Sources of Inconsistencies in Risk Weighted Asset Determinations

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Abstract
Differences in Risk Weighted Assets (RWA) and capital ratios have been noted across firms, both within a particular supervisory jurisdiction, as well as across jurisdictions. Since these differences have created concerns regarding a level playing field, regulatory authorities are in the process of establishing benchmark portfolios to examine these issues in more detail. While some of these differences may be due to different credit profiles and even due to the relative rigor of examination processes, more fundamental differences in methodology and risk management processes must first be understood in the context of quantitative surveys of RWA using benchmark portfolios. This paper explores these differences that may arise in estimates of Probability of Default, Exposure at Default, and Loss Given Default that are required for the Advanced Internal Rating-Based (AIRB) approach. In some instances, improved supervisory guidance in the form of best practices could be issued which could reduce the RWA differences.

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**Introduction**

It has been observed that measures of Risk Weighted Assets (RWA) and thus the ratios of RWA to capital vary considerably across banks subject to the Advanced Internal Rating-Based (AIRB) treatment of the Basel rules. As a result, industry participants have raised considerable concern regarding the non-level playing field impact of these differences. Regulators have also recently agreed to investigate the sources of these differences whether they are due to differences in credit profiles, estimation of input parameters, or varying supervisory review criteria across firms. To that end they are considering providing benchmark portfolios as a method to control for credit profile differences. It should be noted that some industry associations have in the past conducted similar benchmarking surveys among its members. In this paper we will explore some of the sources of the differences associated with the input parameters to the AIRB formula, confining ourselves to the traditional wholesale credit risk product portion of RWA determination. Supervisors will need to understand and account for these differences as they conduct benchmarking surveys and horizontal reviews of banks.

Banks with dissimilar client portfolios or different concentrations of risk types will have different empirical evidence driving their AIRB parameters and resultant RWAs. In addition, AIRB input parameters will be different among banks based on the way they perform forensic analyses of their historical defaults or the way they conduct their risk management practices. Banks with advanced data capture systems are more likely to be able to better account for risk drivers that affect their default and recovery experience. We note that a key factor that leads to differences in risk management practices is the opportunity that banks have through their dynamic relationship with their borrowers that allow them to improve their position as their borrowers slide into difficulty. Such opportunities are usually not available to investors in public bonds.

We will not explore differences in AIRB risk parameters which may naturally arise when banks have different customer bases or credit underwriting standards and report parameters and RWAs based on their associated default and recovery experiences. Nor will we focus on differences that could arise from the manner in which supervisors across different regions or jurisdictions review these parameters at their assigned banks. To best illustrate the potential differences in parameters and RWA, we will use two hypothetical firms, Bank Liberal (L) and Bank Conservative (C) and assume they have had identical portfolios and underwriting standards over a ten-year period that has been examined for historical default information. This data will be the basis for their estimates of the three key AIRB parameters, the Probability of Default (PD), the Exposure at Default (EAD) and the Loss Given Default (LGD). The objective of enumerating the various possible ways to measure these parameters is to make both firms and supervisors aware that these different approaches may or may not have a material effect on AIRB parameters and RWA, yet it is important to at least study their possible impact. Where it is appropriate, we will identify best-practices so that these can be used to provide improved guidance and level the playing field.

I. **Probability of Default**

PD estimates contribute to RWA in a non-linear manner. For example, with a 40% LGD, a 5 year maturity and a hypothetical set of PDs mapped to ratings, a one notch improvement from an “A” rated credit could reduce RWA by 7.5% while a one notch improvement in a “B” rated credit could reduce RWA by 9.5%. The manner in which historical data is extracted from a bank’s internal default data base can influence how PDs are determined and applied. In this section we
will explore how these calculations can differ among banks in response to differences in both risk management practices as well as rating philosophies.

**Non-accrual policy:**
Both Bank L and Bank C use an identical rating process with numerical grades ranging from 1 to 10 with pluses and minuses, corresponding to rating agency grades (AAA, AA+, AA, AA-, etc., down to D for default). Bank L tended to wait until the borrower was 90 days past due, while Bank C would at the earliest sign of weakness place borrowers on non-accrual. For example, in the fourth quarter of 2007 Bank C placed 10 out of the 1000 borrowers in place at the beginning of the year in grade 6 on non-accrual, while Bank L waited until the first quarter of 2008 to place 8 borrowers who actually defaulted into default status. It turned out that two of the borrowers identified by Bank C never actually incurred a payment default. By the beginning of 2008 both Bank L and C originated 10 new borrowers. The early recognition of non-accrual by Bank C continued in 2008. There were 8 additional borrowers who actually defaulted in the third quarter of 2008 according to Bank L, while Bank C had again placed 10 borrowers on non-accrual in the second quarter. Bank C’s default rate calculation was 1% (10/1000) for 2007 and 2008, while Bank L’s default calculation was 0% for 2007 and 1.6% for 2008.\(^1\)

**Definition of default:**
In late 2009 several borrowers who had borrowed in the leveraged finance market experienced distress and while the banks had secured their exposures with significant over-collateralization, subordinated bond holders exchanged their debt for equity with substantial haircuts. The rating agencies deemed the distressed exchange a default, and reflected these in their default statistics. Bank L, however, did not classify these as defaults, as payments to the banks continued uninterrupted. In fact, it maintained its rating grade of 5 that was assigned in 2008 and which was agreed to by its supervisors. However, while Bank C had also assigned them a grade 5, its supervisors mandated a downgrade to default status in 2009. The result of the difference in supervisory review is that Bank L would have a different default rate calculated for grade 5 in 2009 compared to that of Bank C.

**Determination of obligors for default rate calculation purposes:**
The customer base of the banks consisted of 1,000 clients. In addition, 100 of these companies had established nine legal entity subsidiaries for tax purposes. Both the parents as well as all the subsidiaries were borrowing entities. The remaining 900 companies had no subsidiaries. On a parent-only basis there were 1,000 borrowers. Counting parents and subsidiaries there were 1,900 borrowing entities. In 2006, five of the obligors with multiple subsidiaries defaulted, along with each of their subsidiaries, as did 20 of the obligors who had no subsidiaries. Bank L calculated the default rate on the basis of parent observations as 2.5% (25/1000), while Bank C determined the default rate based on a parent and subsidiary count as 3.7% (70/1900). Here, one would argue that a default rate based on a parent basis is more appropriate.

**Calculation of default rates including or excluding withdrawn obligors:**
Annual default rates for a particular rating are based on dividing the number of defaulters observed over a year’s period by the number of obligors at the beginning of the year. A more complete migration analysis will reveal not only the number of defaulters but also those who

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\(^1\) As we will see when we discuss LGD, the placement of two borrowers on non-accrual for whom no losses were incurred will also affect LGD calculations and the determination of downturn periods.
migrated to a different rating at the end of the year. However, there are usually a certain number of obligors whose rating status at the end of the year cannot be determined as they are no longer customers of the bank. The rating agencies recognize this when they observe issuers whose ratings are withdrawn at the request of the borrower or who may have merged with another firm or have had their debt retired. Typical withdrawn rates as reported by the rating agencies are on the order of 3-11%, depending on the grade. Banks have almost twice the withdrawn rates than bond issuers as they can be more active risk managers with clients whom they no longer deem to be acceptable risks and encourage them to refinance elsewhere; they do not renew their facilities. Once they are withdrawn, the banks have no information as to whether they defaulted or not with another creditor. However, they do know they did not default within the year on the credit that they extended.

As an example, assume that for rating class 5 there were 1,100 borrowers at the beginning of the year of which 11 defaulted and 100 were no longer customers at year end for both Bank L and Bank C. Bank L could choose to calculate the default rate as 1% (11/1100) to include withdrawn obligors, while Bank C could choose to exclude them from the beginning population and calculate the default rate as 1.1% (11/1000), a 10% higher default rate. It is appropriate to follow Bank L’s analysis as it is clear that these withdrawn clients did not default on the debt extended by Bank L or by Bank C. Further, it should be clear that PDs should reflect actual default rates, consistent with loss rates and exposure amounts associated with defaulting borrowers. However, there are no loss rates nor exposure amounts available since these borrowers did not default at these banks.

Different risk management practices could also affect PDs. Assume that Bank L has a highly vigilant risk management practice and it was able to encourage 100 customers to refinance elsewhere, while Bank C retained these customers through the end of the year, though none of them defaulted but migrated to a lower rating state. In this case, Bank L would include the withdrawn customers in the beginning of the year and calculate the default rate as 1% (11/1100); Bank C would observe no withdrawn customers and also arrive at a 1% default rate. However, if a number of these 100 customers actually did default, Bank L’s default rate would still be 1%, while Bank C’s default rate would be higher.

**Borrowers without risk ratings:**

For a certain class of obligors, collateral is the prime basis for extending credit, rather than financial condition. Examples include private banking customers who are not willing to provide financial statements but will provide marketable securities as collateral whose value even after haircuts exceed loan amounts by a factor of two or more. While an obligor rating is required to compute RWA, banks will assign a “fallback” rating. For example, Bank L and Bank C may provide the same fallback rating of 5. In computing the internal default rates, Bank C has kept track of which obligors have a rating of 5 based on a credit analysis and which were assigned a fallback rating. Bank L, however, did not distinguish among these two groups. Assuming that none or very few of the obligors with fallback ratings of 5 will default, Bank L’s determination of a PD for its obligors rated 5 will be appreciably less than Bank C’s, who eliminated those obligors with fallback ratings from its PD calculations. Fall back ratings should not be combined with valid ratings in determining PDs.
**PD implementation:**
Even where Bank L’s and Bank C’s experienced default rates are identical, application of the Basel rules could be different. For example, for one borrower whose rating is BB, a guarantee is provided by a third party whose rating is AA. Bank L may choose to use PD substitution based on the guarantor’s AA rating, while Bank C may choose to use LGD substitution based on AA’s LGD, with different impact on RWA.

**Point-in-Time vs. Through-the-Cycle:**
While Bank L and Bank C have the same experienced internal default rates, Bank C chooses to use a point-in-time rating system which is informed by its estimates of PDs extracted from market credit spreads and vendor supplied current default probabilities. Its ratings tend to bounce up and down in response to the credit cycle as well as to idiosyncratic changes in the borrower’s riskiness. Bank L chooses to use a through-the-cycle rating system which tends to examine the borrower’s riskiness based on worst-case, “bottom of the cycle scenarios” such that there is less volatility in its rating system. Let us assume that over time current market-based PDs equate to the average internally and externally experienced default rates. To comply with long run average requirements stated in the Basel rules, Bank C maps the average PDs to their ratings, though the mapping of point-in-time ratings and PDs to through-the-cycle estimates can vary by methodology. As a result, during downturns in the cycle, Bank C will most-likely have downgraded ratings on its set of obligors to a greater extent than Bank L and will therefore have higher associated PDs. The opposite will occur during upturns in the cycle.

II. **Exposure at Default**
EAD impacts RWA in a linear manner but there is relatively little research conducted on what drives EAD. To some extent, the ability of borrowers to continue to draw on commitments as opposed to banks’ ability to reduce unused commitments is a function of the presence of covenants. However, while covenant information is available for publicly traded debt, banks generally do not track covenant behavior on a historical basis. Measurement of EAD for unused contingent obligations is based on the commitment amount one year prior to default and the subsequent exposure at default. Some practitioners break the commitment into two components, the outstanding or “used” exposure and the “unused”. They will measure the loan equivalent amount (“LEQ”) of the unused as the ratio of the additional used amount at default divided by the unused one year prior. The EAD is then the sum of the outstanding one year prior plus the LEQ.

**Revolving Credit EADs:**
Bank L and Bank C evaluated the EAD associated with two revolving credit (RC) facilities, RC-1 and RC-2, to one of its defaulted obligors. RC-1 showed a drawdown prior to default while RC-2 showed a decrease in outstanding at the time of default. Bank C calculated two LEQs, one for each of its facilities, flooring RC-2 to zero, since otherwise it would result in a negative LEQ. Bank L, however, observed that the amount of the drawdown on RC-1 equated to the increase in outstanding on RC-2 and decided to pool the two facilities. Its resulting calculated LEQ was zero usage of the total unused commitment, a more appropriate measure.

**Revolving Credits and Term Loans:**
Bank L and Bank C evaluated the EAD associated with one RC facility to one of its defaulted obligors where there was a 20% drawdown of the unused commitment prior to default. Bank C
included this 20% in its reported LEQs. Bank L observed that the obligor also had a term loan and was in the process of workout. The obligor paid down the term loan by the same amount that resulted in the drawdown of the RC. In reviewing these results, Bank L concluded that the LEQ for RC was zero. This situation could also have been observed if the RC was completely utilized one year prior and the RC commitment was increased just prior to default by the amount of the pay down of the term loan. The economic analysis of EAD as conducted by Bank L appears to be more appropriate.

Revolving Credits and Letters of Credit:
Utilization of a $10 million RC was $7 million one year prior to default. Two months prior to default a $3 million Financial Standby Letter of Credit (SBLC) was subsequently issued under the RC to a municipality to ensure that workers' compensation claims incurred by the obligor would be paid. At the time of default there was no additional cash drawn down but the utilization of the RC was deemed to be 100% due to the issuance of the SBLC. During the reorganization of the company there was no drawing of the SBLC by the municipality as it simply wanted assurance that workmen's compensation claims would be paid, if necessary. Bank L determined that at the time of default since no additional cash left the bank with respect to the $3 million unused commitment, the LEQ was zero, while Bank C calculated the LEQ as 100%.

Revolving Credit LEQs:
A $10 million RC was 98% utilized one year prior to default. The 2% unused commitment remained undrawn at the time of default to an obligor who had been in workout over a two year period. Bank C checked with its middle office and determined that even though 2% was available, covenant violations had prevented the borrower from drawing down the remaining amount and decided to exclude that observation from its data set. Bank L, however, calculated the LEQ as zero basing its determination on the fact that there was an unused commitment but that there were no further drawdowns at the time of default. Bank C's approach would appear to be the more appropriate evaluation.

Revolving Credits and Borrowing Bases:
Commitments are often established for commercial or middle market customers using accounts receivable or inventory as collateral. In addition, usage under the RC is limited to the lesser of the eligible collateral, known as the Borrowing Base (BB) and the commitment. For example, with a $10 million RC and a BB of $8 million, there was $6 million outstanding one year prior to default and an additional $1 million was drawn down at the time of default. The LEQ as calculated by Bank C was 25% percent. Bank L calculated an LEQ of 50% relative to the unused BB of $2 million. In applying the calculated LEQs to their current portfolios Bank L and Bank C applied their approaches with respect to a customer with an RC of $20 million with $5 million outstanding and a BB of $10 million. Bank C applied the 25% LEQ to the unused commitment of $15 million, resulting in a total EAD of $8.75 million. Bank L applied their BB LEQ of 50% to the unused BB of $5 million, resulting in a total EAD of $7.5 million. With the availability of BB information, Bank L's approach appears more appropriate.

III. Loss Given Default
LGD affects RWA calculations in a linear manner and there are even more situations where differences in calculation approaches and risk management processes across firms can affect RWAs than that those cited above for PD and EAD. A number of these arise from the same
circumstances previously cited for PD. In these examples we will assume the recoveries are discounted at approximately 10%.

**Non-accrual policy:**
As described in the PD section, if Bank C places 10 borrowers on discretionary non-accrual prior to their actual default and only 8 of these borrowers actually default, Bank C will record a higher PD than Bank L who will wait until a payment default actually occurs. However, assuming that the 8 borrowers had an average LGD of 40% as determined by Bank L, the inclusion by Bank C of two borrowers with zero LGD will result in a 32% LGD.

**Cohort formation:**
It typically takes at least two years for workouts to completely resolve themselves and those that resolve quickly tend to have lower LGDs, not only because it is likely that the collateral may be stronger, but also because there is less impact of the discount rate on the net present value calculation of the cash flows. Assume that half the exposures resolve within a year and have an average LGD of 20%, one quarter resolve at the end of two years and have an LGD of 30% and the rest have an LGD of 50%. The banks have nine years of data. Bank L will include all 9 years and report an average LGD of 27.6%, while Bank C will include only 7 years, excluding the last two cohort years and report an LGD of 30%. This practice is more consistent with conservative requirements in Basel.

**Borrowers with small exposures at default:**
Assume that both Bank L and Bank C are large global banks who also have middle market and commercial business. While LGD analysis can often be segmented at the line of business level (LOB) to analyze losses based on types of loans, there are situations when large global banks who have exposures ranging between $5 and $200 million, may also have many smaller exposures on the order of $50 thousand or less. In some cases these smaller exposures are deemed “orphan” accounts, which are no longer actively managed by the banks. In other instances these are small unsecured accommodation-types of exposures. Assume that the average LGD for these small exposures, based on 30 observations is 66%, while for the more typical large exposures the average LGD based on 50 observations it is 40%. Bank L may exclude these smaller observations on the basis that they are not representative and report a 40% LGD, while Bank C may include the smaller observations and report their overall LGD as 50%. If these smaller exposures can be identified as a separate class, then separate LGDs should be calculated for them.

**Collateral applied prior to default:**
Bank L and Bank C have obtained collateral equal to 70% of the $10 million exposure for an obligor. Bank C has a more active risk management process and realizing that the obligor is in technical default, is able to apply the collateral to the loan three months prior to default, so that by the time the obligor defaults its exposure is reduced to $3 million, of which there is a $1 million loss. Bank C will calculate an LGD of 33%, while Bank L which did not apply the collateral prior to default will report an LGD of 10%. The Basel rule requires that the bank must demonstrate consistent historical experience during economic downturns in achieving pre-default reductions in exposure and if Bank C cannot demonstrate this, they will have to report the higher LGD.
Change in collateral status prior to default:
Bank L and Bank C have unsecured loans to obligors which include maintenance covenants. Bank C observes that an obligor has violated its covenants and is able to renegotiate and restructure the loan so that it has obtained collateral, yet ultimately the obligor defaults resulting in a 30% LGD. It will associate the 30% LGD with a secured facility since that was its status at the time of default. Bank L did not invoke the covenant violation and incurs a 40% LGD, but will associate that LGD with an unsecured facility. Even if both Bank L and Bank C experience the same LGD percentage of say 40%, these will be reported in two different categories, viz., Bank C will report a 40% secured LGD, while Bank L will report a 40% unsecured LGD.

Change in exposure prior to default:
Bank L and Bank C have unsecured loans of $100 million to obligors with deteriorating credit profiles, but Bank C has a proactive risk management process where eighteen months prior to default it is able to convince its obligor to sell some assets and reduce its exposure down to $50 million. However, eventually the obligor defaulted and the liquidation of the remaining assets resulted in a loss of $25 million or an LGD of 50%. Bank L did not get any reduction in exposure and its loss of $25 million measured against its EAD of $100 million resulted in an LGD of 25%.

Allocation of cash flows to individual exposures:
Bank L and Bank C have two facilities to a borrower of $60 million and $40 million each, the former secured by accounts receivable and the latter by inventory. In the process of the workout a total of $60 million was obtained from the borrower and $40 million was recorded as a loss. Bank L decided to allocate the $40 million loss to the accounts receivable and inventory facilities in proportion to the EAD so that its LGD for both facilities was 40%. Bank C reasoned that two-thirds of the recovery should be allocated to the more liquid receivables facility, resulting in LGDs of 33% and 50% to the accounts receivable and inventory facilities, respectively.

Sale vs. workout approach:
Bank C has a policy of aggressively selling defaulted loans into the market as soon as possible following default, while Bank L prefers to work them out. Typically, Bank C obtains 60% recovery while Bank L, after 2 years, obtains an 85% recovery including workout costs. The LGD for Bank C, after taking into account a discount rate of 10%, is 40%, while for Bank L it is 30%.

The sale vs. workout approach could also have an impact on the degree to which there is a downturn LGD effect. Presumably, during periods of high default, a sale into a depressed market by Bank C is likely to result in a higher LGD during downturn periods while during a period of low defaults Bank C may actually obtain a relatively high price if investors are looking to buy distressed loans. This will accentuate the downturn LGD effect for Bank C and require it to use LGDs that are experienced during downturn periods. Bank L will receive cash flows over an extended period of time which may include economic recovery periods. As a result it may be able demonstrate that its LGDs have a lower correlation with downturn periods and be able to use its full complement of LGDs.

Resolution of defaults:
Workouts can extend over several years and during that time banks both reduce the book value through chargeoffs as well as through receipt of cash flows. Banks will often declare a default.
“resolved” when the book value, as reported in their non-accrual system is zero, rather than wait for the legal balance to be zero. This can lead to a number of differences in measurement of LGDs:

- **Aggressive chargeoffs:** For a $10 million loan, after 2 years, Bank C has received $6 million of cash and has chargeoffs of $4 million and will report an LGD of 50% (discount rate of 10%), considering the default resolved and will not pursue further repayments. Bank L will also receive the same $6 million of cash flows and in the third year will receive an additional $2 million, and will then charge off the remaining $2 million. It will consider the default resolved after 3 years and will report an LGD of 35%, using the same discount rate. Even if Bank C continues to pursue further repayments until the repayment is received, it will report the 50% LGD after 2 years as it considers the loan resolved, while Bank L will not yet report its LGD at the end of 2 years, as it will consider it unresolved. Eventually, Bank C may update its LGD estimate to incorporate the additional repayment received.

- **Capture of past due interest:** Banks that rely exclusively on their non-accrual reporting system to determine cash flows may not capture past due interest that was ultimately received. Assume a $10 million loan which also has unpaid interest of $1 million for a total EAD of $11 million. The loan was repaid in full at the end of 1 year, and six months later the unpaid interest was also repaid. Bank C uses the differences in balances on its non-accrual system to determine cash flows, recording resolution at the end of one year, at which point the loan will be removed from its system and the LGD determined to be 17%. The additional interest that was received will be recorded in its general ledger as “other income” and not easily traceable to the specific loan. Bank L’s system is more sophisticated and will track the recovered interest to the specific loan and recalculate the LGD following final resolution to be approximately 9%.

- **Capture of stock and warrants received:** The same result described above for the collection of past due interest also arises when the bank receives securities, such as stock or warrants for debt previously contracted (DPC) as part of the workout, which it sells at a later date. Bank C will have difficulty in attributing the cash received for these securities to the defaulted loan, recorded as “other income” and will ignore it in calculating the LGD. Bank L will be able to attribute the cash received to the loan and incorporate it into their LGD estimates.

- **Valuation of stock, warrants, and real estate:** Even when banks have the ability to associate the receipt of stock and warrants and foreclosed real estate as part of the workout, their valuations can be different. Generally, the balance of the loan on non-accrual will be reduced by a combination of the payment received, the chargeoff incurred, and the value of the stock, warrants and real estate. At the point when the book value is reduced to zero, the value of the stock, warrants, and real estate will be transferred out of non-accrual to “non-performing”. Conservatism in these valuations can easily drive differences in the LGD. For stocks and warrants there may be restrictions on when the stock can be sold or warrants exercised. Even when there are no restrictions, the workout department may believe that the current value is depressed and choose to sell the securities at a later date. Assume the stock was valued at $100 at time of receipt but held onto and sold opportunistically two years later at $200. Bank L may choose to incorporate the $100 as a cash flow in their LGDs. When the stock is sold for $200, after properly applying the discount rate, they will revise the LGD. Bank C would consider holding onto the stock to be a separate speculative investment decision and ignore the $200 value in determining its LGD.
• **Tail estimates of recoveries:** When workout periods are lengthy, for example 3-4 years, there is a desire to incorporate these defaults into the LGD estimation. However, there may be a relatively small remaining book value, on the order of 15%. Assume Bank C decides at the end of year 3 to attribute no further recovery to the loan and calculates an LGD of 30% on the cash flows it has actually received. Bank L, however, has extensive data that it has compiled on such loans and determines that two-thirds of the remaining book balance is obtained by the end of year 4 in 95% of their cases. It will then add the 10% projected recovery at the end of year 4 and calculate its LGD at approximately 23%.

**Summary and Conclusions:**
As illustrated above, there are many sources of differences in AIRB risk parameters. These arise both from differences in how forensic measurements are constructed as well as how banks approach risk management. The resulting differences in input parameters could well account for substantial divergence in RWA estimates among firms that have identical credit profiles. Sending out benchmark portfolios for horizontal reviews of RWA estimates must be accompanied by qualitative surveys that might facilitate a better understanding of why RWA estimates seem so dissimilar. Most of these differences in the cases cited above will not be resolved through prescriptive guidance, though there may be a number of instances where best practices can be identified.