Treatment of Double-Default and Double-Recovery Effects for Hedged Exposures under Pillar I of the Proposed New Basel Capital Accord

A White Paper by the staff of the
Board of Governors of the Federal Reserve System
in support of the forthcoming
Advance Notice of Proposed Rulemaking

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Foreword

The third consultative paper (CP3) on the proposed new Basel Capital Accord (Basel II), issued in late April by the Basel Committee on Banking Supervision, addresses the use of risk mitigants such as guarantees, collateral, and derivatives to reduce regulatory capital charges on risk exposures. The U.S. regulatory agencies will publish an Advance Notice of Proposed Rulemaking (ANPR) in July to seek comment on how they should apply Basel II in the United States. Some U.S. bankers and trade associations have already indicated that they believe that the CP3 proposal does not adequately deal with the reduction in credit risk associated with credit guarantees. They point out that both a borrower and a guarantor would have to default ("double default") for losses to be incurred on a hedged credit exposure. Supervisors, on the other hand, have suggested that providing greater capital relief for exposures hedged using credit guarantees might be imprudent at this time because of risk concentrations among protection providers, limited experience in evaluating the risk-mitigating effects associated with guarantees, and practical constraints on supervisors' ability to properly monitor those banks that make extensive use of credit guarantees.

This Federal Reserve staff White Paper analyzes these issues in an effort to focus the comments of bankers and other interested parties regarding the forthcoming ANPR. It is being released now to provide time for commenters to develop their positions and gather data. Analysis and evidence that addresses the concerns of supervisors would be particularly helpful.

Commenters should feel free to contact directly the principal researcher on this paper, Erik Heitfield, to discuss the paper and the issues raised. To discuss matters specifically related to bank supervision commenters should contact Norah Barger. Their contact information is on the cover page. However, comments on the ANPR should be sent before the end of the comment period to the addresses given in that document.

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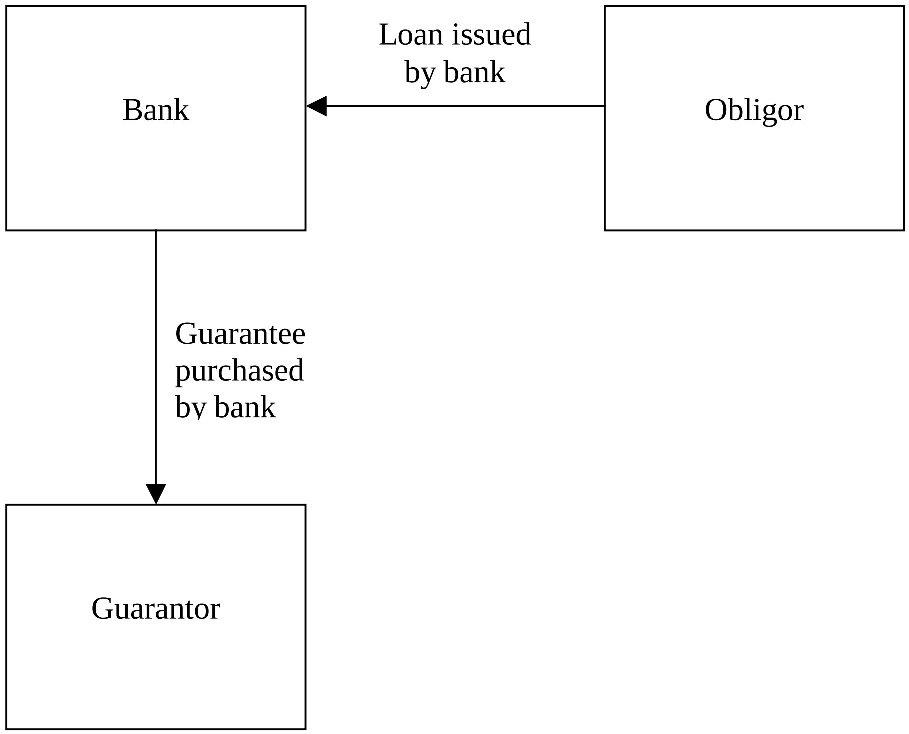
1. Introduction

Under proposed rules for the new Basel capital accord (Basel II), an Advanced Internal-Ratings-Based (A-IRB) bank that purchases credit protection from a qualifying third-party guarantor is permitted to use the probability of default (PD) and loss given default (LGD) associated with the guarantor in assessing regulatory capital charges for the exposure. Some industry representatives have argued that this treatment is too conservative because it fails to account for the fact that *both* an obligor *and* a guarantor must default for a bank to incur a loss on a hedged credit exposure. On the other hand, bank supervisors are concerned that providing greater capital relief under Pillar I for exposures hedged using credit guarantees might be imprudent because of the current state of development of risk management practices and because of practical constraints on supervisors' ability to properly monitor banks that rely heavily on guarantees to mitigate credit risk.

This paper presents staff research on how a more nuanced Pillar I treatment of credit guarantees might be structured. This research is exploratory and should not be taken to represent a firm proposal for modifying the way Basel II handles credit guarantees. It is presented at this early stage with the hope that it will stimulate useful and focused feedback from interested parties. To that end, the document at many points makes explicit requests for comment on topics of particular concern.

Parties can mutually transfer risk through a variety of contractual mechanisms including traditional financial guarantees, credit default swaps, total return swaps, and credit-linked notes. A simple credit guarantee contract is illustrated in figure 1 (next page). Under this arrangement a bank makes a loan to a reference obligor and obtains protection against default losses associated with that loan. In some cases, the obligor pays a guarantor for credit enhancement, which typically is integral to the lending decision. In others, such as with credit default swaps (CDSs), the bank purchases credit protection independently from the borrower. In either case, in exchange for a fee the guarantor agrees to pay the bank principal and interest losses in the event that the reference obligor defaults.

Figure 1: Typical credit guarantee arrangement. Arrows show transfer of credit risk.



Section 2 of this paper examines the theoretical arguments in favor of increasing the amount of capital relief granted under Pillar I for hedged exposures. We see two main benefits from hedging exposures using credit guarantees. First, if a bank hedges the credit risk for an exposure, it will incur losses only if both the reference obligor and the guarantor default simultaneously. In general, the joint probability that both counterparties default together is substantially lower than either counterparty's individual default probability. A simple example illustrates this point. Suppose we flip a fair coin once; the probability that it will come up heads is 50 percent. If we flip two coins, the probability that *both* will come up heads is only 25 percent. Thus, the joint event that both coins show heads is only half as likely as the event that a single coin shows heads. Things become more complicated when we think about the joint event that both an obligor and a guarantor will default because these events may not be independent, but the essential logic is the same. Thus, although the bank may receive a benefit from the fact that the guarantor may have a lower default probability than the obligor, it receives an even greater benefit from the fact that the simultaneous default of both counterparties carries a lower probability than does the separate default of either. The difference between individual and joint default probabilities lies at the core of what has come to be called the “double default” effect.

A second potential benefit from buying credit protection is that if both the reference obligor and the guarantor default the bank may be able to pursue recoveries from both counterparties. Many guarantee arrangements require the bank to give up its claim on the reference obligor in order to collect on the guarantee. Thus, if both the borrower and the guarantor default the bank must choose to pursue claims against one party or the other. However, in a typical CDS contract the bank can retain the right to seek recoveries from the reference obligor while also pursuing recoveries from the protection seller. In this case the protection seller will owe the bank par minus the market value of the defaulted reference obligation. For example, if a bank makes a $100 loan to an obligor and the loan facility has a stress LGD of 50 percent, the bank can expect to recover $50 from that obligor in the event it defaults. Now suppose the bank also purchased a CDS for $100 on a reference asset of the obligor and assume exposures to the protection seller have LGDs of 50 percent. If the guarantor defaults the bank can pursue a claim against it for par less the market value of the reference asset. If the market value of that asset were $50 (that is, the LGD of the asset were the same as the loan facility), the bank would have a $50 claim against the guarantor, of which it would recover $25. Thus, the bank would expect to recover 75 percent of its $100 exposure: 50 percent from the obligor, and half of the remaining 50 percent from the guarantor. For lack of a better term, we will call this ability to collect from two counterparties the "double recovery” effect.

The substitution approach proposed in the Basel Committee's third consultative paper (CP3) incorporates neither double-default nor double-recovery effects (Basel Committee on Banking Supervision, 2003). Their omission is no accident; paragraph 270 of CP3 states that “credit risk mitigation in the form of credit derivatives and guarantees must not reflect the effects of double default.” In comment letters, the International Swaps and Dealers Association (ISDA) argued that excluding double-default effects is excessively conservative, and would discourage banks from using guarantees to mitigate credit risk (ISDA, 2002, 2001).

Section 3 of this paper presents a framework for assessing Pillar I capital charges on hedged exposures that explicitly recognizes both double-default and double-recovery effects. This approach would map PDs and LGDs for obligors and guarantors into capital charges for hedged exposures using a risk-weight formula similar to that currently used to map PDs and LGDs for obligors into A-IRB capital requirements for unhedged exposures. We call this the ASRF approach because it incorporates the same “asymptotic single risk factor” assumptions used to derive Pillar I capital charges for unhedged exposures.

As with the current A-IRB risk-weight functions, the ASRF framework for handling hedged exposures would require that the Basel Committee specify key parameters that describe the extent to which the risks faced by different counterparties are correlated with one another. Very little data is available for the calibration of these parameters, so industry comment on how these parameters should be chosen would be particularly helpful. Section 4 of this paper shows how different assumptions about “wrong way” risk between reference obligors and guarantors and about the exposure of guarantors to systematic risk affect ASRF capital requirements for hedged exposures.

Sections 2 through 4 focus exclusively on the treatment of hedged exposures under Pillar I. However, greater Pillar I recognition for credit guarantees could clearly have important implications for Pillar II, the supervisory component of Basel II. The theoretical justification for recognizing double-default and double-recovery effects could be applied to a broad range of financial transactions with varying degrees of wrong-way risk. Hence, any recognition of these effects would necessarily require that supervisors make judgments about what types of financial transactions would be covered. More generally, supervisors are concerned that in some circumstances a regulatory capital framework that recognized double-default and double-recovery effects could overstate the level of credit protection that guarantees provide. Because credit guarantees are commonly used by banks to reduce concentrations to large counterparties, granting substantial capital relief for hedged exposures under Pillar I could also require a more vigilant accounting of portfolio concentrations risk under Pillar II. These supervisory concerns are discussed in detail in section 5.

Section 6 seeks comment on whether existing markets for credit derivatives and best-practice risk management systems are sufficiently developed to ensure that credit guarantees can supply the degree of risk mitigation that theoretical arguments imply. Though the credit derivatives market has grown rapidly over the last several years, it is still nascent. Only a few dealers are involved in a high proportion of credit derivatives transactions, and the staff is aware of no evidence on the extent to which double-default and double-recovery effects are incorporated into market prices for hedged debt.

The main conclusions of this paper are presented in section 7. We find that when only credit risk is considered, double-default and double-recovery effects can have a significant impact on regulatory capital charges. Explicit recognition of these effects under Pillar I would therefore seem warranted. However, the magnitudes of double-default and double-recovery effects depend on a number of economic drivers about which relatively little data are available. Moreover, fully recognizing these effects would likely lead to significant reductions in Pillar I capital charges for hedged exposures, so the implications of such recognition for other aspects of Basel II need to be carefully evaluated. Section 7 identifies a number of areas where input from industry commenters would be particularly valuable in helping regulators to craft rules for dealing with hedged credit exposures.

2. Double-Default and Double-Recovery Effects

If a bank uses a credit guarantee to hedge the credit risk associated with a loan, it will incur a loss only if both the obligor and the guarantor default at the same time.[1] In general such joint default events are much less likely than individual default events, even when the underlying asset values of the two counterparties are relatively highly correlated. Table 1 (next page) illustrates this point. It reports joint default probabilities

[1] Throughout this analysis "loss" is defined narrowly as the loss associated with a default event. Mark-to-market losses can occur for a hedged exposure when either the guarantor or the reference obligor experiences a decline in credit quality.

for a range of obligor and guarantor PDs under three different assumptions about obligor–guarantor asset correlations.[2]

Table 1: Joint default probabilities under low, medium, and high obligor–guarantor asset-correlation assumptions. All probabilities are expressed in percents.

Asset Correlation (ρ_{og})	Guarantor PD	Obligor PD 0.030	0.100	0.500	1.000	2.000	5.000	10.000	50.000
Low (ρ_{irb})	0.030	0.000	0.000	0.001	0.002	0.003	0.005	0.008	0.022
	0.100	0.000	0.001	0.003	0.005	0.008	0.014	0.023	0.072
	0.500	0.001	0.003	00.11	0.019	0.031	0.060	0.102	0.340
	1.000	0.002	0.005	0.019	0.033	0.055	0.108	0.188	0.659
Medium (0.50)	0.030	0.001	0.002	0.006	0.009	0.012	0.018	0.022	0.030
	0.100	0.002	0.005	0.015	0.023	0.034	0.052	0.068	0.097
	0.500	0.006	0.015	0.050	0.079	0.122	0.205	0.287	0.475
	1.000	0.009	0.023	0.079	0.129	0.206	0.361	0.523	0.935
High (0.75)	0.030	0.005	0.009	0.018	0.022	0.026	0.028	0.030	0.030
	0.100	0,009	0.021	0.047	0.061	0.075	0.090	0.097	0.100
	0.500	0.018	0.047	0.139	0.204	0.281	0.387	0.450	0.500
	1.000	0.022	0.061	0.204	0.317	0.465	0.691	0.848	0.998

The “low” asset-correlation case assumes that the correlation between the assets of the obligor and those of the guarantor is equal to the assumed asset correlation used in the A-IRB C&I risk-weight function proposed in CP3 (paragraph 242). This asset correlation ranges from 12 percent for high-PD obligors, to 24 percent for low-PD obligors. Throughout this paper, we use ρ_{irb} to denote the C&I asset-correlation function given in CP3.[3]

Increasing the correlation between the assets of the obligor and the assets of the guarantor has the effect of increasing the two counterparties' joint default probability.

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[2] In the asymptotic-single-risk-factor framework that serves as the foundation for the Basel II risk weight functions, there is a one-to-one relationship between asset correlations and default correlations. Asset correlations are a more natural metric for measuring dependencies in obligor credit quality because assets can take on a continuum of values, whereas defaults are discrete events. Thus, in keeping with previous research, this analysis uses asset correlations to model cross-obligor dependencies, rather than modeling default correlations directly.

[3] The CP3 asset correlation function r(PD) is only strictly defined for a single counterparty. In this analysis when referring to obligor-guarantor asset correlations, we use $\rho_{irb} = [r(PD_o)r(PD_g)]^{1/2}$ where PD_o is the PD of the obligor and PD_g is the PD of the guarantor.

This effect can be seen by comparing the joint default probabilities reported for the “low” obligor–guarantor asset-correlation case with those reported for the “medium” and “high” cases, which assume asset correlations of 50 percent and 75 percent respectively. Even in the case of high asset correlation the joint default probabilities are generally much lower than either counterparty's marginal default probability. However, double-default effects are attenuated when the asset correlation and the obligor PD are both relatively high.

An extreme case, not shown in the table, occurs when the obligor–guarantor asset correlation is equal to 100 percent so that the assets of the two counterparties move in lock-step with one another. Perfect asset correlation implies that whenever the lower PD counterparty defaults, the higher PD counterparty defaults as well. In this situation the joint default probability is simply equal to the minimum of the two counterparties' marginal default probabilities. This is the assumption implicit in the substitution approach to assessing capital for hedged exposures proposed in CP3.

Depending on the particularities of the contract, a credit guarantee may lead to lower losses in the event that both the obligor and the guarantor default. Such “double recovery” effects arise in circumstances where a lender has legal recourse to pursue recoveries from both a reference obligor and a guarantor. In theory, in these cases the loss given default (LGD) for a hedged exposure should be equal to the product of the stress LGDs for comparable unhedged exposures to the reference obligor and the protection seller. It is important to recognize, however, that double-recovery effects are not a feature of all credit guarantee arrangements since many contracts specify that legal claims against the reference obligor transfer to the guarantor in the event that the obligor defaults. Further, the extent to which double recoveries can be viewed as simply multiplicative is affected by many factors, including differences between the hedged loan and the reference asset and differences between creditor and market expectations regarding the value of a claim against the reference obligor. As an analytical matter, one can abstract from double-recovery effects by assuming that the LGD associated with one of the two counterparties is 100 percent.[4]

[4] LGDs are associated with facilities, not obligors. In this analysis we use the term “obligor LGD” to refer to the loss given default for an unhedged exposure to the reference obligor. The term “guarantor LGD” refers to the loss given default associated with an unhedged exposure to the protection provider.

Under the substitution approach proposed in CP3, the lowest risk weight that can be used for a hedged exposure is the lesser of the risk weights associated with unhedged exposures to the reference obligor and the guarantor. In other words, a bank would be allowed to calculate capital for a hedged exposure by using either the PD and LGD of the guarantor or the PD and LGD of the obligor in the CP3 risk-weight function for unhedged exposures. As is shown in the appendix, this algorithm is consistent with Basel II's capital treatment for unhedged exposures if one assumes that (1) the assets of the obligor and the guarantor are perfectly correlated, and (2) the LGD of the higher PD counterparty is 100 percent. Thus, it does not recognize either double-default or double-recovery effects.

Table 2 (below) reports capital charges derived from the substitution approach. All capital calculations presented in this paper assume a one-year maturity loan and an obligor LGD of 45 percent. Capital charges are expressed as percentages of the loan exposure at default and are reported for a range of obligor and guarantor PDs. Two guarantor LGD parameters are considered: 100 percent and 45 percent. The former abstracts from possible double-recovery effects; the latter permits very substantial double-recovery effects in those capital models that recognize them.

Table 2: Substitution approach capital charges. Shading indicates that the substitution approach produces no reduction in regulatory capital.

Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.62	1.38	1.38	1.38	1.38	1.38	1.38	1.38
	0.10	0.62	1.54	3.42	3.42	3.42	3.42	3.42	3.42
	0.50	0.62	1.54	4.40	6.31	8.56	9.77	9.77	9.77
	1.00	0.62	1.54	4.40	6.31	8.56	12.80	14.03	14.03
45	0.03	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
	0.10	0.62	1.54	1.54	1.54	1.54	1.54	1.54	1.54
	0.50	0.62	1.54	4.40	4.40	4.40	4.40	4.40	4.40
	1.00	0.62	1.54	4.40	6.31	6.31	6.31	6.31	6.31

In table 2 shaded cells indicate PD/LGD combinations for which the substitution approach generates exactly the same capital charge as that that would be applied to an unhedged exposure. Stated differently, in the shaded cells a bank would choose to use the risk weight for an exposure to the reference obligor, not the risk weight for an exposure to the guarantor. The substitution approach provides no capital relief when the PD of the guarantor is greater than or equal to that of the reference obligors. As can be seen in the first four rows of table 2, when the LGD of the guarantor is high the substitution approach provides capital relief for a smaller range of obligor and guarantor PDs. The absence of any capital relief for hedging certain exposures is a sharp contrast to the current capital rules (Basel I). Under Basel I, the substitution approach yields substantial capital relief for all non-financial obligors, regardless of PD.[5]

The substitution approach has been criticized by some bankers and derivatives dealers because it does not recognize double-default effects. Though the credit derivatives market has grown rapidly in recent years, they argue that failing to recognize double-default effects could hinder future growth by discouraging banks from using guarantees to hedge credit risk. They also assert that the substitution approach runs counter to the Basel Committee's stated objective of aligning regulatory and economic capital requirements. To deal with double-default effects, ISDA has proposed that a "haircut" be applied to the smaller of the obligor and guarantor PDs and that this "shaved" PD be used in calculating capital for hedged exposures (ISDA, 2001). Table 3 (next page) reports capital charges derived from ISDA's PD haircut approach.[6] Comparing tables 3 and 2 shows that, relative to the substitution approach, ISDA's PD haircut approach would lead to roughly a one-third reduction in regulatory capital charges.

[5] Under Basel I rules, an exposure with an associated guarantee generally receives a risk weight of 20 percent rather than 100 percent.

[6] ISDA's proposal is not explicit concerning whether obligor or guarantor LGD parameters should be used in calculating regulatory capital charges. The charges reported in table 2 were derived by first applying ISDA's proposed PD haircut to the PDs of the reference obligor and the guarantor and then calculating capital charges for unhedged exposures to both counterparties. The lesser of these two capital charges is reported.

Table 3: ISDA "haircut" capital charges.

Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.35	1.04	1.04	1.04	1.04	1.04	1.04	1.04
	0.10	0.47	0.91	2.01	2.01	2.01	2.01	2.01	2.01
	0.50	0.47	0.91	2.70	3.93	5.40	5.99	5.99	5.99
	1.00	0.47	0.91	2.70	3.93	5.40	8.19	8.74	8.74
45	0.03	0.35	0.47	0.47	0.47	0.47	0.47	0.47	0.47
	0.10	0.47	0.91	0.91	0.91	0.91	0.91	0.91	0.91
	0.50	0.47	0.91	2.70	2.70	2.70	2.70	2.70	2.70
	1.00	0.47	0.91	2.70	3.93	3.93	3.93	3.93	3.93

ISDA's proposed approach is a simple and intuitive way to retain an incentive in favor of hedging credit risk in Basel II. However, ISDA's ad hoc approach is analytically inconsistent with the framework underlying Basel II's treatment of credit risk for unhedged exposures, which sets capital on individual exposures to achieve a portfolio-wide solvency target. Section 3 of this paper describes an analytical approach to incorporating double-default and double-recovery effects derived from the same single risk factor Merton model used to derive capital charges for unhedged exposures under Pillar I. As we shall see, this more rigorous approach can produce capital charges that look different from those generated by either the substitution approach or ISDA's haircut approach.

3. An ASRF Capital Model for Hedged Exposures

Under the Asymptotic-Single-Risk-Factor (ASRF) framework that serves as the theoretical foundation for A-IRB capital requirements, the capital charge for an individual exposure is derived by calculating its conditional expected loss function, given an adverse draw of a single systematic risk factor. The systematic risk factor captures the macroeconomic component of credit risk that drives correlations in defaults across exposures. Gordy (2002) shows that under particular assumptions, the ASRF framework yields capital charges that will satisfy a portfolio-level solvency target.

To apply the ASRF framework to a hedged exposure, one must calculate the conditional probability that both the obligor and the guarantor default, given a realization of the systematic risk factor. This is quite a different calculation from the PD haircut approach proposed by ISDA that was discussed in section 2 of this paper. The appendix shows how a Merton-style credit risk model similar to that underlying the A-IRB risk-weight functions for unhedged exposures can be used to derive conditional joint default probabilities for hedged exposures. This model generalizes the one-factor Merton model by introducing a separate risk factor that affects only the obligor and the guarantor. Because this extra risk factor does not influence other exposures in the bank portfolio, it does not violate the ASRF assumptions.[7] However, it allows for the possibility that an obligor and guarantor may have more in common than a corresponding pair of unrelated obligors.

The advanced IRB risk-weight function for an unhedged exposure depends on an obligor's PD, an LGD, and an asset-correlation parameter. The asset-correlation parameter measures the importance of systematic risk in determining whether the obligor will default. Since regulatory capital is held to cover those unexpected portfolio losses that arise when obligors default in clusters, all else equal, the higher an obligor's asset correlation the higher will be its regulatory capital charge. When calculating capital charges for hedged exposures one must account for the risks facing both an obligor and a guarantor. As a result, the ASRF capital formula for hedged exposures is a bit more complicated than the A-IRB risk-weight function. It requires that one specify multiple asset-correlation parameters, and it depends on the PDs and LGDs associated with both counterparties.

ASRF capital charges for hedged exposures are sensitive to three separate asset-correlation parameters. The first parameter, ρ_o, measures the exposure of the reference obligor to the systematic risk factor. It has exactly the same economic interpretation as the asset-correlation parameter that appears in the C&I risk-weight function. It seems reasonable to assume that the risk characteristics of hedged counterparties are no different from those of unhedged counterparties, so the calibrations presented here use the CP3 C&I asset-correlation formula to calculate ρ_o.

[7] See Pykhtin and Dev (2002) for a similar application to ASRF capital charges for loan-backed securities.

The second correlation parameter, ρ_g, measures the exposure of the guarantor to systematic risk. While it is tempting to assume that ρ_o and ρ_g are the same, there are reasons to believe that the sellers of credit protection may tend to have greater exposure to systematic risk than typical corporate obligors. For example, greater diversification tends to lower a firm's overall risk of default, but increases the proportion of that risk that is systematic. Thus if credit guarantees are commonly sold by large, well-diversified financial institutions we might expect guarantors to have a greater sensitivity to systematic risk than is typical for most corporate obligors. The model derived in the appendix is flexible enough to allow for differences in obligor and guarantor asset-correlation assumptions.

The third correlation parameter, ρ_{og}, measures the correlation between the assets of the obligor and those of the guarantor. This is the same asset-correlation parameter discussed in section 2. It measures the extent to which the obligor and the guarantor face the same sources of credit risk. Because both counterparties are exposed to the same systematic risk factor, there will always be some correlation between their asset values.[8] However, the model derived in the appendix allows for the possibility of "extra" correlation above and beyond that induced by systematic risk. Such extra correlation is often referred to as "wrong way" risk.[9]

For a baseline case, we first consider the capital charges that arise when guarantors are assumed to have the same exposure to systematic risk as other corporate obligors, and there is no "extra" correlation between the assets of obligors and guarantors. The base case capital charges for a range of obligor and guarantor PDs and high and low guarantor LGDs are reported in table 4 (next page). As mentioned earlier, all capital calibrations assume a one-year-maturity loan and an obligor LGD of 45 percent. The first four rows of table 4 report capital charges under a 100 percent guarantor LGD assumption which implies no double-recovery effects. Comparing these charges with those in the first four rows of table 2 reveals that even when double-

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[8] When systematic risk is the only driver of correlation between the assets of the obligor and the guarantor ρ_{og} is equal to the geometric mean of ρ_o and ρ_g. That is, $\rho_{og} = (\rho_o\rho_g)^{1/2}$.

[9] Note that the model explicitly accommodates wrong-way risk in default but not recoveries. In keeping with the CP3 proposed capital treatment for unhedged exposures, all uncertainty associated with recoveries are handled implicitly in the definition of the LGD parameters.

recovery effects are not present, recognizing double-default effects can have a vary large impact. For low PD obligors the ASRF capital charges can be orders of magnitude lower than the substitution approach capital charges. The dramatic differences in capital charges produced by the substitution and ASRF approaches can also be seen in the top panel of figure 2 (page 14), which compares ASRF, ISDA haircut, substitution approach, and unhedged capital charges given a guarantor with a PD of 1 percent and an LGD of 100 percent.

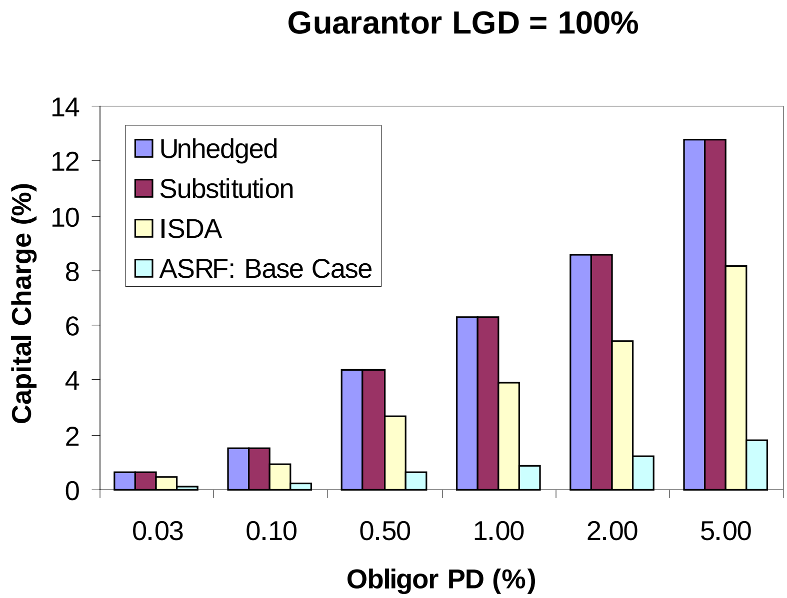
When a 45 percent guarantor LGD assumption is combined with the 45 percent obligor LGD assumption to produce an overall LGD of 20.25 percent for a hedged exposure, double-recovery effects interact with double-default effects to generate an even larger gap between ASRF and substitution approach capital charges. This can be seen by comparing the last four rows of tables 4 and 2 and by examining the bottom panel of figure 2. Both obligor and guarantor LGD parameters enter the ASRF capital formula in a multiplicative manner, so lowering the guarantor LGD parameter has the effect of reducing the resulting regulatory capital charges by a proportional amount.

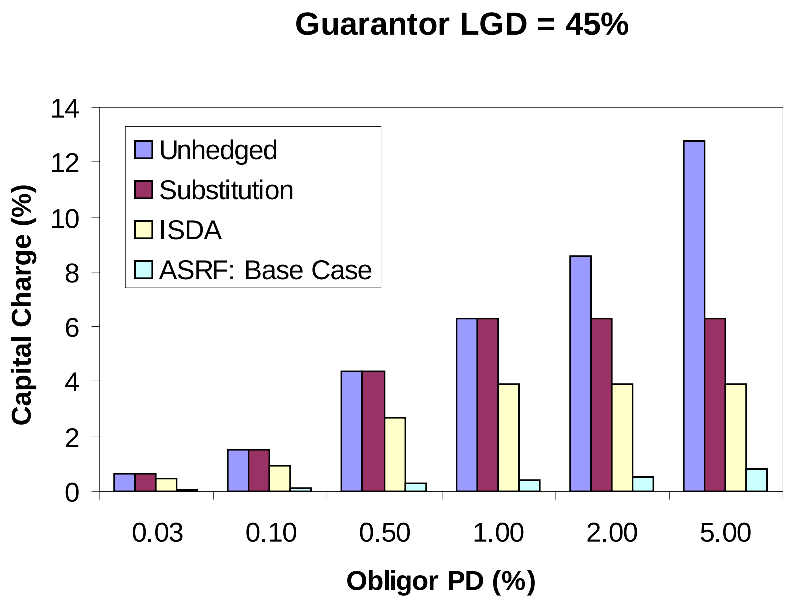
The advanced IRB risk-weight functions for unhedged exposures require banks to provide PDs and LGDs, but relies on "hard wired" asset-correlation parameters. To make use of the ASRF formula for hedged exposures, the Basel Committee would need to set values for guarantor asset correlation and obligor–guarantor asset-correlation parameters, just as they have already done for obligor asset correlations. The next section shows how ASRF capital charges are affected by varying assumptions about ρ_g and ρ_{og}.

Table 4: ASRF capital charged given $\rho_g = \rho_{irb}$ and $\rho_{og} = (\rho_o\rho_g)^{1/2}$ (no wrong-way risk).

Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.01	0.02	0.06	0.09	0.12	0.18	0.26	0.54
	0.10	0.02	0.05	0.15	0.22	0.29	0.44	0.63	1.34
	0.50	0.06	0.15	0.43	0.62	0.84	1.25	1.81	3.84
	1.00	0.09	0.22	0.62	0.89	1.20	1.80	2.60	5.51
45	0.03	0.00	0.01	0.03	0.04	0.05	0.08	0.12	0.24
	0.10	0.01	0.02	0.07	0.10	0.13	0.20	0.29	0.60
	0.50	0.03	0.07	0.19	0.28	0.38	0.56	0.82	1.73
	1.00	0.04	0.10	0.28	0.40	0.54	0.81	1.17	2.48

Figure 2: Capital charges for hedged exposures under the substitution approach, ISDA's PD haircut approach, and the ASRF approach. All capital charges assume a 1 percent guarantor PD and a 45 percent obligor LGD.





4. Asset Correlations and ASRF Capital Charges

ASRF capital charges are sensitive to assumptions about the exposure of guarantors to systematic risk as well as assumptions about co-movements in the credit quality of obligors and guarantors. This section examines the effects of obligor and obligor–guarantor asset-correlation parameters on capital requirements for hedged exposures.

Sensitivity to ρ_g

According to Fitch, Inc. (2003), credit guarantees are most commonly sold by large banks and insurance companies. These types of institutions tend to do a good job diversifying away idiosyncratic risk, so we might expect protection sellers to have low overall risk (low PDs) but relatively high exposure to systematic risk (high ρ_g).

Tables 5 and 6 (page 17) report capital charges for the same obligor–guarantor asset-correlation parameter assumptions used in the base case, but with guarantor asset-correlation parameters of 50 percent and 75 percent.[10] Figure 3 (page 18) shows the effect on capital of increasing the value of ρ_g when the guarantor has a one percent default probability. As can be seen from the tables and the figure, capital charges are quite sensitive to ρ_g. Increasing the value of this parameter greatly increases the resulting capital charges. Comparing tables 5 and 6 with table 2 shows that capital charges are generally significantly lower than those generated by the substitution approach even when the guarantor asset correlation is high. However, when ρ_g and the obligor PD are both relatively high, ASRF capital charges may exceed those generated by the substitution approach.

To understand how the substitution approach can understate capital charges, it is helpful to think about what happens in the limiting case in which the obligor's PD and LGD are both 100 percent. In this setting, all payments to the bank come from the guarantor, so the ASRF capital charge is equal to the A-IRB capital charge given the

[10] If we assume that systematic risk is the only driver of correlation between an obligor and a guarantor (i.e. there is no wrong-way risk), then increasing the value of ρ_g has the effect of increasing ρ_{og} (see footnote 8). For this reason, when the obligor asset correlation is 0.50 and there is no wrong-way risk, the obligor-guarantor asset correlation ranges from 0.24 to 0.35 depending on the obligor PD. When the obligor asset correlation is 0.75 the obligor-guarantor asset correlation ranges from 0.30 to 0.42.

guarantor's PD, LGD, and asset correlation. In contrast, the substitution approach calculates capital using the guarantor's PD and LGD but the CP3 asset-correlation formula. Thus, if the guarantor asset correlation exceeds ρ_{irb}, ASRF capital charges will be larger than substitution approach capital charges. More generally, ASRF capital charges will tend to exceed those generated by the substitution approach when $\rho_g > \rho_{irb}$ and the obligor's PD and LGD are high.

We seek comment on the appropriate value for the guarantor asset-correlation parameter. Should the CP3 asset-correlation function be used so that guarantors are assumed to have the same exposure to systematic risk as obligors? Or should this parameter be set more conservatively to reflect the possibility that guarantors tend to have greater exposure to systematic risk? What data can be used to calibrate this parameter?

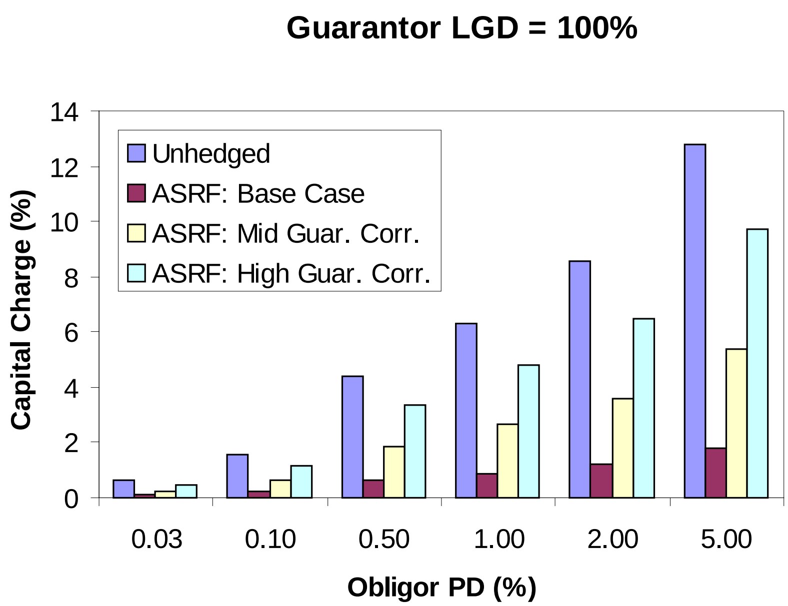
Table 5: ASRF capital charges given $\rho_g = 0.50$ and $\rho_{og} = (\rho_o \rho_g)^{1/2}$ (no wrong-way risk).

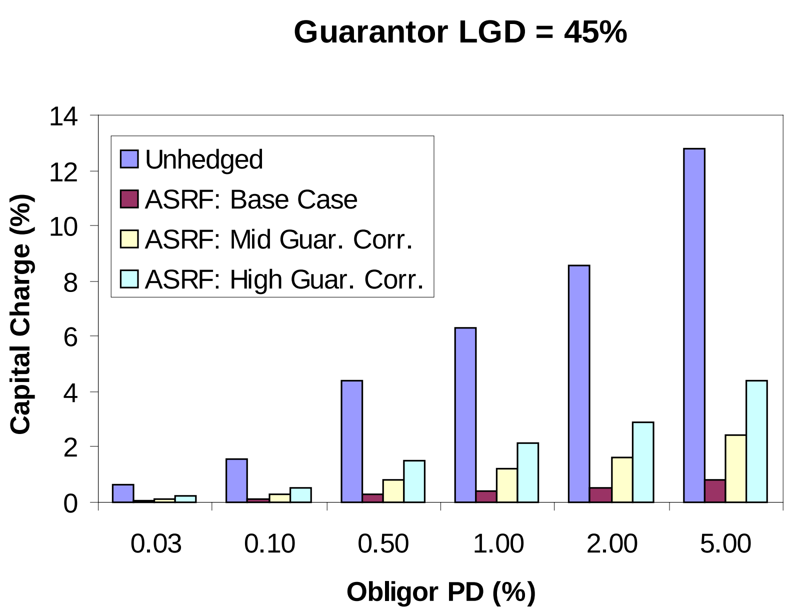
Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.02	0.06	0.17	0.25	0.33	0.50	0.72	1.53
	0.10	0.06	0.15	0.44	0.63	0.86	1.28	1.86	3.94
	0.50	0.18	0.45	1.28	1.83	2.49	3.72	5.39	11.41
	1.00	0.26	0.65	1.85	2.66	3.60	5.39	7.81	16.53
45	0.03	0.01	0.03	0.08	0.11	0.15	0.22	0.33	0.69
	0.10	0.03	0.07	0.20	0.28	0.39	0.58	0.84	1.77
	0.50	0.08	0.20	0.57	0.82	1.12	1.67	2.42	5.13
	1.00	0.12	0.29	0.83	1.20	1.62	2.42	3.51	7.44

Table 6: ASRF capital charges given $\rho_g = 0.75$ and $\rho_{og} = (\rho_o \rho_g)^{1/2}$ (no wrong-way risk).

Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.04	0.10	0.29	0.41	0.56	0.84	1.21	2.57
	0.10	0.13	0.31	0.90	1.29	1.75	2.61	3.78	8.01
	0.50	0.36	0.89	2.55	3.66	4.96	7.42	10.76	22.77
	1.00	0.47	1.17	3.33	4.78	6.49	9.70	14.07	29.78
45	0.03	0.02	0.05	0.13	0.19	0.25	0.38	0.55	1.16
	0.10	0.06	0.14	0.40	0.58	0.79	1.17	1.70	3.60
	0.50	0.16	0.40	1.15	1.65	2.23	3.34	4.84	10.25
	1.00	0.21	0.52	1.50	2.15	2.92	4.37	6.33	13.40

Figure 3: ASRF capital charges for hedged exposures under base case ($\rho_g = \rho_{irb}$), mid ($\rho_g = 0.50$), and high ($\rho_g = 0.75$) guarantor asset-correlation assumptions. All capital charges assume a 1 percent guarantor PD and a 45 percent obligor LGD.





Sensitivity to ρ_{og}

The base case assumes that the only source of common risk between a reference obligor and a guarantor is the systematic risk factor that affects all obligors. In fact, however, it is possible that guarantors and obligors may tend to have more in common than unrelated obligors. Protection sellers may specialize in covering risks in particular industries or regions, or they may have financial dealings with the obligors whose risks they guarantee. In such cases, the obligor–guarantor asset correlation ρ_{og} would be higher than assumed in the base case. All else equal, higher obligor–guarantor asset correlations make joint default more likely so capital charges can be expected to increase with ρ_{og}.

Tables 7 and 8 (next page) and figure 4 (page 21) show the effects of increasing the obligor–guarantor asset-correlation assumption on regulatory capital charges. While capital charges are clearly increasing in ρ_{og}, comparing tables 7 and 8 with tables 5 and 6 reveals that they are much more sensitive to ρ_g.

The ASRF capital formula for hedged exposures is more complex than other Basel II risk-weight formulas. This complexity flows from the need to model wrong-way risk between the guarantor and the obligor. As is shown in the appendix (equation (4)), if we assume that there is no wrong-way risk then the ASRF capital formula becomes much simpler. In this setting, the risk weight for a hedged exposure is calculated by simply taking the product of the risk weights that would be applied for unhedged exposures to the guarantor and the obligor.

We seek comment on the appropriate value for the obligor–guarantor asset-correlation parameter. Is wrong-way risk an important concern for most hedged credit transactions? If so, is dealing with it under Pillar I worth the added complexity? What data can be used to calibrate the obligor–guarantor asset-correlation parameter?

Table 7: ASRF capital charges given $\rho_g = \rho_{irb}$ and $\rho_{og} = 0.50$.

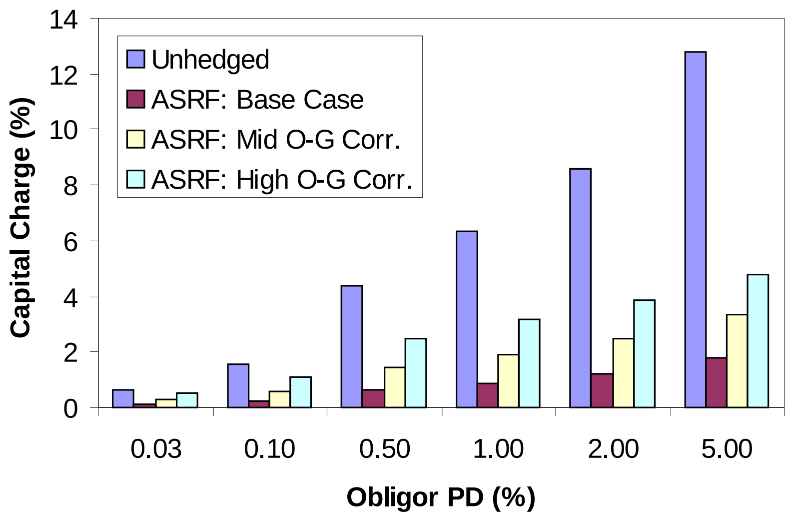
Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.05	0.10	0.21	0.27	0.33	0.42	0.50	0.61
	0.10	0.10	0.20	0.46	0.60	0.75	0.97	1.18	1.52
	0.50	0.21	0.46	1.08	1.44	1.83	2.46	3.10	4.40
	1.00	0.27	0.60	1.44	1.93	2.48	3.36	4.29	6.15
45	0.03	0.02	0.04	0.09	0.12	0.15	0.19	0.23	0.28
	0.10	0.04	0.09	0.20	0.27	0.34	0.44	0.53	0.68
	0.50	0.09	0.20	0.48	0.65	0.82	1.11	1.39	1.94
	1.00	0.12	0.27	0.65	0.87	1.12	1.51	1.93	2.77

Table 8: ASRF capital charges given $\rho_g = \rho_{irb}$ and $\rho_{og} = 0.75$.

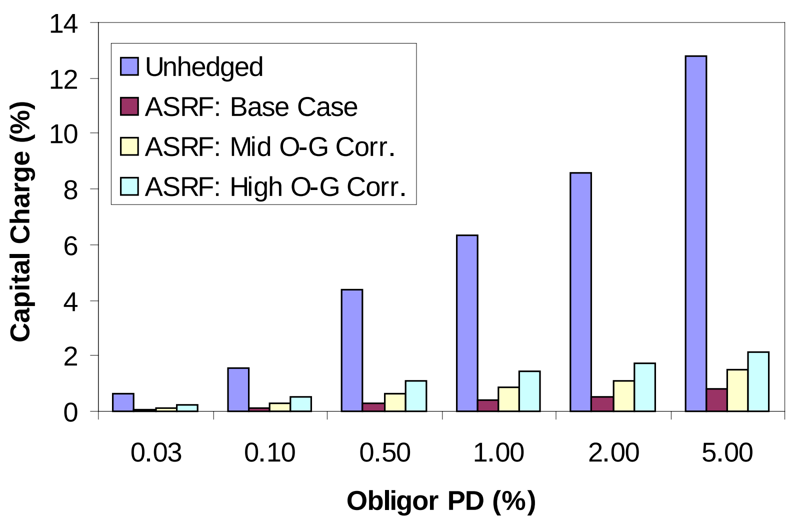
Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.16	0.28	0.44	0.50	0.55	0.59	0.61	0.62
	0.10	0.28	0.51	0.93	1.10	1.24	1.40	1.49	1.54
	0.50	0.44	0.93	1.98	2.48	2.95	3.57	4.02	4.40
	1.00	0.50	1.10	2.48	3.18	3.86	4.81	5.57	6.30
45	0.03	0.07	0.12	0.20	0.23	0.25	0.27	0.27	0.28
	0.10	0.12	0.23	0.42	0.49	0.56	0.63	0.67	0.69
	0.50	0.20	0.42	0.89	1.12	1.33	1.61	1.81	1.98
	1.00	0.23	0.49	1.12	1.43	1.74	2.16	2.51	2.84

Figure 4: ASRF capital charges for hedged exposures under base case ($\rho_{og} = \rho_{irb}$), mid ($\rho_{og} = 0.50$), and high ($\rho_{og} = 0.75$) obligor–guarantor asset-correlation assumptions. All capital charges assume a 1 percent guarantor PD and a 45 percent obligor LGD.

Guarantor LGD = 100%



Guarantor LGD = 45%



5. Supervisory Concerns

Full recognition of double-default and double-recovery effects under Pillar I could have important implications for the supervision of banks under Pillar II. This section discusses and seeks comment on these supervisory issues.

Excessive Concentration to Hedged Counterparties

One of the main reasons banks use credit guarantees is to reduce credit risks to obligors with whom they have exceptionally large exposures. In some cases, guarantees enable banks to make credit extensions that exceed in-house single-borrower limits. However, Pillar I capital charges are intended to cover the credit risk of a well-diversified loan portfolio; they do not cover the additional risk that would arise if a bank's exposures were concentrated among a relatively small number of counterparties.

An ideal regulatory capital framework would capture concentration risk (that is, risk arising from a lack of granularity in a bank's portfolio) in addition to credit risk arising from systematic shocks. The Basel Committee is well aware of the risks associated with lack of granularity. The Committee in fact proposed a so-called "granularity adjustment" in the second consultative paper (CP2), which was subsequently abandoned because of its complexity and because its effects on capital charges were not believed to be of material importance for large, internationally active banks. As a result, under the current Basel II proposal, concentration risk is not explicitly addressed under Pillar I but rather is dealt with as a supervisory matter under Pillar II. Under Pillar II, an A-IRB bank that does not have a loan portfolio that is well diversified across geographic areas, across industries, and across names can be required to hold a larger capital buffer in excess of Pillar I minimums than a more diversified institution.

A potential side effect of granting substantial capital relief for credit guarantees under Pillar I is that supervisors would need to more closely monitor bank portfolio concentrations for Pillar II purposes. In principle, a credit guarantee can reduce both the systematic component of credit risk covered under Pillar I and the idiosyncratic risk arising from poor portfolio diversification covered under Pillar II. In practice, supervisors have no reliable means of quantifying the latter effect. If double-default and double-recovery effects are not recognized under Pillar I then supervisors are reasonably comfortable with the view that for purposes of identifying portfolio credit risk concentrations, a hedged exposure can be treated as an exposure to the guarantor. This view may well overstate the concentration-risk-mitigating effects of credit guarantees for large exposures, but conservatism in the treatment of hedged exposures under Pillar I permits supervisors a measure of flexibility in dealing with them under Pillar II. On the other hand, if substantial capital relief were to be granted for hedged exposures under Pillar I, a more accurate assessment of the effects of credit guarantees on concentration risk would be warranted. No consensus exists among supervisors or within the banking industry regarding how concentration risk should be measured, let alone how it should translate into regulatory capital requirements.

Furthermore, the market for credit derivatives is currently dominated by a relatively small number of dealers (see section 6). Given that granting substantial capital relief for guarantees under Pillar I would likely encourage banks to make more intensive use of credit derivatives, supervisors are concerned that without effective systems for monitoring both single-name and industry portfolio concentrations, banks might tend to substitute concentrations to individual large obligors with concentrations to the derivatives-dealer industry.

Comments are solicited concerning whether recognizing double-default and double-recovery effects is appropriate in the context of the "well diversified" assumption underlying Basel II's Pillar I. Comment is also sought on how banks' internal management systems currently deal with double-default and double-recovery effects for both internal credit risk rating and the management of exposure limits and how banks envision the future evolution of these systems. Supervisors are also interested in industry views on ways to assess exposure concentrations in the event that double-default and double-recovery effects are recognized under Pillar I.

Scope of Application

Much of the discussion relating to double-default effects in this paper focuses implicitly or explicitly on credit protection provided in arms-length transactions by third parties such as derivatives dealers. It is important to recognize, however, that, in theory, double-default and double-recovery effects could arise in a broad range of common financial transactions including, for example, two-name paper, bankers' acceptances, and mortgages carrying private mortgage insurance. Any concrete proposal for providing capital relief in recognition of double-default and double-recovery effects must therefore set standards for the types of financial transactions that would be covered. A guiding principle for such standards should be identifying and carving out those transactions involving excessive wrong-way risk.

In the context of credit guarantees, wrong-way risk refers to a situation in which risks to the reference obligor are highly correlated with those to the protection provider. Wrong-way risk manifested itself during the Russian debt crisis because U.S. banks had hedged their credit exposure to Russian companies with Russian banks. As the companies deteriorated, so did the banks, and the value of the hedges were nearly worthless. Different types of guaranteed transactions clearly involve different degrees of wrong-way risk. For example, wrong-way risk is probably particularly significant for the two-name paper contracts that large companies frequently use to guarantee loans to their suppliers.

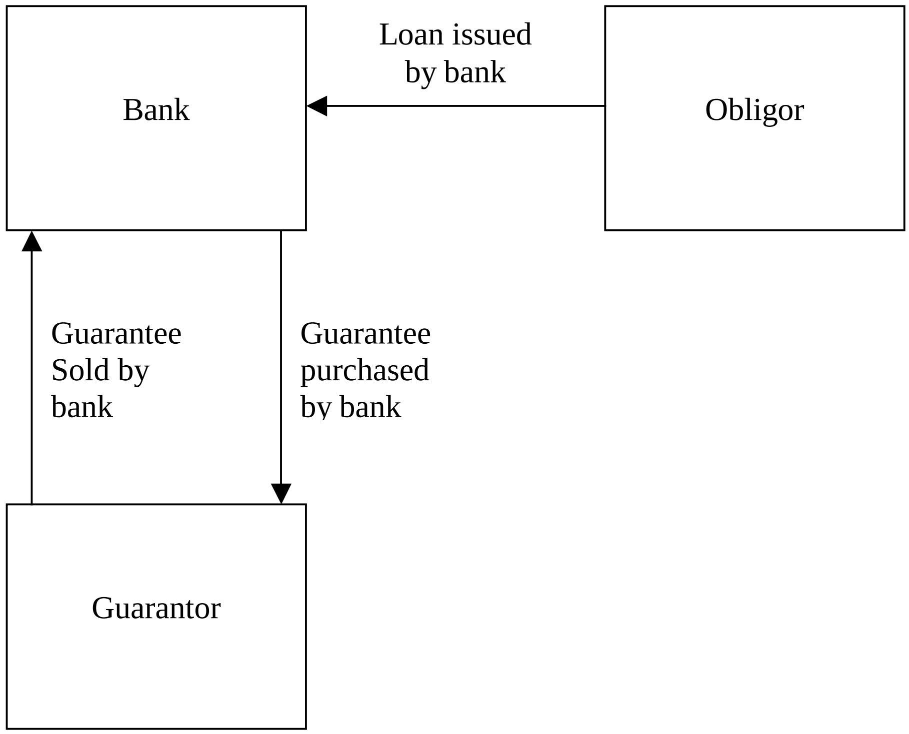
As demonstrated in section 2, wrong-way risk attenuates the benefits of double-default and double-recovery effects. In principle, the ASRF model developed in sections 3 and 4 can capture wrong-way risk through the obligor–guarantor asset-correlation parameter (ρ_{og}). In practice, however, banks are unlikely to be able to provide estimates for this parameter that could be validated by supervisors. For this reason, implementing something akin to the ASRF approach to recognizing double-default effects would almost certainly require that an obligor–guarantor correlation parameter be "hard wired" to reflect the average level of wrong-way risk for hedged transactions. Such an approach could seriously understate the regulatory capital needed to cover credit risk for transactions that involve an exceptionally high degree of wrong-way risk.

Thus, if double-default effects were recognized, the Basel Committee would need to find a way to identify and carve out wrong-way trades that should not be eligible for capital relief beyond the substitution approach. In addition, the Committee would need to ensure that it did not create an incentive for banks to purchase relatively cheap credit derivatives from protection providers whose risks are highly correlated with those of reference obligors. The staff would like interested parties to comment on what types of financial transactions they believe should be eligible for capital relief associated with double-default effects, and what types of transactions should be excluded. Comments should focus on identifying those types of financial transactions for which excessive wrong-way risk is a particular concern.

More generally, staff is interested in industry views on how best to incorporate wrong-way risk into a regulatory capital approach that recognizes double-default effects. Could this be done within a Pillar I framework or should identification of wrong-way risk be addressed under Pillar II? Supervisors have concerns with a purely Pillar II based treatment, as the volume of loans guaranteed by parties with a relationship to the reference obligor could be very large. Ensuring that banks do not receive capital recognition for double-default effects on transactions that entail significant wrong-way risk could potentially require a level of supervisory scrutiny that might not be practical.

An additional issue involves the effect that recognition of double-default and double-recovery effects may have on incentives for shifting exposures from the banking book to the trading book and the potential for such shifts to give rise to capital arbitrage. Incentives for shifting credit exposures from the banking book to the trading book arise primarily from differences in regulatory capital treatment. As discussed in paragraphs 642 though 647 of CP3, trading book exposures that are actively managed and marked to market at least daily will continue to be subject to the 1996 Market Risk Amendment (MRA) to the 1988 Basel Accord. In light of the active management and daily revaluation of positions, capital charges for credit risk exposures under the MRA are generally smaller than those computed for similar instruments held in the banking book. The new definition of trading exposures subject to the MRA contemplates segmentation and A-IRB corporate capital treatment of any credit exposures that may be held in the trading book but are not actively managed and thus not subject to the MRA. Similarly, any credit derivative positions held in the trading book that hedge banking book exposures would also be subject to A-IRB treatment, although current regulatory reporting instructions require such positions (which are considered not held for trading purposes) to be reported as “Other Assets” in the banking book.

Figure 5: Potential capital arbitrage using countervailing credit guarantees. Arrows show transfer of credit risk



Staff would like comments from interested parties on whether significant potential for capital arbitrage exists due to the different capital treatments of MRA trading exposures and A-IRB exposures and whether recognition of double-default and double-recovery effects might amplify incentives for any such arbitrage. Consider the situation illustrated in figure 5 (above). In this example, a bank makes a loan to a reference obligor. If the bank buys credit protection via a default swap on the reference obligor it can reduce its exposure to the borrower. However, assume that the bank simultaneously sells protection or already holds an equivalent swap to the very same guarantor or buys a bond or grants an additional loan to the reference obligor. The net result is that the bank is left with a credit exposure to the same reference obligor. If this credit exposure is subject to the lower MRA capital charge because it is held in an actively managed trading account, concerns over the potential for capital arbitrage may arise since the bank might receive a lower combined regulatory capital charge for the set of transactions than would be required for an unhedged loan to the reference obligor. By lowering the capital charges for hedged loans more than that available using the substitution approach, recognizing double-default effects could increase incentives for this sort of regulatory capital arbitrage.

Staff would like comments on how such capital arbitrage might be prevented. In particular, if the Basel Committee chose to recognize double-default and double-recovery effects under Pillar I, would it need to restrict capital relief to those hedges that are not undone by countervailing, albeit actively managed, trading book exposures such as those held in dealer inventories or as proprietary trading positions? More importantly, is it inappropriate to have different regulatory capital regimes for actively managed, marked to market trading account credit exposures, and non-actively managed trading book and banking book credit exposures? Does the existence of such differences give rise to significant capital arbitrage issues?

6. Is the Market Ready?

Though the market for credit derivatives has grown dramatically over the last several years, it is still relatively nascent. Because this market appears to be highly concentrated, supervisors are concerned that if banks rely heavily on credit derivatives to mitigate credit risk, concentration risk could increase. Furthermore, the staff is not aware of any empirical evidence quantifying the value that market participants place on double-default and recovery effects. This section seeks comment on these issues.

Concentration in Credit Derivatives Markets

Currently, about a dozen global commercial and investment banks dominate the credit derivatives market as intermediaries. Banks hedging their exposures on loans typically purchase protection from these dealers. Dealers (which include banks and securities firms) often lay risk off with other dealers or with end-users such as insurance and reinsurance companies and financial guarantors. Concentration in the dealer market may create concentrations of counterparty credit risk for those banks that purchase credit protection as well as for the dealers themselves. To the extent that dealers frequently lay risk off with a small number of end-users in the insurance industry or any other industry the dealers may also have industry risk concentrations.

Banks have a number of mechanisms open to them for managing the counterparty risks associated with credit derivative transactions. For example banks routinely negotiate master netting agreements with counterparties with whom they frequently transact. Under such an agreement, if a counterparty should default, positions with that counterparty can be terminated and gains and losses netted out. Banks may also enter into collateral agreements requiring their counterparties to post collateral if their net credit exposure exceeds a negotiated threshold. The threshold often shrinks as the counterparty's credit rating declines.

Comments are solicited on whether and to what extent concentrations among dealers and among guarantors might contribute to portfolio-level risk at large, internationally active banks. How do banks manage the increased exposure to market liquidity risk that results from active hedging with credit derivatives? Can interested parties provide data on the overall level of concentration among protection sellers? What information do dealer banks currently use to manage concentration risk among protection sellers? To what extent can master netting agreements, collateral agreements, and other contractual arrangements mitigate counterparty risk in credit derivative transactions?

In the ASRF model presented in sections 3 and 4 the guarantor asset-correlation parameter ρ_g can be interpreted as a measure of the interdependence among risks facing guarantors. Should extra conservatism be used in calibrating this parameter to reflect concerns about guarantor concentrations? Is this sufficient?

It is not clear whether moving from the substitution approach to something like the ASRF approach would tend to encourage or discourage greater concentration among dealers. The substitution approach proposed in CP3 would only permit a reduction in capital when guarantees are provided by very safe (low PD) protection sellers. By favoring a narrow class of guarantors and permitting no capital relief for protection provided by other potential guarantors, the substitution approach could tend to encourage greater concentration in the dealer market. The calibration presented in sections 3 and 4 indicate that the ASRF approach would likely lead to a substantial reduction in capital requirements for most types of hedged transactions. Naturally, this approach provides more favorable capital treatment for exposures guaranteed by high quality protection sellers, but it does not contain an embedded "cliff effect" like that inherent in the substitution approach. Thus, while recognizing double-default and double-recovery effects could be expected to stimulate demand for credit protection broadly, it is unclear what effect such a policy would have on dealer concentrations. Industry views on this matter are solicited.

Market Recognition of Double-Default and Double-Recovery Effects

If market participants with money at risk endorse the conceptual logic of double-default and double-recovery effects, one would expect to see these effects reflected in the market pricing of guaranteed debt instruments. For example, all else equal, debt to an obligor with a given rating should trade at a higher spread than comparable debt that is guaranteed by a protection seller with the same rating. Information on the spreads paid on two-name paper, bankers' acceptances, collateralized debt obligations, and other publicly traded guaranteed debt instruments could help to quantify the value market participants place on double-default and recovery effects.

To date, the staff has been unable to quantify pecuniary benefits from double-default and double-recovery effects. If the market cannot be shown to value these effects, recognition of them for capital purposes would place supervisors in the position of endorsing an economic view of risk that is not held by the market in practice. Accordingly the staff requests that market participants present empirical analysis showing whether and to what extent participants are willing to pay in order to obtain the risk-mitigating benefits associated with double-default and double-recovery effects. Ideally, such analysis should go beyond simply quoting market prices for various types of credit guarantees. It should provide apples-to-apples comparisons of the transaction prices of debt instruments with and without double-default and double-recovery effects. The staff also seeks comments from both buyers and sellers of credit protection regarding how they deal with double-default and double-recovery effects in their own internal risk management, capital allocation, and pricing systems.

7. Conclusion

Table 9 (below) reports ASRF capital charges under conservative assumptions for both guarantor and obligor–guarantor asset correlations. For most obligor and guarantor PD combinations, these ASRF capital charges are a great deal lower than those produced by the substitution approach. Table 10 (next page) gives a sense of the likely effects of using the substitution approach, ISDA's PD haircut approach, and the ASRF approach given typical reference obligor PDs. It reports average capital charges per dollar exposure for an equally weighted portfolio of the top seventeen most commonly hedged U.S. reference obligors according to Fitch, Inc. (2003). All are large corporations with middle to low investment-grade ratings. PDs for these obligors are derived from long-run S&P-grade default frequencies, and each obligor is assumed to have an LGD of 45 percent. For this portfolio, the substitution approach yields a significant reduction in capital only when guarantor PDs and LGDs are quite low. For higher-PD guarantors, the substitution approach actually conveys no reduction in capital. In contrast, the ASRF approach yields significant capital reductions for the full range of guarantor PD and LGD values considered. When the guarantor PD is very small (3 basis points), average ASRF capital charges are an order of magnitude lower than those generated by the substitution approach.

Table 9: ASRF capital charges given $\rho_g = 0.50$ and $\rho_{og} = 0.50$.

Guarantor		Obligor LGD = 45							
		Obligor PD							
LGD	PD	0.03	0.10	0.50	1.00	2.00	5.00	10.00	50.00
100	0.03	0.08	0.17	0.41	0.57	0.76	1.05	1.30	1.72
	0.10	0.16	0.36	0.91	1.27	1.70	2.41	3.09	4.39
	0.50	0.33	0.78	2.08	2.95	3.99	5.81	7.79	12.47
	1.00	0.42	1.00	2.71	3.86	5.24	7.69	10.53	17.86
45	0.03	0.03	0.08	0.19	0.26	0.34	0.47	0.59	0.78
	0.10	0.07	0.16	0.41	0.57	0.77	1.09	1.39	1.98
	0.50	0.15	0.35	0.94	1.33	1.79	2.61	3.50	5.61
	1.00	0.19	0.45	1.22	1.74	2.36	3.46	4.74	8.04

Table 10: Average capital charge per dollar exposure for a portfolio of commonly hedged corporate obligors.

Guarantor LGD	Guarantor PD	Unhedged	Substitution Approach	ISDA Proposal	ASRF Approach*
100	0.03	1.34	1.04	0.73	0.15
	0.10	1.34	1.34	0.85	0.31
	0.50	1.34	1.34	0.85	0.68
	1.00	1.34	1.34	0.85	0.87
45	0.03	1.34	0.62	0.41	0.07
	0.10	1.34	1.13	0.71	0.14
	0.50	1.34	1.34	0.85	0.31
	1.00	1.34	1.34	0.85	0.39

*Assumes $\rho_g = 0.50$ and $\rho_{og} = 0.50$.

Clearly, capital charges for hedged exposures derived under the ASRF approach look very different from those produced by the substitution approach. When we ask the narrow question, “Does the substitution approach produce Pillar I capital charges that are consistent with those applied to unhedged exposures?” the answer appears to be “No.” A guiding principle underlying the development of Basel II is that regulatory capital charges should reflect underlying risks. In this spirit, the Basel Committee may wish to consider implementing a more risk-sensitive Pillar I capital treatment for hedged exposures along the lines described in section 3 and the appendix.

However, if the Basel Committee were to consider implementing an approach similar to the one developed in this paper, three important practical issues would need to be addressed. First, under plausible parameter assumptions, the ASRF approach would lead to exceptionally low capital charges on low-PD exposures guaranteed by low-PD protection sellers, as table 10 clearly demonstrates. To prevent banks from operating with unacceptably high leverage, the Basel Committee would almost certainly wish to impose a floor on ASRF risk weights for hedged exposures. Industry comments are solicited on where such a floor should be set.

Second, applying the ASRF approach would require that supervisors take a stand on assumed values for guarantor asset correlations and obligor–guarantor asset correlations, just as they have already done for obligor asset correlations. Very little public data exists with which to calibrate these parameters. Supervisors have doubts about whether they can be estimated accurately and about whether they can be expected to remain stable during times of economic stress. The staff would appreciate any data or analysis that industry can provide concerning the appropriate values for guarantor asset-correlation parameters and obligor–guarantor asset-correlation parameters. Furthermore, the staff would like to know whether market participants expect these parameters to remain stable over time.

Third, the ASRF capital formula derived in the appendix is more complex than other A-IRB risk-weight formulas because it relies on three asset-correlation parameters rather than one, and it requires that a bivariate normal cumulative distribution function be evaluated. Given the Basel Committee's expressed desire to simplify the new accord and supervisors' concerns about explicitly introducing additional correlation assumptions, the Committee may wish to consider a less mathematically complex capital treatment. As shown in the appendix, a reasonable compromise between realism and simplicity might be to apply a haircut to the A-IRB risk weight (not the PD) for the unhedged exposure. The haircut would depend on the PD and LGD of the guarantor but would be no more difficult to calculate than existing A-IRB risk weights. ISDA has proposed that a haircut be applied to the minimum of the obligor and guarantor PDs, but the analysis presented in this paper suggests that applying a haircut to the risk weight for an unhedged exposure would be more appropriate. The staff would appreciate comment from interested parties concerning how such a haircut might be structured.

In determining whether or not to recognize double-default and double-recovery effects, the Basel Committee will need to look beyond the narrow question of whether Pillar I should handle capital for hedged and unhedged exposures in a more internally consistent manner. By lowering Pillar I capital charges on hedged exposures, recognizing double-default and double-recovery effects may well increase the need for supervisory oversight under Pillar II. We seek comment from interested parties on the following areas of particular supervisor concern.

- Pillar I capital charges do not cover concentration risk, but banks commonly use guarantees to hedge risk to counterparties with whom they have large exposures. If credit-risk mitigation arising from guarantees is fully recognized under Pillar I, will portfolio concentrations be harder to deal with under Pillar II? What standards should be set to ensure that banks that rely heavily on credit guarantees are adequately managing exposure concentrations?

- What can be done to ensure that banks do not receive capital relief for hedge transactions that entail excessive wrong-way risk? Under CP3, banks must demonstrate that protection sellers operate at arms length from reference obligors to be eligible to use the substitution approach. However, as the experience of banks during the Russian ruble crisis makes clear, this requirement does not completely address the potential for wrong-way risk. What additional operational standards might be needed to prevent wrong-way transactions if double-default and double-recovery effects are recognized?
- Will banks be able to arbitrage regulatory capital charges by shifting credit guarantees between banking and trading books? Would such incentives be strengthened or weakened if double-default and double-recovery effects were recognized? What could be done to limit incentives for capital arbitrage?

Finally, it is fair to say that bank supervisors know less about the credit guarantee market than they would like. What limited data exists indicate that a few large dealers are involved in a large share of credit derivatives transactions. Information from parties that actively use credit guarantees would help the Basel Committee to make a more informed decision concerning whether and to what extent double-default and double-recovery effects should be recognized. Answers to the following questions would be particularly helpful.

- Is concentration among dealers of credit derivatives a cause for supervisory concern? By encouraging banks to rely more heavily on credit derivatives to hedge credit risk, would recognizing double-default and double-recovery effects create greater concentration risk?
- Who ultimately holds the risk associated with credit guarantees? Is a significant share of credit risk transferred outside the banking industry as a whole, or do banks simply swap risks with one another? How concentrated is the pool of

protection sellers? How do banks manage concentrations to protection sellers? How useful are collateral agreements and master netting agreements in this regard?

- What evidence can be brought to bear on how the market views double-default and recovery effects? How do banks deal with these effects when evaluating economic capital?

More generally, commenters are asked to provide evidence and analysis that can address concerns about the systemic effects of significantly reducing capital charges on exposures hedged with credit derivatives and financial guarantees.

Appendix

This appendix discusses joint default probabilities, ASRF capital charges, a simplified ASRF formula, and the substitution approach. Throughout this appendix the subscript "o" denotes the obligor, and the subscript "g" denotes the guarantor. The subscript "i" is used when variables may refer to any counterparty.

Joint Default Probabilities

The ASRF approach to calculating capital charges for hedged exposures makes use of the same one-period, Merton-style default model used to derive the Basel II C&I risk-weight function. Let Y_i denote the appropriately normalized asset value for counterparty i at a one-year assessment horizon, and assume

$$Y_i = X_i\sqrt{\rho_i} + U_i\sqrt{1-\rho_i}$$

where X is a systematic risk factor and U_i is a risk factor specific to counterparty i that is uncorrelated with X. Counterparty i defaults if Y_i falls below a fixed threshold γ_i. If X and U_i are both standard normal random variables, then by construction Y_i is also standard normal, and the marginal default probability of counterparty i is simply

$$PD_i = \Phi(\gamma_i)$$

where $\Phi(x)$ is the standard normal cumulative distribution function. Since the normal CDF has a well-defined inverse function, if PD_i is known γ_i can be calculated using the formula $\gamma_i = \Phi^{-1}(PD_i)$.

In the standard single-risk-factor model, the counterparty-specific risk factor U_i is assumed to be independent across counterparties. However, to capture the possibility that an obligor and a guarantor may be more closely related than a pair of unrelated obligors one must introduce a second risk factor that affects only the obligor and the guarantor, but not other exposures in a lender's portfolio. Assume

$$U_i = Z\sqrt{\psi_i} + E_i\sqrt{1-\psi_i}$$

where E_i is independent across *all* counterparties, but Z is shared by both the obligor and the guarantor. E_i and Z are both standard normal random variables. By assumption, Z is not a systematic risk factor because it only affects outcomes for a single obligor and a single guarantor.

This specification implies that the asset correlation measuring the exposure of obligor i to systematic risk is

$$\mathrm{Cor}[Y_i, X] = \sqrt{\rho_i}$$

The obligor–guarantor asset correlation that captures the extent to which the credit quality of the two counterparties moves together is given by

$$\mathrm{Cor}[Y_o, Y_g] = \sqrt{\rho_o \rho_g} + \psi\sqrt{(1-\rho_o)(1-\rho_g)} \equiv \rho_{og}.$$

Notice that when $\psi = 0$, the second term in the correlation formula drops out. In this special case, the correlation between the obligor's and the guarantor's asset values are determined solely by each counterparty's exposure to the systematic risk factor. More generally, ρ_{og} is increasing in ψ.

The joint probability that both the obligor and the guarantor default is given by

$$\text{(1)} \qquad JPD_{og} = F\left(\Phi^{-1}(PD_o), \Phi^{-1}(PD_g);\ \rho_{og}\right)$$

where $F(x_1,x_2;r)$ is the bivariate CDF for a pair of standard normal random variables with correlation r. Equation (1) is used to calculate the joint default probabilities reported in section 2.

Equation (1) is derived under the assumption that assets for the obligor and the guarantor are jointly normally distributed, but richer joint probability specification using copula models could also be used. See Embrechts, Klüppelberg, and Mikosch (1997) for a discussion of this broader class of models.

ASRF Capital Charges

Gordy (2002) shows that given an infinitely-fine-grained portfolio of exposures of the sort described above, a decentralized approach to calculating economic capital is possible. To achieve a portfolio solvency probability target q one need only plug the 1-q percentile of X into the conditional expected loss function for each exposure.

For simplicity, assume that recoveries are fixed so that LGD_i is the loss given default associated with an exposure to counterparty i, The conditional expected loss function for an unhedged exposure given X is

$$
\begin{aligned}
c_i(X) &= \Pr\left[X\sqrt{\rho_i} + U_i\sqrt{1-\rho_i} < \gamma_i \mid X\right] \\
&= \Phi\left(\frac{\Phi^{-1}(PD_i) - X\sqrt{\rho_i}}{\sqrt{1-\rho_i}}\right)\cdot LGD_i
\end{aligned}
$$

Plugging $X = X_q \equiv -\Phi^{-1}(0.999)$, the 0.1th quantile of X, into $c_i(X)$ yields a capital charge for exposure i calibrated to a 99.9 percent portfolio solvency target:

$$
k_U(PD_i, LGD_i) = \Phi\left(\frac{\Phi^{-1}(PD_i) + \Phi^{-1}(0.999)\sqrt{\rho_i}}{\sqrt{1-\rho_i}}\right)\cdot LGD_i. \tag{2}
$$

This calculation is the basis of the A-IRB C&I risk-weight function.[11]

The conditional expected loss function for a hedged exposure is

$$
\begin{aligned}
c_{og}(X) &= \Pr\left[X\sqrt{\rho_o} + U_o\sqrt{1-\rho_o} < \gamma_o \cap X\sqrt{\rho_g} + U_g\sqrt{1-\rho_g} < \gamma_g \mid X\right] \\
&= F\left(\frac{\Phi^{-1}(PD_o) - X\sqrt{\rho_o}}{\sqrt{1-\rho_o}}, \frac{\Phi^{-1}(PD_g) - X\sqrt{\rho_g}}{\sqrt{1-\rho_g}}; \psi\right)\cdot LGD_o \cdot LGD_g
\end{aligned}
$$

Using the definition of ρ_{og} given above, we can rewrite $c_{og}(X)$ in terms of the three asset-correlation parameters ρ_o, ρ_g, and ρ_{og}. Plugging $X = X_q$ into this function yields the ASRF capital charge for a hedged exposure:

$$
\begin{aligned}
&k_H(PD_o, PD_g, LGD_o, LGD_g) = \\
&F\left(\frac{\Phi^{-1}(PD_o)+\Phi^{-1}(0.999)\sqrt{\rho_o}}{\sqrt{1-\rho_o}}, \frac{\Phi^{-1}(PD_g)+\Phi^{-1}(0.999)\sqrt{\rho_g}}{\sqrt{1-\rho_g}}; \frac{\rho_{og}-\sqrt{\rho_o\rho_g}}{\sqrt{(1-\rho_o)(1-\rho_g)}}\right)\cdot LGD_o \cdot LGD_g
\end{aligned} \tag{3}
$$

This is the formula used to calculate the ASRF capital charges reported in sections 3 and 4.

A Simplified ASRF Formula

If one is willing to assume that there is no "extra" correlation between the assets of the obligor and the guarantor beyond that generated by both counterparties' exposures to the systematic risk factor, then calculating the ASRF capital charge for hedged transactions becomes much easier. When $\psi = 0$, defaults by the obligor and the guarantor are conditionally independent given X, so equation (3) simplifies to

[11] Note that the capital formula used in CP3 includes a maturity adjustment term that drops out for the one-year maturity loans analyzed here.

(4) $$k_H(PD_o, PD_g, LGD_o, LGD_g) = \left[\Phi\left(\frac{\Phi^{-1}(PD_o)+\Phi^{-1}(0.999)\sqrt{\rho_o}}{\sqrt{1-\rho_o}}\right)\cdot LGD_o\right]\cdot\left[\Phi\left(\frac{\Phi^{-1}(PD_g)+\Phi^{-1}(0.999)\sqrt{\rho_g}}{\sqrt{1-\rho_g}}\right)\cdot LGD_g\right]$$

Thus, the capital charge for the hedged exposure is simply the product of the capital charges for unhedged exposures to the obligor and the guarantor. Viewed from another perspective, the capital charge for a hedged exposure can be calculated by simply applying a "haircut" of 1 - $k_U(PD_g,LGD_g)$ to the capital charge for the unhedged exposure. The critical difference between this approach and ISDA's haircut proposal is that under this approach the haircut would be applied to the unhedged exposure risk weight, not the minimum of the obligor and guarantor PDs.

The Substitution Approach

When $\psi = 1$, U_o and U_g collapse to a single variable, and the conditional expected loss function becomes

$$\begin{aligned} c_{og}(X) &= \Pr\left[X\sqrt{\rho_o} + Z\sqrt{1-\rho_o} < \gamma_o \cap X\sqrt{\rho_g} + Z\sqrt{1-\rho_g} < \gamma_g \mid X\right] \\ &= \Phi\left(\min\left\{\frac{\Phi^{-1}(PD_o) - X\sqrt{\rho_o}}{\sqrt{1-\rho_o}}, \frac{\Phi^{-1}(PD_g) - X\sqrt{\rho_g}}{\sqrt{1-\rho_g}}\right\}\right)\cdot LGD_o \cdot LGD_g \end{aligned}$$

Furthermore if $\rho_o = \rho_g = \rho$ the conditional expected loss function becomes

$$c_{og}(X) = \Phi\left(\frac{\Phi^{-1}(\min\{PD_o, PD_g\}) - X\sqrt{\rho}}{\sqrt{1-\rho}}\right)\cdot LGD_o \cdot LGD_g .$$

Thus the ASRF approach to calculating capital charges for hedged exposures yields the substitution approach if we assume that (1) both the obligor and the guarantor have the same exposure to the systematic risk factor, (2) asset values of the obligor and the guarantor are perfectly correlated, and (3) the LGD associated with the higher PD counterparty is 100 percent.

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