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RISKS AND CHALLENGES OF COMPLEX FINANCIAL INSTRUMENTS: AN ANALYSIS OF SSM BANKS

by R. Roca[*] and F. Potente[*] (coordinators), L. G. Ciavoliello[*], A. Conciarelli[*], G. Diprizio[*], L. Lodi[*], R. Mosca[*], T. Perez[**], J. Raponi[*], E. Sabatini[*] and A. Schifino[*]

Abstract

We investigate the valuation risk affecting financial instruments classified as L2 and L3 for accounting purposes. These are instruments that are not directly traded in active markets and are often relatively complex, opaque and illiquid. There is a huge volume of L2 and L3 instruments in the balance sheets of SSM banks (around €6.8 trillion worth, considering both assets and liabilities). We argue that the complexity and opacity of these instruments create substantial room for discretionary accounting and prudential choices by financial intermediaries, which have incentives to use this discretion to their advantage. The current regulatory reporting standard is not sufficient to make a comprehensive assessment of the overall risks stemming from L2 and L3 instruments. We highlight that these instruments share some characteristics with NPLs (illiquidity, opacity), and argue that the risk they pose might also be comparable.

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Introduction[1]

One of the key lessons from the 2007-08 crisis is that financial innovation had created highly complex and opaque instruments, that were often priced incorrectly; the subsequent downturn caused a radical liquidity dry-up and a collapse in the prices of these products. In this respect, the crisis started a trend toward simplification and transparency, entailing a radical change in banks' business models.

The issue addressed by the paper is whether, and to what extent, there is still complexity in the balance-sheets of the major banks in the euro area (i.e. the significant institutions, 'SI's). The focus is on financial instruments classified for accounting purposes as Level 2 (L2) and Level 3 (L3). These are instruments whose fair value needs some form of estimation, as it cannot be directly observed from prices in active markets. The paper discusses the lack of transparency and the risks surrounding the valuation of complex, opaque products, which provide fertile ground for opportunistic behaviours by market players aimed at achieving unjustified profits and regulatory capital relief.

The main conclusions of the paper are the following: a) there is still limited information (accounting, prudential and market data) on L2 and L3 instruments, in spite of the enormous stock of such instruments owned by SIs; b) an exhaustive mapping of the actual risk factors is not available; c) the liquidity of the relevant markets are generally low; the reliability and comparability of the pricing models used by banks are at least partially unknown; d) the discretion given to banks under the accounting and prudential regulations – while largely unavoidable – can contribute to complexity and opacity and can reduce comparability; and e) banks have incentives to use this discretion to their advantage. Overall, these facts make it difficult to obtain a complete and reliable assessment of the risks embedded in these complex bespoke products, and to detect potential mispricing of risk and/or valuation uncertainties.

We argue that valuation uncertainty affects not only L3, but also a non-negligible portion of L2 instruments, especially those not based on safety mechanisms like collateralization and margining. Both types of instruments involve a high degree of complexity, which the IAS/IFRS accounting framework manages via a principle-based approach; concepts like model uncertainty, materiality of unobservable inputs, and conditions of inactive market imply a discretional approach on the part of the banks. This blurs the boundary between the two levels (L2 and L3). Initiatives undertaken in this regard, such as the Asset Quality Review conducted within the 2014 Comprehensive Assessment, mainly targeted selected L3 instruments, leaving L2 out of the spotlight.

The need for a close scrutiny of L2 and L3 instruments is confirmed when one considers their size: based on data from SNL Financial, at December 2016 total L2 and L3 assets of the SSM's significant banks

stood at €3.4 trillion and €189 billion, L2 and L3 liabilities were €3.1 trillion and €141 billion, respectively. The distribution of these instruments is highly concentrated: in the Eurozone, most are in the balance sheet of about 15 banks. Given the sheer size of these portfolios and under certain conditions, even modest valuation changes might have effects on capital ratios and on financial stability.

Since its entry on the scene, the SSM has made great efforts to strengthen the supervisory tools used to assess the quality of the loan portfolios and to tackle the issue of non-performing loans (NPLs); the progress achieved so far is remarkable, and has stimulated a large reduction of NPL ratios, thus improving the strength of euro-area banks. We argue that L2 and L3 instruments share several common features with NPLs: they are highly heterogeneous; many of them are opaque and illiquid, lacking an efficient secondary market, and hence subject to relevant downside valuation risk. Aggregating assets and liabilities (as we shall see, there may be a rationale in doing so), the total value of L2 and L3 instruments is 6.8 trillion, more than 12 times greater than that of net NPLs. Against this backdrop, the paper makes a case for close scrutiny of complex financial products.

The work is structured as follows. Sections 2 and 3 contain an overview of the main accounting and prudential rules on valuation of complex financial instruments. Section 4 presents data on the materiality of L2 and L3 instruments in the balance-sheets of SSM banks. Section 5 discusses the risk profile of such instruments, trying to assess the magnitude of potential valuation risks. Section 6 expands on the comparison between L2 and L3 products and NPLs. Section 7 reports the main findings of recent supervisory experiences related to books of complex financial instruments. Section 8 concludes.

1   The accounting framework: Fair value measurement under IFRS 13

1.1   *The distinction between L1, L2 and L3 instruments*

Fair value (FV) measurement of financial instruments is addressed by IFRS 13. FV is defined as '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.' The standard also makes reference to 'an arm's length exchange between parties that are knowledgeable and willing (i.e. not forced).' Therefore FV reflects an 'exit price', i.e. the price at which the asset or the liability 'exits' the bank by sale to a third party. It is a market-based measurement, because it relies on the assumptions that generic market participants would use when pricing financial instruments. Thus, it abstracts from specific features of the position, or of the holder, that can have an impact on the exit price.[2]

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[2]   IFRS 13 clarifies that a price discount resulting from the size of a position held by a certain entity shall not be considered in fair value measurement because it is a characteristic of that specific position, rather than of the instrument per se. There are exceptions to this principle. For instance, in the case of the equity instruments of an unlisted entity, control premiums might be incorporated into the FV, if the ability to control the entity is recognised as an additional intrinsic value by market participants.

The starting point for FV measurement is a quoted price in an active market, if available. A market is active if transactions take place with sufficient frequency and volume to provide meaningful pricing information on an ongoing basis. As these conditions are not always met, IFRS 13 adopts the following hierarchy for inputs that enter the valuation mechanism of a FV instrument:

- **Level 1** (L1) inputs: prices quoted for that specific instrument in an active market at the measurement date.

- **Level 2** (L2) inputs: valuation inputs that are observable, either directly or indirectly. Examples of directly observable inputs include: quoted prices for similar instruments in both active and not active markets; examples of indirectly observable inputs include interest rates, implied volatilities, and credit spreads that are derived from quoted prices (e.g. of bonds, options, and credit default swaps).

- **Level 3** (L3) inputs: valuation inputs that are unobservable, that is, market data on these parameters are either not available or not sufficiently reliable. Examples include: financial forecasts of cash flows or profits used in a present value technique; long-term volatilities and correlations; recovery rates, and non-listed counterparty credit risk.

Financial instruments are classified in homonymous categories – L1, L2 and L3 – according to the hierarchical level of the inputs that are significant in their valuation. Note that, based on this methodology, instruments of the same type can end up in different categories, given that only the specific features of each contract determine which parameters are actually relevant. For example, two otherwise identical plain vanilla swaps may be L2 or L3 depending on the observability of the counterparty credit risk.

IFRS 13 does not envisage specific valuation techniques for L2 and L3 instruments. However, it requires the banks making the valuation to maximize the use of relevant observable inputs, minimize the use of unobservable inputs, and to apply the valuation technique consistently.[3] IFRS 13 also contains specific disclosure requirements on the methodologies and inputs used for the estimations. The most extensive (although still relatively basic) requirements concern L3 instruments. In the notes to their annual financial statements banks should include: a description of valuation policies; information about significant unobservable inputs used in the valuations; unrealized gains and losses; and narrative and quantitative sensitivity analysis to changes in unobservable inputs. In comparison, disclosure requirements on L2 instruments are modest, notwithstanding the huge size and diversity of the books.

For L1 instruments, banks are expected to use market prices as a measure of FV whereas for L2 and especially L3 instruments adjustments may be necessary in order to reflect valuation drivers such as: credit

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[3]   As indicated in IFRS 13.62, two widely used valuation techniques for financial instruments are the market approach and the income approach. The market approach uses prices and other information from market transactions involving identical or similar assets or liabilities. Valuation techniques that fall under the market approach often derive market multiples from a set of comparable assets. The income approach converts future expected amounts (e.g. cash flows or income streams) to a current discounted amount. Common valuation techniques falling under the income approach include present value techniques and option pricing models. A combination of approaches can also be used, when appropriate.

risk; liquidity risk; the funding cost of uncollateralized derivative instruments; model and parameter uncertainty;[4] other factors, such as administrative/servicing costs, or risk premiums relating to the complexity of a financial instrument, or any other measurement uncertainty.

1.2 Uncertainties in measurement and classification

In principle, the disclosure requirements contained in IFRS 13 are meant to provide transparency about the risks embedded in L2 and L3 instruments, whereas the valuation adjustments should yield a fair and conservative valuation. In practice, this is not always the case, for various reasons.

First, accounting standards are principle-based, and therefore leave room for interpretation and discretionary choices by banks. For instance, IFRS 13 requires valuations to be adjusted for liquidity risk, but it does not prescribe the adjustment method, or the size of the adjustment. As a result, two banks with different degrees of conservativeness may decide to treat the same financial product in different ways and end up with different valuations. Second, FV measurement of L2 and L3 instruments is characterized by a high degree of complexity, which interacts with the discretion embedded in the principle-based approach, magnifying the uncertainty surrounding the estimates. Third, banks may have incentives to use their discretion so as to distort the valuation process and the allocation of financial instruments among the various categories; in what follows, several reasons why this may happen are highlighted, ranging from the possibility of recognising uncertain profits immediately, to the minimization of fair value adjustments even in extremely illiquid conditions (in the absence of an active market), and lastly the need to maintain a good reputation 'on the street'.[5] In this context, the following points should be carefully considered:

(i)   *Determining when a market is active requires discretion.* – IFRS 13 states that quoted prices in active markets shall not be adjusted, since they provide the most reliable evidence of the FV of an instrument. However, the standard does not provide clear-cut operational criteria to distinguish between active vs inactive markets. Key indicators are the frequency and volume of transactions, but deciding in practice whether a certain frequency or volume are sufficient to label a market 'active' is a matter of judgment. In a similar vein, the FV of L2 instruments should be based on 'observable inputs', but the standard does not provide an operational definition for this concept. Thus, the boundaries between L1 and L2 and especially those between L2 and L3 assets are de facto not as clear-cut as they sound in principle.

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[4]   Model uncertainty arises from the discretional assumptions needed to build a valuation model. It may arise from complex formulas for determining cash flows (e.g. many underlying instruments, long term or exotic paths) or from a high volume of individual cash flows highly heterogeneous (e.g. ABS, CDOs). Parameter uncertainty refers to the lack of observable market parameters in market quotes which are key in valuation models.

[5]   A challenging question which we do not investigate is whether and how the accounting profile of a transaction, i.e. the combination of its classification (L&R, HFT/FVO, HTM, AFS), fair value hierarchy, and pricing features, interacts with its prudential treatment and the determination of the regulatory capital allocated (see Section 3 for further details).

(ii)   The concept of 'orderly transaction' can be misleading for L3 and complex L2 instruments. – The definition of FV relies on the concept of an 'orderly transaction' even in the absence of an active market. Indeed, the IFRS framework leaves no room for dropping the key assumption that a willing buyer determines the exit price, and therefore the framework rules out a valuation based on a distressed sale or a forced liquidation scenario. However, for some L3 and complex L2 products the only possible 'orderly transaction' can, de facto, be an early termination, to be negotiated with the same contractual counterparty of the instrument. Should a cash sale turn out to be necessary, the complexity of these products, together with the lack of an active market, could create a gap between the accounting value and the sale price.[6] In principle, this gap should be addressed by the so-called 'close-out reserves', mainly related to the uncertainty surrounding liquidity conditions at the closing time of a certain position (e.g. the bid–ask spread). However, these reserves are often estimated at a portfolio level (see point (*iv*) below), so that their allocation to specific trades needs to be proxied; furthermore, they are computed via internal models, adding another significant layer of complexity. Finally, there is no disclosure in banks' financial statements on the relevant methodologies and the related quantitative effects.

(iii)   Discretion is required to establish when unobservable inputs are 'significant' for the purpose of fair value classification to Level 2 vs Level 3. – The valuation of a financial instrument that is not traded in an active market (for instance, an OTC option) often requires more than one input; in some cases a combination of L2 and L3 inputs is needed. According to IFRS 13, whenever unobservable inputs play a significant role, the instrument should be assigned to the most conservative classification (i.e. L3). However, the standard does not provide guidance on how the 'significance' of individual inputs should be assessed. To this end, financial intermediaries have to develop their own internal policies, which are subject to discretionary interpretation and application.[7]

(iv)   The netting issue: the 'portfolio exception'. – In principle, under the fair value standards each financial instrument is a distinct unit of account and, as such, to be valued on its own – that is, on a gross basis. However, accounting standards recognise that banks' risk management policies and hedging techniques may significantly reduce risks computed on a gross basis. A key mechanism is the so-called 'portfolio exception' allowed under IFRS 13/IAS 39: a bank may manage and internally report its exposure to market risks within a certain group (portfolio) of financial instruments (be they assets or liabilities) on a

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[6]   As per IFRS 13 paragraph (23)(c), 'in the absence of an observable market, fair value is determined by considering the characteristics of market participants who would enter into a hypothetical transaction'. In substance, banks need to 'simulate' a market which does not actually exist, including the assumptions about the behaviour expected from theoretical market participants. Clearly, this entire process is highly uncertain and discretional. If no external willing buyer is found at the (hypothetical) book price, banks might in principle keep the asset and decide not to reduce its FV due to conditions not being 'orderly' (e.g. distressed seller, need to meet regulatory or legal requirements, absence of a plurality of market participants, etc.).

[7]   Hanley et al. (2017) find that holders of the same security in the same year report different FVs, particularly at Level 3, and agree on the level only 40% of the time.

net basis, provided this is done in accordance with a documented risk management strategy. In practice, the 'exception' allows a group of assets and liabilities with offsetting market risks to be valued as a single instrument, with an FV equal to the net position. The 'close-out reserves' described under sub-paragraph *(ii)* above are typically computed on the net values. While the portfolio exception approach has a sound economic rationale, it introduces even more complexity, discretion and opacity. First, the portfolio level (e.g. book, desk, business unit, entire balance sheet) at which valuation adjustments are computed, as well as the computation approaches, can significantly vary across banks, with a significant impact on the outcome. Second, the exception should in principle be limited to risks that are the same in nature and duration, to avoid overestimating the amount of risk offset by the portfolio exception and neglecting the basis risks.[8] If the basis risk is material, implementing the portfolio exception is unwarranted. However, in practice, assessing the extent of unheeded basis risk within a certain net portfolio requires very detailed information and extensive knowledge of its structure, which is not usually available outside the bank. Basis risk may be particularly high for bespoke hedges, but it typically remains hidden until the positions need to be unwound. To prevent basis risk underestimation, the relevant accounting standards state that the FV of a complex financial instrument on initial recognition must be compared with observable market transactions in the same instrument. However, this requirement becomes *de facto* inapplicable in the case of bespoke products. To the best of our knowledge, no information is available except inside the banks themselves.[9] Experience indicates that hedging within portfolios is often imperfect, so the application of the portfolio exception may lead to an underestimation of risks (see also Section 3 below).

(v)   *The Day-1 profit mechanism relies on valuation uncertainty.* – According to IAS 39 (Application Guidance 76), the best evidence of the FV of a financial instrument on initial recognition is the transaction price. However, in certain cases exceptions are allowed. Consider the following example: a bank acquires a financial instrument in a market (e.g. from a corporate or retail client) with the intention to sell it at a higher price (or to issue an equivalent offsetting instrument to hedge the underlying risk) in another market (the 'principal market', e.g. an interbank or dealer market). In this case, if the bank is virtually certain to sell the instrument at the higher price (e.g. because of an informational advantage vis-à-vis the seller, or due to a bid-ask spread), the accounting standard not only allows, but even requires an instrument to be initially measured at its FV in the selling/hedging market; the difference between this FV and the transaction price is thus

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[8]   Basis risk is the financial risk that the various instruments in a hedged portfolio will not exactly offset each other's value changes. This imperfect correlation between instruments' valuations creates the potential for excess gains or losses, thus adding risk to the position.

[9]   The portfolio exception pertains to fair value measurement, not to financial statement presentation: whether the instruments in the portfolio are presented on a net or gross basis in the financial statement depends on guidance other than IFRS 13. IFRS 13.50 merely requires institutions to disclose the 'fact' that they use this method and recommends a 'reasonable' allocation of the adjustments. The netting effects arising from the portfolio exception have no disclosure, although some connections may exist with those allowed by other disclosure requirements, namely, the information on 'hedge accounting' and on the exposures subject to rights of set-off and other enforceable master netting arrangements with counterparties.

recognised as a Day-1 profit. In this example and in a few others described in the standard itself[10] a profit at trade date appears justifiable. However, it is not actually the case for a Day- 1 profit purely estimated on the basis of a valuation technique which makes use of unobservable parameters.

Indeed, accounting rules prescribe that banks can only post Day-1 profits for instruments with no unobservable valuation inputs; for the remaining portfolios (i.e. L2 with no significant unobservable inputs, and L3), recognition of profits or losses should be deferred over the life of the instrument and released only to the extent that they arise from a change in a relevant valuation factor (e.g., a non-observable input becomes observable).

However, in Section 7 we argue that a common practice within the industry is to recognize Day-1 profits when unobservable inputs are deemed 'not significant' for an instrument's valuation. Likewise, banks have developed their own interpretations of the general provision of Application Guidance 76 regarding the release of the deferred components. A frequent approach is to recognise the gain or loss linearly until the contractual termination date is reached, thus implicitly assuming that the sensitivity of the valuation to the unobservable inputs tends to decay regularly over time. This practice is questionable; as long as an input remains unobservable and the sensitivity to unobservable risk factors does not decline substantially, the prohibition should remain valid so as to avoid flows of unverified profits being recorded.

Another approach is to release the initial reserves when unobservable parameters are deemed to have become observable. In principle this is in line with the regulation; in practice, such a change of status of the parameter is a condition actively pursued by traders through netting mechanisms like those described above. For instance, a trading desk may execute a deal with an external counterparty to hedge the risk(s) stemming from key unobservable parameters of the original trade and argue that the impact from any remaining unobservable parameter(s) is insignificant to the FV of the original contract. In this case, the upfront profit is assumed to be 'locked in' and recognised. However, this significance assessment is discretionary. Obviously, the trading desk has an incentive to deem the remaining risk immaterial and to recognize a Day-1 profit; in reality, this may simply reflect an 'imperfect' hedge (e.g. achieved through contractual schemes that, for several reasons (notional amount, duration, liquidity of the instrument, etc.) overlook basis risk).

Accounting rules (IFRS 7 and IFRS 13.93) set limited disclosure requirements on Day-1 profits. Profits recognised at the trade date are not subject to any reporting; some information must be provided for profits

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[10] The example described in the text is drawn from IFRS 13, Appendix B4, which also provides other typical cases where the fair value on initial recognition might not be the same as the transaction price: e.g. the transaction is between related parties; or, the seller is forced to accept the price due to financial difficulties.

emerging from L3 contracts initially booked at an FV different from the transaction price, which are allowed to record interim profits or losses due to a change in conditions (valuation inputs that become observable).[11]

In spite of this lack of data, the Day-1 profits issue is not a mere technicality. Anecdotal evidence suggests it may represent a key component, if not the 'raison d'être', of the core trading desks of the main investment banks.

In conclusion, apart from the cases explicitly mentioned in the standard, where their root causes are actually meaningful (forced transactions, contracts with related parties etc.), Day-1 profits might simply reflect an internal model that needs to be recalibrated, or that omits basis risk. Thus, Day-1 profits should be carefully reviewed by the supervisor, all the more in the presence of unobservable inputs to the determination of FV.

(vi) *Banks have incentives to take advantage of the discretion granted by accounting standards.* – Financial intermediaries may have incentives to use the discretion granted them by the accounting rules to classify certain instruments as L2, rather than as L3, and thus limit the amount of L3 exposures on their balance sheets. First, investors, market participants and rating companies are fully aware that L3 instruments are risky, and look with concern at high values of indicators such as L3/Total Asset or L3/CET1.[12] Second, the level of L3 instruments contributes to the assessment of the complexity of G-SIBs (Global Systemically Important Banks)according to the methodology defined by the Basel Committee on Banking Supervision. Third, as discussed above, the classification of a certain instrument as L3 prevents recognition of Day-1 profits (although in Section 7 we shall see that banks have found ways to circumvent this prohibition). More generally, there is ample evidence that the discretion embedded in accounting standards can be used by financial intermediaries to save on capital requirements and/or to engage in window-dressing practices.[13]

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[11] In these cases banks need to disclose the aggregate amount that still needs to be recognised in profit or loss and the yearly changes over the lifetime of the contract, and the reasons why the transaction price was not the best measure of FV, including evidence in support of the chosen measure.

[12] CET1 stands for "Common Equity Tier 1", i.e. the highest quality capital of a bank, under the current prudential framework.

[13] Huizinga and Laeven (2012), analysing the US mortgage crisis, argue that opaque assets such as L2 and L3 might offer the possibility of overstating their asset value, delaying loss recognition to preserve regulatory capital. Glaser, Mohrmann and Riepe (2013) find that capital-constrained banks make the heaviest use of Level 3 assets, and that banks use their own discretion in the valuation of FV assets to ease regulatory constraints. Hanley et al. (2017) find that the predominant predictor of FV inflation is the source of the FV estimate. Regardless of whether the security is reported at L2 or L3, FV inflation is greater when insurers self-estimate FV compared with obtaining FV estimates from third-party sources. The decision to self-estimate FV is associated with insurers' incentives to improve the appearance of regulatory capital and financial health, suggesting that insurers exploit the inherent ambiguity of the FV estimation guidance for strategic reasons. Begley et al. (2017) and Plosser and Santos (2014) document that banks underestimate risk when they self-estimate and that this bias is related to the amount of regulatory capital they hold.

In sum, the accounting framework requires financial institutions to implement a structured approach to FV measurement, which entails making assumptions and exercising a degree of judgment in key areas: whether to value instruments at the individual or at the portfolio level; whether or not to deem the reference markets active; whether or not certain inputs are significant to the FV measurement. Furthermore, financial intermediaries have incentives to use this room for manoeuvre to their advantage. Thus the 'profits' that emerge from certain complex transactions might well be more properly labelled as a premium for a (hidden) risk.

2 Prudential rules on valuation of financial instruments

The complexity of financial instruments valuation is also duly acknowledged in the prudential framework, which addresses two main risks: FV volatility and FV reliability. FV volatility risk, i.e. the risk of uncertain returns due to changes in market conditions and prices, is the target of capital requirements for market risks (e.g. RWAs of the regulatory trading book). FV reliability risk reflects the extent to which the assumptions underlying FV measurement of complex products leave room for uncertainty. Given the main focus of this paper, this section mainly deals with FV reliability risk.

2.1 The 'prudent valuation' mechanism

Following the introduction of IFRS 13, FV reliability has become a key component of the prudential framework. The Capital Requirements Regulation (575/2013, Articles 34 and 105), recently supplemented by an EBA RTS (EBA/RTS/2014/06/rev1), requires banks to compute a 'prudent valuation' of all FV positions, regardless of whether they are classified in the regulatory trading or banking book.[14] The prudent valuation should proxy for the expected orderly exit price of an instrument, taking into account, inter alia, 'entity-specific' factors which are ruled out in the accounting valuation but may influence the exit price of a position.

Simplifying, whenever sufficient market data exist according to its own Independent Price Verification (IPV) framework,[15] a bank should construct a distribution or range of plausible values for each instrument and obtain the 'prudent valuation' at a defined target level of certainty; the difference between the FV and the 'prudent valuation' is labelled Additional Valuation Adjustment (AVA). It measures the potential

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[14] Banks' classification of trades in the regulatory books is independent of the accounting fair value hierarchy. Therefore, a summary measure of capital absorption deriving from complex products is not available.

[15] The IPV is defined in the Basel II Prudent Valuation Guidance as the process by which market prices or model inputs are regularly verified for accuracy. This verification should be performed by a unit independent of the dealing room. This function is also explicitly mentioned in the EBA RTS.

downside risk of exiting within the instrument within the capital calculation time horizon and it must be deducted from CET1.[16]

The prudent valuation/AVA mechanism is an important step forward but it still leaves several open issues as regards the prudential treatment of L2 and L3 instruments. First, prudent valuation is based on IFRS 13 for the taxonomy of possible adjustments, the reference market data, and the assumed distribution of the exit prices. Hence, all major types of AVAs, especially those on complex products, tend to share any shortcomings that affect accounting FV.

Second, in most cases AVAs are not computed on a 'gross basis' but on portfolios, where some risk factors can partly or entirely offset each other.[17] As we have also seen in the case of the accounting 'portfolio exception', this practice may be hiding basis risks, opening the possibility that AVAs are underestimated. Furthermore, the regulation on prudent valuation recognises material diversification benefits when finalizing the calculation of the AVAs (core approach) for price uncertainty, close-out costs and model risk; the rationale is that it would be excessively prudent to assume that all of a bank's positions would simultaneously record the large loss implicit in the AVA calculation, as all adverse valuation estimation errors would have to be perfectly correlated across asset classes. Therefore, the prudential framework acknowledges the principle that across a diversified portfolio a bank's valuation uncertainty would also be diversified.

Third, where sufficient data to form a valid distribution of exit prices are not available, banks are allowed to adopt an expert-based approach to compute AVAs. This is, for example, the case for model risk, which is key for complex products that by definition rely heavily on theoretical pricing functions and parameter calibrations. In principle, computing AVAs for model risk would require a range of plausible valuations derived from alternative models and calibrations. However, experience in the field shows that this is very challenging for banks, since it involves not only an onerous benchmarking exercise, but also massive reviews of the banks' model approval processes and related accounting frameworks for adjusting model risk; in other words, a reconsideration of the balance of powers between the internal control functions (risk manager, product control, IPV, etc.) and the front offices.

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[16]   The EBA RTS requires the gross AVA (i.e. before offsetting and diversification benefits apply) to proxy the valuation uncertainty at a 90% confidence probability. Downside uncertainty matters for long positions, upside uncertainty for short positions. Thus, the prudent valuation coincides with the 10th (long positions) or the 90th (short positions) percentile of the valuation distribution. The book/fair value normally coincides with the mean of the distribution.

[17]   The EBA RTS introduces two methods for computing AVAs. The 'core' approach envisions 9 AVA types, grouped by risk factors: market (close-out costs, market price uncertainty, model risk, unearned credit spreads/Credit Value Adjustments, investing and funding costs/Funding Value Adjustments) and non-market (operational risks, early termination, future administrative costs). The 'simplified' approach can be applied by banks provided the sum of the absolute values of their fair valued asset and their liabilities is less than €15 billion. In this case the AVA charge is calculated as a flat percentage (0.1%) of the aggregate. In the case of portfolios, the calculation of AVA for each risk factor consists in multiplying the residual portfolio sensitivity to the risk factor (after netting long and short exposures) by the difference between the prudent percentile of the risk factor (10% if the sensitivity is positive or 90% if it is negative) and its expected value.

In summary, the AVA adjustment to CET1 builds on the same basic framework that is used for accounting FV adjustments, hence it may not fully address valuation concerns on L2 and L3 assets. In Sections 4 and 5 we shall see that AVA adjustments appear to be relatively small compared with the value and the potential volatility of L2 and L3 instruments.

2.2   The Fundamental Review of the Trading Book

The Fundamental Review of the Trading Book (FRTB) by the Basel Committee on Banking Supervision aims at enhancing the prudential framework for market risk (see BCBS 2014). The reform introduces a new definition of the boundaries between the regulatory trading and banking books, meant to provide a stricter guidance on allocating instruments and to reduce room for arbitrage. It also calls for a radical overhaul of the internal model approach, entailing much stricter requirements for trading desks. Thus, albeit not specifically conceived to address FV reliability, some observers believe that the FRTB should contribute to improving it.

The new 'boundaries' between the two regulatory books aims at aligning capital requirements to the true nature of the risks embodied by each position. As a consequence, it is expected that a larger share of positions with an actual trading intent should be placed in the trading book, and thus be subjected to higher capital charges, other things being equal. This will happen as long as the risk factors (e.g. volatilities and correlations) can be observed in active markets on a daily basis. However, this may not be the case for complex instruments, whose risk parameters are mainly non-observable and measured through proxies and assumptions. For these instruments, we have seen that FV reliability and their related capital absorption are influenced by complexity, basis risk, and netting arrangements. These factors are not going to be radically affected by the new definition of boundaries.

The modelling requirements introduced by the FRTB will restrict the room for manoeuvre implicit in internal models. Banks will be required to differentiate between risk factors that are 'modellable' and those that are 'non-modellable'. Financial instruments whose FV is determined via 'non modellable' factors are subjected to a hefty capital add-on. A risk factor can be deemed modellable if the firm can demonstrate that there are sufficient continuously available prices to model it ('real' prices in the FRTB wording). This mechanism will give banks an incentive to invest in data collection, with potential beneficial consequences for FV reliability. Furthermore, various other mechanisms envisioned by the FRTB may indirectly provide incentives to enhance FV accuracy. For example, the provision of reinforced P&L attribution tests and back-testing[18] should unveil 'unexplained P&L' components at individual desk level; when the unexplained P&L component is too big, the test is classified as 'failed', thus triggering the fallback to the standardized model,

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[18]   In particular, to achieve and keep internal model approval, banks will have to compare at level of individual desks the theoretical P&L (predicted by the sensitivities/risk factors produced by the trading desk pricing models with the hypothetical P&L, arising from holding the positions existing at the end of the previous day constant and revaluing them with the market data at the end of the current day. The difference represents an 'unexplained P&L' component.

with a likely capital penalization. As mentioned, this mechanism may indirectly provide incentives to improve the 'pricing quality' of the desks, to the extent that a high level of unexplained P&L, in addition to indicating an inaccurately designed risk profile for the financial instruments feeding the VaR, might also be a consequence of missed pricing factors by Front Office systems or inaccurate proxies adopted for pricing purposes.

Notwithstanding the significant enhancements introduced by the prudential framework, the new rules cannot ensure that valuation uncertainty of L2 and L3 products is completely cured.

First, the concept of the 'real' price is quite distant from what is commonly thought to be a market price and, in spite of FRTB guidance, it is subject to some discretionary interpretation.[19] Indeed, this definition does not seem to rule out prices derived from (potentially fictional) synthetic sales, to related parties (e.g. own vehicles), or non-executed quotes. Furthermore, the rule sets a minimum of 24 'real' prices per year, with a maximum period of one month between any two consecutive observations. This leaves a 'grey area' for valuation uncertainty. Given the potential consequences in terms of capital charges, banks will have an incentive to interpret this concept broadly.

Second, it is not certain that the regulatory and the accounting perspectives will reinforce each other. The new prudential concept of 'modellable factors' is distinct from, although closely related to, the accounting concept of an 'observable input' as illustrated in Section 2. Unless banks align their accounting definitions to the prudential ones, which is not obligatory, the impact of this new regulatory definition per se does not affect FV reliability. Furthermore, the hedging arrangements illustrated in the previous section will not be affected by the FRTB. This may result in complex interaction between accounting and prudential rules.

Summing up, the implementation of the FRTB is still ongoing, and will likely take several years after the planned implementation date to be fully operational. For instruments allocated in the trading book some improvement in FV reliability is to be expected. However, significant discretion (unavoidable when dealing with complex and bespoke financial instruments) remains.

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In summary, any issues affecting the fair value reliability of financial instruments may have a negative influence not only on a bank's financial statements, but also on the implementation of the prudential framework. This is clear for the AVAs, which are broadly based on the same logic as the accounting fair value adjustments; moreover, it might also be the case of the risk weighted assets of certain bespoke exposures, arbitrarily allocated in the regulatory market book, whose apparently low volatility simply reflects

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[19] A price will be considered 'real' if it is a price from an actual transaction made by the bank, it is a price from an actual transaction between other parties (e.g. at an exchange), or it is a price taken from a firm quote, i.e. a price at which the bank could make a transaction.

a lack of market data in the upstream accounting valuation processes (e.g. stale or even missing risk factors, absence of true sales, bad selection of proxies).

The FRTB could contribute to enhancing the interdependence between the accounting and the prudential perspectives, thereby leading to improvements both in the regulatory booking and in the capital requirement quantification; in turn, this might also have beneficial effects on the soundness and reliability of fair value measurement. As a note of caution, however, it should be pointed out that the implementation of the new regulatory framework is subject to uncertainty.

3   Evidence on L2 and L3 instruments

3.1   Data source

The main sources of supervisory reporting on L2 and L3 instruments are the so-called FINREP and COREP data flows. Supervisors also rely on data from SNL Financial, another source commonly used by market operators and financial analysts and the one we use ourselves. Based on SNL Financial data, the total assets of the SSM significant banks at December 2016 stood at around €22 trillion, of which FV assets accounted for €6.7 trillion (30%). The amount of Level 2 and Level 3 assets held by SSM banks is huge, totalling €3.4 trillion and €189 billion respectively; L2 and L3 liabilities amount to €3.1 trillion and €141 billion.

In Charts 1 to 3 we aggregate the data by country. Chart 1 gives the ratios of FV assets and of FV liabilities to total assets. The 30% FV assets to total assets ratio observed overall conceals a wide dispersion across national banking systems. Banks in Finland (FI), France (FR), Luxembourg (LU) and Germany (DE) stand out, with values far exceeding this threshold. At the other extreme, Greece (EL), Estonia (EE), Lithuania (LT) and Cyprus (CY) display a ratio below 10%. The aggregate share of liabilities valued at FV stands at 16% of total assets, much lower than for FV assets. In this case as well, cross-country dispersion is wide. The ranking of countries emerging from the assets side is broadly confirmed on the liability side.

Chart 2 presents a break-down of the FV component of banks' balance sheets. On average, 97% of total FV assets is almost evenly split between L1 and L2 instruments; the residual 3% is represented by L3 instruments. The high degree of heterogeneity across countries is confirmed. For instance, in some countries (FI, LU, DE, SI), L2 assets represent the large majority of FV assets, with peaks of more than 70% of the total, whereas in others (MT, PT, LT, IE, EE), their share is below 20%. The importance of L3 assets is comparatively small: they account for less than 5% of total FV assets in most countries.

Taken together, Charts 1 and 2 show that countries whose banks have a higher proportion of FV products in their balance sheets also tend to present a higher share of complex instruments of the L2 and L3 types, which is indicative of a greater reliance on mark-to-model valuations.

These results are confirmed by Chart 3 that provides the distribution of L2 and L3 instruments across SSM countries. On the asset side, almost three quarters of the total of L2 and L3 are in FR and DE, against a weight of the banking systems of these countries (by total assets) of around 50%. A similar picture emerges on the liabilities side.

Next, we look at individual bank data, on the basis of SNL Financial data. This part of the analysis focuses on the 18 SSM significant banks with the largest holdings of these instruments on the asset side. Chart 4 reports the share of FV assets and liabilities in relation to total assets. Heterogeneity is present at the micro level as well: the share of FV assets ranges from well above 50% to less than 20%. This dispersion also emerges on the liabilities side.

Chart 5 plots the share of FV assets in relation to total assets against the share of L2-L3 assets among FV assets of the banks in our sample. It shows a clear positive correlation between the two dimensions, suggesting that a wider use of FV valuation is associated with a larger incidence of relatively complex products. This correlation is confirmed on the liabilities side. Chart 6 documents the fact that wider recourse to FV valuation is also associated with a lower RWA density. It is worth recalling that RWA density is subjected to intense scrutiny by the regulator and supervisor.

Chart 7 reports the prudential Additional Valuation Adjustments (AVAs) described in Section 3 for our sample of banks. AVAs are very small in relation to total L2-L3 assets, on average around 28 basis points across the sample of the 13 banks for which AVAs were available.[20] The figure also shows that AVAs are not proportional to the amount of L2-L3 assets held by each bank, which might reflect heterogeneity in the composition of these assets. However, it could also reflect different assumptions and models being used to compute AVAs. In this respect, this issue bears a striking resemblance to that of RWA heterogeneity stemming from internal models. The size of AVAs in terms of prudential measures is also very small: across the same sample of 13 banks, on average AVAs account for only 19 basis points in terms of RWAs.

Next, we provide some insights about the impact on capital positions of a hypothetical decline in the value of total L2-L3 assets. On the horizontal axis, Chart 8 shows the sum of L2 and L3 assets in relation to the CET1 ratio for each bank, while on the vertical axis it reports the hypothetical new CET1 ratio induced by a 5% decline in the value of total L2-L3 assets; the size of the bubbles represents the hypothetical decline in the CET1 ratio in basis points. Across the 18 banks, the average decline of the CET1 ratio is around 350 basis points and the new CET1 ratio stands below 11% (down from 14%) on average. As usual, the mean effect hides substantial heterogeneity across banks, with values as high as 1,470 basis points and as low as 70 basis points, while the CET1 ratio after the shock ranges between 15% and 4%.

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[20] Just to provide an additional scale for the AVAs, they would represent a negligible amount of L2-L3 assets and liabilities, in the absence of offsetting between risk factors on the two sides of the balance sheet. Assuming, at the opposite extreme, complete risk offsetting between L2 and L3 assets and liabilities, AVAs would still represent only around 2% of the L2–L3 absolute net value.

It is necessary to highlight that the exercise is based on three admittedly extreme assumptions: i) all L2s and L3s move in a correlated fashion (i.e. diversification effects are neglected); ii) there are no other compensating effects from other financial items; and iii) no hedging effect exists between assets and liabilities. In other words, the exercise merely provides an indication of the sensitivity of the capital position to a negative shock on L2 and L3 instruments. On the other hand, diversification benefits may rapidly vanish under stressed market conditions; furthermore, a 5% decline may not be so extreme; finally, it is difficult to assess the share of assets and liabilities genuinely hedging each other (we come back to this issue in Section 5).

4.2 Data gaps

The data previously discussed provide an overall picture of the situation concerning L2 and L3 instruments, but fall short of giving indications about the underlying risks. In particular, no information is available on the prices/returns of L2 and L3 instruments. Resorting to COREP and FINREP (in addition to SNL) would not have led to a much deeper analysis. FINREP only includes a modest subset of the information required by IFRS on fair value hierarchy. Banks have to report their allocation of fair valued financial instruments by hierarchical level and, only for L3, the annual change of FV and the cumulative unrealized gains or losses. The supervisory reporting does not include the IFRS additional disclosure requirements on L3 described in Section 2,[21] or information on Day-1 P&L and the FV accounting adjustments. COREP data provide a partial coverage of the regulatory capital requirements, which allows only basic analyses of the overall risk profile of banks. With reference to market risks, as already noted, there is no breakdown of capital absorption by classes of fair value hierarchy; as for the AVAs, basic figures are currently provided by banks in the internal capital adequacy sections in their annual reports, while an ad hoc more detailed template will not be introduced before December 2018. This situation should improve in parallel with the introduction of the new market risk framework (FRTB) which, as previously described, sets specific capital charges for complex instruments.

This situation is indicative of a data gap, partly due to the fact that the bespoke features usually characterizing complex financial products are ill-suited to standardized reporting. In an off-site perspective, a thorough assessment of valuation uncertainty related to complex financial portfolios would require some further basic information.

First of all, descriptive statistics are needed at the desk and portfolio level, to identify the desks dealing with a higher level of complexity in terms of materiality, concentration (by deal or product types), vintage indicators, FV hierarchy and prudential treatment of trades. This information would have to be integrated with the key profitability drivers at the desk level, namely with: a) the mechanics of the P&L

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[21] The description of the valuation processes and of the policies adopted by the bank; the quantitative information about significant unobservable inputs used in the valuation technique; and the narrative and quantitative analysis of sensitivity to changes in unobservable inputs.

contribution, e.g. Day-1 profits from new trades, marking-to-market effects, carry and fees; b) the accounting and prudential adjustments (size and allocation), split by trade-specific and portfolio level adjustments; c) the risk-adjusted profitability, so as to allow benchmarking and identification of outliers based on an integrated view of accounting and risk metrics.

Secondly, collecting information about the pricing models in use at the various banks might be useful to allow benchmarking exercises for similar product types and identify outlier techniques. Indicators of turnover, frequency of material pricing inputs, relevance of stale marks and instruments with fair values measured by numerical methods would also be useful.

All this information should be supplemented with detailed risk factor sensitivities at the desk level, so as to explain the price variations in the books. The absolute value of each relevant risk factor sensitivity in relation to the accounting and prudential adjustments may provide an indication about the risk coverage and may help to rank desks according to potential mispricing risk.

Measures have already been taken to enrich the information set: large European banks active in the US are required to report a set of quantitative metrics for their local branches and subsidiaries; EMIR requires banks to provide granular information on derivative contracts at trade level. Thus, an enhancement of the supervisory reporting would not necessarily impose a heavy burden on banks.

4   Is valuation risk for L2 and L3 instruments sizeable?

In the previous paragraph we have seen that L2-L3 instruments are sizeable in volume and highly concentrated in a relatively limited number of large banks. We have also seen that a 5% valuation shock might have large effects on the resilience of the banks holding these assets, under specific assumptions. Key questions are therefore: Is a large shock possible, or even likely? What does historical experience tell us about the distribution of the prices/returns of these assets? In this section we try to address these questions.

As discussed above, valuation uncertainty affecting L2 and L3 instruments appears to be a possible source of tail risk, particularly when they have to be sold or unwound. Three sources of such risk are: (i) their pricing is based on models; (ii) some parameters used in their pricing function are barely observable, or not observable; and (iii) some pricing factors might be ignored (missing pricing factors).

Gauging the role played by these valuation risk drivers is challenging, because measuring model risk (i), or accounting for omitted risk factors (iii), would require focusing on a specific instrument and elaborating alternative valuation models – a lengthy exercise, whose results would have limited generality anyway. By contrast, the effects of parameter uncertainty (ii) appear easier to gauge. However, again in relation to parameter uncertainty, the bespoke and highly heterogeneous nature of L2-L3 instruments and the lack of adequate data about their specific contractual features impair the feasibility of a general analysis. Thus we decided that, on the basis of our experience in the field and of a screening of financial reports by large European banks, we would focus on five instruments that could be considered as broadly representative

of the L2 and L3 classes. While 'representativeness' in a statistical sense is not warranted, we believe that it provides useful insights on the issues at hand.

As an instance of L1 - which we consider for comparison purposes - we chose a long position on the Itraxx Main index with a five-year maturity (instrument no. 1). Concerning L2 instruments, we considered a portfolio of non-actively traded investment-grade CDSs extracted from the component of the Itraxx Senior Financial index (Series 27) with a five-year maturity (instrument no. 2). This portfolio cannot be considered L1 because the CDSs in the basket are not traded in an active market and it cannot be classified L3 since they do not present significant unobservable pricing factors.

Next, we selected two instruments of an uncertain nature, which could be discretionarily classified as L2 or L3. The first is a short-term structured note (instrument no. 3): a two year floating rate corporate bond in domestic currency which embeds a short position in a call option on a foreign equity index, where the strike is set in euro and the payoff is affected by the dynamic of the S&P500 (equity exposure) and the euro/dollar exchange rate (foreign exchange risk). The FV model used to price this note contains one relevant unobservable input (namely, the implied correlation between euro/dollar and S&P500).[22] The second is a senior ABS (instrument no. 4), which is the average of senior tranches of pools of non-prime credits underlying, for example: Commercial Mortgage-Backed Securities (CMBS), Buy-To-Let mortgages (BTL) and Credit card financing. The price of this instrument partly depends on barely observable factors (i.e. the spreads for similar instruments are adopted as proxies) and/or non-observable risk factors (i.e. the average recovery time of the credit pools).

Finally, we considered two instances of L3 instruments. The first is a portfolio of loans with low credit quality (instrument no. 5). As the price/return is unobservable, returns are proxied by the average spreads over Euribor of mezzanine tranches indexes (rated BBB) in reference to the underlying risk exposure.[23] More specifically, to represent a portfolio of low quality underlying credit exposure, we considered the riskiest categories of credits mentioned before: CMBS, BLT and Credit card financing. In this case, the main non-observable risk factor considered is the average recovery time (with a higher price impact than seen before in the case of the senior tranches). The second is a long-term structured note (instrument no. 6) that we constructed. This has the same characteristics as the two-year note (instrument no. 3), but it features a five-year floating rate corporate bond with an embedded option of the same maturity. Because of the longer duration, this note contains four relevant unobservable pricing inputs.[24]

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[22] In reality, the 2-year projected dividend yield constitutes another unobservable factor, driving the diffusion process of the pricing model. We have omitted it because we deem that for short maturities it exerts a minor impact on pricing. This is an example of the type of discretionary decisions that trading desks working with these instruments are called to make.

[23] These spreads are indicative quotes of the ABS secondary market over a weekly time horizon. Thus they cannot be considered as quotes of an active market.

[24] Long-term implied volatility on the foreign equity index and the exchange rate; long-term implied correlation between the foreign equity index and the exchange rate; long-term dividend yield. Exchange rate and equity index

As a starting point, we calculated traditional risk measures, the VaR and the Expected Shortfall (ES), considering changes in all the risk factors (observable and not observable) in a historical perspective. This approach is aimed at assessing the magnitude of the overall risk potentially affecting these instruments.

Clearly, the unobservability of market data poses formidable challenges in the estimation of VaR and ES for L2 and L3 instruments. We used two alternative estimation techniques, depending on data availability and the characteristics of the particular instruments. For instruments nos. 1, 2, 3 and 6 (CDS and structured notes), we computed input parameters using monthly data from December 2010 to May 2017, extracted from Bloomberg.[25] For instruments nos. 4 and 5 (ABS and loans), we first calculated their returns by multiplying the historical change in credit spreads by the average credit duration of these asset classes. Secondly, we fit a Beta distribution to the returns, and then computed VaR and ES.

Table 1 summarizes the main results. Tail risk tends to increase sharply moving from L1 to L2 to L3 instruments, i.e. the 1% VaR is 6% for the L1 instrument (n.1), 10% for the L2, in the 21-33% range for the L2/L3 assets, and between 43% and 47% for L3 assets. The estimated ES measures confirm these results.

An important qualifier is that the six instruments were considered on a stand-alone basis, so these results (as for those shown in Chart 8) overlook diversification effects and any potential compensating effects due to hedging and netting of risks across assets and liabilities. Thus, Table 1 likely overestimates the extent of valuation shock in a historical perspective. On the other hand, the figures must be interpreted in the light of the snags discussed above in relation to netting practices, considering that our measures do not encompass all sources of risk (e.g. model risk) and that diversification effects might rapidly vanish during periods of market turmoil. Furthermore, the proxies adopted for pricing purposes could be less volatile than the actual risk factors (barely or not observable).

The measures of tail risk presented in Table 1 are by construction influenced by FV volatility (changes in FV due to fluctuations of risk factors over time according to the developments in financial and economic conditions) as well as by FV reliability (potential differences between the bank and the market in the marking of risk factors at any point in time). Thus, in Table 2, we try to isolate the effect of uncertainty due only to unobservable input parameters (an element mostly reflecting FV reliability issues). This is relevant only for instruments 3 to 6. In the case of structured notes, the effect of parameter uncertainty is

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volatilities are generally observable up to 2 years. Valuations for longer maturities make extensive use of extrapolated values.

[25]   In some cases, Bloomberg data refer to market quotes (interest rates, spreads, exchange rates, equity index values, up to 2 years implied volatilities) or last observed values (dividend yield); in other cases, they reflect values extrapolated through Bloomberg's internal algorithms, which might significantly differ from the input parameters actually used for market transactions and, hence, they embed a high degree of uncertainty. However, they constitute the only publicly available source for these input parameters. When these data are not available, we calculate them via a rolling data window technique (long-term dividend yields and implied correlations with the same temporal dimension of the maturity of the note (i.e. two or five years). The dividend yield is therefore computed as the average of the observed values over the most recent two-year (or five-year) period and, similarly, correlation is computed as the historical correlation between the percentage changes of the index and the exchange rate, recorded over the most recent two-year (or five-year) period.

quantified by changing the proxies for unobservable parameters between the 5th and the 95th percentile of their estimated distribution.[26] For ABS and loans, we stress (lengthen) the average recovery time of cash flows within a plausible range. This is in line with market practices when performing a securitization tranching and with banks' risk management testing practices.

The first column of Table 2 shows that parameter unobservability could lead to an adjustment of between 3 and 9% for the L2/L3 instruments, and of between 11 and 13% for the L3 instruments.[27] The second column of the table reports alternative simulations of potential adjustments for the two structured notes under the alternative hypothesis on embedded leverage (i.e. the weight of the optional component in the structured note).[28] It shows that tail risk sharply increases with leverage.

Overall, these results are in line with evidence coming from available studies on the valuation of complex financial products., Based on their model, Goh et al. (2015) argue that in the US, investors' valuations of L2 and L3 assets in 2008 were respectively 15% and 21% lower than book values, on average.[29] Similar results can be found in Short (2012). The results suggest that as the financial crisis worsened in 2008, it exacerbated investors' concerns over illiquidity and the informational risk of the mark-to-model assets.

The valuation risk of complex financial instruments is also recognised by market investors, who tend to take the ratio of L2 and, especially, of L3 assets to total assets into account when assessing the intrinsic value of a financial institution. According to Yao et al. (2016), better performing banks are less likely to use Level 3 inputs. Other recent empirical studies suggest that a bank's exposure to L3 assets is positively correlated with measures of its default risk (see D'Apice et al 2016; Glaser et al, 2013; Mohrmann and Riepe, 2017).

Summing up, the results obtained with reference to the magnitude of the valuation tail risk for a sample of typical L2 and L3 financial products tend to confirm that a sharp valuation shock is not unrealistic. This would be in line with the evidence available from recent studies on the valuation of complex financial products and financial intermediaries.

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[26] Again, for most of these parameters only proxies computed from historical time series are available. Thus, our estimated distributions represent only an approximation (arguably the best possible) of the 'true' distributions. This approximation motivates our choice of a more conservative confidence interval than the one chosen by the EBA's regulatory technical standard, which refers to the 90th percentile (see EBA/RTS/2014/06/rev1).

[27] In unreported simulations we find that our proxy for valuation uncertainty tends to increase with maturity.

[28] In Table 1 and in the column labelled leverage =1 of Table 2, it is assumed that the notional value of the embedded option is equal to notional value of the bond. Leverage=2 indicates that the notional value of the embedded option is twice the notional value of the bond. Leveraged structured notes are instruments commonly placed by banks among investors.

[29] An earlier version of the paper (2009) also reported a sharp decline in investors' valuations over the first three quarters of 2008: 30.6% for L2 and 56.9% for L3, from $0.72 ($0.65) in the first quarter to $0.50 ($0.28) in the third quarter of 2008.

5   L2-L3 instruments and NPLs: a comparison

The previous sections have discussed the main features of L2 and L3 instruments: they are highly heterogeneous, and many of them are opaque, illiquid, lacking a secondary market, and hence subject to high valuation uncertainty. These features are shared with NPLs. We will now elaborate on this comparison.

A comparison between the valuation tail risk inherent in NPLs and L2-L3 instruments can be made by looking at the respective distribution of their returns. Specifically, we consider the riskiest categories of instruments among those analysed in the previous section (ABS, loans and five-year structured notes) and compare the left-hand tail of their distribution (computed in the previous section) with a measure of valuation uncertainty for net NPLs. Calculating the latter is far from trivial, and requires several discretionary assumptions. We focus on the worst class of NPLs, usually referred to as 'bad loans', for which data are available from the Italian Central credit register. The procedure is described in Annex 2.

Chart 9 reports the left-hand tail of the de-meaned distribution for bad loans and L2-L3 instruments. The chart suggests the following:

   i)   the tails of the riskiest categories of FV instruments (in the example the five-year structured note, classified as L3) are in most cases comparable with those of bad loans. Also, the other FV instruments considered (senior ABS, classifiable as L2 or L3 according to the relevance of unobservable risk factors and loans, classified as L3) show non-negligible tail risk. Even if extreme losses appear less likely than for NPLs, shocks to these instruments might have similar or even larger economic impacts, other things being equal, considering the large volumes of L2 and L3 assets and liabilities among SSM banks;

   ii)   financial instruments with a lower ranking of fair value hierarchy (e.g. loans and structured bonds) tend to exhibit a higher frequency of returns below the average;

   iii)   not surprisingly, the riskiest category of bad loans is represented by unsecured exposures, which more frequently show cases of extreme losses.

To examine further the comparison between L2-L3 positions and NPLs we explore the market perception of the riskiness of banks which hold a large proportion of one or other kind of instrument. To this end we construct three equally-weighted portfolios of listed banks and we analyse the distribution of their equity returns. The first portfolio includes a sample of European banks with a high level of NPLs in relation to CET1 (NPL Group); the second is composed of banks with a particularly high ratio of L2 and L3 instruments to CET1 (L2-L3 Group). A third group (Control Group) comprises all other major listed banks not included in the previous two groups.

Chart 10 reports the three distributions, estimated over the 2008-2016 period. The densities of the NPL Group and the L2-L3 Group are remarkably similar; both show more pronounced tail risk relative to the distribution of the Control Group. A Kolmogorov-Smirnov test rejects the null hypothesis that the distribution of returns of NPL or L2-L3 groups is equal to that of the Control Group at the 95% confidence

level, while it fails to reject the same null hypothesis when comparing the NPL and the L2-L3 groups. Overall, this evidence is in line with the view that a high incidence of L2 and L3 assets may be a significant 'risk driver' for a bank's equity performance, in a similar way to a high incidence of NPLs.[30]

Summing up, the frequency and magnitude of the unexpected negative returns for L2-L3 instruments can be considered as comparable with those for NPLs. Furthermore, the market perception of the riskiness of banks with a high incidence of either NPL or L2-L3 assets appears to be similar, in the light of the behaviour of equity prices. This evidence is consistent with the view that both L2-L3 and NPLs are significant risk drivers for a bank's equity performance.

6   Lessons learnt from supervisory experience

In this section we illustrate some stylized facts about L2 and L3 instruments, relying on evidence gathered during supervisory activity (market intelligence, discussions with banks and analysts, on-site inspections on trading desks). While this evidence cannot pretend to be exhaustive or statistically representative, we believe it brings useful insight on these asset classes, given the dearth of reliable information.

Insight #1: The industry of complex products has evolved in reaction to the crisis, but is still thriving.

In the post-crisis environment, characterized by a reduced appetite on the part of investors for opaque and complex securitized products, it has become difficult to generate trading income and the weight in banks' balance-sheets of structuring fees has decreased over time. Against this background, the generation of revenues by banks' trading desks is in some cases increasingly concentrated in bespoke trades aimed at providing customers – especially other banks, insurers and pension funds – with financing, de-risking and capital enhancing solutions. These trades recurrently incorporate the provision of liquidity as a key income-generating factor, and are driven by the clients' desire to obtain effective risk transfer with their regulators, statutory auditors and market analysts; these trades are often characterized by long maturities, lack of observable pricing inputs, complex contractual arrangements and, in some cases, ad hoc investment vehicles with opaque underlying portfolios.[31]

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[30]   The analysis appears to be fairly robust across time. It was replicated taking a two-year rolling window of the same weekly data. Kolmogorov-Smirnov tests consistently confirm that density for the L2-L3 Group differs from that of the Control Group. For the NPL group, the null hypothesis of equal distribution with respect to the Control group starts to be rejected after the beginning of the sovereign crisis.

[31]   The contractual terms generally refer to the rather bespoke portfolio of assets for which the de-risking strategy is executed. In some cases Special Purpose Vehicles (SPVs) with complex financial structures are created for this purpose; the horizon covering the full amortization of transferred exposures can reach 70 years. Legal complexity is consequently high, due to the need to steer early termination conditions, ensure the effectiveness of risk transfer, and define the payment process. Due to the lack of comparable transactions, input parameters entering the valuation model are difficult to link to observable market proxies.

Insight #2: L2 assets are very heterogeneous; a portion of plain vanilla instruments coexist with a non-negligible share of complex products, whose features are similar to those in the L3 class.

Neither accounting nor prudential rules require banks to report sub-categories within the L2 class. However, these instruments are very heterogeneous. While a quantification based on available data is not possible, a non-negligible share is represented by relatively transparent and low-risk instruments (e.g. plain vanilla derivatives margined on a daily basis and assets traded by flow trading desks). The remaining part is a mix of instruments that are often very similar to L3 assets in terms of product type and the valuation uncertainties involved. Indeed, like L3 assets, these instruments incorporate illiquidity as a key factor of income generation (profitability often arises from the value assigned to the unobservable underlying parameters of contractually complex bespoke trades).

This is because risk factors may be hidden in a number of tailored clauses, per se difficult for the internal control functions to detect and whose recognition in a standard booking system proves unfeasible unless simplified workarounds are adopted; therefore, there is a serious risk that even significant contract features are ignored by the algorithms which test the materiality of unobservable parameters and assign a classification under the fair value hierarchy.[32]

Supervisory activities on trading desks show that in several cases complex products have been alternatively classified as L2 or L3 irrespective of the presence of unobservable pricing inputs. For instance, some uncollateralized interest rate swaps with significant embedded lending to newly created, thinly-capitalized SPVs have been labelled L2 despite non-observable counterparty credit risk; identical transactions with similar valuation uncertainties have been classified as L3 when the relevant pricing drivers resulted in estimates of trading profits so uncertain as to induce a more prudent pro-rata recognition over time. In a similar vein, products highly exposed to correlation risk in different forms (e.g. gap risks, wrong-way risk) are often assigned to L2 portfolios, although the correlations are unobserved and are largely based on judgmental and untested assumptions. In practice, ultimately the L3 classification is only used in the case of serious deficiencies in the valuation framework and/or the material sensitivity of profits to shifts in the uncertain parameters; subjective conditions, such as the abilities of the internal control functions and the overall risk culture of the bank, also play a role.

Supervisory experience has also confirmed the importance of managers' incentives in the classification of complex instruments. Notably, the prohibition of immediately recognising Day-1 profits, and the stigma effect illustrated in Section 2 represent strong disincentives to classify financial instruments as L3, even though their characteristics could require it. Given the role played by discretional decisions in this area,

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[32] Legal complexity may involve non-standard early termination conditions, customized collateral arrangements, contractual restrictions on the sale of the asses, non-standard payments waterfall in case of default. All these features are usually not represented in trade booking systems due to operational constraints nor reviewed by control functions, whose checks in the approval phase are performed by areas of competence ("silos") against the trade representation provided by the front office, rather than against the draft legal documentation. As a consequence, the full knowledge of contractual conditions and terms, which could trigger the L3 classification, is limited to the traders involved in the structuring.

classification of financial products as L2 or L3 is frequently based on benchmarking exercises relying on the proportion of L3 assets in similar institutions.

In sum, the L3 and a portion of the L2 accounting portfolios are often similar, albeit to different degrees, in terms of product type, valuation uncertainties, and the key factors of income generation.

Insight #3: Valuation of complex L2 and L3 assets may overlook second-order risks, whose price is misleadingly reported as a 'profit'.

The L3 trades and the complex L2 instruments discussed under insight #2 are often represented and valued as a combination of several plain vanilla instruments, with a subsequent reduced capital absorption. Consequently, second-order risks (e.g. gamma risk relating to credit risk close out costs, tail, basis), difficult to link to observable market products, are neglected or, at most, covered by discretional model reserves. For instance, highly bespoke hedges with 'mono-line' protection sellers are valued disregarding the changes of the market liquidity, thus implicitly assuming no replacement costs and ample market capacity and appetite to absorb demand for new hedges in all circumstances, in spite of solid evidence of the contrary. Returns generated by taking on these second-order risks may well be treated as excess returns (or *alpha*), potentially eligible to be up-fronted.

As described in Sections 2 and 3, valuation issues typically remain hidden, unless the bank needs to exit the trade through a cash sale. Indeed, a buyer would require the real risks to be fairly recognised in the transaction price. In such cases, the trading intent initially realized by hedging out the risk of the exposure to third parties ('synthetic sale'), might be unproven. Thus, the regulatory classification in the trading book should be discontinued, triggering capital requirements appropriate to the real nature of the exposure (i.e. an unhedged banking book position).[33]

Insight#4: The search for capital relief creates incentives for biased valuations of complex products.

Increased competition – including from less regulated entities (e.g. hedge funds, asset managers) – and the aggressive hurdle rates set by banks for approving new transactions have led to a strong drive towards structuring and representing trades so as to minimize the associated capital charges and to inflate the estimated trading profits.[34]

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[33] As per article 104 CRR, the trading intent needs to be verified on the basis of the tradability of an exposure (e.g., absence of legal restrictions) or of the hedgeability of its risks based on an hedging instruments which, in turn, is tradeable in liquid and active markets. That said, illiquid hedges used in synthetic risk-transfer strategies are often not only unable to achieve such trading intent, but also not eligible as mitigant under the credit risk framework applicable to banking book positions, due to material uncertainties over the legal enforceability and timely pay-out of guarantors' obligation. Therefore, the classification out of the trading realm could translate into an immediate and substantial increase of risk-weighted assets. Certain bespoke transactions, if classified in the banking book may attract credit risk RWAs up to 3 times their notional amount, compared almost null market risk RWAs if classified in the trading book

[34] Hurdle rate systems set minimum returns on consumed resources for the approval of trades. For desks carrying out proprietary trading, hurdle rates of up to 25% in terms of returns on equity are not uncommon.

Capital relief can be obtained in several ways: (i) If a bank can assume that a complex instrument is perfectly hedged, it is allowed to set its VaR and related capital absorption at zero. In reality, the hedge is often achieved through illiquid bilateral products, arbitrarily modelled like standard derivatives mirroring the assets' sensitivity to market inputs; the protection they offer may be significantly lower than that offered by standard derivatives. (ii) Unwarranted capital relief can be obtained by neglecting correlation components (e.g. wrong-way risk, gap risk) as an additional source of risk, resulting in partly ineffective hedges and retained exposures. (iii) Under the counterparty credit risk framework, capital relief for illiquid hedges may be obtained through the interposition of non-financial SPVs - currently exempted from the scope of the CVA (Credit Value Adjustment) risk charge - as hedge counterparties.[35] (iv) Certain peculiar businesses whose risk profile is not specifically considered in the regulatory framework (e.g. actuarial risks) may lend themselves to regulatory arbitrage.[36] (v) Valuations of complex financial instruments are often updated infrequently. This practice may be justified by the reduced observability of credit spread and migration risks, but may also contribute to minimizing the internal estimates of replacement costs for the illiquid instruments used to provide the risk transfer.

Overall, these practices may yield unwarranted capital relief and inflated returns which, as discussed above, are very difficult to ascertain outside a targeted on-site inspection. There are reasons to believe that these practices are not exceptional for certain business models, investment banking in particular.

Insight #5: Complex L2 and L3 assets are typically highly illiquid

Due to the features illustrated in the previous findings, for certain complex instruments willing buyers simply may not exist. In the case of a forced sale, these instruments can only be unwound via a bilateral negotiation with the initial counterparty, who can decide to apply different valuation principles and assumptions, yielding a lower valuation than the carrying value.

Insight #6: Unobservability of pricing inputs does not prevent the recognition of Day-1 profits

In Section 2 we have seen that, under accounting rules, Day-1 profits are prohibited for both L3 assets and for those L2 assets that include even only a few unobservable parameters. Banks have developed various ways to circumvent the prohibition. Of these, it is worth mentioning: (a) the 'substantial risk offset', where a trading desk hedges a given percentage of the risks stemming from unobservable parameters included in an exposure, and assumes that the residual risk is negligible; (b) the 'credible range test', which consists in assessing if the impact on the estimated trading profit of a 'credible variation' of an unobservable parameter

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[35] To avoid the regulatory consolidation, such vehicles are structured so that banks cannot exercise any dominant influence over them, as per CRR art. 4.1(16), e.g. with minority interests and with only monitoring powers on the managers.

[36] Standardized approaches for determining the potential exposure to derivatives counterparties rely on the notional amount of transactions. For certain exposure categories, like longevity and mortality trades, the identification of a trade notional amount is not straightforward and is subject to discretional assumptions.

is higher than a given threshold; (c) the 'worst case scenario' method, where a bank shows that even considering the worst possible realization of the unobservable parameter there is still a trading profit.

As discussed in section 2, all these techniques find vague (if any) support in the accounting regulation, which simply states that a deferred profit or loss may be released only to the extent that a change in a risk factor occurs such that market participants would consider it when setting a price. Thus, their implementation is subjective. The absence of prescriptive standards reduces both the traceability and the auditability of their application, making it impossible to review this process off-site and substantially increasing the time needed for a proper on-site assessment.

7   Conclusions

L2 and L3 are complex and opaque financial instruments; their valuation does not directly rely on prices measured in active markets. As at December 2016 SSM banks held €3.6 trillion of such instruments on the asset side of their balance sheets (€3.4 trillion L2 and €189 billion L3), equal to 16% of their total assets; L2 and L3 liabilities amounted to €3.1 trillion and €141 billion.

We argue that L3 instruments and a non-negligible share of L2 instruments are subject to valuation uncertainty, potentially inherent to both sides of the balance sheet (assets and liabilities). Indeed, mispricing might consist in both inflated asset values and deflated liability values. Risks can offset each other as long as L2 or L3 instruments on the asset side are perfectly hedged by instruments on the liability side, or vice-versa. However, hedges are seldom perfect, especially in the case of complex bespoke positions. For this reason, it is not correct to assess the valuation uncertainty surrounding L2 and L3 instruments in terms of their net value. Against this backdrop, the huge amount of L2 and L3 assets and liabilities warrants information and close scrutiny of these instruments.

The analysis of the accounting and prudential framework suggests that much has already been done by policymakers in order to strengthen the valuation process for complex financial instruments, but there is still room for improvement.

On the accounting side, we argue that the distinction between L1, L2 and L3 instruments is clear in principle, but not in practice. First, L1 instruments are those traded in active markets, but accounting standards do not provide an objective definition of 'active markets'. Deciding when a market is active entails some discretion of the bank holding the instrument. In a similar vein, accounting standards recommend that a certain instrument be assigned to the most conservative classification (L3) whenever unobservable inputs play a significant role in the valuation process. However, establishing when unobservable inputs are 'significant' requires a discretionary assessment by the bank. Overall, these factors blur the boundaries between the FV hierarchical levels, and suggest that the reliability of valuations may be an issue not only for L3 instruments, but also for a non-negligible share of those classified as L2.

Second, the definition of FV relies on the concept of an 'orderly transaction' even in the absence of an active market. However, L3 and complex L2 instruments are highly illiquid and have no efficient secondary market; the only possible orderly transaction may be, de facto, an early termination, to be negotiated with the same counterparty already involved in the contract. Should disposal before the contractual maturity become necessary, a gap between the accounting value and the sale price could well emerge.

A third issue concerns netting practices. Accounting standards state that each financial instrument should be valued individually, on a gross basis, but they also recognise the role of banks' risk management strategies and hedging techniques. By invoking the 'portfolio exception' banks can value portfolios of instruments on a net basis. While it may have a sound economic basis, this approach introduces complexity, discretion and opacity. Basis risk is created whenever the instruments contained in a portfolio are not perfectly hedged, which is a frequent situation. The issue is whether the overlooked risk is material, but this information is generally unknown outside of the bank and it is often difficult to ascertain even by the banks' internal control functions.

A final issue concerns "Day-1" profits. In certain cases the estimated FV of an instrument can be higher than its price. The difference can then be posted by the buyer as a Day-1 profit, regardless of whether the instrument is actually sold at the higher valuation later on. We argue that Day-1 profits realized with complex financial products might in some cases be the compensation for a risk not explicitly acknowledged by the valuation methodology. Not surprisingly, accounting rules prohibit the recognition of Day-1 profits for L3 instruments whose FV estimation involves unobservable risk factors. However, unobservability is assessed resorting to a 'materiality principle': if unobservable risk factors are considered negligible, some instruments can be classified as L2 (rather than L3) so that Day-1 profits can be booked. This mechanism, together with the desire to limit the amount of L3 exposures appearing on the balance sheet, creates incentives for banks to use the discretion granted to them by the accounting rules to classify certain instruments as L2, rather than L3. Experience in the field confirms that such practices do exist.

Across a group of banks featuring the largest holding of L2 and L3 assets, a simulation which assumes no netting and no diversification benefits shows that a 5% decline in the value of L2 and L3 assets would cause the CET1 ratio to drop by about 350 basis points on average, with peaks in the 500-1500 points range. Is a large shock possible, or even likely? While the above considerations suggest that valuation uncertainty may indeed be present, this question is hard to answer, due to data gaps for historical prices and returns, and for hedge effectiveness. To get some insight on the issue, we estimate standard tail risk measures (value at risk – VaR – and expected shortfall – ES) using proxy data, as well as simulations of shocks to the parameters entering the valuation models. Our results suggest that tail risk assessed on a stand-alone basis is significant: in stressed market conditions the value could fall up to 10%, for L2 instruments (without any unobservable risk factors), about 30%, for instruments classifiable as L2 or L3 (according to the materiality of unobservable parameters), and close to 50% for L3. These figures are computed on the gross value of the

individual instrument, and therefore overlook hedging and diversification; however, the effectiveness of risk mitigation techniques becomes questionable during stress situations. The evidence available in the academic literature and among market practitioners is scarce and suffers from data limitations, but is broadly consistent with the conclusion that valuation risk is significant.

Moving to the prudential treatment of complex products, an important recent innovation is represented by the Additional Valuation Adjustments (AVAs), computed as the difference between the FV and the 'prudent valuation' (a conservative value that holders of these instruments are required to compute). AVAs measure the potential downside risk of FV accounting; as such, they must be deducted from CET1. In our view AVAs are an important step forward but are not the ultimate solution to the problem of the prudent treatment of L2 and L3 assets. First, the prudent valuation is grounded on accounting methods, hence it tends to share the shortcomings of FV accounting illustrated above. Second, AVAs are typically computed on a portfolio basis, not on single positions. Therefore, they are influenced by risk offsetting – an approach that may lead to underestimation of risk, as we have argued. The evidence available shows that AVAs are quite low: over our sample of selected SSM banks they account on average for 19 basis points, in terms of RWA.

Another important prudential mechanism illustrated in the paper concerns the capital regulation of the accounting portfolios. In principle, a position where market risk is prominent should attract higher capital charges if allocated to the trading book than to the banking book. However, in practice this need not be the case. In particular, capital absorption can be significantly reduced by diversification techniques whose effectiveness may be hard to assess especially for complex instruments entailing scarcely or non-observable risk factors. As a result of these mechanisms, allocation of a complex financial product in the trading book may end up absorbing less regulatory capital than allocation in the banking book.

In sum, our analysis of the accounting and regulatory framework suggests two main conclusions. First, the accounting framework requires banks to make assumptions and discretionary decisions in key areas of FV measurement: whether to value instruments at the individual or at the portfolio level; whether or not to define the reference markets as active; whether or not certain inputs to FV measurement are observable; whether or not certain non-observable inputs are material. Second, banks have various incentives to use this discretion to their advantage. Complex trades can be structured and represented so as to minimize the associated capital charges and to inflate the estimated trading profits.

The following stylized facts emerge from our analysis of the available data on L2 and L3 instruments. First, holdings of these instruments are concentrated among a number of institutions that rely heavily on trading as a source of income. Second, these banks also have a relatively high incidence of L2 and L3 instruments on the liabilities side, a higher proportion of FV assets in relation to total assets and a lower RWA density. Third, there are significant data gaps for L2 and L3 instruments; incomplete information is available as regards key profitability drivers; anecdotal evidence suggests that a portion of L2 instruments is of the plain-vanilla type, whereas another portion has features that are fairly similar to those of L3 instruments; no reliable data on this break-down are available.

We also emphasize several remarkable similarities between L2-L3 instruments and NPLs. Both of them are bespoke, opaque, illiquid (lacking a secondary market) and hence subject to relatively high valuation uncertainty. Our simulations suggest that the valuation risks of L2-L3 and NPLs are of a similar order of magnitude; further, the distribution of stock market returns for a sample of SSM banks with high NPLs is remarkably similar to that of banks with high L2-L3 assets: both distributions show higher tail risk relative to the control group.

Work is ongoing to address information gaps on complex instruments: large European banks active in the US are required to report a set of quantitative metrics for their local branches and subsidiaries; EMIR requires banks to provide extremely granular information on derivative contracts at trade level. Thus, enhanced supervisory reporting would not necessarily impose a heavy burden on banks. Specific supervisory projects have been directed so far towards specific aspects of L2-L3 books, or have mostly been focused on L3 instruments (i.e. the 2014 Asset Quality Review). Further supervisory efforts in this field could yield a more comprehensive and in-depth view of the valuation of these assets and their underlying risks.

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Tables and Charts

Sources: Data from SNL and annual reports, with the exception of Chart 8 and Tables 1 and 2 (based on Bloomberg and JP Morgan data) and Chart 9 (Bloomberg). Data in Charts 4-8 pertain to (in alphabetical order): Banco Santander; Bayerische Landesbank; BBVA; BNP Paribas; Commerzbank; Crédit Agricole Group; Crédit Mutuel Group; Deutsche Bank; DZ BANK AG; Groupe BPCE; HSBC France; ING Groep; Intesa Sanpaolo; Landesbank Baden-Württemberg; Nordea Pankki Suomi Oyj; Rabobank; Société Générale; UniCredit. In Charts 1, 4 and 7, 'Avg' is the simple average across the sample considered. In Chart 2, 'SSM' refers to total assets and liabilities for the SSM countries investigated.

Chart 1 – FV Assets/Total Assets and FV Liabilities/Total Assets for SSM countries
(Dec. 2016)
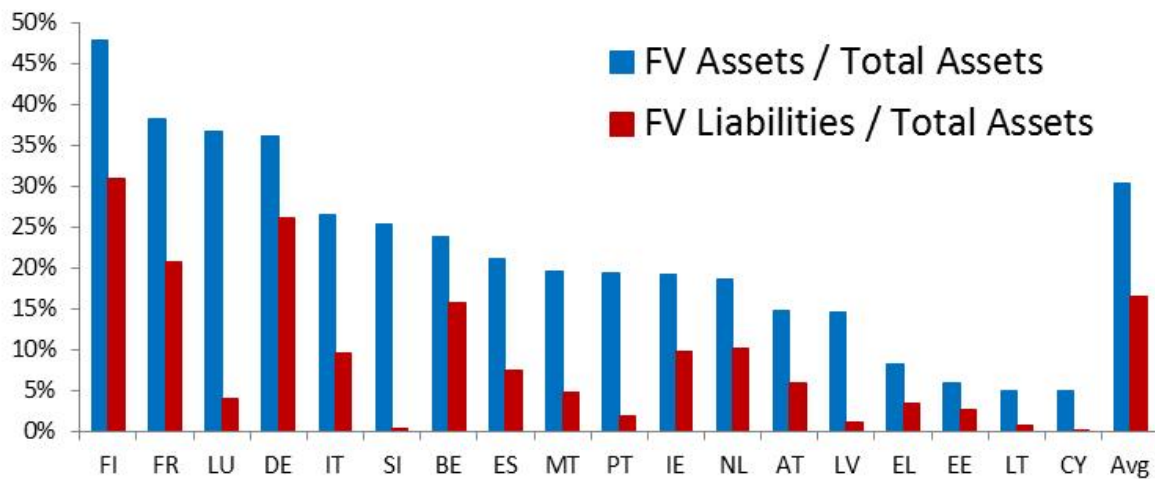
Chart 2 – Fair Value hierarchy across SSM countries
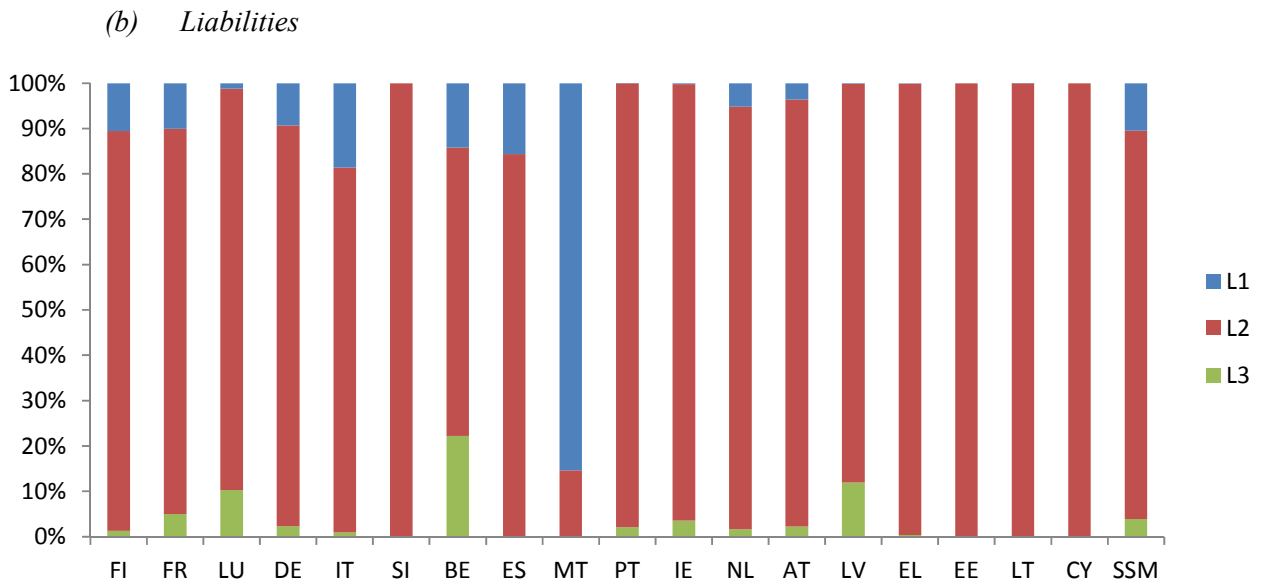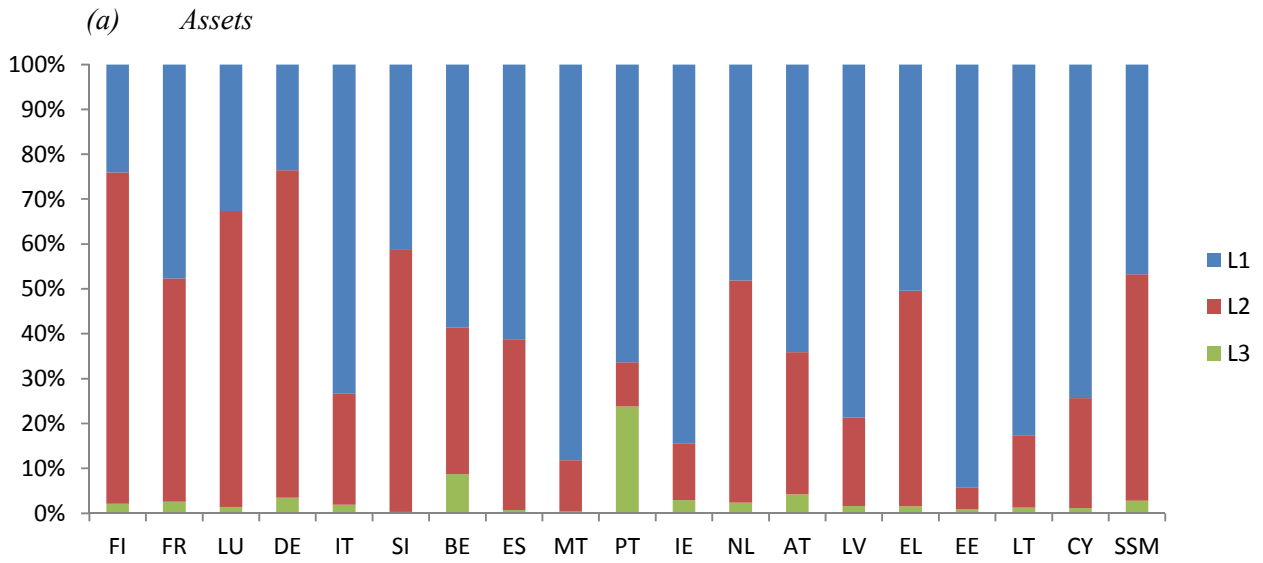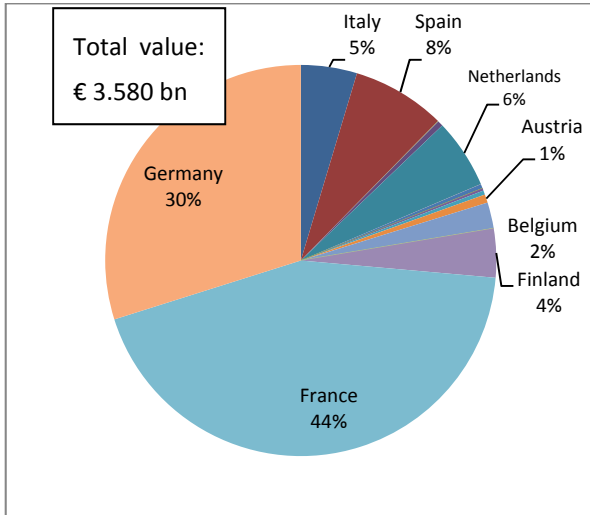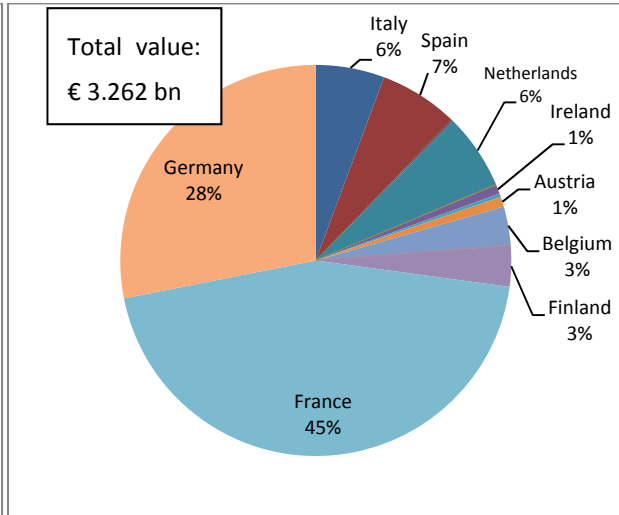### *(December 2016)*

(a)   Assets

(b)   Liabilities

Chart 3 – Distribution of L2 and L3 instruments across SSM countries
(December 2016)

(a) Assets

Total value: € 3.580 bn

Italy 5%
Spain 8%
Netherlands 6%
Austria 1%
Belgium 2%
Finland 4%
Germany 30%
France 44%

(b) Liabilities

Total value: € 3.262 bn

Italy 6%
Spain 7%
Netherlands 6%
Ireland 1%
Austria 1%
Belgium 3%
Finland 3%
Germany 28%
France 45%

Note: shares are computed using balance sheet values.

Chart 4 – Fair Value assets and liabilities among the main SSM banks
(December 2016)

■ FV Assets / Total Assets
■ FV Liabilities / Total Assets
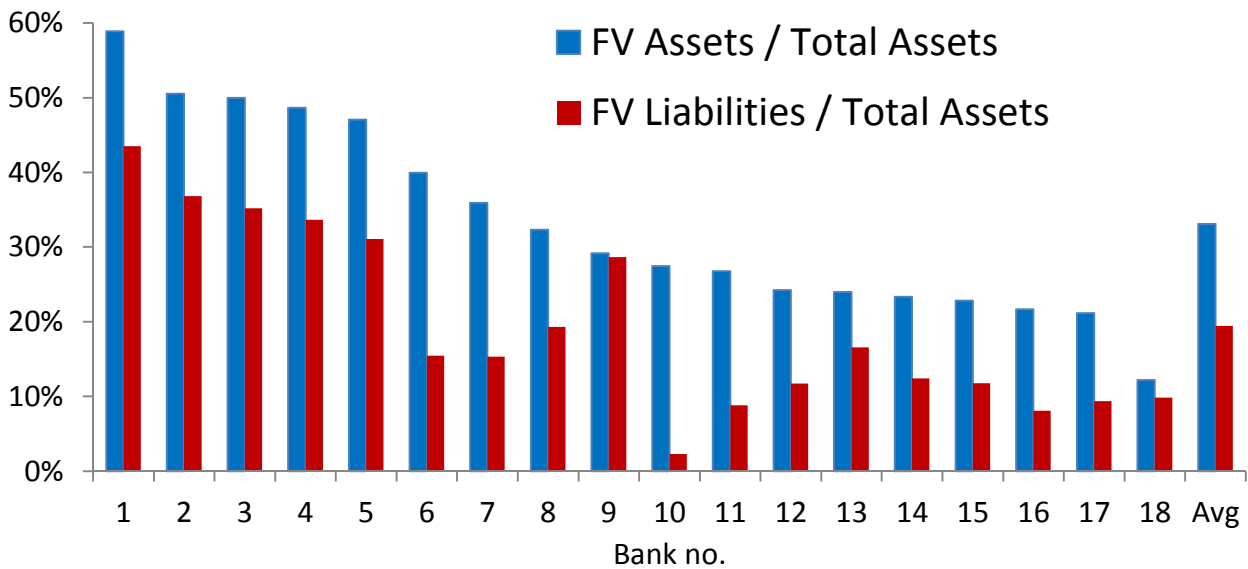
Bank no.

Chart 5 – FV Assets/L2 + L3 assets among the main SSM banks
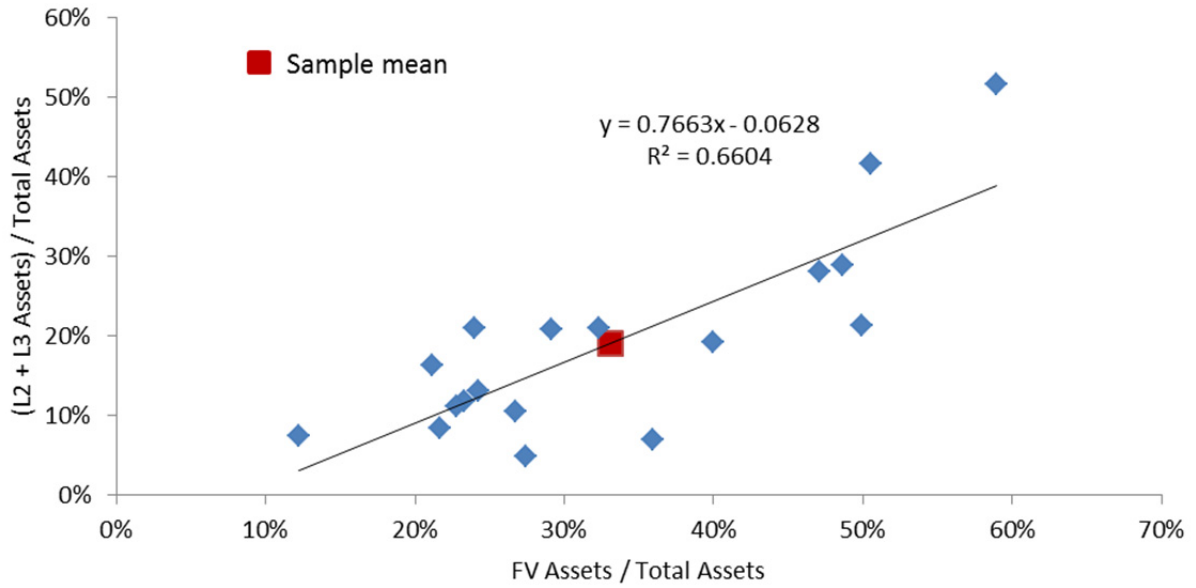*(December 2016)*

Chart 6 – L2 + L3 assets in relation to RWA density among the main SSM banks
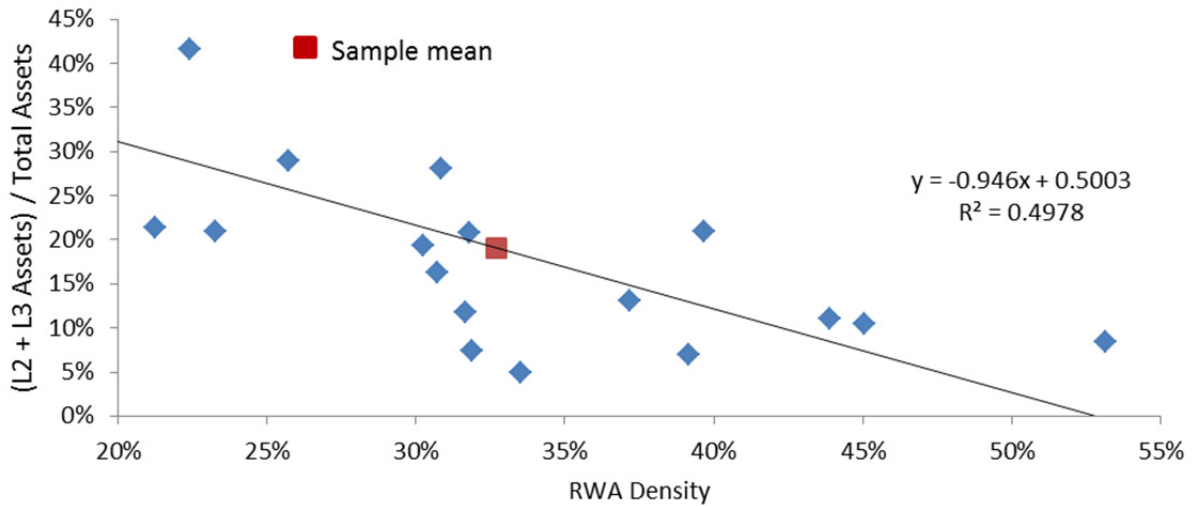*(December 2016)*

Chart 7 - Additional Valuation Adjustment (AVAs) as a share of RWAs or L2-L3 assets
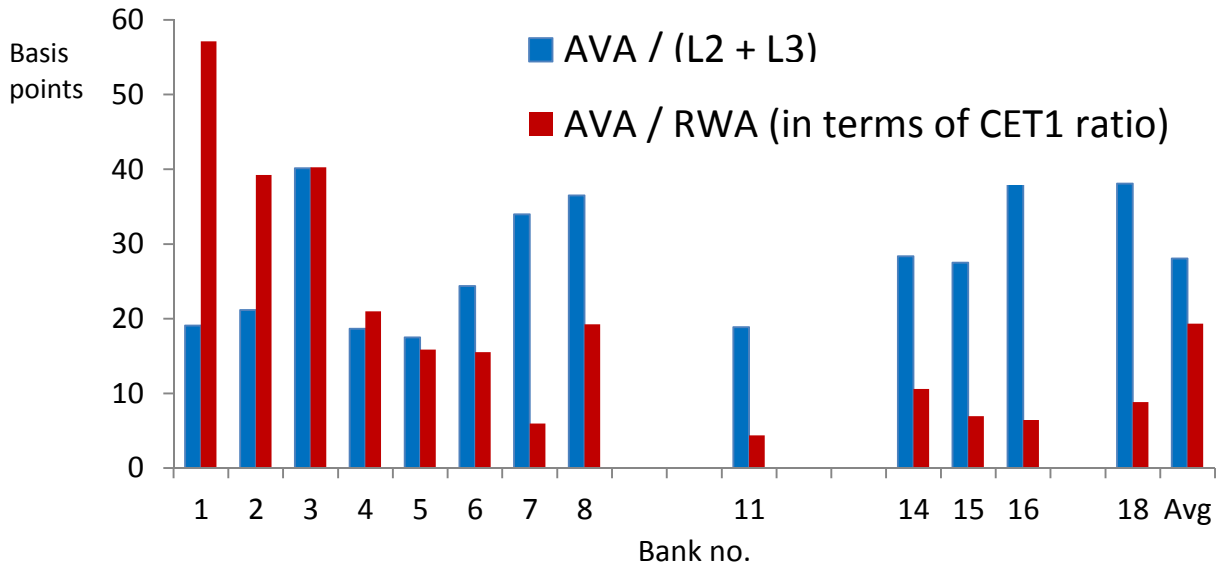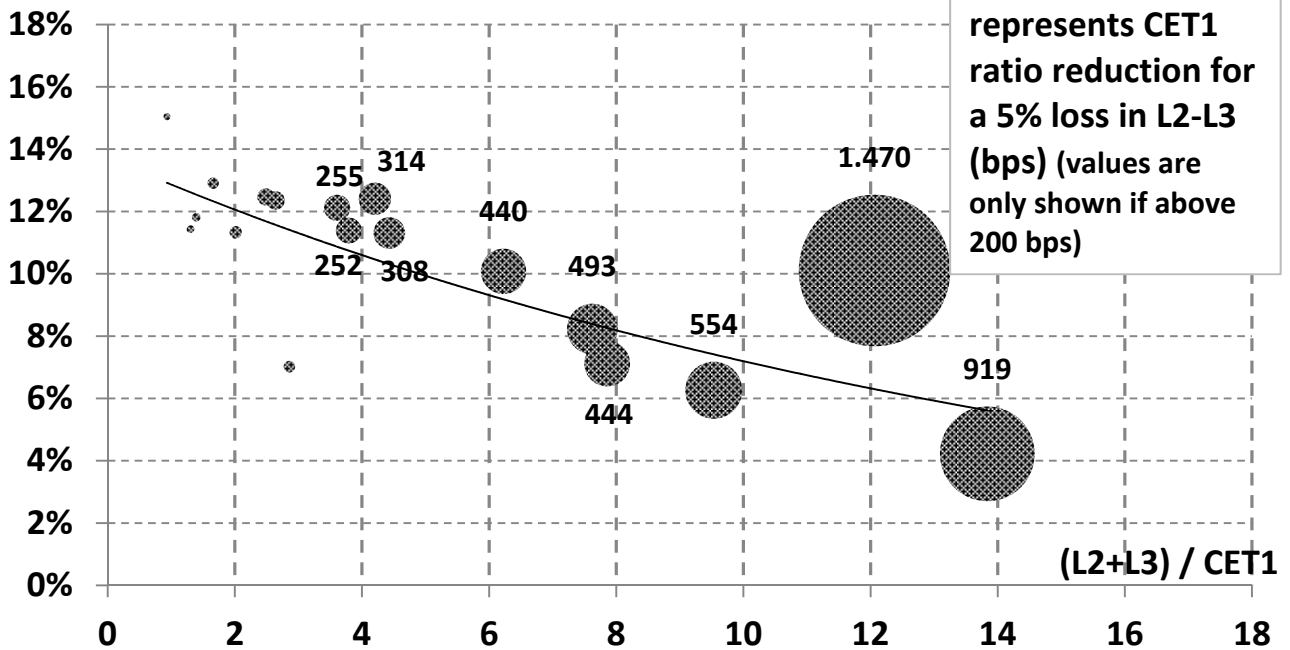*(basis points; December 2016)*

**Chart 8 – Effects of a shock to L2 and L3 assets valuations**

Note. Calculations assume that the RWA density remains constant before and after the valuation shock. The chart shows, on the y-axis, the CET1 ratio resulting after a shock of 5% hypothetical losses in all L2 and L3 assets; the x-axis gives the ratio between L2 and L3 assets and CET1. In general terms, the higher the magnitude of L2 and L3 compared to CET1, the higher the expected impact in terms of the CET1 ratio (represented by the size of the bubbles). Clearly, the relationship is not strictly linear due to the RWA component in the CET1 ratio.

Chart 9 – Tail distributions of L2-L3 instruments and NPLs
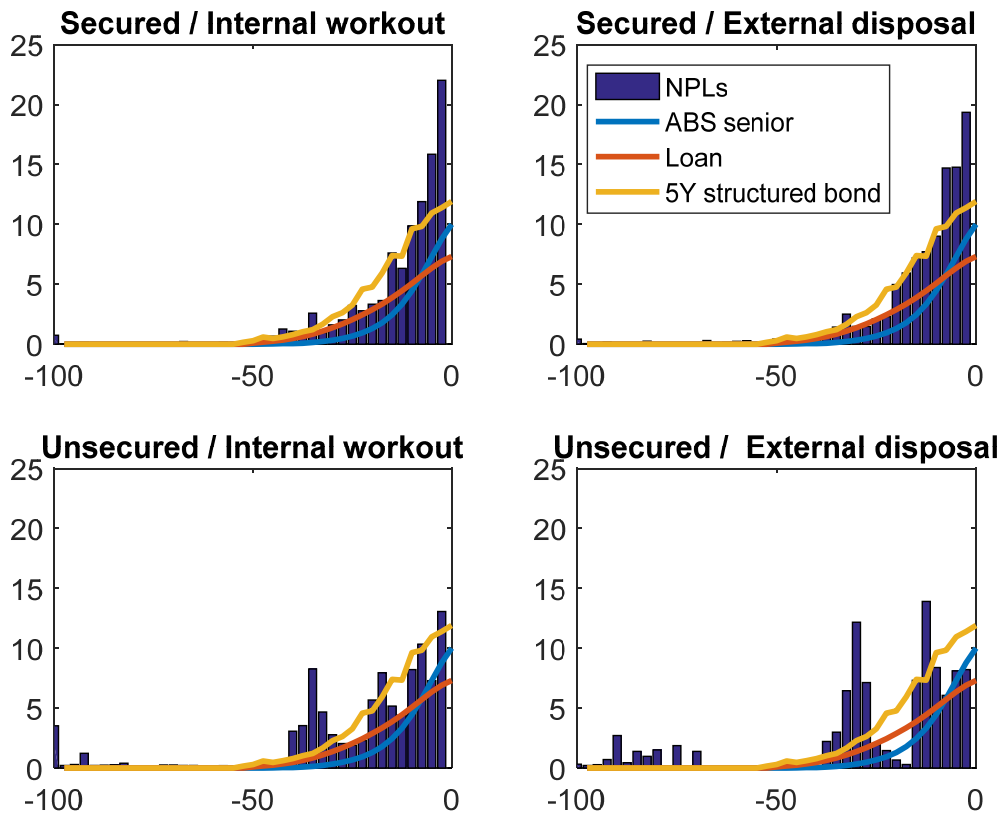
Note. All data are represented considering classes of returns on the x-axis with a bandwidth of 2.5% for each class. The ABS and loans curves are obtained by averaging the distribution frequencies smoothed with beta distributions; data on 5-year structured notes are represented as a line joining the raw frequencies; data on NPLs are represented by the blue bars.

Chart 10. Distribution of equity returns for selected groups of SSM banks
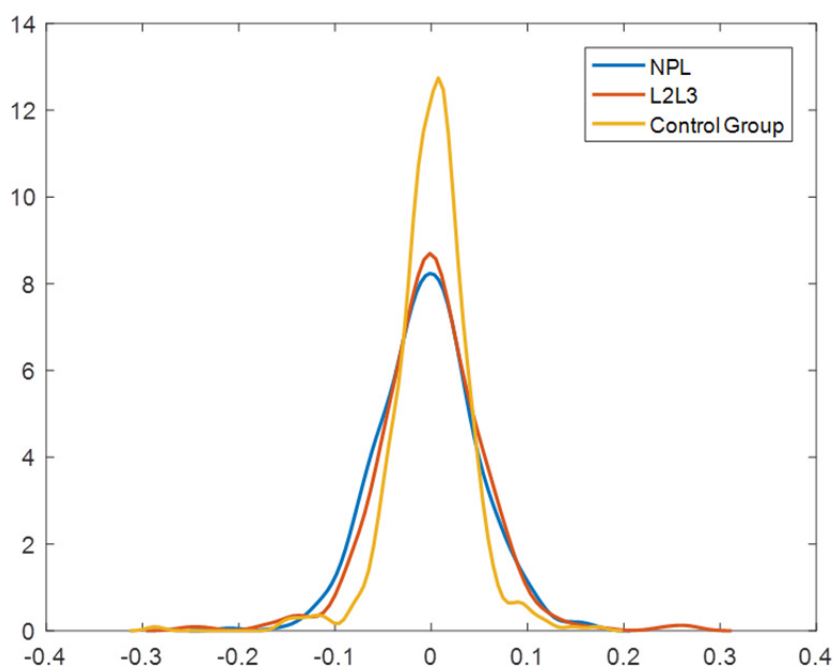
Note. NPL: banks with high NPLs (Allied Irish Banks, Banca Carige, Banca Monte dei Paschi di Siena, Banco BPM, Banco Comercial Portuguese, Banco de Sabadell, Banco Popular Espanol, BPER Banca, Unicredit); L2-L3: the group of banks with a high incidence of L2-L3 assets (Banco Santander, BNP Paribas, Commerzbank, Crédit Agricole, Deutsche Bank, Société Générale); Control Group: all the remaining banks in the Eurostoxx 600 as at August 2017 (Banco Bilbao Vizcaya Argenta, Banco de Sabadell, Bank of Ireland, Bankinter, Barclays, Crédit Suisse, Danske Bank, DNB, Erste Group, HSBC, ING, Banca Intesa, Jyske Bank, KBC, Komercni Banka, Lloyds Banking Group, Mediobanca, Natixis, Nordea, Raiffeisen, RBS, Skandinaviska Enskilda, Standard Chartered, Svenska Handelsbanken, Svenka Handelbsanken, Swedbank, SydBank, UBI Banca, UBS. We discarded banks without a complete time series for the period under consideration: ABN, Bankia, Cembra Money Bank, Caixa, CYBG, Fineco, Julious Baer, Metro Bank, Sydbank). We first calculate the simple average distribution of the weekly total returns on the equities in the relevant group over the period August 2007-December 2016. Then we estimate the distributions using normal kernel functions, evaluated at optimized equally-spaced points. The returns on the equally weighted portfolios have been computed from the weekly total returns (i.e. including dividends) calculated by Bloomberg.

Table 1 – Measures of tail risk for selected L2 and L3 instruments: VaR and Expected Shortfall (*)

(1-year horizon)

Product no.	Description	Level	VaR (5%)	VaR (1%)	ES (5%)	ES (1%)
1	Itraxx Main	L1	-4%	-6%	-5%	-7%
2	Investment Grade CDS portfolio	L2	-7%	-10%	-9%	-12%
3	2Y structured note	L2/L3	-15%	-21%	-18%	-23%
4	ABS senior	L2/L3	-29%	-33%	-30%	-34%
5	Loans	L3	-36%	-43%	-39%	-44%
6	5Y structured note	L3	-30%	-47%	-40%	-55%

Note. Tail risk measures (VAR and Expected Shortfall) are computed on the basis of the yearly return distributions of the selected instruments. Specifically, for instruments nos. 1, 2, 3 and 6 (CDS and structured notes) via a bootstrapping technique on historical data over a 12-month window (10,000 trials are carried out). The observation period for the monthly time series of input parameters is from December 2010 to May 2017; input parameters are directly extracted from Bloomberg, when available, or calculated through a rolling data window technique (long-term dividend yield and correlations). For instruments nos. 4 and 5 (ABS and loans), a Beta distribution is fitted onto historical returns calculated by multiplying the historical change in credit spreads by average credit duration.

Table 2 – Measures of tail risk for selected L2 and L3 instruments: effect of parameter uncertainty

Product no.	Description	Level	Valutation uncertainty		Unobservable parameters
			Leverage =1	Leverage = 2	
3	2Y structured note	L2/L3	-3%	-5%	Correlation
4	ABS senior	L2/L3	-9%	n.a	Average recovery time
5	Loans	L3	-11%	n.a	Average recovery time
6	5Y structured note	L3	-13%	-24%	Implied volatilies, implied correlation, dividend yield

Note. The measures for valuation uncertainty due to parameter unobservability are calculated taking into account the lowest values obtained. Specifically, for structured notes (instruments 3 and 6), values were obtained by changing the proxies for unobservable parameters between the 5th and the 95th percentile of their estimated distribution. As for Table 1, input parameters are directly extracted from Bloomberg, when available, or calculated through a rolling data window technique (long term dividend yield and correlations). The observation period is from January 2008 to May 2017. For ABS and loans (instruments 4 and 6), values were obtained by stressing (lengthening) the average recovery time of cash flows within a plausible range, in line with market practices when tranching securitized instruments according to banks' risk management testing practices.

Annex 1: Measurement of financial instruments under IAS 39

International accounting standards 39 and 32.11 define a financial instrument as 'any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity'. The scope includes either cash or derivative instruments, depending on whether their value can be determined directly by the market (securities, loans, deposits) or, conversely, has to be derived from the value and characteristics of one or more underlying entities (such as an asset, index, or interest rate).

Under IAS 39 *Financial Instruments: Recognition and Measurement* the classification and measurement of financial instruments depend on three major factors:

- the purpose for which the financial instruments are held (e.g. trading, long-term investment);
- their contractual characteristics;
- whether or not they are listed or exchanged.

IAS 39 requires financial assets to be classified in one of the following categories (Table A1):

Table A1 – Accounting classification of financial assets

IAS 39 Categories	Characteristics	Measurement after initial recognition ([37])
Financial Assets at Fair Value through Profit or Loss	Financial assets that are either: classified as held for trading (HFT), or designated to the FVTPL category on initial recognition as a result of the adoption of the Fair Value Option.	Fair Value through Profit or Loss (FVTPL)
Loans and Receivables	Non-derivative financial assets with fixed or determinable payments that are not quoted in an active market.	Amortized Cost
Held to Maturity	Non-derivative financial assets with fixed or determinable payments and fixed maturity other than loans and receivables, for which there is a positive intention and ability to hold the financial asset to maturity.	Amortized Cost
Available for sale	Non-derivative financial assets that are not classified in any other category. Therefore, the AFS category is the residual category under IAS 39.	Fair Value through Other Comprehensive Income (FVOCI)

More in detail, financial instruments designated to the FVTPL category have to meet the trading definition. Accordingly, they are: a) acquired or incurred for the purpose of selling or repurchasing in the near term; b) part of a portfolio of identified financial instruments that are managed together and for which

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[37] Regardless of the classification category, on initial recognition financial assets are measured at their fair value.

there is evidence of a pattern of short-term profit-taking; and c) derivatives (if they are not designated as effective hedging instruments). Trading intent may be achieved through hedges held at FVTPL. The Fair Value Option (FVO) is a classification which in certain circumstances,[38] allows financial instruments to be held at FVTPL, even where they do not qualify as trading instruments.

Available-for-sale (AFS) financial assets are a residual category only for non-derivative financial assets which have to be recognised at fair value. Any gain or loss where the fair value is supported by observable prices or parameter inputs in a valuation model is recognised directly in equity (Other comprehensive income or OCI).

Loans and receivables include non-derivative financial assets (e.g. loan assets, trade receivables, investments in debt instruments and deposits) that an entity does not intend to sell in the near term, whose expected recovery is not substantially dependent on reasons other than the deterioration of the creditworthiness of a counterparty. A loan underwritten to be syndicated may be partly designated as trading (the portion anticipated to be sold down), partly designated as loans and receivables or available for sale.

Held-to-maturity investments - other than those the entity designates on initial recognition as FVTPL or AFS and which meet the definition of loans and receivables – may include a variety of instruments with a fixed maturity, e.g. a debt security that bears interest at a fixed or variable rate without the risk of non-payment; shares with a fixed maturity or callable by the issuer who classifies them as a liability; or debt instruments callable by the issuer as long as almost all of the carrying amount would be recovered if the call were exercised.

According to IAS 39, financial liabilities can be classified as follows: i) at fair value through profit or loss (FVTPL), which includes financial liabilities that are either classified as held for trading or are designated to the FVTPL category on initial recognition; ii) at amortized cost (AC).

The conditions to be met in order to designate a financial liability at fair value through profit or loss are the same as for financial assets. Derivative liabilities are always treated as held for trading unless they are designated and effective hedging instruments. An issued debt instrument that the entity intends to repurchase soon to make a gain from short-term movements in interest rates is an example of a liability held for trading.

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[38] This option may be exercised if one of the following conditions is met (IAS 39.9:1): 1) The election will eliminate or significantly reduce an accounting mismatch that would otherwise arise from measuring assets or liabilities or recognising gains or losses on them on different bases; 2) A group of financial assets or liabilities or both is managed and its performance is evaluated and reported on a fair value basis in accordance with a documented risk management strategy; 3) If a contract contains one or more embedded derivatives, the entire hybrid contract can be measured at fair value if the embedded derivative does not significantly modify the cash flows that would otherwise be required by the contract or it is clear that separation of the embedded derivative is prohibited.

Financial liabilities measured at amortized cost are the default category. Most financial liabilities fall into this category (accounts payables, loan notes payable, issued debt instruments, and deposits from customers).

Importantly, from 1 January 2018, IAS39 will be replaced by IFRS9. Unlike the definition of fair value, the criteria for the classification and measurement of financial assets in the previously mentioned categories (amortized cost, fair value through other comprehensive income, and fair value through profit or loss) will change, to the extent they will be based more extensively on a bank's business model for managing financial assets as well as the cash-flow characteristics of its financial assets. In particular, all financial assets whose contractual characteristics fail the 'SPPI' test (solely payment of principal and interest) and all remaining financial assets that are not held to collect contractual cash flows only, will be measured at Fair Value.

According to preliminary evidence gathered by the EBA, the impact of IFRS9 on European banks is not likely to be particularly huge.[39] Nevertheless, in some cases financial assets could be reclassified from amortized cost or FVOCI under IAS 39 to FVPL under IFRS 9 because their cash flows fail the SPPI test (e.g. investments in funds, loans or debt securities with specific characteristics including syndicated loans and contractually linked instruments). Therefore, it is possible that some asset types that are currently measured at amortized cost might migrate to FV through profit and loss portfolios; in turn, this might make the valuation of Level 2 and Level 3 books more complex.

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[39] https://www.eba.europa.eu/documents/10180/1360107/EBA+Report+on+impact+assessment+of+IFRS9

Annex 2 – A measure of valuation uncertainty for the net book value of bad loans

To obtain a measure of valuation uncertainty for NPLs we use Central Credit Register data on individual bad loans in Italy over the period 2006-2016. Based on these data we can estimate the net present value of the recoveries, and therefore the recovery rates (the ratio of recoveries to the initial gross book value; see Ciocchetta et al. 2017 for a description of the data and the methodology). We then compute the loss rates as one minus the recovery rates. The distribution of these loss rates cannot be directly compared with that for L2-L3 assets because the latter measures uncertainty over a one-year time horizon. To make the two distributions comparable we divide each individual loss rate by the vintage of the underlying position (the number of years elapsed from the moment the position was classified to bad loan status until it was closed). This leaves us with historical data on annualized losses expressed in terms of gross book value. Since we are interested in a measure of valuation uncertainty in terms of net book values, we first de-mean the distribution using a value-weighted average of loss rates (this is used as a proxy of average provisions), providing a proxy for the loss rates in excess of average provisioning. Second, we divide the values obtained by one minus the same value-weighted averages, where this denominator represents a proxy for the average net book value. We can then compute a distribution of loss rates in terms of net book values by pooling data over the entire period available. Chart 8 reports the left-hand-side tail of this distribution. The rationale for removing the average loss in the case of bad loans is that we are interested in the unexpected component of losses, in excess of bank provisions. Ciocchetta et al (2017) show that the average system-wide recovery rate on bad loans is 43%, broadly in line with the current book value of 41%. This suggests that the average expected loss on net book values should be close to zero.

Several clarifications and caveats about this analysis are in order: (i) since the information on the time pattern of recoveries over the lifetime of the bad loan is not available in the Central Credit Register, we assume a linear process. In reality this process may be (highly) non-linear, depending on the features of the loans. For instance, anecdotal evidence suggests that for collateralized positions, the recovery takes place all at once, at the end of the judicial insolvency procedure. This linearity assumption tends to downward bias loss rates. However, the bias should be relatively small. Ciocchetta et al (2017) also assume linearity, and present simulations showing that the results for recovery rates are not excessively sensitive to this assumption. (ii) the Central Credit Register data available to us concern the worst category of NPLs (bad loans). Had we considered total NPLs, the loss rates would have been smaller. Thus, we are presumably overestimating tail risk for NPLs.