

Regulatory Capital Treatment of Aircraft Backed Loans: Basel Data Exercise*

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Study Background

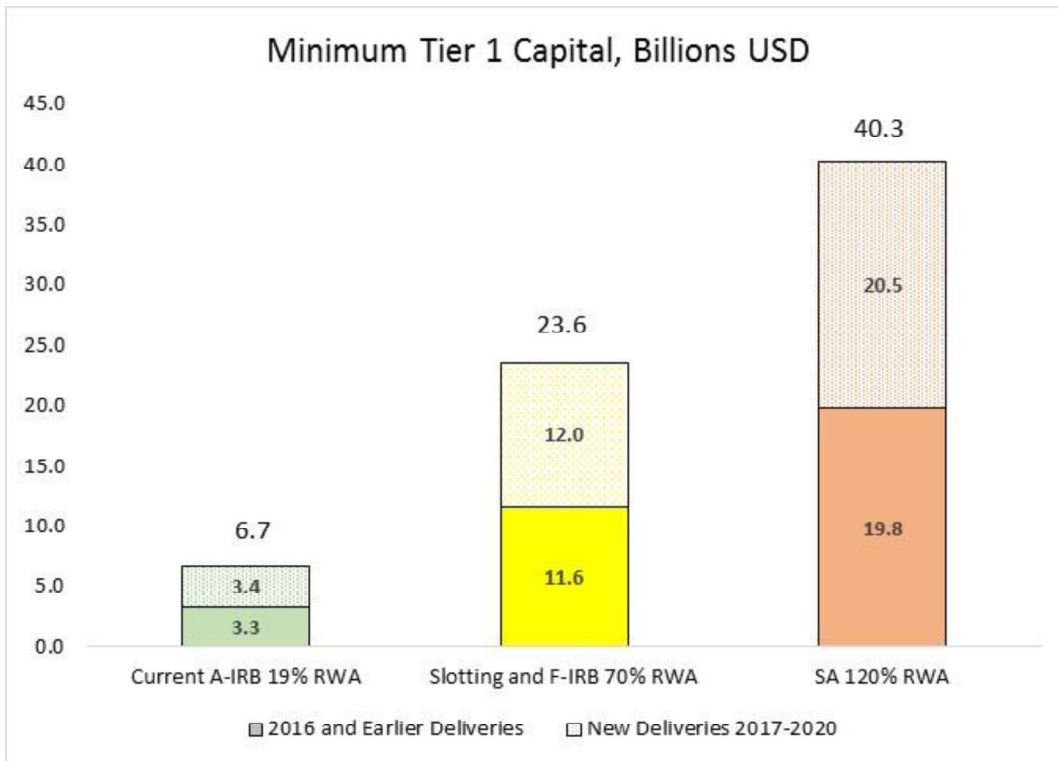
- This study seeks to assess the impact of the Basel Committee on Banking Supervision (BCBS) proposals “**Revisions to the Standardised Approach for credit risk**” of December 2015 and “**Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches**” of March 2016 on secured aircraft lending.
- Secured aircraft loans are generally treated either as specialized lending (object finance) or as corporate exposures, depending on transactional features.
- BCBS Proposals for Specialized Lending: BCBS Consultative Document “Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches” proposes to remove the Internal Ratings Based (IRB) approaches for specialized lending, leaving only the Standardised Approach (SA) and supervisor slotting. BCBS Consultative Document “Revisions to the Standardised Approach for credit risk” proposes to increase risk weights (RW) for specialized lending to 120%. Supervisory slotting approach is based on a grid with five categories with prescribed RW: Category 1 (Strong) 70% RW, Category 2 (Good) 90%, Category 3 (Satisfactory) 115% RW, Category 4 (Weak) 250% RW, Category 5 (Default) write off 50% of the outstanding loan amount (RW figures are for maturities greater than 2.5 years typical of aircraft lending). Assignments of loans to slots are approved by the bank’s supervisory regulator.
- BCBS Proposals for Corporate Exposures: Under the proposal “Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches”, corporate exposures are classified as follows:
 - Corporates with >EUR50bn total group assets: remove the IRB approaches, leaving only the SA.
 - Corporates with <EUR50bn group assets but >EUR200mn revenues: remove the Advanced IRB (A-IRB) approach, leaving the Foundation IRB (F-IRB).
 - Corporates with <EUR200mn revenues: introduce 20% LGD floor in the A-IRB approach.Most major airlines fall into the middle category.
- To assess the impact of these proposals on risk weighting secured aircraft loans and resulting changes in regulatory capital required to support secured aircraft lending, Dr. Linetsky undertook the **AWG Basel Data Exercise** (BDE) on behalf of the Aviation Working Group. This study presents the findings from the BDE.

Executive Summary

- Historical LGDs in the aircraft sector: Aircraft backed financings historically realized strong recoveries and low LGDs.
 - Capital markets: According to Kroll data, historical LGD for all EETC A and B tranches combined (A+B LTV comparable to bank loans) is **0.82%** (Kroll EETC recovery data are undiscounted.)
 - Export credit agency (ECA) portfolios: Historical LGD for US Exim Bank portfolio is **0%**. Historical LGD for Export Development Canada (EDC) and Brazilian Development Bank (BNDES) is **2.7%**. (Data aggregated for 2 agencies. ECA recovery data undiscounted.)
 - Bank loans: historical average senior secured aircraft bank loan LGD is **7.8%**. (Based on Global Credit Data, recoveries discounted at Euribor.)
- AWG Basel Data Exercise (BDE): Seven (7) global banks, that are major providers of aircraft-backed loans in 2015-2016 and which currently use A-IRB approaches, returned confidential AWG BDE questionnaires. These banks, collectively, have a substantial market share of such loans, and, thus, are representative of currently active banks in this field using A-IRB. BDE results:
 - For aircraft loans newly funded in 2015-2016: average A-IRB LGD: 7.9%, average RWA: 19.0%.
 - For aggregate aircraft loan portfolio of the banks: average A-IRB LGD: 8.8%, average RWA: 19.7%.
- The anticipated impact of the BCBS proposals on capital requirements in the aircraft sector is a x3.5 to x6 increase in Tier 1 capital requirements on secured aircraft loans. If implemented, this would require the banking industry to raise \$17bn to \$34bn in new Tier 1 capital to support the existing aircraft loan banking books and sustain the bank market share in new aircraft delivery financing in 2017-2020.
- Impact on availability of bank financing and risk profile in the aircraft sector: By not recognizing the historically low risk of aircraft collateral, the BCBS proposals put secured aircraft loans at a drastic risk-return profile disadvantage relative to higher risk unsecured corporate loans and secured loans with other types of collateral that historically realized higher LGDs. Within the aircraft sector, the BCBS proposals put lower risk aircraft loans at a disadvantage relative to higher risk loans (e.g. low LTV vs. high LTV loans). According to the BDE respondents, consequences will likely include:
 - Reduced capital availability to secured aircraft lending.
 - Reduce size of low risk aircraft loan portfolios on banking books via possible asset sales, undermining the long term partner role played by banks aligned with their airline customers.
 - Overall increase in bank portfolio risk through re-allocating capital away from secured aircraft lending towards riskier unsecured lending and riskier types of collateral.
 - Some aircraft financing may shift towards unregulated shadow banking entities.
 - Remaining secured aircraft financing in banks may shift to riskier terms and borrowers to capture higher margins to compensate for increased regulatory capital costs that are made essentially risk-insensitive by the current BCBS proposals.

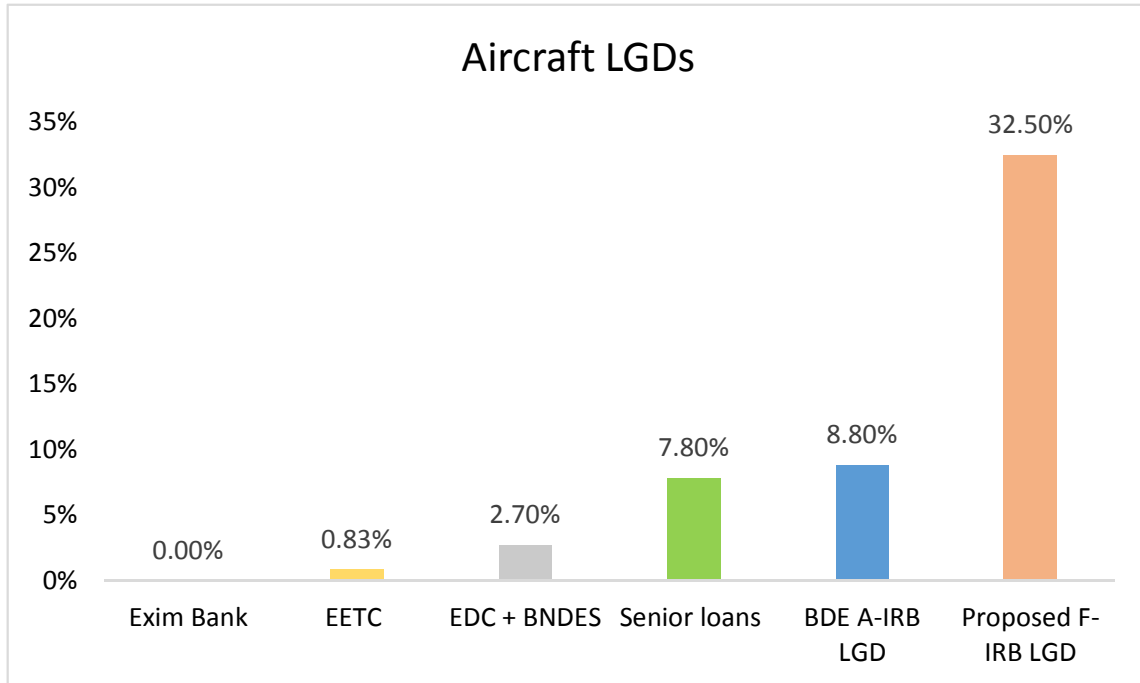
Impact of the BCBS Proposals on Tier 1 Capital Supporting Aircraft Loan Banking Books

The summary chart shows our estimates of minimum Basel III Tier 1 capital required to support secured aircraft loans financing 2016 and earlier aircraft deliveries and projected new deliveries in 2017-2020 under three scenarios: 1) current A-IRB average 19.7% RWA for seasoned loan portfolios / 19% for new deliveries, 2) 70% RWA for supervisory slotting for specialized lending and (approximately similar) F-IRB for corporate lending, and 3) 120% RWA under SA for specialized lending. (Details on pages 10 and 11.)



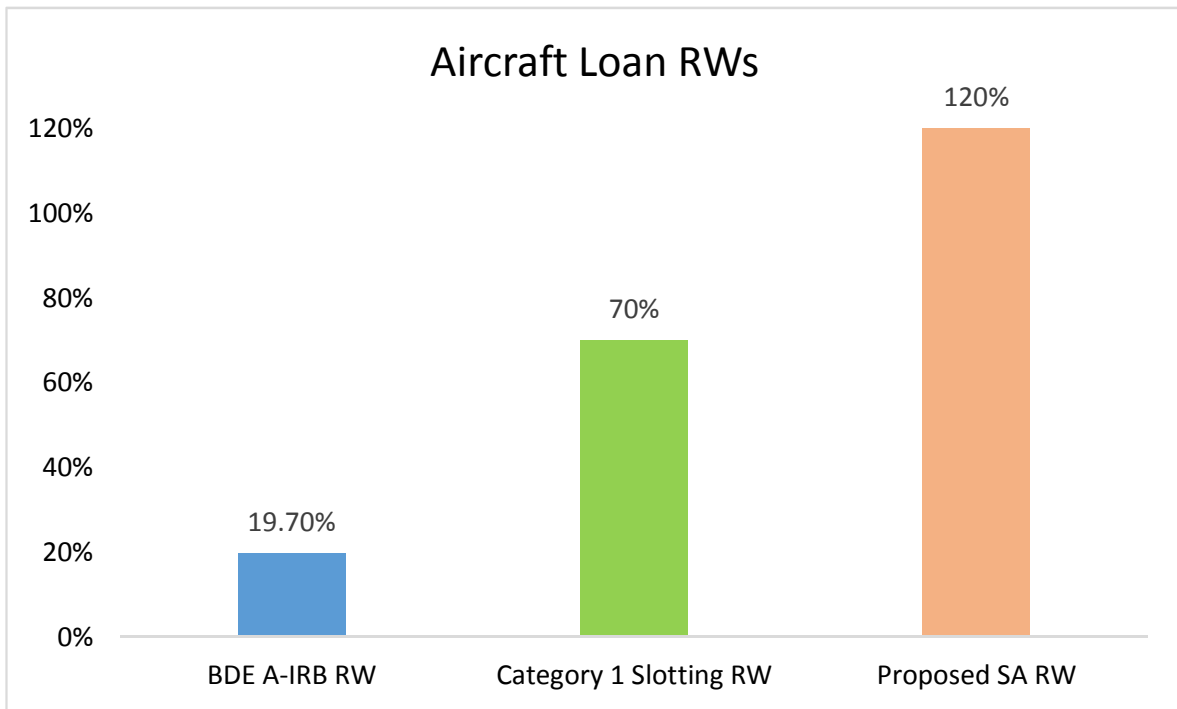
Aircraft Financing LGDs

The summary chart shows historical Exim bank LGD (details page 15), EDC and BNDES LGD (p.15), EETC combined A and B tranche LGD (p.14), historical senior secured loan LGD (p.16), BDE A-IRB LGD (p.8), and the proposed F-IRB LGD for an 80% LTV aircraft loan with 50% collateral value haircut and 25% LGD for secured portion and 45% LGD for unsecured portion (p.9).



Aircraft Loan RWs

The summary chart shows BDE A-IRB RWs (details page 8), Category 1 Slotting RW of 70%, and proposed SA RW 120% for specialized lending (p.9).



I. AWG Basel Data Exercise

AWG Basel Data Exercise

- Seven (7) global banks, that are major providers of aircraft-backed loans in 2015-2016 and which currently use A-IRB approaches, returned confidential AWG BDE questionnaires. These banks, collectively, have a substantial market share of such loans, and, thus, are representative of currently active banks in this field using such approaches.
- AWG BDE questionnaire was intended to establish average LGD and RWA for first priority aircraft-backed loans currently in use by banks in their regulator-approved A-IRB calculations. It asked for average figures for aircraft-backed loans funded during the 2015-2016 period, as well as for the bank's entire portfolio of aircraft-backed loans.
- The majority of respondents are Global Systemically Important Banks (G-SIBs).

AWG BDE Results	
Average Portfolio LGD	8.8%
Average Portfolio RWA	19.7%
Average LGD 2015-6	7.9%
Average RWA 2015-6	19.0%

Application of the BCBS Proposals on Bank Regulatory Capital to Secured Aircraft Loans

- To assess the impact of the proposals on those aircraft loans treated as specialized lending, we consider two scenarios: increase in RW from the current average RW of 19.7% for seasoned portfolios and 19% for loans funded in 2015-2016 to the 70% RW under the supervisory slotting approach for Category 1 (the minimum RW available to specialized lending under the current proposal) and 120% RW under SA.
- For those aircraft loans treated as corporate exposures, since most major airlines fall in the middle category with assets <EUR50bn and revenues >EUR200mn, we consider F-IRB with 25% LGD for secured portion and 45% for unsecured portion, as prescribed by F-IRB. BCBS Consultative Document “Reducing variation” prescribes a 50% haircut on the collateral value. Example calculation for an aircraft secured loan with 80% LTV:
$$\text{F-IRB LGD} = 25\% * 50/80 + 45\% * 30/80 = 32.5\%.$$
- Using average portfolio LGDs and RWAs collected in the AWG BDE and the linear relationship between LGD and RWA via the IRB formula, this corresponds to approximately 73% RW on average for aircraft portfolios of respondents to the AWG BDE. Based on these data, on average, the impact of the F-IRB approach with proposed 50% collateral haircut and LGDs of 25% for secured and 45% for unsecured portions of the aircraft loan after the haircut would have a similar impact to supervisory slotting for Category 1 with 70% RW, assuming LTV of 80%.
- Based on these considerations, in our analysis of the impact of the proposals we use the range of 70% (minimum) to 120% (maximum) RW.

BCBS Proposals on Bank Regulatory Capital: Impact on Seasoned Aircraft Loan Portfolio

- To estimate the aggregate size of the seasoned aircraft loan portfolio on the banking books as of the end of 2016, the following data and assumptions were used:
 - Aggregate new aircraft delivery figures in USD for 2009-2016 supplied by Airbus, ATR, Boeing, Bombardier and Embraer.
 - Percentage share of bank financing for deliveries in each year 2009-2016 supplied by Airbus, ATR, Boeing, Bombardier and Embraer.
 - 10% per year principal amortization was assumed.
 - Due to data availability, the figures do not include refinancings of previously delivered aircraft due to lack of data. Only new delivery financing included in the estimate.
 - Loans supported by export credit guarantees are excluded from the study.
- Based on this approach, estimated size of the aircraft loan portfolio on the banking books as of the end of 2016 is approximately USD 165bn. This figure is likely understated due to not including refinancings of previously delivered aircraft.
- To estimate the amount of additional Tier 1 capital required to support the seasoned loan portfolio, the following assumptions were made:
 - The portfolio average RWA of 19.7% in the AWG BDE exercise is used as the base to assess anticipated increases in capital requirements.
 - 10% Tier 1 Capital = 6% Basel III minimum Tier 1 capital + 2.5% Basel III conservation buffer + 1.5% additional G-SIB Tier 1 capital (majority of respondents to AWG BDE are G-SIBs).
 - Considered increases to 70% and 120% RWA (as discussed on page 9).
- Based on these assumptions, the BCBS proposals will result in net increases in regulatory capital of between x3.5 and x6 and will require the banking industry to raise between \$8.3bn to \$16.3bn in new Tier 1 capital to support existing banking books that financed 2016 and earlier aircraft deliveries (new deliveries only, not counting refinancings).

Minimum Tier 1 Capital (at 10%) to support USD 165bn secured aircraft loan portfolio			
	Tier 1 Capital	Increase, USD	Increase, x
Current average: 19.7% RWA	USD 3.3bn		
70% RWA	USD 11.6bn	USD 8.3bn	x 3.5
120% RWA	USD 19.8bn	USD 16.5bn	x 6

BCBS Proposals on Bank Regulatory Capital: Impact on New Aircraft Deliveries in 2017-2020

- To estimate bank financing share of new aircraft deliveries in 2017-2020, the following assumptions were made:
 - Projected new aircraft deliveries in USD for 2017-2020 supplied by Airbus, ATR, Boeing, Bombardier and Embraer.
 - Assumed bank financing share in 2017-2020 remains at the 2016 levels for each manufacturer.
- Based on this approach, projected bank share of the aircraft financing market in 2017-2020 is estimated at approximately USD 177bn. This figure includes Airbus, ATR, Boeing, Bombardier and Embraer aircraft.
- To estimate the amount of additional Tier 1 capital required to support new deliveries, the following assumptions were made:
 - The 2015-2016 transaction average RWA of 19% in the AWG BDE exercise used as the base to assess anticipated increases in capital requirements for new deliveries in 2017-2020.
 - 10% Tier 1 Capital = 6% Basel III minimum Tier 1 capital + 2.5% Basel III conservation buffer + 1.5% additional G-SIB Tier 1 capital (majority of respondents to AWG BDE are G-SIBs).
 - Considered increases to 70% and 120% RWA (as discussed on page 7).
- The BCBS proposals will result in net increases in regulatory capital of between x3.5 and x6 and will require the banking industry to raise between \$8.6bn to \$17.1bn in new equity in order to maintain the 2016 banking industry market share in financing new aircraft deliveries in 2017-2020.

Minimum Tier 1 Capital (at 10%) to support USD 177bn in new aircraft financing			
	Tier 1 Capital	Increase, USD	Increase, x
Current average: 19% RW	USD 3.4bn		
70% RW	USD 12.0bn	USD 8.6bn	x 3.5
120% RW	USD 20.5bn	USD 17.1bn	x 6

Adverse Consequences of the BCBS Proposals on the Aircraft Sector

- While the stated intent of the BCBS's proposals is reduction in variation in RWAs across different financial institutions, rather than material net increases in regulatory capital requirements across the banking industry, the impact on the aircraft sector specifically is a drastic x3.5 to x6 increase in capital requirements on secured aircraft loans that, if implemented, would require the banking industry to raise \$17bn to \$34bn in new equity to support the existing aircraft loan banking books and sustain the current bank market share in new aircraft delivery financing in 2017-2020.
- In addition to the *net* increases in regulatory capital to the aircraft sector, the proposals are insensitive to the risk spectrum *within* the aircraft sector. LGDs on aircraft loans strongly depend on transaction characteristics (age of aircraft and aircraft type, LTV, maturity, amortization profile), in addition to legal jurisdiction.
- AWG BDE respondents indicated that outcomes of the proposed drastic increases in capital requirements for secured aircraft financing will range from some of the institutions considering exiting the secured aircraft financing market entirely due to disproportionate increases in capital requirements relative to other sectors, while some of the institutions considering reducing the size of existing aircraft books via possible asset sales and scaling back new financings.
- By not recognizing the historically low risk of aircraft collateral, the BCBS proposals put secured aircraft loans at a drastic risk-return profile disadvantage relative to higher risk unsecured corporate loans and secured loans with other types of collateral that historically realized higher LGDs. Within the aircraft sector, the BCBS proposals put lower risk aircraft loans at a disadvantage relative to higher risk loans (e.g. low LTV vs. high LTV loans). According to the BDE respondents, consequences will likely include:
 - Reduced capital availability to secured aircraft lending.
 - Reduce size of low risk aircraft loan portfolios on banking books via possible asset sales, undermining the long term partner role played by banks aligned with their airline customers.
 - Overall increase in bank portfolio risk through re-allocating capital away from secured aircraft lending towards riskier unsecured lending and riskier types of collateral.
 - Some aircraft financing may shift towards unregulated shadow banking entities that are possibly less concerned with the long-term health of the aviation industry.
 - Remaining secured aircraft financing in banks may shift to riskier terms and borrowers to capture higher margins to compensate for increased regulatory capital costs that are made essentially risk-insensitive by the current BCBS proposals.

II. Historical LGDs in Aircraft Finance

Capital Markets: EETC LGDs

- Since mid-90s enhanced equipment trust certificates (EETC) have become the common form of aircraft-secured capital markets debt financing for airlines.
- Kroll Bond Rating Agency (“EETC historical recoveries and current outlook”, September 2015) conducted a comprehensive study into EETC recoveries in bankruptcy during the 20 year period 1994-2014.
- Typical bank loan LTVs are broadly comparable to B tranche LTVs (A tranche LTVs are generally lower than bank loan LTVs, C tranche LTVs are generally higher). This study uses combined A and B tranche EETC financing as proxy for bank loans.
- \$19.3bn in face value of combined A and B tranches issued by US airlines went through bankruptcy proceedings during 1994-2014 period. Aggregate losses on this issuance totaled \$162mn during this period, for an LGD of 0.84% --- exceptionally low historical loss rates, considering that this historical period included high-stress periods for the airline industry (airline industry downturn following the 9/11 terrorist attacks, high jet fuel costs of 2006-2008, and the financial crisis of 2008 and the subsequent recession).
- *EETC recoveries in Kroll study are undiscounted recoveries.

Loss and Recovery Rates for EETCs in Bankruptcy 1994-2014				
Tranche	Total loss (mn)	Original Face (mn)	LGD	Recovery*
A	\$ 35	\$ 16,000	0.20%	99.80%
B	\$ 127	\$ 3,300	3.90%	96.10%
A+B	\$ 162	\$ 19,300	0.84%	99.16%

Export Credit Agency LGDs

- Export Credit Agencies (ECAs) support aircraft exports either via pure cover guarantees or direct lending. Typical terms of aircraft-backed loans supported by ECAs are 10 or 12 year maturity with full amortization and with LTV ranging from 70% to 85%, depending on the credit rating of the borrower and the corresponding risk mitigants (see OECD Aircraft Sector Understanding (ASU) documentation at <http://www.oecd.org/tad/xcred/aircraftsectorunderstandings.htm>).
- **Exim Bank Portfolio Experience:** Between October 1993 and June 2016 Export-Import Bank of the United States guaranteed export credits for **\$106,317 million** in aircraft financing to over 200 borrowers in **68 countries**. Total claims on defaulted financing paid during this period amounted to \$624 million. Total recoveries amounted to \$814 million. Total recovery expenses amounted to \$7 million, *resulting in no net loss to Exim* (recoveries exceeded claims plus expenses) and effective historical **LGD of 0%**. Data source: Exim Bank.
- **Export Development Canada (EDC) and Brazilian Development Bank (BNDES) Portfolio Experience:** Between 1996 and 2016 EDC and BNDES supported approximately **\$56 billion** (combined) of aircraft exports in the form of direct lending. Defaults during this period totaled approximately **\$9.2 billion** (aggregated for the two agencies). Total losses amounted to approximately **\$249 million** with historical **LGD of 2.7%**. EDC financed in approximately **44 countries**. BNDES financed in approximately **27 countries**. Data sources: EDC and BNDES.
- Note: ECA recovery data are undiscounted recoveries.
- While until recently EETCs were primarily issued by US airlines, Exim, EDC and BNDES portfolios are highly diversified across jurisdictions. The mid-90s to 2016 historical period for the ECA portfolios coincided with the historical period for the EETC market and included high-stress periods for the airline industry (airline industry downturn following the 9/11 terrorist attacks, high jet fuel costs of 2006-2008, and the financial crisis of 2008 and the subsequent recession).

Historical Bank Loan LGDs: Global Credit Data Study

- For the purpose of this study Natixis has provided to Prof. Linetsky an extract of the Global Credit Data (GCD) data on aircraft loans (which is a sub-sample of the GCD database available to Natixis as GCD member and may not be the same as the whole GCD database). It contains data on all aircraft loans that experienced a default event during the period from 2000 to 2013 and which were resolved by the time of the data extraction and were reported to the GCD by the GCD member banks. In our study we excluded unsecured loans and subordinated loans. After these filters, 960 senior secured loans that experienced a default event during 2000-2013 were included in our analysis. We computed the (unweighted) average of LGDs in this loan data set (using uncapped and Euribor-discounted recovery data in the GCD data set).
- **The average senior aircraft-secured bank loan LGD is 7.8%. The median LGD is 1.3%.**
- We note that this LGD is higher than ECA and EETC LGDs likely due to the fact that virtually all ECA transactions and majority of EETC transactions are collateralized by new aircraft deliveries, while the GCD data include older aircraft collateral, as well as possible differences in terms and conditions. We also note that the current ECA practice is to include cross-default and cross-collateral provisions (as per the ASU). Historical losses in ECA portfolios may also be lower due to this factor.

Historical Bank Loan LGDs: Global Credit Data Study Continued

- We note the difference with the LGD of 11% reported in IIF and AFME submissions to the BCBS based on the GCD data. The differences are due to the following methodological differences: 1) we removed junior loans from the data set, as our study focused on senior aircraft-secured loans only, while the GCD study included both senior and junior secured loans. 2) We did not apply caps to recoveries or LGD. 3) Our average was computed as simple average at the loan level (average LGD for all loans in the data set). The GCD calculation followed a different methodology. It first aggregated recoveries on all loans to the same entity and then divided by the aggregate exposure on all loans to the same entity. The results were then averaged across entities to arrive at the average entity-level LGD across entities. The average LGD in our study is across loans, rather than entities. We thank the GCD for explaining their calculation methodology.
- The IIF and AFME submissions added an additional 5% to the base historical LGD figure of 11% to account for discounting of recovery from resolution back to default event date at the loan rate that includes margin vs. the raw GCD data that include discounting at Euribor. Since no data on loan margins were available in the data extraction we examined and we could not confirm whether all recoveries reported in the data set included accrued loan interest to the default resolution date in cases where such accrued interests were received, we could not confirm the 5% discounting figure. Hypothetically, if we add the 5% figure to our base 7.8% LGD, we arrive at the discounted LGD of 12.8% vs. 16% reported in IIF and AFME submissions.

Comparison of AWG BDE Figures with Historical Figures

- To compare these historical LGD figures with the average reported A-IRB LGD of 8.8% in the AWG BDE, we note that these figures are of a different nature.
- The average 8.8% A-IRB LGD in the current bank portfolios represents banks' modeled stressed LGDs for the current portfolio, also taking into account the bank's historical data. Current portfolios may have a significantly different risk profile than the historical data in the GCD database, such as aircraft age and type, loan LTV, maturity and amortization profile, and borrower PDs. Since the financial crisis of 2007-2008, banks have worked to reduce portfolio risk. It is likely that the current bank portfolio risk profiles are lower than the risk profile in the historical data during the 2000-2013 period.
- Additionally, the groups of banks in the AWG BDE and in the GCD are not the same (while some of the banks participated in both data collection exercises, some participated in only BDE or only GCD).
- We also note that secured aircraft loan LGDs are generally low due to the residual life of the aircraft which enables lenders to restructure the loan with the same operator or re-position the aircraft with another operator, thus avoiding sale of the aircraft in unfavorable market environments.

Comparison of AWG BDE Figures with Historical Figures

- We further note that the AFME submission translated the LGD of 16% into RW of 55% using historical observed default frequency in the GCD database as the PD input into the A-IRB RW formula.
- We note that the corresponding translation of LGD into RW using the data collected in the BDE on current bank portfolios results in a materially lower RW of 36% corresponding to 16% LGD (and RW of 29% corresponding to 12.8% LGD). The difference is likely accounted for by the higher PD in the historical data vs. current bank portfolios due to higher risk profiles in the historical data, as discussed above.
- Table below summarizes translation of LGD into RW using the current average bank portfolio data collected in the BDE.

LGD	RW
7.8%	17.5%
8.8%	19.7%
12.8%	28.7%
16.0%	35.8%