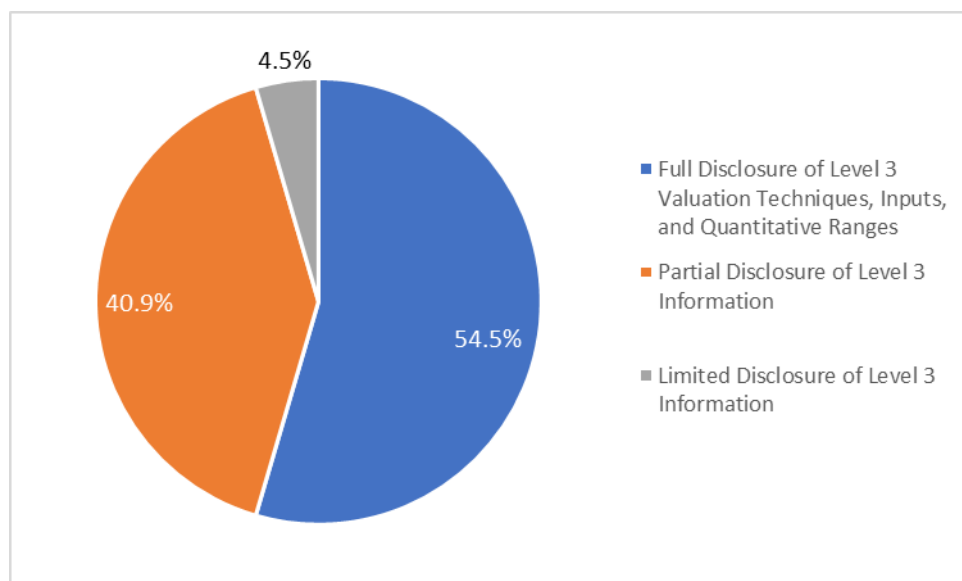
Source: Financial statements of the respective bank for the years 2017, 2019, and 2021.

Consistent with the general evidence on the disclosure compliance of European banks, compliance with the level 3 requirements is also mixed. We present our main finding in Figure 3. We observe that 54.5% of our sample banks provide detailed disclosures with comprehensive information about all three elements of the disclosure score. 40.9% of our sample banks only provide partial disclosures. Most of these banks fail to present any quantitative information about the valuation inputs and are rather unspecific in the description of these inputs. One bank (4.5%) explicitly chooses to only disclose more detailed level 3 information for a limited subset of their instruments. They argue that their valuation models do not provide a sufficient basis for level 3 estimates of the largest part of their loan portfolio.² The graph presents the distribution for the year 2021. The disclosure practice remains remarkably

² They measure these loans at amortized cost on balance sheet and income statement. Therefore, the information on the fair value hierarchy is not relevant to assess the sensitivity of the bank's equity to the valuation risk of level 3 estimates.

stable over the 5-year sample period and the evidence for 2017 and 2019 looks highly similar. The partial disclosures are not necessarily non-compliant with IFRS reporting requirements which provide significant scope of interpretation. The large fraction of less than full disclosures arises from the lack of standardization of reporting templates and materiality thresholds. This shortcoming impedes the emergence of uniform disclosure practices and makes strict enforcement impossible.

Figure 3: Disclosures of Level 3 Fair Values (2021)



Source: Own research. The figure presents statistics for 22 IFRS-reporting banks from Germany and describes the reporting of Level 3 fair values in the 2021 financial statements. The graph distinguishes between banks that provide all required disclosures of (i) the valuation techniques, (ii) the main observable and unobservable valuation inputs, and (iii) the quantitative ranges of these inputs, banks that only provide partial disclosures and banks that do not provide any of these disclosures.

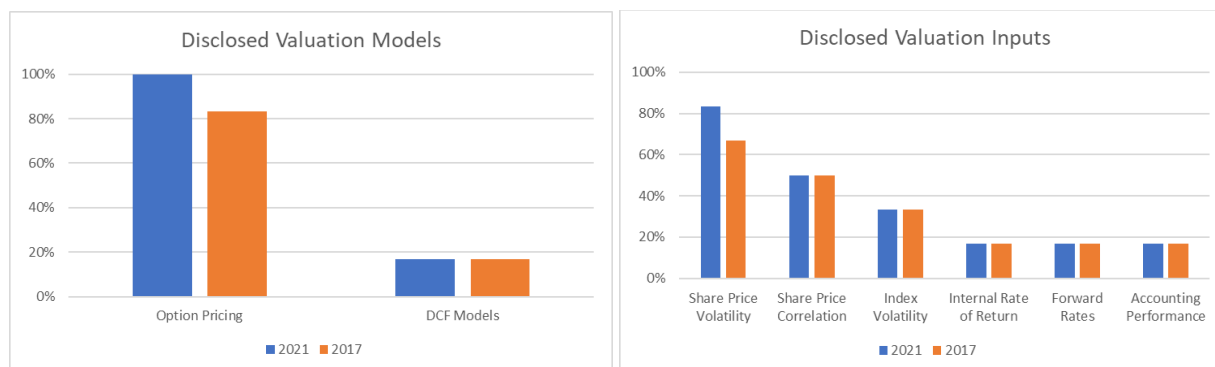
2.3. Heterogeneity in Disclosure Practice

For those banks that provide detailed disclosures, we are able to further assess the disclosure content and judge the overall comparability of disclosures on level 3 fair value estimates. We classify the disclosures into 17 categories for different financial instruments. Many instruments are highly specific (e.g., ship finance loans) and only presented by very few banks. We focus our analysis on the three instruments that are most widely used by our sample banks: equity derivatives, interest-rate derivatives, and credit derivatives. Even for these instruments, we can only identify information in 50.0% of the reports with detailed disclosures. It is unclear whether the remaining banks do not use these instruments (which appears highly implausible), do not use level 3 estimates (which would require the availability of level 2 or level 1 input), or intentionally choose to withhold the information because they view these investments as immaterial. This initial finding points to issues with the comparability of level 3 disclosures.

The comparability concerns become more severe when we look into the detailed disclosures that are available. Figure 4 presents the findings for equity derivatives. The graphs show the fraction of banks that use the respective valuation models (left-hand bars) and the respective valuation inputs (right-hand bars) in their estimation of level 3 fair values for equity derivatives. The blue (orange) bars present the statistics for financial year 2021 (2017). Most of the disclosing banks (100% in 2021) use option pricing models, few banks also use Discounted Cash Flow (DCF) models. The input is more diverse. 50% or more of the disclosing banks report that they are using share price volatility and correlations as inputs. Other inputs include index volatilities, internal rates of return, forward rates, or accounting

performance indicators. However, less than 40% of the disclosing banks report the use of any of the latter inputs.

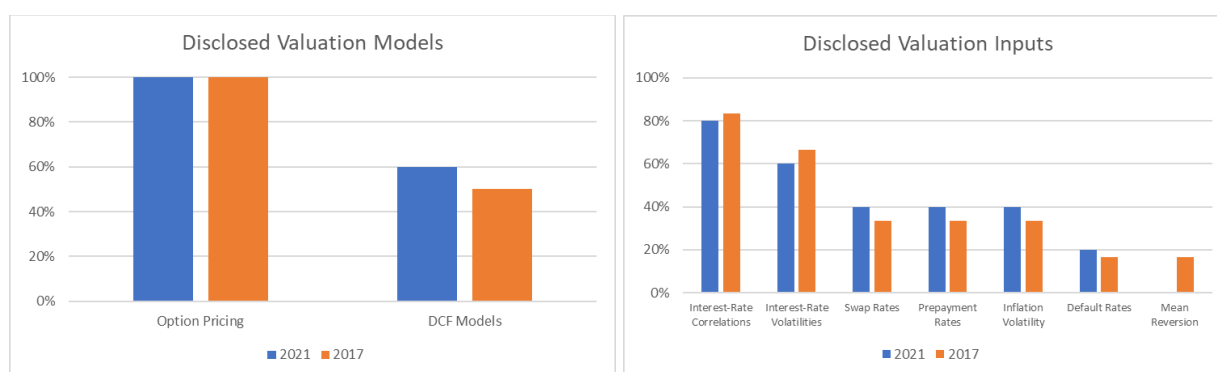
Figure 4: Disclosures of Level 3 Information on Investments in Equity Derivatives



Source: Own research. The figure presents statistics for 22 IFRS-reporting banks from Germany and describes the reporting of equity derivatives that are classified on level 3 of the IFRS 13 fair value hierarchy. 6 of the 22 provide the disclosures for equity derivatives. The left-hand graph presents the disclosed valuation models used for the estimation of level 3 fair values in financial years 2017 and 2021. The right-hand graph presents the disclosed parameters used in the implementation of these models in financial years 2017 and 2021.

Figure 5 presents the findings for interest-rate derivatives. The graphs show the fraction of banks that use the respective valuation models (left-hand bars) and the respective valuation inputs (right-hand bars) in their estimation of level 3 fair values for interest-rate derivatives. The blue (orange) bars present the statistics for financial year 2021 (2017). Similar to equity derivatives, all disclosing banks (100% in 2021 and 2017) use option pricing models, more than 50% of the disclosing banks also use DCF models. The input is again highly diverse. 50% or more of the disclosing banks report that they use interest rate volatilities and correlations as inputs. Other inputs include swap rates, prepayment rates, inflation volatilities, default rates, or mean reversion factors. Again, only 40% or less of the disclosing banks report the use of any of the latter inputs.

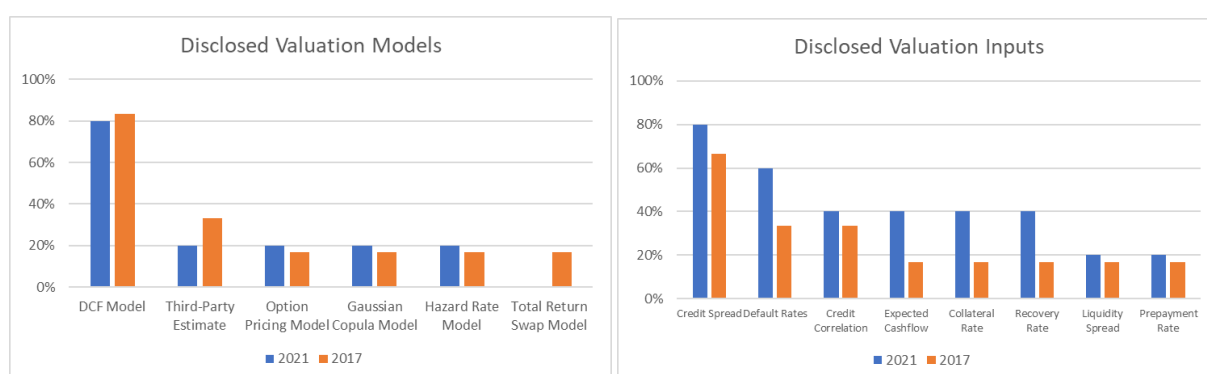
Figure 5: Disclosures of Level 3 Information on Investments in Interest-Rate Derivatives



Source: Own research. The figure presents statistics for 22 IFRS-reporting banks from Germany and describes the reporting of interest-rate derivatives that are classified on level 3 of the IFRS 13 fair value hierarchy. 6 of the 22 banks provide the disclosures for interest-rate derivatives. The left-hand graph presents the disclosed valuation models used for the estimation of level 3 fair values in financial years 2017 and 2021. The right-hand graph presents the disclosed parameters used in the implementation of these models in financial years 2017 and 2021.

Figure 6 presents the findings for credit derivatives. The graphs show the fraction of banks that use the respective valuation models (left-hand bars) and the respective valuation inputs (right-hand bars) in their estimation of level 3 fair values for credit derivatives. The blue (orange) bars present the statistics for financial year 2021 (2017). The valuation models vary more widely than for equity and interest-rate derivatives, with most of the disclosing banks (approximately 80% in 2021 and 2017) using DCF models. Other models that banks include in their lists are third-party estimates, option pricing models, Gaussian Copula models, hazard rate models, or total return swap models. The input into these models is even more diverse. 50% or more of the disclosing banks report that they are using credit spreads and default rates as inputs. Other inputs include credit correlation, expected cash flows, collateral rates, recovery rates, liquidity spreads, or prepayment rates. Only 40% or less of the disclosing banks report the use of any of these inputs.

Figure 6: Disclosures of Level 3 Information on Investments in Credit Derivatives



Source: Own research. The figure presents statistics for 22 IFRS-reporting banks from Germany and describes the reporting of credit derivatives that are classified on level 3 of the IFRS 13 fair value hierarchy. 6 of the 22 banks provide the disclosures for credit derivatives. The left-hand graph presents the disclosed valuation models used for the estimation of level 3 fair values in financial years 2017 and 2021. The right-hand graph presents the disclosed parameters used in the implementation of these models in financial years 2017 and 2021.

Overall, the evidence suggests that it is extremely difficult, if not impossible to compare the precision and reliability of banks' level 3 estimates on the grounds of the disclosures that banks provide in accordance with IFRS 13. First, many banks simply do not provide sufficient information in their level 3 disclosures and do not present the valuation models and the valuation input on an instrument-by-

instrument basis. For some of these non-disclosing banks, the immateriality of their level 3 estimates will be a valid explanation; others may not fully comply with the rules in the absence of strict enforcement. Second, the disclosures of the compliant banks reveal a large divergence of valuation procedures and, especially, valuation inputs. Our analyses of the level 3 disclosures for derivatives documents that banks use different methods and different inputs when estimating level 3 fair values for the same class of instruments. The use of different valuation inputs can be well justified (e.g., because of differences in data availability), but it reduces the comparability of the estimates.

The quantitative information about the valuation inputs that banks report in accordance with IFRS 13 frequently includes value ranges for the unobservable parameters. While comparability can generally benefit from such an information, the disclosure practice falls short of this objective. The value ranges for many unobservable inputs are extremely wide, without any additional information about the underlying distribution of the inputs in use. Therefore, an interbank comparison becomes almost meaningless. For example, one bank is reporting that its credit spread estimates in the DCF valuation of their credit derivatives range from 13 to 800 basis points, while a second bank is reporting a range for the same input and the same valuation purpose from 30 to 500 basis points. Additional information would be necessary for investors to understand whether the significant variation in these ranges is due to fundamental differences in the underlying derivative portfolio (and would thus be economically justified) or whether the variation points to different assumptions in value estimates for a largely identical portfolio.

3. FAIR VALUE RISKS AND BANKS' CAPITAL REQUIREMENTS

Bank regulation has introduced the principle of a prudent valuation of financial instruments. The Basel framework addresses valuation risks in Chapter CAP50 "Prudent Valuation Guidance". Consistent with financial reporting standards such as IFRS 13, the chapter distinguishes between mark-to-market fair values (i.e., the equivalent to level 1 fair values under the IFRS fair value hierarchy) and mark-to-model fair values (i.e., the equivalent to level 2 and level 3 fair values under IFRS hierarchy). These rules primarily affect institutions applying IFRS, because they rely more frequently on fair value measurement. However, formally speaking, the application of prudent valuation is irrespective of the applied accounting standards. Therefore, the principles are also binding for institutions applying national accounting standards (local GAAP).

In the euro area, the concept of prudent valuation is incorporated in CRR articles 34 and 105 and, in line with the Basel framework, requires banks to conduct a prudent valuation of all assets measured at fair value when computing their regulatory capital. If the prudent value is lower than the carrying amount (i.e., the fair value on the IFRS balance sheet), the Common Equity Tier 1 capital has to be reduced by the full amount of the difference (on these prudential filters see also Tröger (2022)).

Box 3 provides an excerpt from the valuation adjustments mandated by CAP50. These requirements are particularly pronounced when the asset is less liquid and its valuation risk is greatest. In these instances, banks have to make downward adjustments that specifically incorporate the model risk in level 2 and level 3 fair value estimates. Model risk, under these rules, considers both the risk of using possibly incorrect valuation methods and of using possibly incorrect valuation inputs ("calibration parameters").

Effective rules are thus in place that can provide an additional capital buffer and shield prudential capital against the risk of valuation overstatements when level 2 and level 3 fair values are used on IFRS financial statements. It is the responsibility of bank supervisors (both the ECB and the NCAs) to strictly enforce these prudential filters and care for adequate valuation adjustments and capital deductions.

Enforcement could be a critical issue if on-site supervisors cannot access internal assumptions that could be benchmarked against the respective assumptions of other banks that value a quasi-identical asset.

Disclosure requirements accompany the prudent valuation guidance. Banks' supervisory Pillar 3 reports are supposed to include a template that systematically reports the valuation adjustments for different classes of instruments (equity, interest rates, foreign exchange, credit, commodities) in the banking as well as the trading book. The standardization of these disclosures goes beyond the level of detail that banks have to report under IFRS and could serve as a role model for the standardization of the disclosures about the valuation inputs per se.

Box 3: Prudential Valuation Adjustments under the Basel Framework

Valuation adjustments

CAP 50.9: "As part of their procedures for **marking to market**, banks must establish and maintain procedures for considering valuation adjustments. Supervisory authorities expect banks using third-party valuations to consider whether valuation adjustments are necessary. Such considerations are also necessary when **marking to model**."

CAP 50.10: "Supervisory authorities expect the following valuation adjustments/reserves to be formally considered at a minimum: unearned credit spreads, close-out costs, operational risks, early termination, investing and funding costs, and future administrative costs and, where appropriate, **model risk**."

CAP 50.11: "Banks must establish and maintain procedures for judging the necessity of and calculating an adjustment to the current valuation of less liquid positions for regulatory capital purposes. This adjustment may be in addition to any changes to the value of the position required for financial reporting purposes and should be designed to reflect the **illiquidity** of the position. Supervisory authorities expect banks to consider the need for an adjustment to a position's valuation to reflect current illiquidity whether the position is marked to market using market prices or observable inputs, third-party valuations or marked to model."

CAP 50.13: "For complex products including, but not limited to, securitisation exposures and n-th-to-default credit derivatives, banks must explicitly assess the need for valuation adjustments to reflect two forms of **model risk**: the model risk associated with using a **possibly incorrect valuation methodology**; and the risk associated with using **unobservable (and possibly incorrect) calibration parameters** in the valuation model.

CAP 50.14: "The adjustment to the current valuation of less liquid positions ... must impact Tier 1 regulatory capital **and may exceed those valuation adjustments made under financial reporting standards**."

Source: Basel Committee for Banking Supervision, Basel Framework, Chapter CAP50.

4. LEVEL 2 AND LEVEL 3 INSTRUMENTS OUTSIDE THE ECB'S DIRECT SUPERVISION

Banks' use of level 2 and level 3 instruments is much more limited at less significant banks than it is for significant banks under direct ECB supervision. First, level 2 and level 3 fair value estimates only play a prominent role in IFRS reporting and much less so in the local GAAP of the euro area countries. The fraction of the less significant institutions that are required to adopt IFRS is significantly lower than that of the significant institutions. According to Bureau van Dijk BankFocus data for financial year 2020, only 29.1% of all euro area banks adopted IFRS, whereas the fraction is above 90% for significant institutions under direct ECB supervision.³ A large part of those banks that adopt local GAAP are not exposed to any valuation risk from level 2 and level 3 fair values at all. Second, by definition, the less significant banks are systematically smaller in size. Thus, the magnitude of their level 2 and level 3 portfolios is also smaller. Third, as we have shown in Section 1, the fraction of level 2 and level 3 assets held by the smaller banks is also lower than that of the largest banks.

In absolute terms, we use Bureau van Dijk BankFocus to benchmark the aggregate book value of level 2 and level 3 fair values estimated by the 110 significant institutions within the Single Supervisory Mechanism (SSM) against the aggregate book value of these fair values estimated by all other institutions. The data is consistent with our reasoning above and shows that the aggregate level 2 and level 3 fair values estimated by financial institutions outside the ECB's direct supervision make up 18.4% (i.e., less than one fifth) of the aggregate fair values estimated by banks under direct ECB supervision. Put differently, 84.5% of all level 2 and level 3 estimates by euro area banks are under direct ECB supervision.

³ Note that the fraction also varies substantially across countries. For example, only 2.6% of banks in Germany, but 81.5% of banks in Spain are listed as IFRS adopters in financial year 2020.

5. QUESTIONS

Could bank supervision distinguish more clearly between level 2 and level 3 fair values, consistent with the fair value hierarchy from financial reporting standards such as IFRS, or are all mark-to-model fair values assessed in a uniform way?

How could a standardized disclosure template for the reporting of quantitative information about valuation models and valuation inputs on an instrument-by-instrument basis be designed and should such a template rather be embedded in the supervisory Pillar 3 reporting or the IFRS financial statements?

How does onsite supervisory practice ensure the access to the critical internal inputs into the valuation models and all major assumptions about unobservable parameters in a way that a consistent valuation of quasi-identical instruments can be enforced across banks?

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ANNEX: DIS30 DISCLOSURE TEMPLATE FOR BANKS' PVAS

Template PV1: Prudent valuation adjustments (PVAs)

Purpose: Provide a breakdown of the constituent elements of a bank's PVAs according to the requirements of [CAP50](#), taking into account the guidance set out in *Supervisory guidance for assessing banks' financial instrument fair value practices*, April 2009 (in particular Principle 10).

Scope of application: The template is mandatory for all banks which record PVAs.

Content: PVAs for all assets measured at fair value (marked to market or marked to model) and for which PVAs are required. Assets can be non-derivative or derivative instruments.

Frequency: Annual.

Format: Fixed. The row number cannot be altered. Rows which are not applicable to the reporting bank should be filled with "0" and the reason why they are not applicable should be explained in the accompanying narrative. Supervisors have the discretion to tailor the format of the template to reflect the implementation of PVA in their jurisdictions.

Accompanying narrative: Banks are expected to supplement the template with a narrative commentary to explain any significant changes over the reporting period and the key drivers of such changes. In particular, banks are expected to detail "Other adjustments", where significant, and to define them when they are not listed in the Basel framework. Banks are also expected to explain the types of financial instruments for which the highest amounts of PVAs are observed.

	a	b	c	d	e	f	g	h
	Equity	Interest rates	Foreign exchange	Credit	Commodities	Total	Of which: in the trading book	Of which: in the banking book
1	Closeout uncertainty, of which:							
2	Mid-market value							
3	Closeout cost							
4	Concentration							
5	Early termination							
6	Model risk							
7	Operational risk							
8	Investing and funding costs							
9	Unearned credit spreads							
10	Future administrative costs							
11	Other							
12	Total adjustment							

Definitions and instructions

Row number	Explanation
3	<i>Closeout cost:</i> PVAs required to take account of the valuation uncertainty to adjust for the fact that the position level valuations calculated do not reflect an exit price for the position or portfolio (for example, where such valuations are calibrated to a mid-market price).
4	<i>Concentration:</i> PVAs over and above market price and closeout costs that would be required to get to a prudent exit price for positions that are larger than the size of positions for which the valuation has been calculated (ie cases where the aggregate position held by the bank is larger than normal traded volume or larger than the position sizes on which observable quotes or trades that are used to calibrate the price or inputs used by the core valuation model are based).
5	<i>Early termination:</i> PVAs to take into account the potential losses arising from contractual or non-contractual early terminations of customer trades that are not reflected in the valuation.
6	<i>Model risk:</i> PVAs to take into account valuation model risk which arises due to: (i) the potential existence of a range of different models or model calibrations which are used by users of Pillar 3 data; (ii) the lack of a firm exit price for the specific product being valued; (iii) the use of an incorrect valuation methodology; (iv) the risk of using unobservable and possibly incorrect calibration parameters; or (v) the fact that market or product factors are not captured by the core valuation model.
7	<i>Operational risk:</i> PVAs to take into account the potential losses that may be incurred as a result of operational risk related to valuation processes.
8	<i>Investing and funding costs:</i> PVAs to reflect the valuation uncertainty in the funding costs that other users of Pillar 3 data would factor into the exit price for a position or portfolio. It includes funding valuation adjustments on derivatives exposures.
9	<i>Unearned credit spreads:</i> PVAs to take account of the valuation uncertainty in the adjustment necessary to include the current value of expected losses due to counterparty default on derivative positions, including the valuation uncertainty on CVA.
10	<i>Future administrative costs:</i> PVAs to take into account the administrative costs and future hedging costs over the expected life of the exposures for which a direct exit price is not applied for the closeout costs. This valuation adjustment has to include the operational costs arising from hedging, administration and settlement of contracts in the portfolio. The future administrative costs are incurred by the portfolio or position but are not reflected in the core valuation model or the prices used to calibrate inputs to that model.
11	<i>Other:</i> "Other" PVAs which are required to take into account factors that will influence the exit price but which do not fall in any of the categories listed in CAP50.10 . These should be described by banks in the narrative commentary that supports the disclosure.

European banks have substantial investments in assets that are measured without directly observable market prices (mark-to-model). Financial disclosures of these value estimates lack standardization and are hard to compare across banks. These comparability concerns are concentrated in large European banks that extensively rely on level 3 estimates with the most unobservable inputs. Although the relevant balance sheet positions only represent a small fraction of these large banks' total assets (2.9%), their value equals a significant fraction of core equity tier 1 (48.9%). Incorrect valuations thus have a potential to impact financial stability. 85% of these bank assets are under direct ECB supervision. Prudential regulation requires value adjustments that are apt to shield capital against valuation risk. Yet, stringent enforcement is critical for achieving this objective.

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