Fair Value Illiquid Assets and the Opacity Discount in Banks' Valuation

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Abstract

The paper investigates the impact of illiquid fair value (Level 2 and Level 3) assets on banks' valuation, with a focus on the change in the ratio between holdings of Level 3 assets (the most opaque and illiquid fair value asset category) and holdings of Level 2 assets. The boundary between Level 3 and Level 2 assets is blurred and less clear than the one between Level 1 and Level 2 assets. This unclear border provides room for opportunistic behavior by management which can opt for the less transparent Level 3 instrument instead of Level 2. The paper introduces changes into Level 3-to-Level 2 assets ratio as new measure for capturing an increase in the opacity of fair value assets and suggests a negative relationship between the increase of this ratio and price-to-book-value for European banks. The rationale behind this intuition is that market participants understand a growth of Level 3-to-Level 2 assets ratio as an increase of the opacity of firm's fair value assets, since Level 3 assets might offer similar features as extremely illiquid Level 2 assets, though relying on an entirely proprietary model-based valuation. With a sample of 35 European banks and a time horizon from 2009 to 2018, I find that an increase of 100 bps in Level 3-to-Level 2 assets ratio drives a decrease of 67.5 bps (81.3 bps with firm-year fixed effects) in price-to-book value. Results are robust when compared with different measures of firm relative valuation and with another measure of illiquidity in fair value assets holdings (Level 2-to-Level 1 assets ratio).

Keywords: Banking, Opacity, Fair Value Accounting, Level 3 Assets

JEL-Classification: G21, G28, G32, M41

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1. Introduction

Fair value measurement (FVM) since its introduction in U.S. GAAP and later on in the International Financial Reporting Standards (IFRS)[2] has witnessed a strong interest by a wide audience. Both academics as well as supervisory authorities dealt with this topic, due to the relevance of this accounting principle for the stability of banks and the transparency of their balance sheets.

Fair value is intended to be a market-based measurement as opposed to an entity-specific measurement and/or amortized cost valuation. To isolate different degrees of market-based fair values and in order to increase the consistency and comparability in fair value measurement, IFRS 13 defines a 'fair value hierarchy' (FVH) that distinguishes among three levels of inputs implemented in valuation techniques to measure the fair value of financial instruments. The three levels of the fair value hierarchy are based on the observability of the pricing inputs and hence the transparency of the pricing models as well as, indirectly, the degree of illiquidity of the financial instrument[3].

This paper deals with the fair value measurement of illiquid assets. There are at least three concurrent pieces of evidence that motivate the growing importance of this topic.

Firstly, the relevance of fair value measurement has grown side by side with the realization that some of the most illiquid financial instruments, whose valuation depends on FVM and FVH, may pose a threat to the financial system. Illiquid and marked-to-model fair value measured assets are now under the scrutiny of regulatory authorities, due to their relative significance in the balance sheets of European banks. Bank of Italy (2017) investigates the valuation risk affecting less liquid fair valued financial instruments that weight more than 6.8 trillions of euro (considering both assets and liabilities) in Single Supervisory Mechanism (SSM) banks' balance sheets.

Secondly, a further supporting evidence of the gain in momentum for fair value measurement of illiquid assets is given by the inclusion of such instruments in the EBA (2018) stress test 2018 methodology[4]. The total impact coming from the inclusion of Level 2 and

[2] Fair value measurement was firstly introduced in September 2006 in the U.S. Generally Accepted Accounting Principles (GAAP) by FASB, through the release of its Statement of Financial Accounting Standards n. 157 (FAS 157). The principle then became effective for the U.S. as the beginning of the new fiscal year in November 2007. The same principle was later introduced in IFRS adopting countries in May 2011 via the release of IFRS 13 "Fair Value Measurement", which then became effective as January 2013. IFRS 13, likewise FAS 157, introduced a standard definition of fair value: "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.".

[3] Annex 1 describes in detail the inputs for the three levels of fair value hierarchy.

[4] The EBA 2018 stress tests methodology implements as a new feature a liquidity and model uncertainty shock on banks' reserves covering most illiquid fair-value measured instruments (Level 2 and Level 3 instruments). The stress tests methodology formulates a shock in the market risk scenario which is then transferred into the

Level 3 instruments in the stress tests amounts to -21 billion euros (or -25 bps on average on the CET1 capital ratio) of which -5.4 billion euros correspond to the most illiquid level in the hierarchy (i.e., Level 3 instruments) and -16 billion euros the second most illiquid level in the hierarchy (i.e., Level 2 instruments), and affects capital mainly through P&L (with a detriment of reserves by -19.5 billion euros) with some banks suffering from a reduction in CET1 capital ratio as high as -75 bps.

Thirdly, the appropriate assessment of market risk is also one of the supervisory priorities set out by the European SSM for 2019. The European Central Bank (2018) states that the risk of an abrupt and significant repricing in financial markets has increased in 2018. In case a repricing would occur, banks would be affected mostly through their holdings of instruments recognized at fair value, collateral requirements and through the additional costs to raise capital or liquidity. Illiquid assets may play a crucial role in such circumstances.

As mentioned by Kisseleva and Lorenz (2016), the banking sector represents the perfect environment to evaluate the fair value hierarchy disclosure for several reasons. First, banks naturally hold the largest amount and variety of fair value instruments due to their institutional purpose, so these assets significantly affect banks' balance sheet. Secondly, banks are also more likely to recognize a significant amount of their financial assets and liabilities at fair value because they have advanced knowledge of the market and various estimation techniques. Finally, the banking sector is subject to strict regulation, so a complete and detailed disclosure on fair value estimates is expected.

Whereas the interest for fair value measured instruments in considering the risks for banks stability has grown in relevance, the homogeneity of each FVH level is somehow given for granted and the assessment of this homogeneity is a less beaten path. Meanwhile the requirements for belonging to the most liquid level of fair value instruments (Level 1) are clear and defined, the same clearness is not true for the other two levels.

This paper addresses such issues by focusing on the foggy boundary that separates Level 2 and Level 3 instruments, the two most illiquid levels of instruments in the fair value measurement. Specifically, I examine whether the ratio between Level 3 and Level 2 assets is interpreted by the market's participants as value relevant. A sudden increase in this ratio (hence a sudden increase in the relative weight of Level 3 w.r.t. Level 2 assets) is expected to have a negative effect on bank market value, as this implies that the bank is relying more on the most opaque and illiquid level of the FVH, that in turn also implies stronger discretional

bid-ask spread of fair value instruments and produces an increase in the reserves on fair value adjustments covering liquidity issues and model risk.

inputs in the valuation model. This ratio may be understood as a broad and easy-to-measure statistics that describes the overall behavior of banks regarding the two most illiquid levels of fair value instruments, as well as a metric to capture the dependency of the bank on Level 3 instruments[5].

This paper contributes to the literature by introducing a new and easy-to-compute ratio that depicts the dependency of banks' business on relatively illiquid assets and the rate of opacity of their balance sheets. Other papers, such as Kolev (2019), highlight the importance of addressing the distinction between Level 2 and Level 3 instruments and consider the net transfer into Level 3 assets as a measure for management inclination to shift to mark-to-model during harsh times. Unfortunately, net transfer into Level 3 does not capture the entire picture regarding opacity in fair value assets (henceforth also referred as FVA), as different forms of counterbalancing can be employed by the management (i.e. management could unwind a Level 2 asset and then issue a brand-new Level 3 asset answering to the same need for the client as the previous Level 2 instrument). However, by considering the change that occurs in the ratio between Level 3 and Level 2 assets for 35 major banks from mid-2009 to mid-2018 I propose a comprehensive measurement of bank's fair value illiquid assets opacity.

A clear finding of this paper is the following: banks' relative valuation (i.e., market capitalization over equity book value, or price to book value) decreases whenever a financial institution increases its stake in Level 3 assets w.r.t. Level 2 assets. An increase of 100 basis points (bps) in the ratio between Level 3 assets and Level 2 assets implies a decrease in the price to book value (PBV) by 86 bps on the day of disclosure of this information.

The paper is organized as follows, Section 2 describes the literature on the relevance of fair value measured assets on firms' market capitalization, Section 0 introduces the two hypotheses under investigation, Section 4 presents the data and the methodology employed in the empirical analysis, Section 5 shows the results of the empirical analysis and the robustness' check. Section 6 concludes.

2. Previous literature

Since their implementation in international accounting standards, fair value measurement and fair value hierarchy have received more and more interest from researchers

[5] This ratio reflects any change into the two categories, such as purchases, sales, issuances and settlements, as well as any transfer of instruments into and out of the two levels, due to recurring re-calibration of instrument's fair value hierarchy. Being comprehensive and not solely depending on re-calibration of instruments in fair value hierarchy, makes this ratio a more suitable item to describe the overall shift in opacity of bank's fair value assets rather than being a measure only suitable to explain the propensity of management to the transfer of instruments from Level 2 to Level 3.

and regulatory authorities. The most prudential understanding of FVM is that is a more farsighted valuation tool for assets and liabilities when historical cost figures poorly represent instruments' true value[6]. Topics of significant interest in this area relate the relationship between the fair value measured in firm's balance sheets and the market value of the firm, whether FVM produces procyclical effects in valuating instruments held on firms' balance sheet items as well as whether or not it concurs in deepening financial crisis for banks already in distress. Another major area interest is whether managers have a discretionary chance to inflate firm's balance sheet valuation by relying on fair value valuation. However, in the area of management behavior, incentives and transparency, the study of the narrow boundary between Level 2 and Level 3 instruments itself is something less examined.

Kolev (2019)[7] is among the earliest to study if equity investors perceive fair value estimates as value relevant. Relying on a data set of 177 U.S. financial institution for the first three quarter of 2008 the author examines whether investors perceive mark-to-model fair value estimates as reliable and if they consider them in assessing firms' value. In this framework Kolev (2019) documents a significant positive association between stock prices and Level 1, Level 2, and Level 3 fair values net assets, which is interpreted as evidence that fair value estimates are value relevant to equity investors. This also implies that such estimates are deemed as sufficiently reliable to be included in firms' value.

Furthermore Kolev (2019) finds that the relevance of fair value assets increases in the observability of the measurement inputs and the difference between mark-to-market (Level 1) and mark-to-model (Level 3) is associated to a discount of roughly 30 percent. This finding supports the hypothesis that investors do perceive opaqueness in fair value assets valuation as a discounting factor based on the observability of the measured item. Paper results are confirmed when the analysis focuses only on banks with thin capital cushion, poorer information environment and weaker corporate governance.

These earliest findings suggest that investors perceive management-provided mark-to-model valuations reliable enough, although to a lesser extent than valuation based on more observable inputs. Investors do apply a discount to more opaque financial instruments which

[6] A tradeoff between relevance and reliability exists, where supporters of fair value cite its informativeness to financial statement users and emphasize the improved timeliness and transparency of the reported financials (Ryan 2007; 2008). Consistent with this idea, prior studies find that fair value estimates are generally value-relevant over and above historical cost figures (i.e., Barth et al. 1996, 2001; Carroll et al. 2003) and are useful to communicate managers' private information (Beaver and Venkatachalam 2003; Beatty and Harris 1999). Opponents of fair value accounting, however, emphasize that fair value estimates are inherently unreliable, introducing noise and bias in the firms' financial reports.

[7] The first draft of Kolev's paper dates back to 2009. This is the reason why Kolev's paper is the first to be reviewed in this Section.

can be driven by the discretionary assumptions in the valuation models rather than by the illiquidity of the instrument.

The paper then also examines investors' perception of the reliability of mark-to-model estimates through the study of periodic changes in fair value estimates. The author, among other things, documents a significantly positive association between Level 3 net gains and quarterly returns. In order to assess if the composition of period-to-period changes in Level 3 assets affects investors' perception, the author relies on the information from the reconciliation of the change in Level 3 assets and liabilities disclosure mandated by FAS 157. In this reconciliation statement the overall net change in Level 3 asset is decomposed into i) total net gain on Level 3 assets and liabilities for the quarter, ii) net purchase on Level 3 assets and liabilities for the quarter and iii) net transfer into Level 3 net assets for the quarter[8]. If the market for a particular asset measured at fair value ceases to be sufficiently deep and liquid, then the asset will be transferred into the Level 3 group . The author finds (i) a positive and significant coefficient for net gains w.r.t. market equity value of firms, consistent with the conjecture that equity investors find the management-generated fair value estimates to be sufficiently reliable, (ii) a positive and significant coefficient for net purchases and (iii) a negative and significant coefficient for net transfer, reflecting a liquidity discount.

Goh et al. (2015) expand further the analysis performed by Kolev and investigate how investors price fair value estimates of assets on 477 U.S. banks between 2008 and 2011. As Kolev (2019) they find a negative relationship between observability of inputs and the discount on fair value assets. Level 3 assets are typically priced lower than Level 1 and Level 2 fair value estimates. They also show that differences in discounting across levels of FVH decrease over time and they interpret this finding as a marked improvement with regard to how investors perceive less liquid fair value estimates as market conditions stabilize. As markets stability strengthen in the aftermath of the 2008 financial crisis, reliability concerns about Level 3 estimates dissipate to some extent.

Goh et al. (2015) also examine whether Level 3 gains affect the pricing of Level 3 estimates since managers have discretion to use Level 3 gains to manage earnings and inflate asset values. They find no statistical evidence suggesting that the magnitude of Level 3 fair value gains and losses lead investors to price Level 3 assets differently. The discounting of Level 3 estimates is thought to be driven by concerns about a lack of reliability in the fair value estimation of illiquid assets rather than concerns on managers' misuse of fair value

[8] Net gain captures any increment given by the re-measurement of Level 3 assets, net purchases capture open market transactions or maturity of investments (i.e., it involves the exchange of cash or another balance sheet component with known market value for the respective Level 3 asset or liability), and net transfer component reflects the change in the liquidity of the firm's portfolio.

estimates to inflate earnings and asset values. The relevance of managers behavior on fair value assets gains and losses disclosure is essential to address the broader topic of whether FVH inherently carries a design flaw regarding opacity and misreporting of firms' assets.

Among previous studies Benston (2006) asserts that fair value estimates are easily manipulated in the absence of an actively traded market. He describes how fair value estimates of financial instruments priced using traders' own valuation models and relying on traders' own estimates of forward price curves are easily manipulated by tweaking the inputs' assumptions. Martin et al. (2006) suggest that auditors face significant challenges trying to verify hard-to-estimate fair value measurements, given that Level 3 gains and losses are based on valuation techniques that incorporate inputs and outcomes that cannot be directly verified. Ryan (2008) argues that when quantitative disclosure on Level 3 inputs is not given, reported Level 3 measurements are difficult to interpret and to compare across different firms and over time. Then, at the eve of the introduction of fair value accounting Benston (2008) predicted that opportunistic managers will use it to manipulate reported net income.

Finally, Goh et al. (2015) address whether pricing of fair value estimates changes as banks show different capital adequacy ratios. The authors find that banks with capital adequacy above the median benefit from higher pricing of Level 1 and Level 2 fair value estimates by investors, whereas Level 3 is not affected by cross-sectional variation in firms' capital adequacy ratios. This finding is interpreted by the authors as if investors are concerned that banks with low capital adequacy might incur in fire sale of these relatively more liquid assets, given the greater cost to raise new equity.

Song et al. (2010) study the relationship between corporate governance mechanism and fair value hierarchy by focusing on the trade-off between relevance and reliability. They point out that proponents of fair value accounting argue that fair value information has greater relevance and a greater accuracy in reflecting real assets volatility. By contrast, opponents of fair value accounting argue that fair value measurements are less verifiable by investors and subject to greater estimation error by management and/or managerial manipulation. These shortcomings may create information asymmetry between investors and managers that threaten the reliability of fair values and this threat is expected to be increasing as fair value inputs become less observable by investors. Using quarterly reports on the first three quarters of 2008 for 341 U.S. banking firms, resulting in a total of 1,260 firm-quarter observations, they test the value relevance of fair value measures for each of the three disclosure levels and find that the value relevance of Level 1 and Level 2 fair values is greater than the value

relevance of Level 3 fair values[9]. To verify whether their hypothesis of discounted fair value relevance for Level 3 with respect to Level 1 holds for a heterogenous sample of banks and it is not correlated with bank-specific characteristics (e.g., firm size and firm capitalization) they perform the analysis on sub-samples partitioned by firm size and Tier 1 capital ratio and find that their results continue to hold in all sub-samples.

Song et al. (2010) results are in line but not identical to previous studies on the same topic such as Kolev (2019) and Goh et al. (2015). They find that valuations of Level 1 and Level 2 assets are close but below one (i.e., investors value each dollar invested in Level 1 and Level 2 assets slightly less than management valuation) and Level 1 and Level 2 liabilities close and below negative one, while previous papers find valuations of Level 1 and Level 2 net assets significantly less than one.

Divergences also exist in fair value relevance across different levels of the hierarchy. Goh et al. (2015) document that investors value Level 2 net assets less than Level 1 net assets but do not value Level 2 and Level 3 net assets differently. Song et al. (2010) show that Level 1 and Level 2 assets are valued similarly (0.968 and 0.972 respectively), while Level 3 assets are valued the least (0.683).

Results differ as well across time: Goh et al. (2015) document that the value relevance of net fair value assets decreases over the first three quarters of 2008, whereas Song et al. (2010) find that the value relevance of fair values does not decrease over this period.

The discounting effect for Level 3 assets is rather established in previous empirical literature as well as strongly supported by the rationale employed by investors in understanding the fair value hierarchy (i.e., the opaquer and more distant from market-related variables is the valuation procedure, the less valuable is the asset/liability for the investor). By contrast, differences in discounting with respect to time, liquidity of the market and other variables associated with the economic cycle are less investigated topics[10]. In addition, Song et al. (2010) evidence that the value relevance of fair values assets (especially Level 3 fair values) is greater for firms with strong corporate governance, suggesting that investors apply a more severe discount to Level 3 estimates for those banks with a weak corporate governance.

Bosch (2012) is the very first to analyze the value relevance of FVM for European banks, by focusing on the lack of reliability of Level 3 instruments. The study uses 408 yearly

[9] As a measure of value relevance originated from management for balance sheet items, they use per share fair value assets and per share fair value liabilities. As a measure of value originated by investors for the entire bank, they use price per share.

[10] Understanding whether a link exists between fair value relevance and market liquidity is a topic of interest especially for regulatory authorities who are interested in the market's perception of the reliability of fair values during an economic crisis.

financial observation from 2006 to 2010 and shows that fair values for all measurement levels are value relevant, although Level 3 measurements are significantly less reliable than Level 1 or Level 2. In comparison with earlier studies on the U.S. market, the discount for fair value estimates associated to European banks is stronger, especially for Level 3 assets. The author, as in previous studies, relies on price per share as a measure of the current value of the firm and fair value assets deflated by outstanding number of shares as explanatory variables. Bosch (2012) overtakes the limitation of previous papers by extending the sample period, where the analysis strongly relies on the subprime crisis in 2008 and cover only a small post-crisis period. Based on the forward-looking feature of fair value measurements the author postulates and finds value relevancy for investor regarding the overall amount of fair value instruments and for each level of the hierarchy. Then, because of greater measurement errors, the author also finds a decrease in the value relevance (and the reliability) of the instruments with decreasing hierarchy level. Finally, the author also investigates the impact of regulatory capital and reclassification decisions on the reliability of mark-to-model fair values. In contrast to the results of Goh et al. (2015), this paper shows that the regulatory capital ratio has no significant influence on the reliability of Level 3 measurements.

Bagna et al. (2014) also investigate whether FVA instruments held by banks located in Europe suffer from a market discount. The paper employs a sample of 120 European banks during the period between 2008 and 2012 for a total of 540 firm-year observations. They found that the main sources of the discount for Level 3 instruments are the opacity of the disclosure related to those instruments, the ability for management to manipulate Level 3 inputs (and indirectly the earnings related to those instruments) and the presence of a discount on illiquid instruments, which is not included in management Level 3 fair value estimates.

In partial conflict with Bosch (2012), Kisseleva and Lorenz (2016) focus their study on FVM analysis for European banks but reach different results. The authors investigate whether Level 3 assets fair values disclosed by European banks provide useful information to investors and whether this information is reflected in firm value changes. Using a sample of 416 firm-year observations and measuring the relationship between price per share and FV assets scaled by the number of common shares outstanding they find no overall evidence that changes in Level 3 fair values are associated with changes in firm value. They interpret this lack of informativeness for European banks on Level 3 estimates as a failure in the disclosure of the reporting and, based on previous results from the literature, they suggest that this disclosure should be improved, especially on the qualitative side (i.e., with additional information such as text-written descriptions and explanations).

They also study whether the recognition of Level 3 assets for accounting treatment is value relevant for the firm. They find that Level 3 instruments held for trading (HFT) are reflected in firm value. The authors link this relevance to the short-term purposes of HFT assets. Since these trading instruments are held for short-term purposes only, investors may assess their valuation technique as less susceptible to estimation errors and tend to rely more on managers' estimates, whereas for longer term FV assets this reliability breaks down. The conflicting findings of Bosch (2012) and Kisseleva and Lorenz (2016) suggest that outstanding number of shares as a deflator might be used carefully for European banks due to its high volatility on both cross-sectional and time-series basis. Nonetheless Kisseleva and Lorenz (2016) correctly address the requirement of further disclosure for the European banking sector.

Mohrmann and Riepe (2017) study the relationship between fair value assets and bank riskiness. Specifically, they investigate the link between Level 3 estimates and banks' default risk as well as default costs and whether a large allotment of resources in Level 3 assets pose a threat to a bank's creditors as well as to the regulatory authorities. They use a sample of 644 banks and consider quarterly observation from 2008 to 2012. They find a link between Level 3 estimates and higher volatilities as well as lower market values. Using a period and banks fixed effect panel model they identify the effect of Level 3 assets on banks' overall default risk identifies as Merton's Distance-to-Default (DD). Mertons' DD captures the expected default probability and thereby represents a metric that is important to creditors and regulatory authorities. They find a strong and positive link between Level 3 estimates and the distance to default which points towards a higher default risk for banks that rely more on Level 3 estimates.

They also analyze information risk and overvaluation as potential drivers of Merton's DD. By exploring the link of the different fair value levels on the information risk as measured by the volatility in the share return, they find a strong relationship between the Level 3 estimates and the return volatility. The positive link stays strong even after controlling for the beta factor and these findings furtherly corroborate the empirical evidence provided by Riedl and Serafeim (2011) as well as Chung et al. (2017) on the leveraging effect of Level 3 estimates on Capital Asset Pricing Model (CAPM) betas. Overall, the main contribution from Mohrmann and Riepe (2017) indicates that Level 3 estimates not only increase the systemic risk but also the idiosyncratic information risk.

Lastly, Bank of Italy (2017) focus on Level 2 and Level 3 assets in order to investigate the level of complexity in the balance sheets of the major euro area banks. The paper argues that the complexity and opacity of these instruments create room for discretionary accounting

and prudential choices by financial intermediaries and also that the current regulatory reporting standard is not sufficient to make a comprehensive assessment of the overall risks stemming from the most illiquid instruments. The authors also highlight that these instruments share most of the characteristics with NPLs, such as illiquidity and opacity in the valuation, and argue that the risk they pose might also be comparable.

Table 9 summarize the main findings of previous literature.

3. Hypotheses development

Previous literature shows the relevancy of FVH and its contribution to the value of financial firms, yet, as briefly mentioned in Section 1, FVA and L2A in particular might differ considerably among themselves. This rich heterogeneity in the sample and the absence of any further sub-level hierarchy solicit a deeper analysis and specification of the problem only partially addressed by previous literature. As L2A might substantially differ internally, where some of them have a pricing structure closer to a complete mark-to-market approach and others with barely enough observable inputs to be considered Level 2, any changes and transfer across Level 2 and Level 3 represent the clear subject of study. However instead of studying net transfer from Level 2 to Level 3 gathered from the reconciliation of the change in Level 3 assets and liabilities disclosure mandated by FAS 157, the ratio between L3A and L2A, offers a broader and practical representation about how much the financial institution relies on the most illiquid fair value instruments and how intense is the opacity of the FVA structure. A change in the observability of the inputs for a very illiquid L2A might trigger a change in its FVH, from Level 2 to Level 3, resulting in an increase of the opacity of FVA, this phenomenon is not always captured by net transfer of FVA into and out of L3A and other discretional accounting opportunities might arise if net transfer into/out of L3A is the solely clue of interest regarding an increase in the opacity of FVA structure. For example, cannot be excluded that an unwinding of L2A in t_0 might result, later on, in a new issuance of L3A in t_{1+i} and what is ultimately a net transfer of asset from one hierarchy to the other is neglected from the selected measure. Focusing only on net transfer offer a short-sighted solution to the problem. The presence of different available solutions for management when a L2A must be restated as L3A requires a broader measure than just the amount of L2A transferred into L3A and $\frac{L3A_{i,t}}{L2A_{i,t}}$ suits this requirement. $\frac{L3A_{i,t}}{L2A_{i,t}}$ can be understood as the reliability of the firm on severely illiquid and complex fair value instruments (L3A) w.r.t. its overall holdings of fairly illiquid and slightly complex fair value instruments (L2A). Furthermore, deflating L3A with L2A excludes any issues related to the business structure of the firm which might be collected

by measures such as L3A (L2A) over total assets, equity or other capital-based deflator[11]. But in order to capture a shift in the opacity of firms' FVA structure, the change in the ratio of L3A to L2A, truly represents our main variable of interest. Focusing on changes rather than level of L3A to L3A ratio, furtherly insulate the analysis from any business structure of the firm related issues.

Hypothesis 1 wants to verify if this change is value relevant for market participants and a negative relevancy is expected, as market participants translate an increase in the opacity of FVA as detrimental for the value of the firm.

Hypothesis 1 (H1): Increases in the degree of opacity of fair value instruments held by the financial institution (measured as changes in the ratio between Level 3 Assets and Level 2 Assets) drives a negative value relevance for market participants.

As a supportive analysis for H1, is crucial to verify whether the above-mentioned Hypothesis is true only for the opaquest fair value assets and does not affect the entire FVA holdings of a firm. Instead, if this would be the case, a general discount on firm's value is supposed to show whenever FVA holding shifts its composition away from marked-to-market instruments, such as L1A, towards assets with indirectly observable inputs, such as L2A. A statistically significant relationship between the change in the ratio between L2A and L1A would dismantle findings in H1 as market participants merely apply a general discount for illiquidity in fair value instruments held by the financial institution. The following statement describes the second Hypothesis of study.

Hypothesis 2 (H2): Increases/decreases in the reliability on fair value assets valued through indirectly observable inputs in comparison with quoted fair value assets (measured as changes in the ratio between Level 2 Assets and Level 1 Assets) drives no value significance for market participants.

[11] As Bosch (2012) and Kisseleva and Lorenz (2016) findings suggest, using outstanding number of shares as a deflator could prove it difficult when the analysis relates European banks, given the high volatility on both cross-sectional and time-series. In the analysis, although I utilize more stable deflators like book value of equity and total assets, I still find that the informativeness degree of fair value Levels for European banks is lower than what can be found for U.S. banks.

H2 want to verify whether changes in the relative weight of the most liquid category of fair value assets valued through indirectly observable inputs (Level 2) over quoted fair value assets (Level 1) drives value significance for market participants. The expected result is that no significant value is driven by changes in this ratio since the boundary between Level 1 and Level 2 assets is well defined and any streaming out from one level to the other is unlikely. Given this defined boundary the ratio between L2A and L1A is less inclined to changes and mostly produced by bank's business model rather than accounting opportunities.

4. Data and methodology

The current Section is organized in two different sub-sections, the first one introduces and describes the data for the analysis whereas the second one defines the methodology of the paper.

4.1. Data description

The sample includes semi-annual observations on balance sheet items and market-related data regarding 35 European banks from 2009 to the first half of 2018. The source of the data is Bloomberg and the starting number of observations is 595. The data have then been cleaned for missing values, data entry mistakes and extreme outliers, by removing the first and the ninety-ninth percentiles. The final number of observations results in 509. Using a sample of European banks rather than U.S. banks presents several hurdles related to data gathering. The absence of a unified filing form such as U.S. SEC filings Form 10-K and Form 10-Q results in greater complexity associated to the gathering of data on some balance sheet items such as fair value assets, which in Europe are not easily available within the firm's balance sheet but instead are reported in the explanatory notes. This lesser degree of availability of such data in Europe is to be found both on a cross sectional basis and on a time series one. On the cross-sectional dimension, less banks disclose information about their fair value instruments and small capitalized banks rarely provide this additional information in their financial report. On a time-series dimension, fair value instruments holdings are regularly disclosed only on a semi-annual frequency. These two main hurdles coupled with the implementation of IFRS 13 that occurred in 2011, contribute to a significant reduction in the size of the dataset. Table 1 presents the descriptive statistics for the dataset.

In the sample period the average share of Level 1 assets over bank's total assets is about 13 percent, Level 2 represents the largest fair value assets category held by a bank with a weight of about 22 percent and Level 3 has a residual weight of almost 1 percent of bank's total assets and Figure 1 describes these average ratios over time. When book value of equity is considered as a deflator, Level 1 fair value assets is more than twofold (2.50x) equity book

value, Level 2 settles with 4.5 times and Level 3 weights 0.2 times equity book value. As we focus on the two less liquid hierarchy levels in the FVH, the ratio between Level 3 assets and Level 2 assets measures, within the perimeter of less liquid fair value instruments, the opaqueness of bank's fair value assets. As the pricing of fair value instruments shifts from Level 2 to Level 3 inputs, instruments with at least some of their inputs observable are replaced with instruments with none of their inputs observable. Level 3 assets weights approximately 6 percent of Level 2 assets, and the average semi-annual change in this ratio depicts and increase in the relative weight of Level 3 assets by 27 bps. Figure 2 describes the evolution of L3A to L2A ratio over time. As an additional measure Table 1 reports the average weight of Level 2 assets over Level 1 assets (2.04x or 203.9 pps) that captures how many euro the bank has invested in non-quoted assets w.r.t. one unit of currency invested in quoted assets.

Table 2 describes the behavior of the above-mentioned variables throughout each year of the sample period. It is worth noting that the average weight on total assets for the two most illiquid levels in the FVH is reducing over time. Level 2 assets weight 15.66 percent in 2018 from 29.21 percent in 2009 and Level 3 assets weight 72 bps in 2018 from 154 bps in 2009. The deleverage in Level 2 and Level 3 assets is vividly shown with respect to the equity book value, with the former weighting 2.89 times equity (from 7.13x) and the latter weighting 0.12 times (from 0.37x). Although the reduction is persistent the ratio between Level 3 and Level 2 assets is mildly growing in the first part of the tens with an abrupt increase in the last two years.

4.2. Model description

In order to test Hypotheses 1 and 2 the empirical strategy needs to account for several features. First of all, it is crucial to appropriately deflate the variables under investigation. In respect of that the model should rely on a stable measure to standardize individual figures, which is suitable for all the banks present in the sample and which is consistent over time. Several papers such as Kolev (2019), Song et al. (2010), Bosch (2012), and Goh et al. (2015) use price per share as endogenous variable and deflate exogenous variables, such as fair value assets, with outstanding number of shares, resulting in a fair-value asset 'per share' framework on the RHS of the equation. The outcome of this normalization procedure is a relative valuation by market participants for each unit of currency invested in fair value assets.[12] However, choosing the deflator without examining the data first could result in a misspecification of the model due to extreme volatility in the selected deflator and ultimately

[12] i.e. a resulting coefficient statistically significant and greater than one suggests a premium for each euro invested in the corresponding fair value assets (Level 1, Level 2 or Level 3), whereas a coefficient lower than one implies a discounting on each euro invested in the asset.

producing more harm than good. This case fully applies to a dataset composed by European banks. The considerable volume of new stock issuances and consolidation promoted by European banks through these last ten years jeopardize outstanding number of shares as a suitable deflator. In light of this information I made no prior assumption on the best deflator and I relied on a pool of suitable variables such as total assets, risk-weighted assets, equity book value, common equity tier 1 capital and outstanding number of shares to identify the proper one. By comparing the normalized standard deviation for each of the above-mentioned variables across the entire dataset I identify equity book value as the most stable variable (with the smallest normalized standard deviation) and use it as deflator in the main analysis. I also identify tangible equity book value and total assets as second and third more stable variable and use them as additional in the robustness check analysis. Common equity tier 1 capital and risk-weighted assets, although to a lesser extent, also provide a suitable deflator for the analysis and hence are implemented as well. On the contrary and as expected, outstanding number of shares holds the highest normalized standard deviation in the selected sample and does not represent a suitable deflator for the analysis. The choice of equity book value as main deflator for exogenous variables is consistent with previous papers on fair value asset valuation such as Bagna et al. (2014) and Mohrmann and Riepe (2017).

A second feature to account for relates to banks' differences in holding of fair value assets due to their business model. As banks' business model varies consistently across the sample it is critical to remove any elements of disturbance in the analysis from this characteristic. Bagna et al. (2014) specify the model using country and year fixed effects, which account for different national Central Banks and for different cycles in national economies but does not addresses changes in banks' business model. In order to account for this feature, after providing a pooled OLS model I also specify the model using firm-time fixed effects.

A third feature to address in the model is the informativeness of the selected explanatory variables. The goal of the analysis is to verify whether market participants discount banks' relative value when an opaque composition of fair value assets is in place. More precisely when the shift in FVA holdings increases the opacity of banks' balance sheet. Fair value asset holding by themselves are not the target of this paper, whereas shifts in the composition of most illiquid fair value assets is at the center of the analysis. The choice of the explanatory variable that complies with this third feature is to be intended also as the result of the previously introduced remarks on data availability. The main explanatory variable must account for low availability of data for European banks, must be comprehensive enough to collect any relative change in the composition of the most illiquid fair value assets holding

and, as a side help on top of banks' fixed effect implementation, must be as less influenced as possible by banks' business model. As main explanatory variable I consider changes through time in the ratio between Level 3 assets and Level 2 assets, defined for bank *i* in time *t* as $opaque_{i,t}^{L3L2} = \Delta\frac{L3A_{i,t}}{L2A_{i,t}}$. The preference for changes, $opaque_{i,t}^{L3L2}$, rather than levels, $\frac{L3A_{i,t}}{L2A_{i,t}}$, as explanatory variable to identify a market discount on opacity in FVA holdings, is given by the fact that only shifts in transparency of fair value items is considered to be driving additional information, as the ratio itself, $\frac{L3A_{i,t}}{L2A_{i,t}}$, is to be considered more related to the business model of the firm[13].

As Figure 1 and Figure 2 show, at the end of 2017 the European financial industry has 14% of total assets invested in Level 1 assets, 15.6% in Level 2 assets and 0.7% in Level 3 assets. The average pbv is 1.18x and the ratio between Level 3 assets holdings and Level 2 assets holdings is 10.2%, which it means that for each unit of currency invest in Level 2 assets the banks has 10 cents invested in Level 3 assets. At the end of first half of 2018 (H1) this ratio jumps to 14.6% with an increase of 4.4 percentage points, resulting in additional Level 3 assets held for each unit of currency invested in Level 2 assets by the bank. This increase of 4.4 percentage points is measured by the variable of interest $opaque_{i,t}^{L3L2}$.

This variable captures the increase (decrease) in opacity for bank's fair value assets holdings[14] and the normalization of Level 3 asset over Level 2 assets ensures that the overall holding of Level 2 assets is out of the picture in the main analysis addressed in H1. For H2 the same principle applies. As main explanatory variable for testing H2 I consider changes through time in the ratio between Level 2 assets and Level 1 assets, defined for bank *i* in time

[13] As further explanatory variable, Level 3 assets gains have been considered. However according to Goh et al. (2015) investors focus their interest more on the stock of fair value assets held by a firm rather than the profitability of these assets. Moreover, due to the additional discretion of managers in reporting Level 3 assets gains and losses w.r.t. Level 3 fair value estimates, as well as the struggle in interpreting these results as suggested by previous literature, I decide to exclude profitability recognition on Level 3 assets from the analysis on the opacity of FVH.

[14] Another suitable candidate, not part of the analysis, yet more specific and less broad, is the net transfer of Level 2 assets into Level 3 assets (and vice versa) described into the reconciliation of Level 3 assets in the explanatory notes of the financial report. This variable although perfectly targets true changes in the availability of fair value inputs has been excluded by the analysis due to:

1) a lower degree of availability of information;
2) the necessity of further assumptions regarding the inclusion of other items present in the reconciliation of Level 3 assets such as total gains, and losses, purchases and sales, issuances and settlements on Level 3 assets;
3) the possibility of management discretionary behavior regarding Level 3 net transfer w.r.t. the above-mentioned items also present in the reconciliation of Level 3 asset;
4) the inability of selecting an explanatory variable for H1 and H2 consistent with each other, due to the lack of a reconciliation of financial instrument classifies as Level 2 assets in the financial report.

t as $opaque_{i,t}^{L2L1} = \Delta \frac{L2A_{i,t}}{L1A_{i,t}}$. The variable captures (changes in) how much banks rely on fair value assets valued through indirectly observable inputs in comparison with fair value assets quoted on the market. Eq. (1) describes the model tested for H1.

$$pbv_{i,t} = \alpha_{0,i} + \alpha_1 L1A_{i,t} + \alpha_2 L2A_{i,t} + \alpha_3 L3A_{i,t} + \alpha_4 opaque_{i,t}^{L3L2} + \mathbf{X} + \varepsilon_{i,t} \qquad (1)$$

Where $pbv_{i,t}$ represents the ratio between market capitalization and equity book value for bank *i* at time *t* (Price-to-book-value). Market capitalization is observed on the day of release of bank's financial report, usually three months after the end of half-year fiscal period, whereas equity book value and other balance sheet related variables refer to the end of the half-year fiscal period *t*[15]. The delay in the observation of the endogenous variable is particularly important as it addresses endogeneity problems in the model.
$L1A_{i,t}$, $L2A_{i,t}$ and $L3A_{i,t}$ are the ratio of Level 1, Level 2 and Level 3 assets w.r.t. the deflator, (i.e. equity book value) and capture any the effect of overall fair value assets holdings on $pbv_{i,t}$. The explanatory power of these three variables should gather any information regarding discounting of FVA holding by market participants and prevents the additional inclusion of $\frac{L3A_{i,t}}{L2A_{i,t}}$ in the model due to multicollinearity issues[16]. **X** is a vector of control variables related to size and profitability of the bank. I specify the general analysis using pooled cross section and, in order to verify for bank's business model, I also specify the analysis using bank-time fixed effects. Standard errors are clustered at bank's level. Lastly, to test for H2 the only needed modification to Eq. (1) is the substitution of the parameter $opaque_{i,t}^{L3L2}$ with a variable that captures the change in the ratio between L2A and L1A ($opaque_{i,t}^{L2L1}$).

5. Results and robustness' check

Hypothesis 1 verifies if any increase in the opacity of fair value instruments held by the financial institution and measured as $opaque_{i,t}^{L3L2}$ drives value relevance for market participants and Table 3 describes the correlation coefficient for the variable of interest. As a

[15] i.e. for equity book value of bank *i* on second half of 2017 (2017H1), the selected equity book value is, as reported in the financial report for end of 2017 and the related market capitalization is observed on the day of the release of the financial report, usually three months after the end of the 2017H1 half-year fiscal period.

[16] The inclusion of $\frac{L3A_{i,t}}{L2A_{i,t}}$ in the model produces no statistically significant results except when multicollinearity issue arises, which has been verified via a variance inflation factor analysis.

supportive argument for the absence of multicollinearity in the sample, the variable $opaque_{i,t}^{L3L2}$ shows no correlation above 12% in absolute terms[17]. Nevertheless, the variable shows small but significant correlation coefficient w.r.t. to total assets, NPLs to total loans and loan loss reserves to total loans. As the size of the firm increases the change in relative weight of L3A over L2A decreases and the structure of FVA becomes more stable and less opaque, as shows the negative correlation coefficient of $\frac{L3A}{L2A}$ w.r.t. total assets. The opposite conclusion can be reached for NPLs and loan loss reserves: those firms with higher ratio of non-performing loans and higher reserves for loan losses show a higher degree in the opacity of fair value instruments. The relevancy of the link between Level 3 Assets and non-performing loans can be also verified by comparing the latter correlation coefficients for $opaque_{i,t}^{L3L2}$ with the same coefficients on non-performing loans and loan loss reserves for $opaque_{i,t}^{L2L1}$. As we focus on the change of relative weight of L2A over L1A the coefficients are positive, smaller in absolute terms and non-statistically significant.

Table 4 presents the analysis for H1 and results for the Eq. (1) model when pooled cross sectional data are considered and Table 5 presents the analysis for H1 with firm-year fixed effects. Specifications 1 and 2 present the model without the variable of interest, whereas Spec. 3 and 4 introduce the variable $opaque_{i,t}^{L3L2}$. The variable $opaque_{i,t}^{L3L2}$ is significant both specifications of Table 4 and strongly significant when the model considers firm-time fixed effects. Regarding Table 4 for a full increase of 100 basis points (bps) in the ratio between Level 3 assets and Level 2 assets over the last six months the fully specified model (Specification 4 – S.4) describes a decrease by 67.5 bps of pbv on the day of disclosure of the information. The absence of overall holding of FVA (L1A, L2A and L3A) decreases the explanatory power of $opaque_{i,t}^{L3L2}$ as shown in S.3, where the decrease of pbv is 19 bps. When firm-year fixed effects are considered, a full increase of 100 bps in the ratio between Level 3 assets and Level 2 assets over the last six months describes a decrease by 18.3 bps of pbv on the day of disclosure of the information for the univariate model (S.5), whereas for the fully specified (S.7) model the decrease is 81.3 bps of pbv on the day of disclosure of the information. As the model refines more and more the analysis from firm-related issues, the detrimental impact of $opaque_{i,t}^{L3L2}$ on pbv increases in magnitude.

[17] With an exception for the variable of origin $\frac{L3A_{i,t}}{L2A_{i,t}}$.

Overall, H1 is respected and investors do perceive an increase in the degree of opacity in fair value instruments as negative value relevant for the market capitalization of banks, due to the blurred boundary between L3A and L2A.

In order to verify that this relationship is valuable only for illiquid fair value assets and that is not something affecting the entire FVA holdings of a firm I perform, as first part of the robustness' check, the analysis of Eq. (1) model also with $opaque_{i,t}^{L2L1}$ as the main explanatory variable. H2 want to verify whether changes in the relative weight of the less illiquid category of fair value assets valued through indirectly observable inputs (Level 2) over quoted fair value assets (Level 1) drives value significance for market participants. The expected result is that no significant value is driven by $opaque_{i,t}^{L2L1}$ as the boundary between Level 1 and Level 2 is well defined, the observability of inputs for plain vanilla L2A is straightforward and the ratio of L2A w.r.t. of L1A is even a stronger function than $\frac{L3A}{L2A}$ of bank's business model rather than management discretional use of FVH, which might influence $\frac{L3A}{L2A}$. H2 is intended as the first building block of robustness' check: if $opaque_{i,t}^{L2L1}$ shows similar significance of $opaque_{i,t}^{L3L2}$ it means that investors are sensible to any shift in the entire FVH structure rather than just those that happens on the boundary between L2A and L3A and therefore as the balance sheet gathers more and more illiquid assets, investors linearly perceive the firm as more opaque and less valuable. Meanwhile if H2 is confirmed and $opaque_{i,t}^{L2L1}$ is not relevant we can safely state that investors consider prevalently changes in L3A to L2A ratio as value relevant, given that this boundary is blurred and shifts across this boundary are partially product of management behavior.

Table 6 presents the results for H2, where $opaque_{i,t}^{L2L1}$ is the main variable of study and across all three model's specifications (9-11) $opaque_{i,t}^{L2L1}$ fails to deliver value relevant information. The absence of any statistical significance is a confirmation of H2 and a further support to H1 findings. In specific:

- market participants apply a discount to their valuation of financial firms when holdings of L3A increase w.r.t. to L2A as the illiquid structure of FVA becomes less transparent in its pricing inputs;
- no premium or discount is considered by investors when holdings of L2A increase w.r.t. L1A, as this change has minor or no effects on the transparency of FVA and a relatively small increase in the illiquidity of FVA.

As a supportive robustness' check, I provide the analysis for Eq. (1) with different deflators then equity book value. This to cover any misspecification of the model given by the deflator

I use for the endogenous variable. Table 7 presents the result of this analysis. The selected alternative deflators are total assets, common equity tier 1 capital, tangible book value of equity and risk weighted assets. Across specifications from 12 to 15 of Table 7 the variable $opaque_{i,t}^{L3L2}$ is negative and statistically significant and the change of the normalization item for market capitalization produces no alteration of the results.

Finally, Table 8 furtherly expands the robustness' check analysis by providing two additional insight. The first one relates whether in the RHS of Eq. (1) we substitute $L1A_{i,t}$, $L2A_{i,t}$ and $L3A_{i,t}$ with the respective ratio over total asset, as deflating the actual amount of Level 1 (Level 2 and Level 3) fair value assets by the equity book value might produce a misspecification of the results for $opaque_{i,t}^{L3L2}$, for $opaque_{i,t}^{L2L1}$ and for the other explanatory variables. S.16 provide the analysis for Eq. (1) when $opaque_{i,t}^{L3L2}$ whereas S.17 refers to $opaque_{i,t}^{L2L1}$. Both Specifications confirm previous findings, where in S.16 $opaque_{i,t}^{L3L2}$ produce a decrease in pbv by 150.9 bps and in S.17 $opaque_{i,t}^{L2L1}$ is not statistically significant. The second insight relates to three Specification (S.18-20) of Eq. (1) where both $opaque_{i,t}^{L3L2}$ and $opaque_{i,t}^{L2L1}$ are included in the model. The motivation of the analysis is to verify whether the explanatory power of $opaque_{i,t}^{L3L2}$ might deteriorate when another measure of opacity in the fair value assets such as $opaque_{i,t}^{L2L1}$ is also part of the model. All three Specification rely on firm-time fixed effects in order to provide an in-depth understanding of the inquire. The main variable of interest, $opaque_{i,t}^{L3L2}$ preserve its statistical significance for all three Specifications resulting in a decrease of pbv between 81.5 bps and 148.2 bps. On the other hand, $opaque_{i,t}^{L2L1}$ still produce no supplementary significance to the model.

6. Conclusion

The analysis of fair value measurement and its relevance for financial firms' valuation has become more popular since IFRS 13 implementation and the presence of a discount for firms holding a higher share of their assets in Level 3 instruments is somewhat established. This topic is one of significance for the European financial system, as regulating authorities increase their awareness on the possible threat that opaque and illiquid instruments pose. This paper focus on shifts in the holding structure of fair value instruments where at least part of the inputs are non-observable. Given that the blurred boundary between less liquid Level 2 instruments and Level 3 instruments might offer discretional opportunity to management and

due to the severe opacity of Level 3 instruments, the paper studies whether a change in the ratio between Level 3 and Leve 2 assets is value relevant for investors.

In order to verify for bank's business model, I also specify the analysis using bank-time fixed effects and a series of control variables for targeting size, profitability and non-performing-loan assets. Endogeneity issues are at least partially addressed via a lag in the model between banks' semi-annual balance sheet information and market capitalization on the day of the disclosure of these information (usually at least three months after the end of the time period taken into account for financial report compilation). Robustness' check analysis is conducted by substituting equity book value as measure of standardization with tangible book value of equity, total assets, risk-weighted assets and CET 1 regulatory capital as well as by using a specification of the model with a different yet comparable measure, such as the change in the ratio between Level 1 and Level 2 assets. As the distinction between Level 1 and Level 2 assets is defined, I discover no relationship between this measure and the relative market value of equity on the day of disclosure as market participants do not perceive this measure as telling for the degree of opacity in bank's business.

Regarding the main variable of study results support the initial hypothesis. An increase in Level 3 to Level 2 assets ratio is statistically significant and produces a decrease in the market value of the firm. In detail, when the fully specified model is considered an increase of 100 bps in the ratio between Level 3 assets and Level 2 assets over the last six months defines a decrease by 81.3 bps of Price-to-equity book value on the day of disclosure of the information. As holding of fair value instruments become more and more opaque market participants apply a discount to the value of the firms.

References

Bagna E., G. Di Martino and D. Rossi, 2014, "An Anatomy of the Level 3 Fair Value Hierarchy Discount", *Working paper*.

Bank of Italy, 2017, "Risks and Challenges of Complex Financial Instruments: An Analysis of SSM Banks", *Occasional Paper*, 417.

Barth, M. E., Beaver, W. H., and W. R. Landsman, 1996, "Value-relevance of banks fair value disclosures under SFAS no. 107", *The Accounting Review,* 71 (4), 513–537.

Barth, M. E., Beaver, W. H., and W. R. Landsman, 2001, "The relevance of the value relevance literature for financial accounting standard setting: Another view", *Journal of Accounting and Economics,* 31, 77–104.

Beatty, A., and D. G. Harris, 1999, "The effects of taxes, agency costs and information asymmetry on earnings management: A comparison of public and private firms", *Review of Accounting Studies,* 4, 299–326.

Beaver, W., and M. Venkatachalam, 2003, "Differential pricing of components of bank loan fair values", *Journal of Accounting, Audit and Finance,* 18 (1), 41–67.

Benston, G.J., 2006, "Fair Value Accounting: a Cautionary Tale from Enron", *Journal of Accounting and Public Policy,* 25 (4), 465-484.

Benston, G.J., 2008, "The Shortcomings of Fair-Value Accounting Described on SFAS 157", *Journal of Accounting and Public Policy,* 27 (2), 101-114.

Bosch, P., 2012, "Value Relevance of the Fair Value Hierarchy of IFRS 7 in Europe - How reliable are mark-to-model Fair Values?", Working Paper SES, 439.

Carroll, T., Linsmeier, T., and K. Petroni, 2003, "The reliability of fair value versus historical cost information: Evidence from close-end mutual funds", *Journal of Accounting, Audit and Finance,* 18, 1–23.

Chung, S.G., B.W. Goh, J. Ng and K.O., Yong (2017) "Voluntary Fair Value Disclosures Beyond SFAS 157's Three-level Estimates"*, Review of Accounting Studies*, 22 (1), 430-468.

ECB, 2018, "ECB Banking Supervision: Risk Assessment for 2019", *European Central Bank*.

Goh B.W., D. Li, J. Ng and K.O. Yong, 2015, "Market Pricing of Banks' Fair Value Assets Reported under SFAS 157 since the 2008 Financial Crisis", *Journal of Accounting And Public Policy*, 34 (2), 129-145.

Kisseleva K. and D. Lorenz, 2016, "Are Level 3 Fair Values Reflected in Firm Value? Evidence from European Banks", *ESMT Working Paper*, 16 (3).

Kolev K. S., 2019, "Do Investors Perceive Marking-to-Model as Marking-to-Myth? Early Evidence from FAS 157 Disclosure", *Quarterly Journal of Finance*, 9 (2).

Martin, R.D., Rich, J.S., Wilks, T. J., 2006, "Auditing Fair Value Measurements: a Synthesis of Relevant Research, *Accounting Horizons,* 20 (3), 287-303.

Ryan, S., 2007, "Financial Instruments & Institutions – Accounting and Disclosure Rules. 2nd ed" New Jersey, *John Wiley & Sons, Inc.*

Ryan, S., 2008, "Accounting in and for the Subprime Crisis", *The Accounting Review,* 83 (6), 1605-1638.

Riedl, E. and G. Serafeim, 2011, "Information Risk and Fair Values: An Examination of Equity Betas", *Journal of Accounting Research*, 49, 1083-1122.

Song, C.J., W.B. Thomas, H. Yi, 2010, "Value Relevance of FAS 157 Fair Value Hierarchy Information and the Impact of Corporate Governance Mechanisms", *The Accounting Review*, 85 (4), 1375-1410.

Mohrmann U. and J. Riepe, 2018, "The Link between Level 3 Assets of Banks and their Default Risk and Default Costs", *Review of Quantitative Finance and Accounting*, Forthcoming.

Annex 1

The three levels of inputs are the following:

- Level 1 inputs: where inputs are quoted (unadjusted) prices in active markets for identical assets or liabilities at measurement date (financial instruments such as quoted fixed income fully represent fair value instruments priced using Level 1 inputs).
- Level 2 inputs: are observable inputs other than quoted prices for the asset or liability, either direct or indirect, including:
    - quoted prices for similar assets or liabilities in active markets;
    - quoted prices for identical/similar assets or liabilities in markets that are not active;
    - observable inputs other than quoted prices for the asset or liability (i.e., interest rates and yield curves observable at commonly quoted intervals, implied volatilities, credit spreads and default rates);
    - inputs that are derived principally from or corroborated by observable market data by correlation or other means (market-corroborated inputs).

  Examples of Level 2 instruments are interest rate derivatives such as swaps and options, structured and securitized bonds.
- Level 3 inputs: unobservable inputs, developed from the reporting entity's assessment of market participant assumptions, based on the best information available under the circumstances. In particular, the notion of unobservable or Level 3 inputs applies when there is little, if any, market activity for the asset or liability at the measurement date. In this case the valuation follows a mark-to-model approach rather than a mark-to-market approach and these kinds of inputs represent the less liquid and problematic to price financial instrument into the fair value hierarchy. Examples of Level 3 instruments are mortgage-backed securities (MBS), private equity shares and distressed debt.

Tables and Figures

Table 1 – Descriptive Statistics

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. Total Assets, Risk-weighted Assets, Equity Book Value and Market Capitalization are expressed in current millions of euro. Market Capitalization is collected after the release of the financial report, three months after the end of the fiscal half-year interim period, and represents the overall market value of the equity after the release of the financial information on banks' fair value assets. L1A (L2A, L3A)/Total Assets represents the ratio of Level 1 (Level 2, Level 3) assets held by the financial institution w.r.t. its total assets and is expressed in percentage points. CET1 ratio is the Common Equity Tier 1 capital ratio, NPL/Loans represents the ratio between non-performing-loans and total loans. PBV represents the price-to-equity-book-value ratio and is the ration between Market Capitalization introduced above and Equity Book Value. L1A (L2A, L3A)/Equity Book Value is the ratio between Level 1 (Level 2, Level 3) Assets and Equity Book Value, and as well as PBV is expressed in 'per unit' of Equity Book Value. L3A/L2A (L2A/L1A) is the ratio between Level 3 (Level 2) assets and Level 2 (Level 1) assets and $opaque_{i,t}^{L3L2}$ ($opaque_{i,t}^{L2L1}$) is the last change in the fiscal half-year interim period. ROA expresses the return-on-assets, Loan Loss Reserves/Loans represents the ratio of provisions for non-performing-loans over total loans, Option Implied Volatility is the ATM 3-months put implied volatility and Yield is the yield on 10 years Govt. Bond for the country of reference of each bank. ROA, L1A (L2A, L3A)/Total Assets, CET1 ratio, NPL/Loans, Loan Loss Reserves/Loans, L3A/L2A, L2A/L1A, $opaque_{i,t}^{L3L2}$, $opaque_{i,t}^{L2L1}$, Option Implied Volatility, and Yield are expressed in percentage points.

Variable	Unit of measure	N. obs.	Mean	St. Dev.	p25	p50	p75
Total Assets	Millions of euro	509	847,851	712,484	252,116	715,418	1,250,949
Risk-weighted Assets	Millions of euro	509	268,250	227,008	77,596	236,161	362,747
L1A/Total Assets	Pps	509	13.32	5.06	9.63	12.88	16.34
L2A/Total Assets	Pps	509	21.56	18.02	8.66	15.05	31.05
L3A/Total Assets	Pps	509	1.01	1.07	0.33	0.67	1.37
Equity Book Value	Millions of euro	509	44,172	36,896	13,605	41,591	60,036
Market Capitalization	Millions of euro	509	32,607	27,712	14,901	25,077	40,387
CET1 ratio	Pps	509	16.06	4.24	13.41	15.28	17.43
PBV	Times	509	1.10x	1.34x	0.55x	0.77x	1.14x
L1A/Equity Book Value	Times	509	2.50x	1.32x	1.61x	2.26x	2.97x
L2A/Equity Book Value	Times	509	4.55x	4.48x	1.20x	2.86x	6.84x
L3A/Equity Book Value	Times	509	0.21x	0.27x	0.04x	0.13x	0.25x
L3A/L2A	Pps	509	6.45	8.74	2.10	4.48	7.21
$\boldsymbol{opaque_{i,t}^{L3L2}}$	Pps	509	0.27	5.07	-0.35	0.00	0.51
L2A/L1A	Pps	509	203.95	228.01	62.24	120.47	263.25
$\boldsymbol{opaque_{i,t}^{L2L1}}$	Pps	509	-0.26	109.40	-16.80	-0.27	9.26
ROA	Pps	509	0.28	0.45	0.09	0.34	0.57
NPL/Loans	Pps	509	5.32	4.38	1.84	4.48	7.51
Loan Loss Reserves/Loans	Pps	509	2.78	2.18	0.89	2.48	4.15
Option Implied Volatility	Pps	509	33.86	12.79	24.80	30.88	39.24
Yield	Pps	509	1.98	1.38	0.93	1.73	2.67

Table 2 – Descriptive Statistics through time

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. The Table presents the average statistic for the entire sample for each year of considered time frame. PBV and L1A (L2A, L3A) /Equity Book Value are expressed in times the book value of equity, whereas the remaining variables are expressed in percentage points.

Variables	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
L1A/Total Assets	13.14	12.61	12.14	11.74	13.54	14.20	14.10	13.96	13.84	11.48
L2A/Total Assets	29.21	27.16	23.88	24.85	21.05	22.25	20.04	18.99	15.62	15.66
L3A/Total Assets	1.54	1.24	1.09	0.97	1.01	0.97	0.91	0.78	0.70	0.72
PBV	1.86x	1.17x	0.72x	0.85x	1.14x	1.22x	1.01x	1.04x	1.17x	1.11x
L1A/Equity Book Value	3.01x	2.65x	2.46x	2.42x	2.51x	2.60x	2.45x	2.41x	2.30x	1.96x
L2A/Equity Book Value	7.13x	6.55x	5.54x	5.69x	4.26x	4.34x	3.73x	3.54x	2.79x	2.89x
L3A/Equity Book Value	0.37x	0.30x	0.26x	0.22x	0.18x	0.18x	0.17x	0.14x	0.12x	0.12x
L3A/L2A	5.18	4.76	5.58	4.84	7.30	6.44	5.64	5.23	7.98	11.78
$\boldsymbol{opaque_{i,t}^{L3L2}}$	-0.66	-0.20	-0.05	-0.37	0.60	-0.84	-0.04	-0.11	1.45	3.23
L2A/L1A	236.71	253.14	221.78	234.77	189.46	223.27	200.40	189.39	153.64	167.54
$\boldsymbol{opaque_{i,t}^{L2L1}}$	16.93	-17.10	9.57	-4.94	-15.61	28.24	-20.64	-3.96	-13.45	20.23
ROA	0.09	0.34	0.20	0.08	0.23	0.23	0.37	0.29	0.48	0.48

Table 3 – Correlations

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. The Table shows Pearson's correlation coefficients with their respective statistical significance (where * represents a statistical significance of 10%, ** a statistical significance of 5% and *** a statistical significance of the coefficient of 1%).

Variables	Total Assets	Equity	L1A/Total Assets	L2A/Total Assets	L3A/Total Assets	PBV	L3AL2A	$opaque_{i,t}^{L3L2}$	L2A/L1A	$opaque_{i,t}^{L2L1}$	ROA	NPL/Loans	Loan Loss Reserves/Loans
Total Assets	1.000 ***												
Equity	0.924 ***	1.000 ***											
L1A/Total Assets	-0.124 ***	-0.153 ***	1.000 ***										
L2A/Total Assets	0.178 ***	0.060	0.022	1.000 ***									
L3A/Total Assets	0.039	-0.064 **	0.195 ***	0.663 ***	1.000 ***								
PBV	0.130 ***	0.143 ***	-0.052	0.006	0.004	1.000 ***							
L3A/L2A	-0.322 ***	-0.280 ***	0.155 ***	-0.268 ***	0.283 ***	0.066	1.000 ***						
$opaque_{i,t}^{L3L2}$	-0.082 **	-0.063 *	0.071	-0.092 ***	0.016	-0.090	0.34 ***	1.000 ***					
L2A/L1A	0.319 ***	0.290 ***	-0.473 ***	0.632 ***	0.326 ***	0.004	-0.22 ***	-0.078 **	1.000 ***				
$opaque_{i,t}^{L2L1}$	0.084	0.020	-0.098	0.138	0.066	0.003	-0.027	-0.142 ***	0.242 ***	1.000 ***			
ROA	0.159 ***	0.229 ***	0.042	-0.157 ***	-0.13 ***	0.355 ***	0.170 **	0.032	-0.078	-0.055	1.000 ***		
NPL/Loans	-0.532 ***	-0.472 ***	0.165 ***	-0.437 ***	-0.277 ***	-0.342 ***	0.189 ***	0.067 **	-0.339 ***	-0.063	-0.339 ***	1.000 ***	
Loan Loss Reserves/Loans	-0.514 ***	-0.467 ***	0.230 ***	-0.410 ***	-0.286 ***	-0.320 ***	0.237 ***	0.116 ***	-0.342 ***	-0.038	-0.199 ***	0.904 ***	1.000 ***
Option Implied Volatility	-0.239 ***	-0.33 ***	0.032	0.061	0.142 ***	-0.280 ***	0.046	-0.069	0.013	0.139	-0.432 ***	0.329 ***	0.290 ***

Table 4 – Model specifications for $opaque_{i,t}^{L3L2}$

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. The Table presents Eq. (1) pooled cross sectional model specifications where $pbv_{i,t}$ (price-to-equity book value) is the endogenous variable and $opaque_{i,t}^{L3L2}$ is the main exogenous variable (H1). For $pbv_{i,t}$, Market capitalization is collected after the release of the financial report, usually three months after the end of the fiscal half-year interim period and represents the overall market value of equity after the release of the financial information on banks' fair value assets, whereas equity book value is referred as end of the fiscal half-year interim period. L1A (L2A, L3A) represents the ratio of Level 1 (Level 2, Level 3) assets held by the financial institution w.r.t. equity book value and as $pbv_{i,t}$ is expressed in 'per unit' of equity book value. NPL/Loans represents the ratio between non-performing-loans and total loans. $opaque_{i,t}^{L3L2}$ is the last change in the fiscal half-year interim period of the ratio between Level 3 assets and Level 2 assets as presented in Table 1. ROA expresses the return-on-assets. ROA, NPL/Loans and $opaque_{i,t}^{L3L2}$ are expressed in percentage points. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Bold figures represent coefficient of variables with a p-value of 1% or lower.

Variables	1		2		3		4	
	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat
Total Assets	**0.061**	**8.704**	**0.076**	**8.134**	**0.061**	**8.715**	**0.075**	**7.744**
ROA	**0.387**	**3.051**	**0.439**	**2.973**	**0.381**	**3.069**	**0.448**	**3.017**
NPL/Loans	-0.017	-1.964	**-0.030**	**-2.903**	-0.017	-2.014	**-0.030**	**-3.024**
L1A			-0.017	-0.390			-0.012	-0.244
L2A			-0.011	-0.453			-0.011	-0.447
L3A			0.086	0.274			0.073	0.228
$opaque_{i,t}^{L3L2}$					**-0.190**	**-2.697**	**-0.675**	**-2.781**
Deflator	Equity		Equity		Equity		Equity	
Clustered Std. Errors	Firm		Firm		Firm		Firm	
Firm fixed effects	No		No		No		No	
Time fixed effects	No		No		No		No	
Adj. R-squared	0.86		0.87		0.87		0.88	
F-stat (robust)	111.55		53.81		83.45		48.33	
N. Observation	509		509		509		509	

Table 5 – Model specifications for $opaque_{i,t}^{L3L2}$ with firm-year fixed effects

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. The Table presents Eq. (1) model specifications where $pbv_{i,t}$ (price-to-equity book value) is the endogenous variable and $opaque_{i,t}^{L3L2}$ is the main exogenous variable (H1) and with firm-year fixed effects. For $pbv_{i,t}$, Market capitalization is collected after the release of the financial report, usually three months after the end of the fiscal half-year interim period and represents the overall market value of the equity after the release of the financial information on banks' fair value assets, whereas equity book value is referred as end of the fiscal half-year interim period. L1A (L2A, L3A) represents the ratio of Level 1 (Level 2, Level 3) assets held by the financial institution w.r.t. equity book value and as $pbv_{i,t}$ is expressed in 'per unit' of equity book value. NPL/Loans represents the ratio between non-performing-loans and total loans. $opaque_{i,t}^{L3L2}$ is the last change in the fiscal half-year interim period of the ratio between Level 3 assets and Level 2 assets as presented in Table 1. ROA expresses the return-on-assets. ROA, NPL/Loans and $opaque_{i,t}^{L3L2}$ are expressed in percentage points. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Bold figures represent coefficient of variables with a p-value of 1% or lower.

Variables	5		6		7		8	
	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat
Total Assets			0.076	0.520	0.149	1.282	0.195	1.809
ROA			**0.127**	**2.445**	**0.112**	**2.383**	**0.112**	**2.354**
NPL/Loans			-0.009	-0.962	-0.010	-1.253	-0.007	-0.761
L1A			0.010	0.450	0.023	1.103		
L2A			-0.006	-0.522	-0.002	-0.159		
L3A			0.310	2.067	0.185	1.072		
$opaque_{i,t}^{L3L2}$	**-0.183**	**-3.960**			**-0.813**	**-11.423**	**-0.736**	**-11.775**
Deflator	Equity		Equity		Equity		Equity	
Clustered Std. Errors	Firm		Firm		Firm		Firm	
Firm fixed effects	Yes		Yes		Yes		Yes	
Time fixed effects	Yes		Yes		Yes		Yes	
Adj. R-squared	0.88		0.90		0.92		0.95	
F-stat (robust)	100.05		195.22		205.94		220.64	
N. Observation	509		509		509		509	

Table 6 – Model specifications for $opaque_{i,t}^{L2L1}$

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. The Table presents Eq. (1) model specifications where $pbv_{i,t}$ is the endogenous variable and $opaque_{i,t}^{L2L1}$ is the main exogenous variable (H2). For $pbv_{i,t}$ Market capitalization is collected after the release of the financial report, three months after the end of the fiscal half-year interim period, and represents the overall market value of the equity after the release of the financial information on banks' fair value assets, whereas equity book value is referred as end of the fiscal half-year interim period. L1A (L2A, L3A) represents the ratio of Level 1 (Level 2, Level 3) assets held by the financial institution w.r.t. equity book value and is and as $pbv_{i,t}$ is expressed in 'per unit' of equity book value. NPL/Loans represents the ratio between non-performing-loans and total loans. $opaque_{i,t}^{L2L1}$ is the last change in the fiscal half-year interim period of the ratio between Level 2 assets and Level 1 assets. ROA expresses the return-on-assets. ROA, NPL/Loans and $opaque_{i,t}^{L2L1}$ are expressed in percentage points. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Bold figures represent coefficient of variables with a p-value of 1% or lower.

Variables	9		10		11	
	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat
Total Assets	**0.061**	**8.638**	**0.076**	**8.139**		
ROA	**0.388**	**3.036**	**0.439**	**2.982**		
NPL/Loans	-0.017	-1.926	**-0.030**	**-2.905**		
L1A			-0.016	-0.350		
L2A			-0.011	-0.449		
L3A			0.085	0.268		
$opaque_{i,t}^{L2L1}$	0.006	0.629	0.008	0.491	0.001	0.231
Deflator	Equity		Equity		Equity	
Clustered Std. Errors	Firm		Firm		Firm	
Firm fixed effects	No		No		Yes	
Time fixed effects	No		No		Yes	
Adj. R-squared	0.86		0.87		0.88	
F-stat (robust)	87.12		46.24		102.23	
N. Observation	509		509		509	

Table 7 – Analysis for different deflator for market capitalization

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. For the description of the main variable $opaque_{i,t}^{L3L2}$ and control variables see Table 4. The Table present the analysis for Eq. (1) when different measure for relative-value of the firm are considered. Whereas the numerator of the endogenous variable is still Market capitalization as described in Table 4 and the set of deflators is different for each of the four specifications and represent different measure of balance sheet book value. TBV represent the tangible book value of the firm, Total asset represent the total asset detained by the firm, CET1 is the common equity tier 1 capital and RWA is the risk-weighted assets. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Bold figures represent coefficient of variables with a p-value of 1% or lower.

Variables	12		13		14		15	
	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat
Total Assets	0.160	0.979	-0.012	-0.942	0.122	1.071	0.059	0.888
ROA	**0.118**	**2.621**	**0.009**	**2.349**	0.097	2.080	0.002	0.146
NPL/Loans	-0.019	-2.159	0.001	0.364	-0.013	-1.380	-0.002	-0.328
L1A	0.009	0.582	-0.074	-1.028	0.007	0.257	0.056	1.207
L2A	0.000	0.029	-0.035	-1.945	0.005	0.364	0.022	0.376
L3A	0.287	1.348	1.056	2.051	0.416	1.894	**1.167**	**3.029**
$opaque_{i,t}^{L3L2}$	**-1.143**	**-6.993**	**-0.095**	**-3.248**	**-1.193**	**-6.138**	**-0.288**	**-6.034**
Deflator	TBV		Total Assets		CET1		RWA	
Clustered Std. Errors	Firm		Firm		Firm		Firm	
Firm fixed effects	Yes		Yes		Yes		Yes	
Time fixed effects	Yes		Yes		Yes		Yes	
Adj. R-squared	0.85		0.90		0.85		0.83	
F-stat (robust)	126.11		151.65		150.95		96.4	
N. Observation	509		509		509		509	

Table 8 – Further robustness' check analysis

The sample is based on 509 firm-semi-annual observation on 35 European major banks from 2009 to 2018. For the description of the main variable $opaque_{i,t}^{L3L2}$ and control variables see Table 4, for variable $opaque_{i,t}^{L2L1}$ see Table 6. L1A (L2A, L3A)/Total Assets express the ratio between the amount of Level 1 (Level 2, Level 3) fair value assets and the amount of total assets held by the bank. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Deflator relates to the endogenous variable and to L1A, L2A and L3A only. Bold figures represent coefficient of variables with a p-value of 1% or lower.

Variables	16		17		18		19		20	
	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat	Coeff.	T-Stat
Total Assets	**0.075**	**7.261**	**0.075**	**7.486**	**0.075**	**7.750**			0.152	1.339
ROA	**0.439**	**3.065**	**0.435**	**2.948**	**0.445**	**3.061**			**0.116**	**2.475**
NPL/Loans	**-0.031**	**-2.961**	**-0.031**	**-2.797**	**-0.030**	**-3.036**			-0.010	-1.317
L1A/Total Assets	0.078	0.089	-0.017	-0.020						
L2A/Total Assets	-0.357	-0.832	-0.338	-0.775						
L3A/Total Assets	2.151	0.379	2.361	0.393						
L1A					-0.011	-0.225			0.024	1.111
L2A					-0.012	-0.466			-0.004	-0.325
L3A					0.082	0.257			0.211	1.169
$opaque_{i,t}^{L3L2}$	**-1.509**	**-3.799**			**-1.482**	**-3.637**	**-0.815**	**-3.102**	**-1.078**	**-5.558**
$opaque_{i,t}^{L2L1}$			0.009	0.591	-0.007	-0.289	0.010	1.599	0.009	1.187
Deflator	Equity		Equity		Equity		Equity		Equity	
Clustered Std. Errors	Firm		Firm		Firm		Firm		Firm	
Firm fixed effects	No		No		No		Yes		Yes	
Time fixed effects	No		No		No		Yes		Yes	
Adj. R-squared	0.70		0.70		0.70		0.90		0.91	
F-stat (robust)	42.75		39.55		127.30		217.86		202.04	
N. Observation	509		509		509		509		509	

Table 9 – Main findings in previous literature on fair value assets informativeness

The Table describes the main findings on fair value instruments informativeness of previous literature. In the first column is reported the name of the paper, in the second column is reported the overall number of firms and the geographical area of origin, the time-span of the sample and, in parenthesis, the number of available observations. The third column presents the endogenous variable(s) of study of the paper and the Fourth column presents the exogenous variables with their relative scaling items (i.e. outstanding number of shares, book value of equity and total assets). Column five describes the methodology for the main regression(s) of the model and column six briefly describes the main findings of the paper where, in parenthesis, next to each variable is reported the related coefficient. The R-squared for the presented regression(s) is also reported. L1A (L2A and L3A) represent the amount of Level 1 (Level 2 and Level 3) Assets. IRLS refers to iteratively re-weighted least squares. NS stands for 'Not statistically significant' at 10% level.

Author(s)	Dataset firms, timeframe, (obs.)	Endogenous Variable(s)	Exogenous variables	Methodology	Results
Kolev (2019)	177 U.S. S&P firms, Q1, Q2 and Q3 of 2008, (512)	Price per share	L1A, L2A and L3A per share	Pooled OLS (IRLS), Industry FE	Coefficient is positive, less than 1, and significant for L1A (0.982), L2A (0.957), L3A (0.873) on share price. Asset growth, Total assets, Net income and Net book value of equity as control variables and R-sq. is 73.96% (43.02% for IRLS). The discount is increasing in the FVH (opaqueness) of the asset as the coefficients are: 1>L1A>L2A>L3A.
Song et al. (2010)	431 U.S. banks, Q1, Q2, Q3, and Q4 of 2008. (1,260)	Price per share	L1A, L2A and L3A per share	Pooled OLS	Coefficient is positive and significant and less than 1 for L1A (0.968), L2A (0.972), L3A (0.683) on share price. Net income and Non-fair value assets as control variables and R-sq. is 56.53%. The discount is increasing in the FVH (opaqueness) of the asset as the coefficients are: 1>L1A>L2A>L3A.
Bosch (2012)	27 EU banks, 2006-2010, quarterly (408)	Price per share	L1A, L2A and L3A per share	Pooled OLS	Coefficient is positive and significant and less than 1 for L1A (0.687), L2A (0.690), L3A (0.320) on share price and the magnitude of coefficients is smaller than previous studies. Net income, Non-fair value assets as control variables and R-sq. is 48.4%. The discount is increasing in the FVH (opaqueness) of the asset only for L3A. For small banks the discount is increasing in each FVH (opaqueness) of the asset.
Short (2012)	46 U.S. banks with assets >25 bln USD. 2007-2011, quarterly (594)	Price per share	L1A, L2A and L3A per share	Pooled OLS	Coefficient is positive and significant and less than 1 for L1A (0.816), L2A (0.733), L3A (0.604) on share price. EPS and non-fair value assets as control variables and R-sq. is 74.52%. The discount is increasing in the FVH Level (opaqueness) of the asset as coefficients are: 1>L1A>L2A>L3A.
Goh et al. (2015)	477 U.S. banks, 2008-2011, quarterly (6,893)	Price per share	L1A, L2A and L3A per share	Pooled OLS	Coefficient is positive and significant for L1A (1.020), L2A (0.960), L3A (0.870) on share price. Non-fair value assets and EPS as control variables and R-sq. is 74%. The discount is increasing in the FVH (opaqueness) of the asset.
Bagna et al. (2014)	120 EU banks, 2008-2012, yearly (540)	Price/TBV	L1A, L2A and L3A per share and over TBV	Year-country FE	Coefficient is positive and significant for L1A (0.088), NS for L2A (0.016) and negative and significant for L3A (-0.108). Return on tangible equity, 1Y Beta, Net income growth, Total assets, type of business, Turnover, Tier1 Capital ratio as control variable and R-sq. is 72.96%.
Mohrmann and Riepe (2018)	644 U.S. banks, 2008-2012, quarterly (8,069)	(1) Market-cap. to equity book value (2) Merton DD (3) Return volatility	L1A, L2A, L3A scaled by total assets	Bank-quarter FE	(1) For market cap. to equity book value ratio Coefficient is NS for L1A (-0.001), NS for L2A (0.024) and negative and significant for L3A (-1.696). R-sq. is 32%. (2) For Merton Distance-to-Default, coefficient is NS for L1A (0.476), is negative and significant for L2A (-1.092) and negative and significant for L3 (-5.840) and R-sq. is 48.60%. (3) For Return volatility, coefficient is NS for L1A (0.106) and L2A (0.143) and positive and significant for L3 (1.150). R-sq. is 48.60%. For (1), (2) and (3) ROE, Tier 1 capital ratio, deposit ratio, Total Assets, Mortgage risk and dummy for negative net profit as control variables.

Figure 1 – Fair Value Assets by hierarchy as percentage of Total Assets

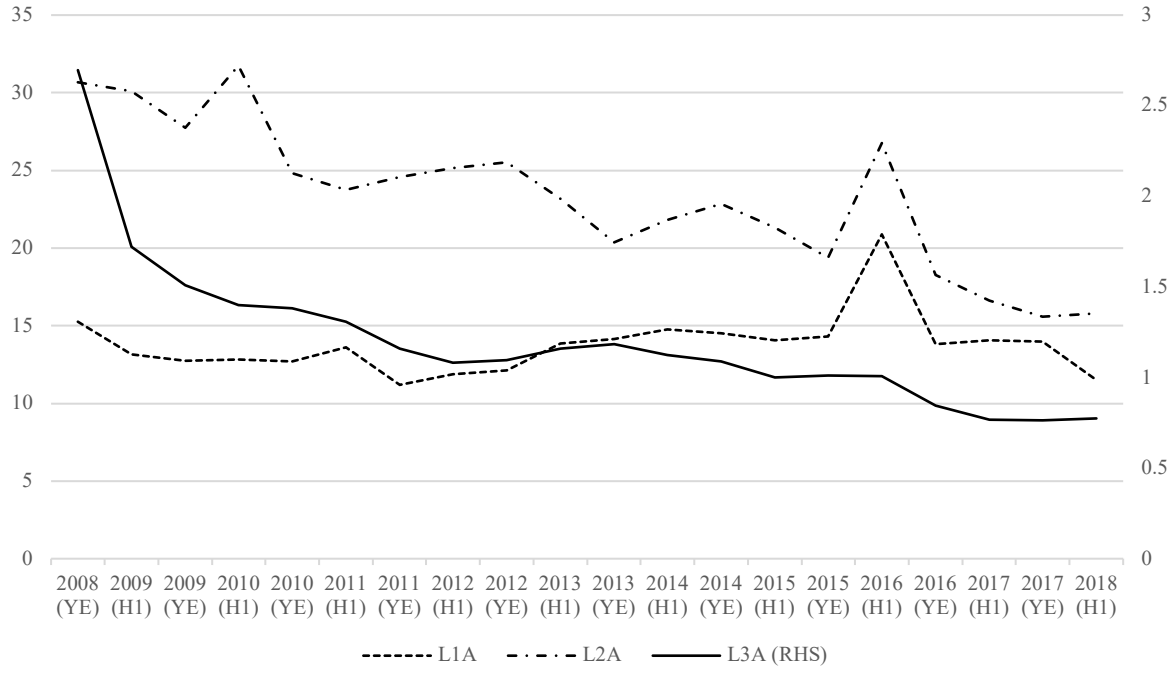

Figure 2 – L3A to L2A ratio and Price-to-book-value