Economic Benefits of the Cape Town Treaty[1]

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October 18, 2009

[1] The views expressed herein are those of the author and do not necessarily reflect the views of Northwestern University. Moreover, the views of the author are preliminary, are based on research and analysis performed to date, and are subject to change based on additional data, evidence, research, and analysis. While a number of leading institutions in the air transport industry provided information and views which where taken into account in the preparation of this study, the responsibility for the study remains with the author.

Executive Summary

The Dynamic Asset Financing model developed by Prof. Linetsky has been applied to assess economic benefits of the ratification of the Cape Town Treaty and its Aircraft Protocol (C.T.T.) with qualifying declarations permitting prompt enforcement, in particular the selection of Protocol Article XI, Alternative A (rights on insolvency) with a maximum period of sixty (60) days. Our conclusion is that the ratification and effective implementation of the C.T.T. results in significant risk reduction to lenders in secured aircraft financing transactions. In particular, assuming the reduction in the aircraft repossession delay from ten months (worldwide average delay according to our adjustment of the World Bank contract enforcement data) to two months may reduce the loss-given-default (LGD) of a typical aircraft loan by between twenty five and thirty percent. The risk reduction results in commensurate reduction in risk spreads (margins) on aircraft financings. The risk spread reduction depends on the credit rating of the airline and the lender's estimate of the repossession delay in the pertinent jurisdiction. The benefits increase for lower rated borrowers and jurisdictions with perceived longer repossession delays.

Our analysis shows that below investment grade borrowers (ratings below BBB-) enjoy the risk spread reduction commensurate to between one and two notches credit rating upgrade when the expected repossession delay is reduced from the worldwide mean of ten months to two months.

According to our model, in a 12 year aircraft loan with the initial 85% loan-to-value airlines rated B would see the upfront risk fee reduction of about 3.25% of the loan principal if the expected repossession delay is reduced from ten months to two months. The savings of 3.25% of the loan principal are significantly larger than would result from the upgrade of the airline one notch to B+ (corresponding to the savings of 2.48%), assuming the repossession delay remains at ten months. The airline would have to be upgraded two notches to BB- to enjoy a larger reduction in the upfront risk fee.

Assuming the average airline credit rating of B and using the Airline Monitor's forecast of total aircraft orders in 2009-2030 of US$4,728 billion and the financing need of US$4,018 billion (85% of total orders), *according to our analysis the total savings directly resulting from the risk reduction due to reducing the worldwide repossession delay from ten to two months are on the order of US$161 billion over this period.* The actual savings can be significantly larger as our analysis takes into account only the direct risk reduction in a *given* financing transaction, and does *not* take into account increased general availability of financing to the air transport industry resulting from the risk reduction.

<u>Qualification</u>

To produce maximum benefits, the C.T.T. must be effectively implemented, including all actions necessary to ensure that their provisions will be strictly and reliably enforced by national authorities. The study results are predicated on full implementation and compliance.

I. Introduction and Methodology of the Study

This document analyzes the economic benefits of the ratification of the Cape Town Treaty and its Aircraft Protocol (C.T.T.) with qualifying declarations permitting prompt enforcement, in particular the selection of Protocol Article XI, Alternative A (rights on insolvency) with a maximum period of sixty (60) days. The focus is on the quantitative analysis of risk reduction in financing transactions and the expected commensurate reduction in financing costs resulting from shortening repossession delays.

Prof. Linetsky has developed a mathematical model for risk assessment and risk-based pricing of secured asset financing, the *Dynamic Asset Financing Model* (*DAFIM*). The model is generally applicable to a wide range of assets, including real estate, mobile equipment (aircraft, ships, rail stock, trucks and truck trailers), and other equipment (construction, mining, factory equipment). The DAFIM has recently been applied to the analysis of export credit financing in the context of the Aircraft Sector Understanding (ASU).

One of the distinguishing features of the DAFIM is that the delay in repossession of the collateral asset is explicitly included as one of the key variables determining the risk and pricing of secured asset financing transactions. This makes the model well suited to the analysis of the economic benefits of the CTT. This document applies the DAFIM to analyze the impact of repossession delays on the risk and cost of aircraft financing and demonstrates economic benefits of ratifying the Cape Town Treaty with its qualifying declarations[2] that reduce repossession delays to 60 days.[3]

The structure of the document is as follows. A brief description of the DAFIM is provided in Section II. The focus here is on describing the model assumptions, input variables, and the output risk analysis and pricing of the secured asset financing transaction.

In order to apply the DAFIM to analyze the economic impact of reducing repossession delays on the risk and pricing of aircraft financing, the key problem is to ascertain some typical delays that may occur in aircraft repossessions in the event of default. These delays can then be input in the DAFIM to evaluate the risk and pricing of aircraft financing in jurisdictions that have not yet selected Article XI, Alternative A. The same financing transaction is then evaluated by the DAFIM, assuming the jurisdiction has selected Article XI, Alternative A with the 60 day period. *The reduction in risk of the financing transaction and the commensurate reduction in the annual running spread/margin and the equivalent upfront risk fee of the transaction directly measure the economic benefit of reducing the delay to 60 days.*

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[2] By 'qualifying declarations', we mean those so defined in the new OECD Aircraft Sector Understanding, which crucially include, but are not limited, to Article XI of the Aircraft Protocol, Alternative A (insolvency), with a 60 day waiting period.

[3] While the remarketing period would need to be added to the 60 day period, it would also need to be added to all other repossession delay periods. Thus, we treat that period as a constant, and do not add it to the repossession delay in our calculations. Instead, we treat remarketing delay as part of the fixed costs of the repossession process.

A statistical study of contract enforcement delays is presented in Section III. It is based on two data sets. The first the data set on contract enforcement delays in 180 jurisdictions worldwide is maintained by the World Bank at and is available at http://www.doingbusiness.org/ExploreTopics/EnforcingContracts/ (data included in Annex A). This data on contract enforcement delays are general and not specific to aircraft financing contracts. To adjust these data to the aircraft financing context, we have examined some commercial data on aircraft repossessions supplied by financial institutions. While the original data are proprietary and confidential, we have derived a statistical adjustment to the publicly available World Bank data to make them more compatible with the aircraft financing market. The result of this analysis is a mathematical formula that estimates a hypothetical delay to repossess an aircraft in a given jurisdiction based on (1) the World Bank data on general contract enforcement delays for that jurisdiction and (2) our statistical adjustment based on our examination of the aviation-specific data.

The results of the repossession delay study in Section III are applied to the analysis of the risk and pricing of aircraft financing in Section IV. A hypothetical 12 year aircraft mortgage loan with typical terms is analyzed within the DAFIM framework and the following outputs are produced:

(1) Loss-given-default (LGD) with the Article XI, Alternative A 60 day repossession delay vs. repossession delays ascertained in Section III. *The LGD reduction directly measures the risk reduction to the lender resulting from shortening the repossession delay to 60 days.*

(2) Running annual spread (margin) and the equivalent upfront fee required to compensate the lender for the risk with the 60 day delay and the typical delay. *The reduction in spread/fee shows the financing cost reduction and is a direct economic benefit to the airline.*

Section V summarizes our main conclusions and estimates the potential aggregate savings to the global air transport resulting from reducing the aircraft repossession delay to two months.

An important qualification to this study is the overriding assumption that the jurisdiction not only ratifies the C.T.T., but also follows through on the full and effective implementation and compliance. To produce maximum benefits, the C.T.T. must be effectively implemented, including all actions necessary to ensure that their provisions will be strictly and reliably enforced by national authorities. All the results in this study are predicated on such full implementation and compliance. Without full confidence in the implementation and compliance, financial institutions may be reluctant to grant the borrowers full reductions in risk spreads/fees that result from the actual reduction in repossession delay to 60 days.

II. Dynamic Asset Financing Model

The DAFIM consists of the following components:
(1) Dynamic model of collateral asset market value (asset value process);
(2) Default model;
(3) Repossession model;
(4) Financing facility model;
(5) Advanced Internal Ratings Based (IRB) Basel II capital reserving model.

The outputs of the model are the annual risk spread (margin) and the equivalent upfront fee that compensate the lender for the expected loss (EL), as well as remunerate for the cost of carrying capital reserves for unexpected losses (UL) according to the Basel II Advanced IRB approach. The expected year-by-year Loss-Given-Default (LGD) values and the corresponding expected year-by-year capital reserves under Basel II are calculated as intermediate outputs.

A brief description of each of the DAFIM components is provided below.

(1) The *asset value process* is a stochastic process similar to the one used in the Black-Scholes options pricing model. In contrast with the Black-Scholes model, it takes into account the age and the economic depreciation of the asset. To calibrate the asset value process to commercial aircraft historical market data, Prof. Linetsky undertook a statistical study of historical aircraft market values using AVAC and Ascend historical data from 1967 to 2008. In particular, inflation adjusted expected residual value curves reflecting the expected economic depreciation of the aircraft and volatility curves reflecting market fluctuations around these expected values were estimated across more than 450 model/vintage time series of annual current market value (CMV) appraisals, including a total of over 10,000 historical aircraft appraisal data points. The stochastic process modeling the aircraft market value through time was calibrated to the statistically estimated residual value and volatility curves. It serves as the engine for risk analysis and pricing in the DAFIM.

(2) *Default model.* We use probabilities of default (PD) from historical Standard & Poor's 1981-2007 default data.[4]

(3) *Repossession model.* The model assumes that the borrower's default results in the subsequent collateral repossession by the lender. In this scenario, the lender faces some repossession delay. The model assumes the repossession delay of 60 days in jurisdictions that ratified the C.T.T. with Article XI, Alternative A. In other jurisdictions, the repossession delay is generally longer and is an important risk variable. The model allows the user to explicitly analyze the impact of the repossession delay on risk spreads, and thus provides an analytical framework for establishing the magnitude of the reduction in the LGD and corresponding risk spreads/fees resulting from reducing the repossession delay to 60 days. The lender also faces some fixed costs in repossession (legal costs,

[4] Standard & Proof's, Default, Transition, and Recovery: 2007 Annual Global Corporate Default Study and Rating Transitions, page 11.

repair, maintenance, reconfiguration, remarketing), as well as the distressed sale discount (DSD) reflecting the necessity to sell or lease the aircraft to a 3rd party under the compressed time frame to prevent long downtimes. For examples in this document the assumptions are: fixed costs in repossession 6% for the aircraft less than 6 years old, 10% for the aircraft 6 years old or older and the percentage distressed sale discount of 13%. Appropriate repossession delays to use in jurisdictions that have not ratified the C.T.T. with Article XI, Alt. A are studied in Section III of this document.

(4) *Financing facility model.* The DAFIM explicitly models terms and conditions of the financing facility, including payment schedule, loan-to-value (LTV), principal amortization profile, and subordination structure if any. A representative transaction studied in this document is a 12-year aircraft loan with semiannual payments and mortgage-style principal amortization with no balloon.

(5) *Advanced IRB Basel II capital reserving model.* The DAFIM calculates the present value of the cost of reserving the BIS II regulatory capital for the entire life of the financing facility under the Advance Internal Ratings Based Approach (A-IRB). The DAFIM estimates expected capital reserve requirements needed in each year of financing facility's life. The LGD is internally generated in the model for each year of the loan, based on the asset and loan models. The LGD is different for each year of the facility's life and depends on asset depreciation vs. loan amortization. The regulatory capital is costed at the Return on Equity (ROE) minus LIBOR. In this study we assume 20% pre-tax ROE (often used internal corporate target). To reserve for unexpected loss (UL), the BIS II requires estimating the *distressed LGD* (as opposed to average or expected LGD used in the expected loss (EL) calculation). We define distressed LGD as the average LGD during the market downturn (bottom half of market cycle). We do this by estimating the Tail Conditional Expectation of LGD (Conditional VaR) defined as the expected LGD, conditional on the downturn (conditional on the bottom half of the asset value distribution below the median). Fixed repositioning costs and the distressed sale discount are applied on top of the market downturn LGD, resulting in conservative assumptions likely satisfy regulatory reviews.

III. Statistical Study of Repossession Delays

The World Bank collects data on contract enforcement delays in 180 jurisdictions worldwide. The data are available at http://www.doingbusiness.org/ExploreTopics/EnforcingContracts/ and are reproduced in Annex A. The data are collected through study of the codes of civil procedure and other court regulations as well as surveys completed by local litigation lawyers (and, in a quarter of the countries, by judges as well). In the World Bank data contract enforcement time is recorded in calendar days, counted from the moment the plaintiff files the lawsuit in court until payment. This includes both the days when actions take place and the waiting periods between. The respondents make separate estimates of the average duration of different stages of dispute resolution: the completion of service of process (time to file the case), the issuance of judgment (time for the trial and obtaining the judgment) and the moment of payment (time for enforcement). The data estimate the average duration of contract enforcement cases through the courts in the majority of jurisdictions worldwide in a consistent and uniform manner. As far as we are aware, this is the only publicly available data set of this nature.

The drawback for our purposes is that the data are not specific to aircraft financing transactions. The assumption in the World Bank study is that the amount of the disputed contract is 200% of the country's income per capita. Aircraft transactions are much larger and presumably would receive higher priority in the courts. Furthermore, aircraft repossession may take place via a variety of means, including the voluntary surrender of the aircraft by the obligor, self-help remedies where available, expedited court processes where available, and, if all else fails, litigation as assumed in the World Bank data. Therefore, we generally expect aircraft repossession delays to be shorter than in the World Bank data. We view contract enforcement delays in the World Bank data as the *worst case scenario* for aircraft repossessions that do resolve through the judicial process, rather than the *average scenario*.

To adjust the World Bank data to the aviation context, we have examined some commercial data on aircraft repossessions supplied by financial institutions. While the original data are proprietary and confidential, we have derived a statistical adjustment to the publicly available World Bank data to make them statistically compatible with the commercial aviation financing market in the following sense. The histogram of worldwide contract enforcement delays measured in months in the World Bank data set is presented in Figure 1. *The mean delay is 20 months, with the standard deviation of 10 months.* In contrast, in the commercial data we have examined, *the mean worldwide delay is 10 months, with the standard deviation of 3.7 months*. To normalize the World Bank data to have the same mean and standard deviation as in the commercial data, we perform the following adjustment to the World Bank data:

$$AD_i = a \times WBD_i + b,$$

where

WBD_i: Contract enforcement delay in the World Bank data set for jurisdiction *i*

AD_i: Adjusted delay for jurisdiction *i*

a and *b*: adjustment coefficients determined by setting the mean and standard deviation of the adjusted distribution of delays equal to the mean and standard deviation of the commercial aviation data. Namely,

$$a = \frac{\sigma_c}{\sigma_{WB}},$$

and

$$b = \mu_c - \frac{\sigma_c}{\sigma_{WB}} \times \mu_{WB},$$

where μ_{WB} and σ_{WB} are the mean and standard deviation of delays in the World Bank data, respectively, and μ_c and σ_c are the mean and standard deviation of delays in the commercial data, respectively. Substituting the numerical values (μ_{WB} = 20 months, σ_{WB} = 10 months, μ_c = 10 months, σ_c = 3.7 months), the adjustment reads:

$$\boxed{AD_i = 0.37 \times WBD_i + 2.66} \qquad (1)$$

Figure 2 presents the histogram of adjusted delays. It has the mean and standard deviation of 10 months and 3.7 months, respectively. Table 1 presents selected percentiles of the original World Bank data set and the adjusted data set. In our study of economic benefits of the C.T.T. we employ the adjusted distribution to generate expected aircraft repossession delays. We view the original World Bank delays as the worst case scenarios.

Percentile	WB Delay Distribution (months)	Adjusted Distribution (months)
10th	9.7	6.2
25th	13.3	7.5
50th (median)	18.4	9.4
75th	23.7	11.3
90th	32.4	14.5
Mean	20.1	10.0
Standard Deviation	10.0	3.7

Table 1. Selected percentiles, mean, and standard deviation of the contract enforcement delay distributions: the original World Bank data and the adjusted data.

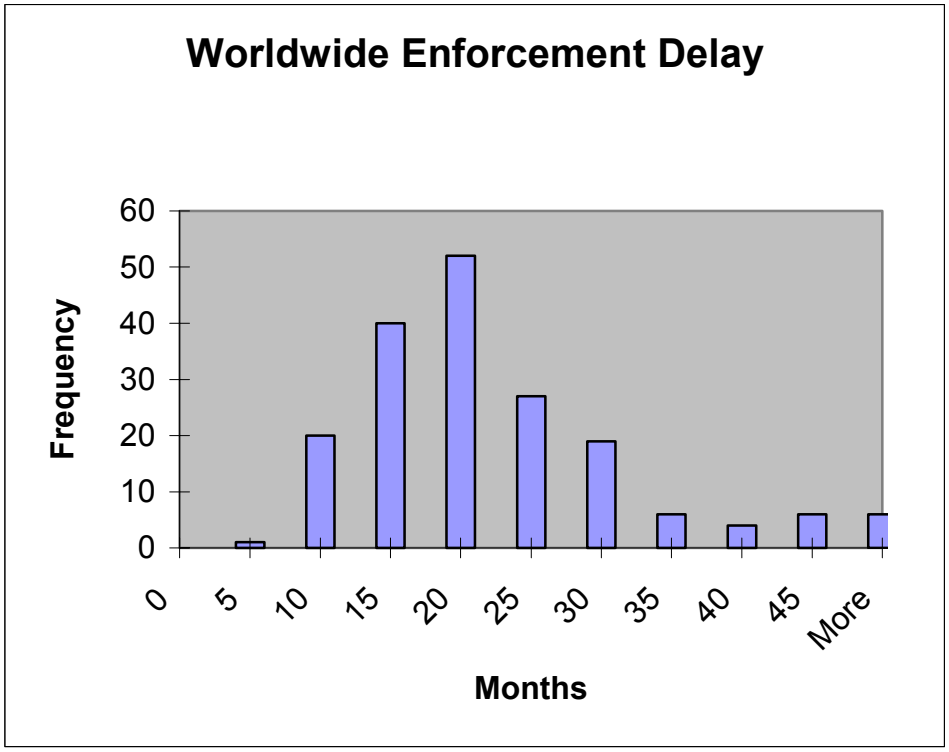

Figure 1. Histogram of worldwide contract enforcement delays (World Bank data).

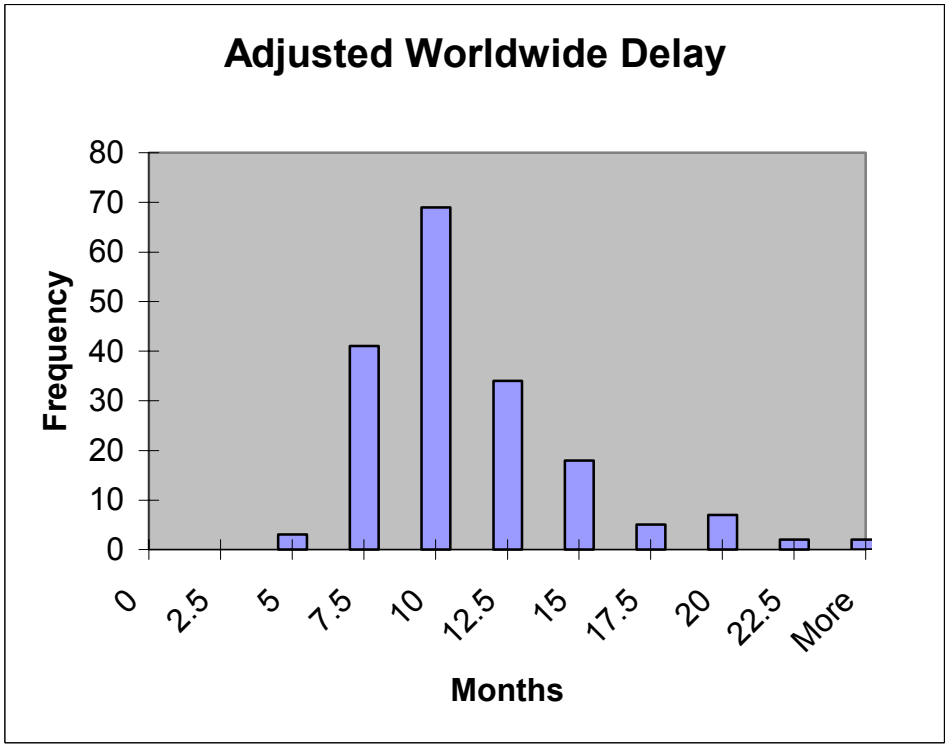

Figure 2. Histogram of adjusted worldwide contract enforcement delays.

IV. Economic Benefits of the Cape Town Treaty with Article XI, Alternative A

IV.a. Assumptions

To quantify the economic benefits of ratifying the Cape Town Treaty with Article XI, Alternative A, we apply the DAFIM to a sample 12-year aircraft loan with semiannual payments and mortgage-style principal amortization with no balloon. The initial loan-to-value is 85% of the net purchase price of the aircraft. Assumptions about the probabilities of default, aircraft values, repossession process, and capital reserving under the BIS II are as detailed in Section II.[5]

IV.b. Economic Benefit to the Lender: Reduction in the Loss Given Default (LGD)

The key economic benefit to the lender from reducing the repossession delay is in the reduction in the LGD. The repossession delay impacts the LGD in three ways:
(i) Accrued interest during the repossession delay period while the lender does not receive interest payments and have no access to the aircraft;
(ii) Continuing economic depreciation of the aircraft during the repossession delay period;
(iii) Continuing exposure to the market risk (volatility) of the aircraft market value during the repossession delay period.

These three factors combined have a significant impact on the LGD. To appreciate the impact of these factors on the LGD, consider a 12 month repossession delay. The full year's interest is not received during this period, while the aircraft is subject to the continuing economic depreciation. Furthermore, there exists a risk that the used aircraft market will suffer an overall decline during this twelve month period, so that the lender will take an additional market loss over and above the economic depreciation when the aircraft is finally repossessed and sold or leased to a 3rd party. The combination of the lost interest, continuing economic depreciation of the aircraft, and market risk may drastically increase the LGD, in some cases as much as doubling it or more relative to what it would have been under the limited 60 day repossession delay.

The DAFIM has the capability to model the LGD of asset backed loans dynamically throughout the life of the loan. Table 2 presents the LGD computed for each year of the life of the twelve year loan. Three repossession delays are considered: two months (C.T.T. with Article XI Alt. A), ten months (correspond to the mean worldwide delay according to our adjusted delay distribution), and twenty months (corresponds to the mean of the original unadjusted World Bank contract enforcement delay distribution that proxies for the worst case scenario in our study). For each of these delay assumptions, the DAFIM computes the *average* or *expected LGD* for each year of the loan's life, as well as the *distressed LGD* as required by Basel II. We observe that the impact of reducing the

[5] Sample transactions analyzed in this section are for illustration purposes only. In any commercial transaction there may be additional factors that influence transaction risk and pricing.

repossession delay from ten to two months results in cutting both the expected and the distressed LGD by between twenty five and thirty percent (from about 16% to 11% and from 27% to 20%, respectively). If one assumes the worst case repossession delay[6] corresponding to the unadjusted average worldwide contract enforcement delay in the World Bank data of twenty months, the LGD reduction is even more dramatic (reduction from 21% to 11% and from 35% to 21%, respectively).

[6] In our analysis we present two sets of results for the LGD and for the resulting annual risk spreads and the equivalent upfront fees. The first set of results is based on our adjusted distribution of delays with the mean of ten months. This is our base case or average case analysis. The second set of results is based on the *unadjusted* World Bank distribution of contract enforcement delays. This is the *worst case analysis*.

	Distressed LGD			Expected LGD		
Year	2 months	10 months	20 months	2 months	10 months	20 months
1	19.6%	27.9%	36.8%	12.8%	19.4%	27.0%
2	23.3%	30.9%	39.2%	14.1%	20.4%	27.8%
3	25.6%	32.9%	40.8%	14.9%	20.8%	28.0%
4	26.9%	33.9%	41.7%	15.0%	20.6%	27.7%
5	27.0%	34.1%	41.9%	14.5%	19.8%	26.6%
6	29.5%	36.5%	44.4%	15.7%	20.9%	27.7%
7	31.1%	38.3%	46.3%	16.2%	21.3%	28.0%
8	27.1%	34.8%	43.4%	13.4%	18.0%	24.4%
9	20.1%	28.1%	37.7%	9.8%	13.7%	19.3%
10	11.9%	17.7%	26.8%	5.8%	8.5%	12.8%
11	4.6%	7.4%	12.4%	2.2%	3.5%	5.8%
12	0.8%	1.7%	2.6%	0.4%	0.8%	1.1%
Average	**20.6%**	**27.0%**	**34.5%**	**11.2%**	**15.7%**	**21.3%**
Maximum	**31.1%**	**38.3%**	**46.3%**	**16.2%**	**21.3%**	**28.0%**

Table 2. Expected and distressed LGD for each year of life of the 12-year aircraft loan for repossession delays of two, ten, and twenty months.

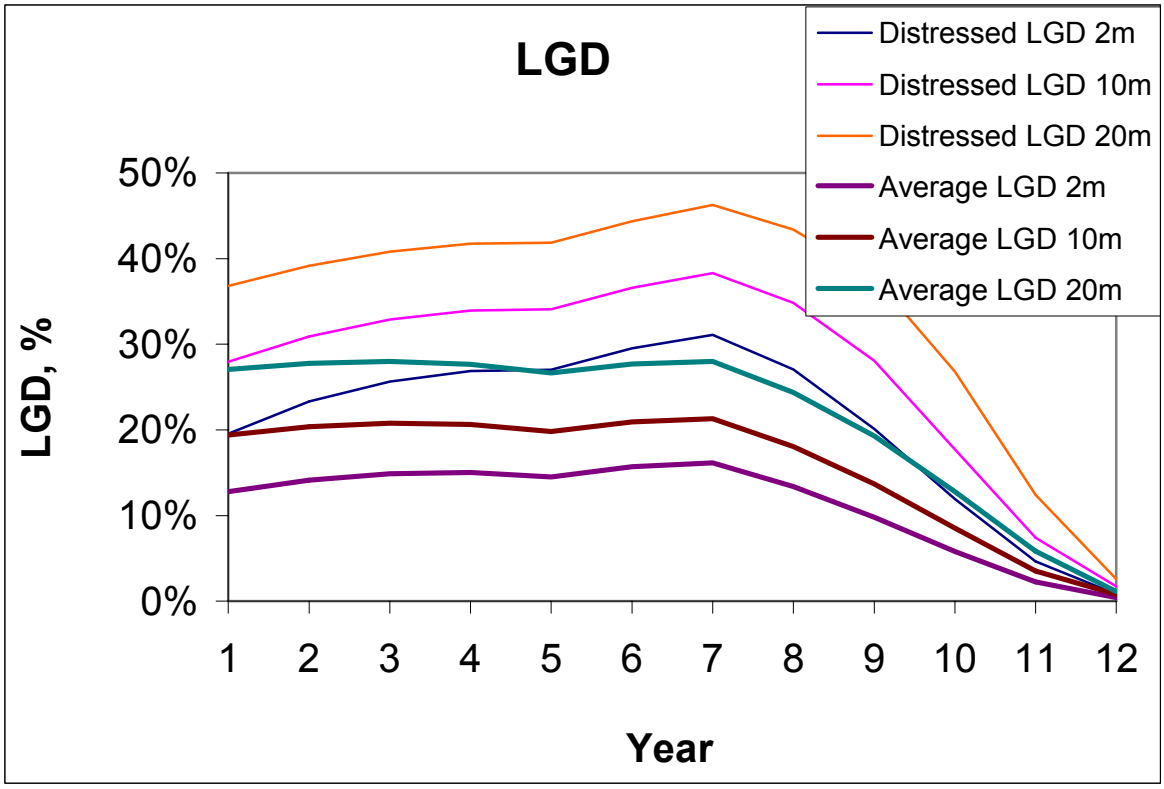

Figure 3. Graphical representation of data in Table 2.

IV.c. Economic Benefit to the Airline: Reduction in the Risk Spread

Having considered how reducing the repossession delay reduces the lender's LGD, we now show the commensurate reduction in risk spreads (margins) to be charged to the airline. Table 3 and Figure 4 provide the quantitative analysis of annual risk spreads (margins) in basis points per annum to be charged over and above the LIBOR on a sample loan for different credit ratings and under differing assumptions on the repossession delay. For each of the credit rating categories, the spread is computed for seven different assumptions about the repossession delay: 2 months (C.T.T. with Article XI Alt. A), 10 months (mean of the adjusted worldwide delay distribution), and 10th, 25th, 50th (median), 75th, and 90th percentiles of the adjusted worldwide delay distribution. The results show significant reductions in risk spreads achieved by shortening the repossession delay, with larger reductions to borrowers with lower credit ratings. According to our model, in this sample loan an airline rated B- would see the risk spread reduction from 252 basis points per annum to 184 basis points if the expected repossession delay is reduced from 10 months to 2 months. This is a significantly larger spread reduction than would result from the upgrade of the airline one notch to the B credit rating (risk spread of 208 basis points), assuming the repossession delay remains at 10 months. The airline would have to be upgraded two notches to B+ to enjoy a larger reduction in risk spread (166 basis points for B+ rated borrowers with expected repossession delay of 10 months).

Our analysis shows that below investment grade borrowers (ratings below BBB-) enjoy the risk spread reduction commensurate to between one and two notches credit rating upgrade when the expected repossession delay is reduced from the worldwide mean of ten months to two months.

This conclusion appears to be in agreement with the qualitative opinion of credit ratings agencies. Standard and Poor's note "Aircraft Securitization Criteria"[7] states that US financings are likely to benefit from a one- to two-notch credit rating enhancement by virtue of the protection afforded to creditors under Section 1110.

Table 4 and Figure 5 further illustrate the impact of repossession delay by considering the unadjusted World Bank data that we view as the worst case scenario. The spreads computed under the assumption of the mean worldwide contract enforcement delay through litigation of twenty months are fifty to ninety percent greater than the spreads computed under the assumption of the two month delay. *The spread reduction from twenty month delay to two month delay is commensurate to the credit upgrade of two to three notches for lower rated borrowers.*

[7] Standard and Poor's, 1999, "Structured Finance: Aircraft Securitization Criteria", page 7.

		Loan Spread (Margin) in Basis Points per Annum						
			Percentiles of Adjusted Worldwide Delay Distribution					
		C.T.T.	10th	25th	50th	Mean	75th	90th
		Repossession Delay in Months						
Credit	Rating	2	6.2	7.5	9.4	10	11.3	14.5
1	AAA	15	17	18	19	20	20	22
2	AA	15	18	19	20	20	21	23
3	A	22	26	27	29	29	30	33
4	BBB+	37	43	45	48	48	50	55
5	BBB	39	46	48	51	52	54	59
6	BBB-	53	62	65	69	70	72	79
7	BB+	64	76	79	84	86	89	97
8	BB	80	95	99	105	107	111	122
9	BB-	101	119	124	132	135	140	153
10	B+	123	146	153	163	166	173	189
11	B	152	182	191	204	208	217	238
12	B-	184	220	231	247	252	263	289
13	CCC/C	286	347	366	392	400	418	460

Table 3. Risk spreads corresponding to different credit ratings and expected repossession delays (mean and selected percentiles of the adjusted worldwide distribution).

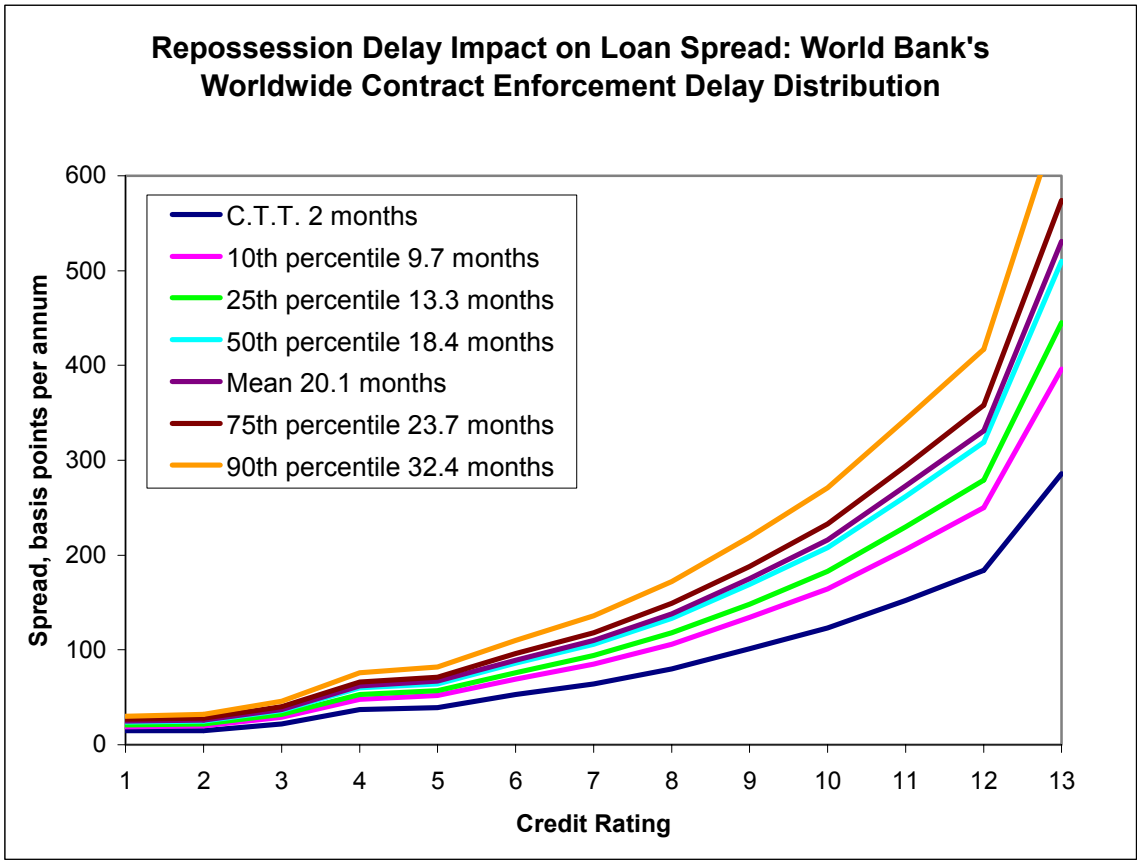

Figure 4. Graphical representation of data in Table 3.

		Loan Spread (Margin) in Basis Points per Annum						
			Percentiles of World Bank's Worldwide Delay Distribution					
		C.T.T.	10th	25th	50th	Mean	75th	90th
		Repossession Delay in Months						
Credit	Rating	2	9.7	13.3	18.4	20.1	23.7	32.4
1	AAA	15	19	21	24	25	27	30
2	AA	15	20	22	25	26	28	32
3	A	22	29	32	36	37	40	46
4	BBB+	37	48	53	60	62	66	76
5	BBB	39	52	57	64	67	71	82
6	BBB-	53	69	76	86	89	96	110
7	BB+	64	85	94	106	110	118	136
8	BB	80	106	118	133	138	149	172
9	BB-	101	134	148	169	175	188	219
10	B+	123	164	183	208	216	233	271
11	B	152	206	230	262	273	294	343
12	B-	184	250	279	319	331	358	417
13	CCC/C	286	396	445	510	531	574	670

Table 4. Risk spreads corresponding to different credit ratings and expected repossession delays (mean and selected percentiles of the unadjusted World Bank distribution).

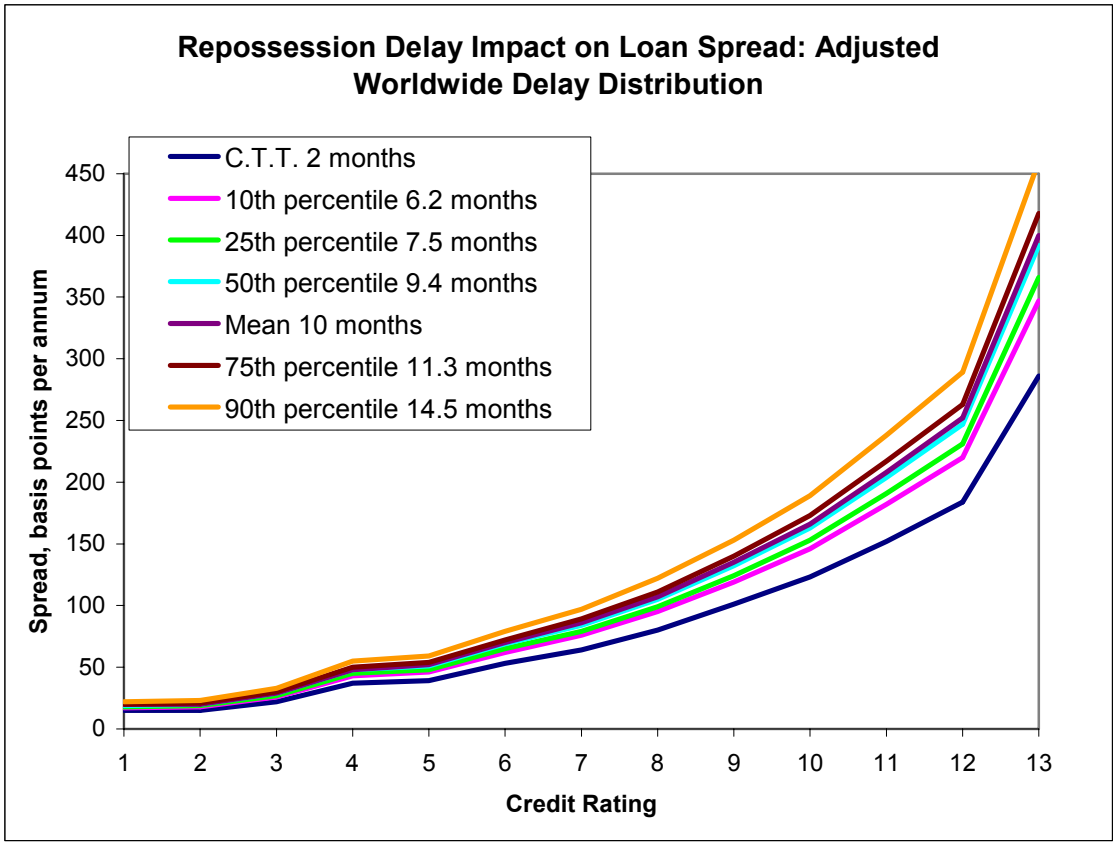

Figure 5. Graphical representation of data in Table 4.

To further illustrate the benefits of reducing the repossession delay, Tables 5 and 6 and Figures 6 and 7 convert the running annual spread into an equivalent upfront risk fee expressed as percentage of the principal amount of the financing. The upfront risk fee is the present value equivalent of the running annual spread. According to our model, in this sample loan an airline rated B- would see the upfront risk fee reduction from 14.46% to 10.43% of the loan principal if the expected repossession delay is reduced from the worldwide average of 10 months to 2 months. These savings of 4.03% of the loan principal are significantly larger than would result from the upgrade of the airline one notch to the B credit rating (upfront fee of 11.85% of the loan principal, corresponding to the savings of 2.61% resulting from the one notch upgrade), assuming the repossession delay remains at 10 months. The airline would have to be upgraded two notches to B+ to enjoy a larger reduction in the upfront risk fee (9.39% for B+ rated borrowers with expected repossession delay of 10 months).

	Equivalent Upfront Risk Fee, Percentage of Loan Principal						
		Percentiles of Adjusted Worldwide Delay Distribution					
	C.T.T.	10th	25th	50th	Mean	75th	90th
	Repossession Delay in Months						
Rating	2	6.2	7.5	9.4	10	11.3	14.5
AAA	0.83	0.97	1.01	1.07	1.09	1.13	1.22
AA	0.85	1.00	1.05	1.11	1.13	1.17	1.27
A	1.23	1.45	1.51	1.60	1.63	1.69	1.84
BBB+	2.04	2.39	2.50	2.65	2.70	2.80	3.04
BBB	2.19	2.57	2.68	2.85	2.90	3.01	3.27
BBB-	2.93	3.45	3.60	3.82	3.89	4.04	4.40
BB+	3.59	4.23	4.42	4.70	4.79	4.97	5.42
BB	4.49	5.31	5.55	5.91	6.02	6.26	6.83
BB-	5.64	6.69	7.00	7.46	7.60	7.91	8.66
B+	6.91	8.23	8.63	9.21	9.39	9.78	10.73
B	8.61	10.34	10.86	11.62	11.85	12.36	13.59
B-	10.43	12.57	13.22	14.16	14.46	15.09	16.62
CCC/C	16.44	20.15	21.27	22.89	23.40	24.49	27.12

Table 5. Upfront risk fee expressed as percentage of the loan principal equivalent to the running annual spreads in Table 3.

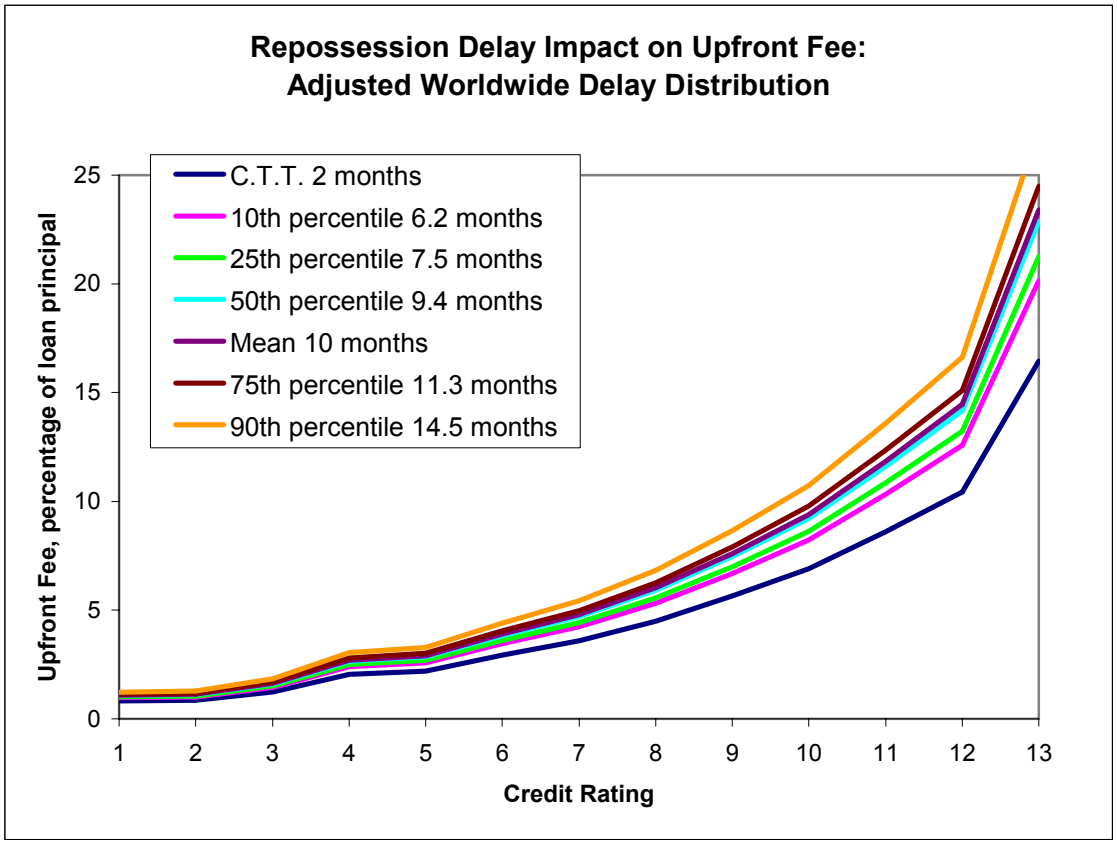

Figure 6. Graphical representation of data in Table 5.

	Equivalent Upfront Risk Fee, Percentage of Loan Principal						
		Percentiles of World Bank's Worldwide Delay Distribution					
	C.T.T.	10th	25th	50th	Mean	75th	90th
	Repossession Delay in Months						
Rating	2	9.7	13.3	18.4	20.1	23.7	32.4
AAA	0.83	1.08	1.18	1.33	1.38	1.47	1.68
AA	0.85	1.12	1.24	1.39	1.44	1.54	1.77
A	1.23	1.62	1.78	2.01	2.08	2.23	2.56
BBB+	2.04	2.67	2.95	3.32	3.44	3.69	4.25
BBB	2.19	2.87	3.18	3.58	3.71	3.98	4.59
BBB-	2.93	3.86	4.27	4.82	5.00	5.37	6.20
BB+	3.59	4.74	5.25	5.95	6.17	6.63	7.68
BB	4.49	5.97	6.62	7.51	7.80	8.40	9.76
BB-	5.64	7.53	8.38	9.54	9.92	10.70	12.48
B+	6.91	9.30	10.38	11.85	12.32	13.31	15.57
B	8.61	11.73	13.13	15.05	15.67	16.95	19.88
B-	10.43	14.31	16.05	18.43	19.20	20.79	24.42
CCC/C	16.44	23.14	26.14	30.24	31.56	34.30	40.53

Table 6. Upfront risk fee expressed as percentage of the loan principal equivalent to the running annual spreads in Table 4.

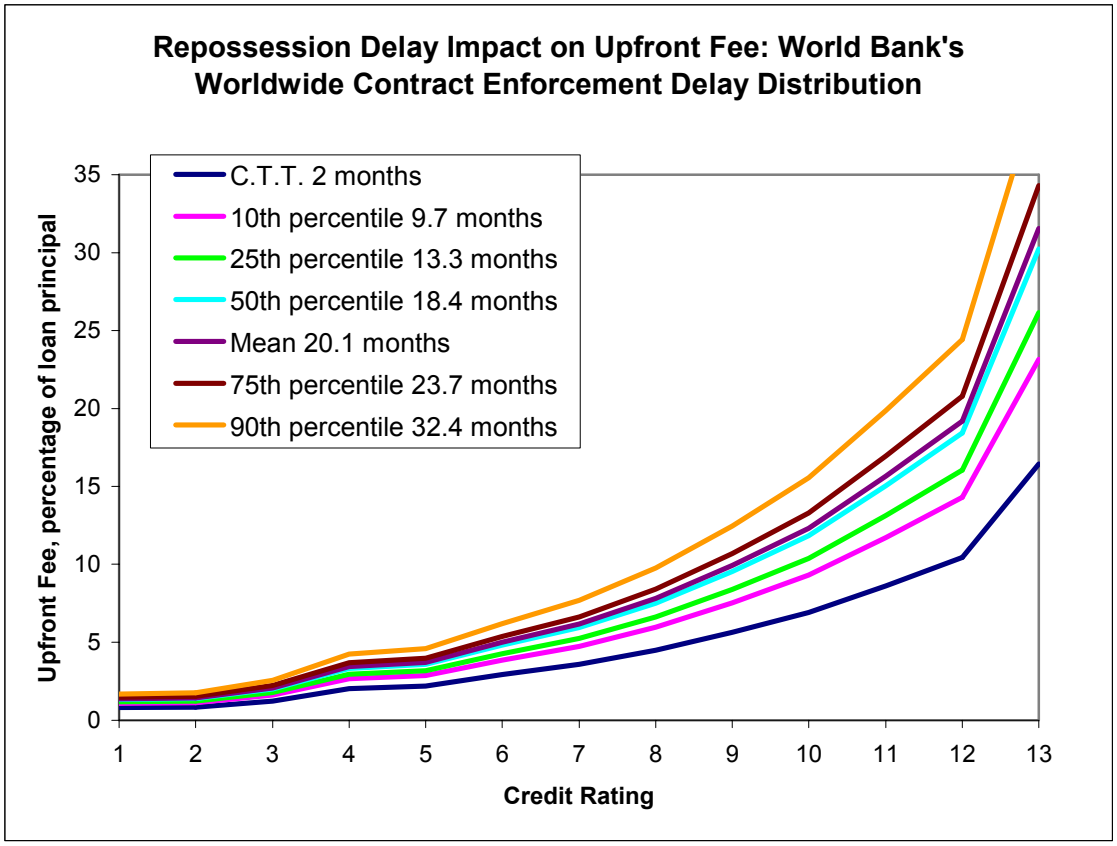

Figure 7. Graphical representation of data in Table 6.

V. Conclusion

The Dynamic Asset Financing model developed by Prof. Linetsky has been applied to assess economic benefits of the ratification of the Cape Town Treaty and its Aircraft Protocol (C.T.T.) with qualifying declarations permitting prompt enforcement, in particular the selection of Protocol Article XI, Alternative A (rights on insolvency) with a maximum period of sixty (60) days. Our conclusion is that the ratification of the C.T.T. results in significant risk reduction to lenders in secured aircraft financing transactions. In particular, assuming the reduction in the aircraft repossession delay from ten months (worldwide average delay according to our adjustment of the World Bank contract enforcement data) to two months may reduce the loss-given-default (LGD) of a typical aircraft loan by between twenty five and thirty percent. The risk reduction results in commensurate reduction in risk spreads (margins) on aircraft financings. The risk spread reduction depends on the credit rating of the airline and the lender's estimate of the repossession delay in the pertinent jurisdiction. The benefits increase for lower rated borrowers and jurisdictions with perceived longer repossession delays.

To summarize the economic benefits of ratifying the C.T.T. with Article XI Alt. A, the table below presents the reduction in the upfront risk fee expressed as percentage of the loan principal resulting from reducing the repossession delay from ten months to two months for different credit ratings.

Upfront Fee Reduction Resulting from Reducing Repossession Delay from 10 to 2 Months												
AAA	AA	A	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C
0.26	0.28	0.40	0.66	0.71	0.96	1.20	1.53	1.96	2.48	3.24	4.03	6.96

Our analysis shows that below investment grade borrowers (ratings below BBB-) enjoy the risk spread reduction commensurate to between one and two notches credit rating upgrade when the expected repossession delay is reduced from the worldwide mean of ten months to two months.

According to our model, in a 12 year aircraft loan with the initial 85% loan-to-value airlines rated B would see the upfront risk fee reduction of about 3.25% of the loan principal if the expected repossession delay is reduced from ten months to two months. The savings of 3.25% of the loan principal are significantly larger than would result from the upgrade of the airline one notch to B+ (corresponding to the savings of 2.48%), assuming the repossession delay remains at ten months. The airline would have to be upgraded two notches to BB- to enjoy a larger reduction in the upfront risk fee.

Assuming the average airline credit rating of B[8] and using the Airline Monitor's forecast[9] of total aircraft orders in 2009-2030 of US$4,728 billion and the financing need of US$4,018 billion (85% of total orders), ***according to our analysis the total savings directly resulting from the risk reduction due to reducing the worldwide repossession delay from ten to two months are on the order of US$161 billion over this***

[8] According to the median of KMV Expected Default Frequencies (EDF) for all rated airlines.
[9] The Airline Monitor, July 2009, page 23.

period. **The actual savings can be significantly larger as our analysis takes into account only the direct risk reduction in a *given* financing transaction, and does *not* take into account increased general availability of financing to the air transport industry resulting from the risk reduction.**

While it is difficult to quantitatively assess potential increases in the availability of funds to the air transport industry resulting from reducing repossession delays to 60 days, it is reasonable to expect an especially significant positive impact on lower rated borrowers. While the probability of default (PD) is substantial for these ratings, a significant reduction in the LGD would make these transactions more palatable to a wider range of lenders.

Annex. European Union Analysis

This Annex presents the data specific to the European Union. Table EU.1 presents the World Bank contract enforcement delays in twenty five of the E.U. member states (the World Bank data do not include Cyprus and Malta), together with the adjusted delays. The E.U. mean contract enforcement delay is 17.7 months with the standard deviation of 9.1 months according to the World Bank data (both values slightly lower than the worldwide average delay of 20.1 months with the standard deviation of 10 months.). Our adjusted data have the mean of 9.1 months with the standard deviation of 3.3 months (slightly lower than the worldwide mean of 10 months with the standard deviation of 3.7 months).

E.U. Contract Enforcement Delays (months)		
Jurisdiction	Delay	Adjusted delay
Austria	13.0	7.4
Belgium	16.6	8.7
Bulgaria	18.5	9.4
Czech Republic	26.9	12.5
Denmark	12.5	7.2
Estonia	13.9	7.7
Finland	7.7	5.5
France	10.9	6.6
Germany	12.9	7.4
Greece	26.9	12.5
Hungary	11.0	6.7
Ireland	16.9	8.8
Italy	39.7	17.1
Latvia	9.1	6.0
Lithuania	6.9	5.2
Luxembourg	10.5	6.5
Netherlands	16.9	8.8
Poland	27.2	12.6
Portugal	18.9	9.6
Romania	16.8	8.8
Slovakia	18.5	9.4
Slovenia	44.3	18.8
Spain	16.9	8.8
Sweden	16.7	8.7
United Kingdom	13.2	7.5
Mean	17.7	9.1
Standard Deviation	9.1	3.3

Table EU.1. E.U. contract enforcement delays according to the World Bank data and our adjustment as detailed in Section III.

Table EU.2 and Figure EU.1 are counterparts of Table 2 and Figure 3 in Section IV. The LGD is analyzed for the nine month mean delay (adjusted distribution) and the original World Bank eighteen month delay. Tables EU.3 and EU.4 are the E.U. counterparts of Tables 3-6 in Section IV. They present annual running spreads and equivalent upfront

fees for all credit ratings. For each E.U. member state and each credit rating, the values are computed for the World Bank contract enforcement delay and for the adjusted delay, as well as for the E.U. mean delay. The spreads and fees corresponding to the two month delay are included for comparison.

The conclusions are similar to the conclusions of the worldwide analysis since the mean delay in the E.U. is close to the worldwide figure (nine months vs. ten months). Our analysis shows that, on average, below investment grade borrowers (ratings below BBB-) in the E.U. enjoy the risk spread reduction commensurate to between one and two notches credit rating upgrade when the expected repossession delay is reduced from the E.U. mean of nine months to two months under the C.T.T. Article XI Alternative A. Investment grade borrowers with ratings BBB- and above on average enjoy the risk reduction commensurate to up to one notch credit rating upgrade.

	Distressed LGD			Average LGD		
Year	2 months	9 months	18 months	2 months	9 months	18 months
1	19.6%	27.0%	35.1%	12.8%	18.6%	25.6%
2	23.3%	30.0%	37.6%	14.1%	19.6%	26.3%
3	25.6%	32.0%	39.3%	14.9%	20.1%	26.6%
4	26.9%	33.1%	40.3%	15.0%	19.9%	26.3%
5	27.0%	33.2%	40.4%	14.5%	19.2%	25.3%
6	29.5%	35.7%	42.9%	15.7%	20.3%	26.3%
7	31.1%	37.4%	44.8%	16.2%	20.7%	26.7%
8	27.1%	33.9%	41.8%	13.4%	17.4%	23.1%
9	20.1%	27.0%	35.9%	9.8%	13.2%	18.1%
10	11.9%	16.9%	24.8%	5.8%	8.1%	11.9%
11	4.6%	7.0%	11.3%	2.2%	3.3%	5.3%
12	0.8%	1.6%	2.4%	0.4%	0.7%	1.0%
Average	**20.6%**	**26.2%**	**33.0%**	**11.2%**	**15.1%**	**20.2%**
Maximum	**31.1%**	**37.4%**	**44.8%**	**16.2%**	**20.7%**	**26.7%**

Table EU.2. The EU counterpart of Table 2.

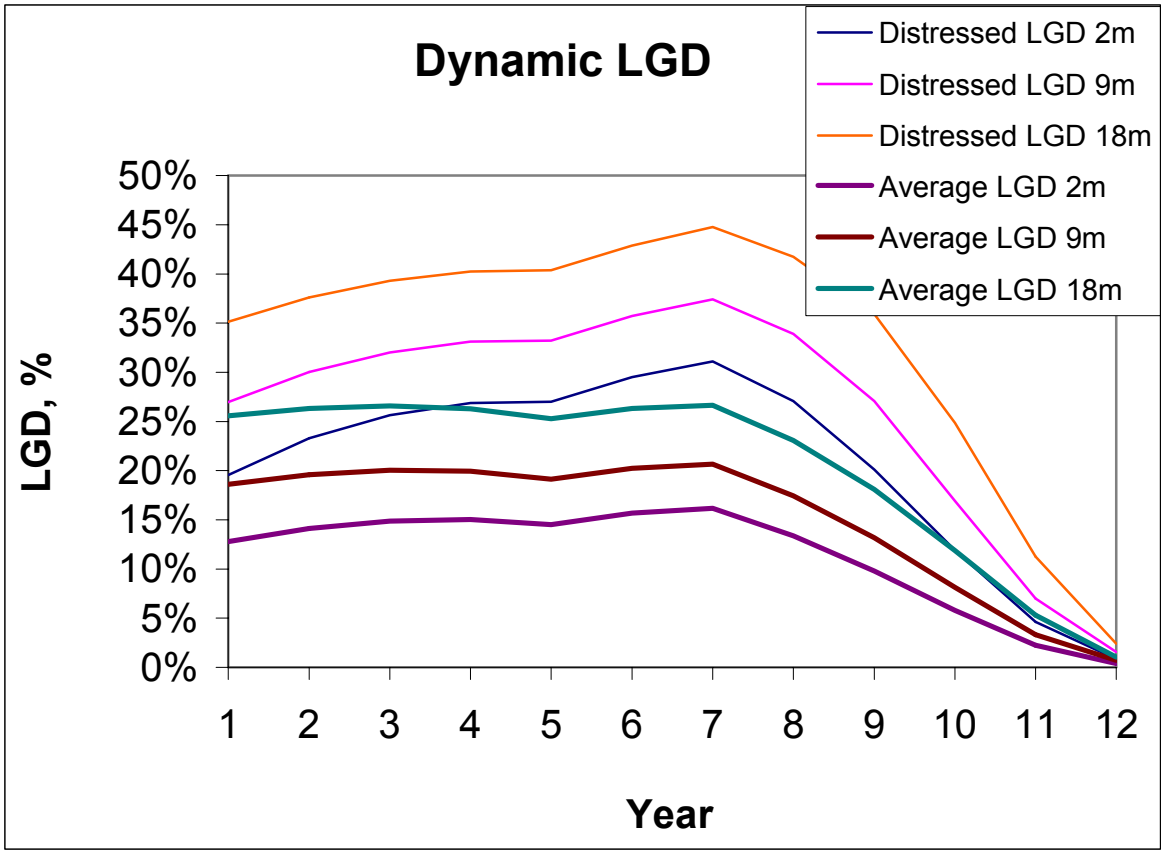

Figure EU.1. The EU counterpart of Figure 3.

Table EU.3 "Spreads" and **EU.4** "Upfront Fees" are presented on pages 24 and 25.

Country	Delay mos	Credit Spread (Margin) in Basis Points per Annum												
	W.B.	1	2	3	4	5	6	7	8	9	10	11	12	13
	Adjusted	AAA	AA	A	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C
Austria	13.0	21	22	32	53	57	76	93	117	147	181	228	277	441
	7.4	18	19	27	45	48	64	79	99	124	152	191	231	364
Belgium	16.6	23	24	35	57	62	83	102	128	161	199	251	305	487
	8.7	19	20	28	47	50	67	82	103	130	159	199	242	382
Bulgaria	18.5	24	25	36	60	64	86	106	134	169	208	263	319	511
	9.4	19	20	29	48	51	69	84	105	132	163	204	247	392
Czech Rep.	26.9	28	29	42	70	75	101	125	158	200	247	312	380	610
	12.5	21	22	31	52	56	75	92	115	145	179	225	272	434
Denmark	12.5	21	22	31	52	56	75	92	115	145	179	224	272	433
	7.2	18	19	27	44	48	64	78	98	123	151	189	229	361
Estonia	13.9	22	23	33	54	58	78	95	120	151	186	234	284	453
	7.7	18	19	27	45	49	65	80	100	125	154	193	234	369
Finland	7.7	18	19	27	45	49	65	80	100	125	154	193	233	368
	5.5	17	18	25	42	45	60	74	92	116	142	177	214	337
France	10.9	20	21	30	50	53	72	88	110	138	170	214	259	412
	6.6	18	18	26	44	47	63	77	96	121	148	185	224	353
Germany	12.9	21	22	32	52	56	76	93	117	147	181	227	276	440
	7.4	18	19	27	45	48	64	79	99	124	152	190	230	364
Greece	26.9	28	29	42	70	75	101	125	158	200	247	312	380	610
	12.5	21	22	31	52	56	75	92	115	145	179	224	272	433
Hungary	11.0	20	21	30	50	54	72	88	110	139	171	215	260	414
	6.7	18	18	26	44	47	63	77	96	121	148	185	224	354
Ireland	16.9	23	24	35	58	62	83	102	129	163	201	253	307	491
	8.8	19	20	28	47	50	67	83	103	130	160	200	243	384
Italy	39.7	33	35	51	84	90	122	150	190	242	300	380	462	743
	17.1	23	24	35	58	62	84	103	130	164	202	254	309	494
Latvia	9.1	19	20	29	47	51	68	83	105	131	161	202	245	389
	6.0	17	18	26	43	46	61	75	94	118	145	181	219	344
Lithuania	6.9	18	19	27	44	47	63	78	97	122	150	187	226	357
	5.2	17	17	25	42	45	60	73	91	114	140	175	212	332
Luxemb.	10.5	20	21	30	49	53	71	87	109	137	169	212	257	407
	6.5	18	18	26	43	47	62	77	96	120	147	184	223	351
Netherl.	16.9	23	24	35	58	62	83	102	129	163	201	253	307	490
	8.8	19	20	28	47	50	67	83	103	130	160	200	242	384
Poland	27.2	28	29	43	70	76	102	126	159	201	249	314	382	614
	12.6	21	22	32	52	56	75	92	116	146	179	225	273	435
Portugal	18.9	24	25	37	60	65	87	107	135	170	211	265	323	516
	9.6	19	20	29	48	51	69	84	106	133	164	205	249	394
Romania	16.8	23	24	35	58	62	83	102	129	162	200	252	306	490
	8.8	19	20	28	47	50	67	82	103	130	160	200	242	383
Slovakia	18.5	24	25	36	60	64	86	106	134	169	209	263	320	511
	9.4	19	20	29	48	51	69	84	105	133	163	204	248	392
Slovenia	44.3	35	37	53	88	95	128	159	201	256	318	402	489	786
	18.8	24	25	36	60	65	87	107	135	170	210	265	322	515
Spain	16.9	23	24	35	58	62	83	102	129	163	201	253	307	491
	8.8	19	20	28	47	50	67	83	103	130	160	200	243	384
Sweden	16.7	23	24	35	57	62	83	102	128	162	200	251	305	488
	8.7	19	20	28	47	50	67	82	103	130	159	200	242	383
U.K.	13.2	21	22	32	53	57	76	94	118	148	183	230	279	444
	7.5	18	19	27	45	48	65	79	99	124	153	191	231	365
Mean	17.7	24	25	36	59	63	85	104	131	166	205	258	314	501
	9.1	19	20	29	47	51	68	83	104	131	161	202	245	388
C.T.T.	2.0	15	15	22	37	39	53	64	80	101	123	152	184	286

Country	Delay mos	Equivalent Upfront Risk Fee, Percentage of Loan Principal												
	W.B.	1	2	3	4	5	6	7	8	9	10	11	12	13
	Adjusted	AAA	AA	A	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C
Austria	13.0	1.18	1.23	1.77	2.93	3.15	4.24	5.21	6.57	8.31	10.29	13.03	15.91	25.91
	7.4	1.01	1.04	1.51	2.49	2.68	3.59	4.41	5.54	6.98	8.60	10.82	13.18	21.19
Belgium	16.6	1.28	1.34	1.93	3.19	3.44	4.62	5.70	7.20	9.13	11.32	14.37	17.58	28.78
	8.7	1.05	1.09	1.57	2.59	2.79	3.74	4.60	5.78	7.29	9.00	11.34	13.82	22.30
Bulgaria	18.5	1.33	1.39	2.01	3.33	3.59	4.83	5.96	7.53	9.56	11.87	15.08	18.47	30.31
	9.4	1.07	1.11	1.60	2.65	2.85	3.83	4.70	5.91	7.46	9.21	11.62	14.17	22.90
Czech Rep.	26.9	1.55	1.63	2.35	3.90	4.21	5.68	7.03	8.91	11.36	14.16	18.05	22.15	36.64
	12.5	1.16	1.21	1.74	2.89	3.11	4.18	5.14	6.47	8.19	10.13	12.81	15.65	25.46
Denmark	12.5	1.16	1.21	1.74	2.89	3.11	4.17	5.14	6.47	8.18	10.13	12.81	15.65	25.45
	7.2	1.00	1.04	1.50	2.47	2.66	3.57	4.38	5.50	6.93	8.54	10.74	13.08	21.01
Estonia	13.9	1.20	1.26	1.81	3.00	3.23	4.34	5.34	6.73	8.53	10.56	13.38	16.35	26.66
	7.7	1.02	1.06	1.52	2.52	2.71	3.63	4.46	5.60	7.06	8.71	10.96	13.34	21.48
Finland	7.7	1.01	1.05	1.52	2.51	2.70	3.63	4.45	5.59	7.05	8.69	10.94	13.33	21.45
	5.5	0.94	0.98	1.41	2.33	2.50	3.36	4.12	5.17	6.51	8.00	10.04	12.21	19.51
France	10.9	1.11	1.16	1.67	2.76	2.97	3.99	4.91	6.18	7.81	9.65	12.19	14.87	24.11
	6.6	0.98	1.02	1.47	2.43	2.61	3.50	4.29	5.39	6.79	8.36	10.51	12.78	20.51
Germany	12.9	1.17	1.22	1.76	2.92	3.14	4.23	5.20	6.55	8.29	10.26	12.99	15.87	25.83
	7.4	1.00	1.04	1.50	2.49	2.67	3.59	4.40	5.53	6.97	8.59	10.81	13.16	21.16
Greece	26.9	1.55	1.63	2.35	3.90	4.21	5.68	7.02	8.91	11.36	14.15	18.04	22.14	36.62
	12.5	1.16	1.21	1.74	2.89	3.11	4.17	5.14	6.47	8.18	10.13	12.81	15.65	25.45
Hungary	11.0	1.12	1.16	1.68	2.77	2.98	4.01	4.93	6.20	7.84	9.69	12.24	14.94	24.22
	6.7	0.98	1.02	1.47	2.43	2.61	3.50	4.30	5.40	6.80	8.37	10.52	12.81	20.55
Ireland	16.9	1.29	1.35	1.94	3.22	3.46	4.66	5.74	7.25	9.20	11.42	14.49	17.73	29.04
	8.8	1.05	1.09	1.57	2.60	2.80	3.76	4.62	5.80	7.32	9.03	11.39	13.88	22.40
Italy	39.7	1.85	1.94	2.81	4.68	5.06	6.84	8.49	10.81	13.86	17.33	22.14	27.23	45.33
	17.1	1.29	1.35	1.95	3.23	3.48	4.69	5.78	7.30	9.26	11.49	14.58	17.85	29.24
Latvia	9.1	1.06	1.10	1.59	2.63	2.83	3.80	4.66	5.86	7.40	9.13	11.52	14.04	22.68
	6.0	0.96	1.00	1.44	2.38	2.55	3.42	4.20	5.27	6.63	8.17	10.25	12.47	19.97
Lithuania	6.9	0.99	1.03	1.48	2.45	2.63	3.53	4.33	5.44	6.85	8.44	10.61	12.92	20.74
	5.2	0.93	0.97	1.39	2.31	2.48	3.32	4.08	5.11	6.43	7.91	9.92	12.05	19.25
Luxemb.	10.5	1.10	1.15	1.65	2.74	2.94	3.95	4.86	6.12	7.73	9.55	12.06	14.71	23.84
	6.5	0.98	1.01	1.46	2.42	2.60	3.48	4.27	5.36	6.76	8.32	10.46	12.72	20.40
Netherl.	16.9	1.29	1.34	1.94	3.21	3.46	4.66	5.74	7.25	9.19	11.41	14.48	17.71	29.01
	8.8	1.05	1.09	1.57	2.60	2.80	3.76	4.61	5.80	7.32	9.03	11.38	13.87	22.39
Poland	27.2	1.56	1.64	2.36	3.92	4.23	5.71	7.07	8.96	11.43	14.25	18.16	22.29	36.88
	12.6	1.16	1.21	1.75	2.90	3.12	4.19	5.15	6.49	8.22	10.17	12.86	15.71	25.56
Portugal	18.9	1.34	1.41	2.03	3.36	3.62	4.88	6.02	7.60	9.66	11.99	15.24	18.66	30.64
	9.6	1.07	1.12	1.61	2.66	2.86	3.84	4.72	5.94	7.50	9.26	11.68	14.24	23.03
Romania	16.8	1.28	1.34	1.94	3.21	3.46	4.65	5.73	7.24	9.18	11.39	14.45	17.68	28.96
	8.8	1.05	1.09	1.57	2.60	2.80	3.75	4.61	5.80	7.31	9.02	11.37	13.86	22.37
Slovakia	18.5	1.33	1.39	2.01	3.33	3.59	4.83	5.96	7.54	9.57	11.88	15.09	18.48	30.34
	9.4	1.07	1.11	1.60	2.65	2.85	3.83	4.70	5.91	7.46	9.22	11.62	14.17	22.91
Slovenia	44.3	1.94	2.04	2.96	4.93	5.33	7.21	8.97	11.44	14.68	18.37	23.49	28.89	48.19
	18.8	1.34	1.40	2.02	3.35	3.61	4.86	6.00	7.58	9.63	11.96	15.20	18.61	30.56
Spain	16.9	1.29	1.35	1.94	3.22	3.46	4.66	5.74	7.25	9.20	11.42	14.49	17.73	29.04
	8.8	1.05	1.09	1.57	2.60	2.80	3.76	4.62	5.80	7.32	9.03	11.39	13.88	22.40
Sweden	16.7	1.28	1.34	1.93	3.20	3.45	4.63	5.71	7.21	9.15	11.35	14.40	17.62	28.86
	8.7	1.05	1.09	1.57	2.60	2.79	3.75	4.60	5.79	7.30	9.01	11.35	13.84	22.33
U.K.	13.2	1.18	1.23	1.78	2.95	3.17	4.26	5.25	6.61	8.37	10.36	13.11	16.02	26.10
	7.5	1.01	1.05	1.51	2.50	2.68	3.60	4.42	5.55	7.00	8.63	10.86	13.22	21.26
Mean	17.7	1.31	1.37	1.98	3.28	3.53	4.75	5.86	7.40	9.39	11.65	14.80	18.12	29.71
	9.1	1.06	1.10	1.59	2.63	2.83	3.79	4.66	5.86	7.40	9.13	11.51	14.03	22.66
C.T.T.	**2.0**	**0.83**	**0.85**	**1.23**	**2.04**	**2.19**	**2.93**	**3.59**	**4.49**	**5.64**	**6.91**	**8.61**	**10.43**	**16.44**

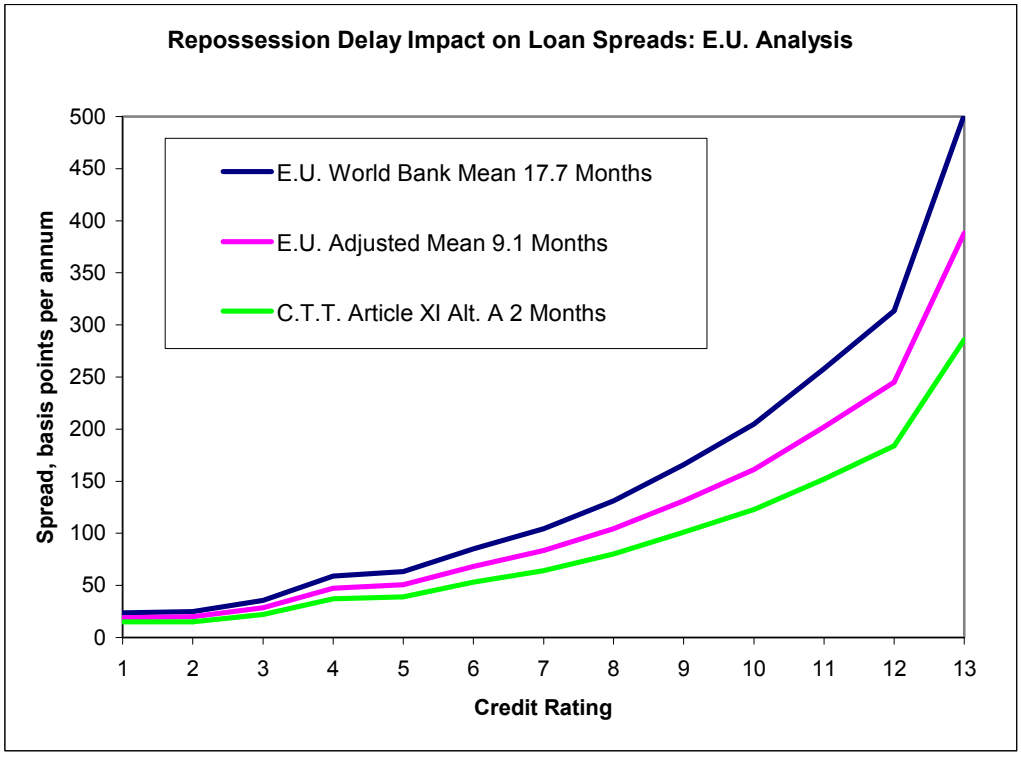

Figure EU.2. Annual spreads assuming mean delays of 2, 9.1, and 17.7 months.

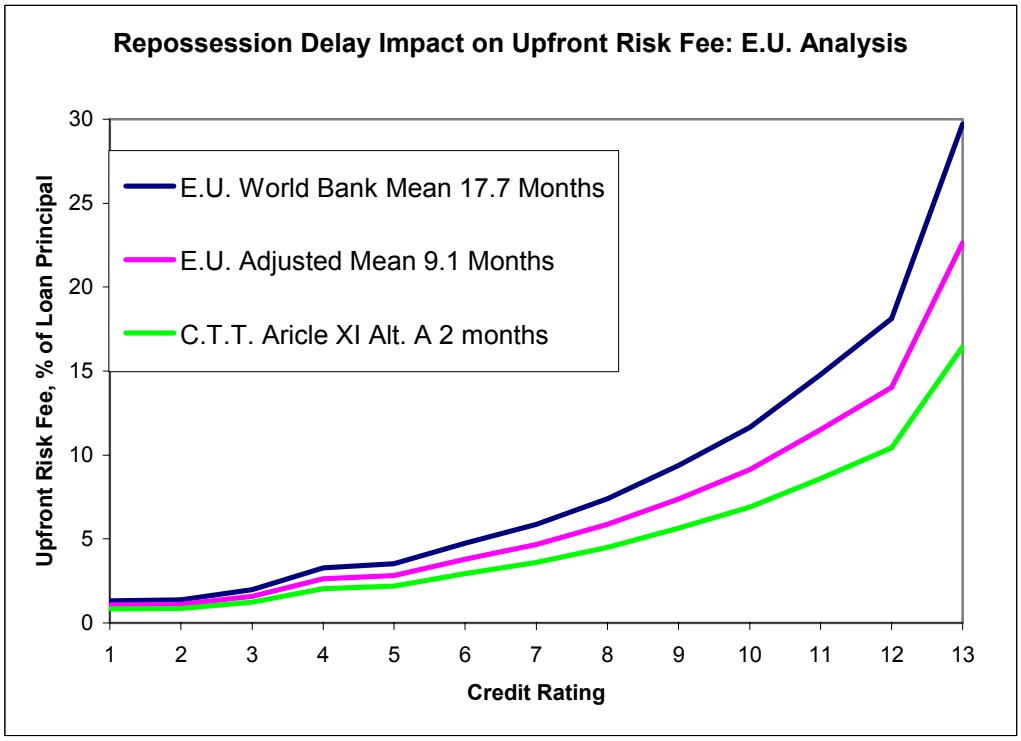

Figure EU.3. Upfront fees assuming mean delays of 2, 9.1 and 17.7 months.