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Recent financial reforms, such as the Dodd-Frank Act in the U.S. and the European Market Infrastructure Regulation, encourage greater use of clearing and therefore increased margining of derivative trades. They also impose margining requirements on OTC derivative dealers. One question arising out of the debates over these reforms is, does a margin mandate increases the cost of hedging by non-financial corporations—the so-called end-users of derivatives? Our answer is, No. We show that a non-margined derivative is equivalent to a package of (i) a margined derivative, and (ii) a contingent line of credit. A margin mandate merely requires that this package be marketed as two distinct products, but it does not change the total financing or capital that the non-financial corporation requires to back its hedging. Nor does it raise the cost to banks or other dealer of offering the package, at least not directly. There may be an indirect effect if the clearing mandate succeeds in lowering systemic risk, but indirect macro effects such as this are beyond the scope of this paper. We also explore how accounting rules and bank regulations may treat the implicit credit embedded in the non-margined derivative differently from an explicit line of credit. This is important to understanding business and banker reaction to details of the proposal. Finally, we place the current debate in the context of the historical evolution of margin practices and regulations from the earliest trading of derivatives in the U.S. in the 1860's to the present.

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"I strongly suspect the subject of margins wouldn't even have been on your program a year or two ago. Other than for a speculator who just watched his long corn go limit down or his short soybeans go limit up, no one gave much thought to margins. Or to what they are, or what they do, or why we have them. A few years ago, in fact, our clearing corporation considered preparing a little booklet to explain margins. It never got published. The reaction to the idea ranged from an "ugh" to a "why?" The consensus was that margins are arcane, margins are dull, and, besides, who really cares?

That I am on this side of the speaker's table, that margins are on your program today, is one indication that the situation has rather suddenly changed. Commodity margins have suddenly become interesting. All at once, it seems that just about everyone cares. Market participants care. Newspaper and TV commentators care. Including those who'd barely even heard of futures markets until the day before yesterday. Government regulators care because there is no greater anathema than that which can be regulated but isn't. Additionally, of course, there are all manner of congressional crisis chasers. They, too, express care."

Remarks by Walter Brinkman, President, Board of Trade Clearing Corporation, at a conference on speculation held in 1980 after the dramatic collapse of the Hunt brothers' silver corner following a change in the margin requirement. Brinkman (1981)

INTRODUCTION

When a company hedges with a derivative sold on an exchange such as the CME, ICE or Eurex, which use central counterparty clearing, the company is generally required to post margin. However, if the derivative is sold over the counter (OTC) by a dealer bank, it may not be cleared and the company may not have to post margin. The terms of the OTC derivative contract are up to the two counterparties. Oftentimes companies are required to post margin, but other times they are not. Even when a company must post margin, the terms governing when and how much is to be posted may differ from the terms imposed by a clearinghouse. Recent regulatory actions introduced after the financial crisis of 2008 encourage greater use of clearing and therefore increased margining of derivative trades. They also impose margining requirements on OTC derivative dealers. These changes have significant implications on how corporations hedge with financial derivatives. In this paper we review these changes and the implications to corporations, having in mind the value to the hedger of being granted the hedge with and without having to post margin. Our focus is on non-financial corporations—the so-called end-users of derivatives—seeking to hedge commercial risks, as opposed to financial speculators of various stripes and as opposed to financial intermediaries like the dealer banks. Do margins significantly impact the cost of hedging and the way corporations hedge commercial risks?

Since the debate leading to the passage of the Dodd-Frank Act in the U.S. in June 2010, and the EMIR in Europe this issue has been very prominent. A large number of corporations complained that the requirement to post margin would significantly raise the cost of hedging, and they demanded an exemption. For example, in a hearing in the U.S.

House of Representatives in 2009 discussing the Treasury Department's proposal, Timothy Murphy, the Foreign Currency Risk Manager for the 3M Company testified that:

> While we are mindful of the reduction in credit risk inherent in a clearing or exchange environment, robust margin requirements would create substantial incremental liquidity and administrative burdens for commercial users, resulting in higher financing and operational costs. Capital currently deployed in growth opportunities would need to be maintained in a clearinghouse. This could result in slower job creation, lower capital expenditures, less R&D and/or higher costs to consumers. Murphy (2009)

In January 2010, the European Assocation of Corporate Treasurers submitted an Open Letter to the Commissioners of the European Union stating that:

> We are deeply concerned by some of the proposed reforms to the OTC derivatives market currently being considered, in that they will disadvantage many end users who rely on OTC derivatives to hedge underlying commercial exposures. Specifically, the intent to drive OTC derivative transactions into central clearing and onto exchanges will increase liquidity risk and funding costs through the requirement to post cash collateral… EACT (2010)

Ultimately, both the Dodd-Frank Act and the EMIR included some exemptions from the clearing mandate for derivatives bought by end-users for commercial hedging purposes. Debate continues, however, as the terms of these exemptions are specified in the implementing regulations, as legislators consider expanding or narrowing the exemptions, and as related banking and other regulations are written which impinge on margin and related credit practices.

We argue in this paper that these complaints about the costs imposed by a margin mandate are misguided. Our central point is that the cost normally attributed to the margin mandate is actually attributable to the underlying credit risk inherent in the derivative transaction. A mandate to post margin is just one way in which this cost can be pushed onto the company hedging with a derivative. If, instead, a dealer sells the

company an OTC derivative without any margin requirement, the same cost arises and is paid by the company but in a different form. The non-margined derivative entails greater credit risk, and the dealer charges for that, building in an extra premium to the bid-ask spread. It is the same cost of hedging, just paid for in a different guise. Negotiating an OTC derivative transaction does not magically reduce the credit risk inherent in the transaction, thereby lowering the real cost of hedging. The funding or liquidity which the non-margined derivative provides can be replicated by a margined derivative and a contingent line of credit that funds the margin. The contingent line of credit poses exactly the same liquidity and credit risk to the bank as the credit embedded in the non-margined derivative. Consequently, the mandate to margin is only a mandate to separately account for the credit associated with the derivative. The margin mandate imposes no additional cost.

Critics of a margin mandate often overlook the cost of credit that is implicit to a non-margined derivative sold OTC. However, some institutional practices may give rise to a real difference between credit that is implicit to a non-margined derivative contract and credit that must be granted explicitly to fund margin. We highlight two such practices. First, is the different accounting for the two types of credit. Second, is the different treatment by banking regulators which can create a difference in the cost passed to bank customers. Of course these institutional practices do not actually make the non-margined derivative truly cheaper. There is no free lunch. But they can hide costs or misallocate them – e.g., letting taxpayers subsidize the credit risk in non-margined derivatives.

2. THE MECHANICS OF MARGIN A DERIVATIVES CONTRACT

Given the wide variety of settings in which derivatives are traded, there is no single, standardized set of margin rules. Practice differ across markets—futures exchanges v. OTC swap markets—across classes of participants within a market—clearinghouse members v. customers, hedgers v. speculators—across the life of a transaction—initial margin v. maintenance margin, v. delivery month margin, and in the OTC market across individual transactions. Throughout most of this paper, we abstract from these many details, and discuss the generic issues involved with the practice of charging margin. We focus on a non-financial company purchasing a derivative from a dealer bank and examine the same transaction done with and without margin.

We construct a simple illustrative example of an oil-indexed swap contract negotiated between a non-financial company and a dealer bank. The swap is opened in November 2010 and has a single payment date three months later, in February 2011. The floating price is the price on an oil futures contract with delivery in March 2011. When the swap is opened in November 2010, the price on the March futures contract is $82.00/bbl, and this is the fixed price of the swap. The company buys the swap, i.e., takes a long position, and so in February 2011 it will receive the difference between the floating and the fixed prices multiplied times the notional quantity of oil specified in the swap. The notional quantity is 10 million barrels. Because the mark-to-market value of the swap, the final swap payment, and the margin cash flows depend upon the evolution of the oil futures price, both tables show results for two scenarios. Scenario #1 is a path in which the price falls through time, and Scenario #2 is a path in which the price rises.

Cash Flows on a Non-Margined Swap

Table 1 shows the cash flows through time on a non-margined swap. In Scenario #1, the mark-to-market value of the swap declines by $10 million each month. The total loss in value at the close of the swap is $30 million. This loss is unrealized until the single payment date of February 2011, at which point the full $30 million is due.

Scenario #2 is the mirror image. The mark-to-market value of the swap increases by $10 million each month. At the close of the swap, the total gain in value is $30 million. This gain is unrealized until the single payment date of February 2011, at which point the full $30 million is received.

Cash Flows on a Margined Swap

Table 2 shows how things change when we add the obligation to post margin. The margin required is calculated off a base level of 15% of the notional value—the notional quantity times the current price on the March futures contract. However, we assume that the accrued mark-to-market gain or loss on the swap is credited or debited in calculating the required margin. For Scenario #1, line [10] shows the calculation of the 15% of notional value through time. Line [11] shows the calculation of net margin balance required, which is equal to the 15% of notional value less the mark-to-market value. At inception in November 2010, the futures price is $82/bbl, so the notional value is $820 million and 15% of the notional value is $123 million. Since the mark-to-market value is zero at inception, the company must post the full $123 million margin to open the position. Line [12] shows the monthly cash flow to and from the margin account. To keep the calculations in the example simple, we ignore the interest earned on the margin account. Later we will discuss the opportunity cost of funding the margin account. In the

succeeding two months, as the swap position accrues losses, the company makes contributions to maintain the margin balance. In Scenario #1, as the mark-to-market value on the swap declines, the company must make offsetting contributions to the margin account. However, since the notional value of the swap is declining slightly, the required contribution to the margin account is slightly less than the accrued loss each month. When the swap is closed out in February 2011, the entire margin balance can be withdrawn. Line [13] shows the swap payment, and line [14] shows the net cash flow, which is the sum of the contributions to fund the margin account and the swap payment.[1] Lines [15]-[22] show the same calculations for Scenario #2.

Comparing Table 2 against Table 1, we can see that the total net cash flow on the margined swap is the same as the total net cash flow on the non-margined swap. But the timing of the cash flows is different due to the requirement to post margin. The margined swap forces potential losses to be pre-funded. If the losses do not materialize, then the money is returned. Hence, margin is often described as a performance bond.

3. MARGINS, CREDIT RISK AND THE COST OF HEDGING

Posting margin is a claim on scarce capital, and therefore buying a hedge and posting margin is costly. Other things equal, companies would prefer to hedge without posting margin. Other things equal, a higher margin raised the cost of hedging, thus reducing the amount of hedging. This, in turn, would increase expected financing costs, lowering the scale of investments and the value of firms. This is the argument made by critics of mandated margins.

[1] The table has ignored interest earned on the margin account for the purpose of keeping the example as simple as possible.

The problem with this argument is the premise that one can avoid posting margin while keeping other things equal. Posting margin minimizes the credit risk borne by the bank selling the derivative. If the bank, instead, sells a non-margined derivative, then the bank shoulders credit risk not present in the margined derivative. This is costly for the bank, and it will charge the company accordingly. Most likely the company pays through the pricing terms on the non-margined swap.

It is illusory for a non-financial company to imagine that by negotiating a non-margined swap it is conserving its scarce capital. In taking the implicit credit embedded in the non-margined swap, the company is using up some of its debt capacity, just as it used its scarce capital when it had to fund the margin account. The funding of a margin account just makes explicit the drain on the company's scarce capital. When agreeing to sell a non-margined derivative, the dealer bank calculates the potential size of the liability that might accrue. The bank's credit committee will have to approve the derivative, just as if the derivative included a loan. Before approving the deal, the credit committee will review the company's file, examining its current credit rating, the set of other liabilities it has outstanding, its current cash flow situation and so on. If the company has already used up all of its debt capacity, the bank is not going to approve the derivative. It will only approve the derivative if the company has some unused debt capacity, and the bank will count on that unused debt capacity to assure that the bank gets paid in the event that the price of the derivative moves against the company. Each non-margined derivative contract approved consumes some of the company's debt capacity, so there is a limit to the volume of non-margined transactions the dealer bank will approve.

To a first approximation, the cost of hedging with a non-margined swap must be the same as the cost of hedging with a margined swap once credit risk is taken into account. This is because the ultimate source of the cost is the same, and the decision to charge a margin simply changes the channel through which that cost manifests itself. When the company has to fund a margin account, it sees an explicit cost in the use of scarce cash. When the company negotiates a non-margined swap, the cost is embedded into the terms of the deal, and the consumption of debt capacity is not explicit.

Cash Flows on a Margined Swap Combined with a Contingent Line of Credit

A powerful way to show these points is to replicate the cash flow structure of the non-margined swap using a margined swap packaged together with a credit arrangement that funds the margin account. A non-margined swap should be thought of as a package of (i) a margined swap, plus (ii) a contingent line of credit to fund the margin. The credit line is contingent because the amount drawn varies according to the changes in the value of the swap and the payments under the swap.

To illustrate this, Table 3 extends our example to show the replication of the non-margined swap cash flows using a margined swap plus a contingent line of credit. Under Scenario #1, lines [9]-[13] show the margined swap items and lines [14]-[15] show the contingent credit line items. The line is drawn on to fund the margin account, and paid down when the swap is closed out. Line [16] shows the combined net cash flow on the margined swap plus the credit line. Line [17] shows the difference between the net cash flow on this package and the net cash flow on a non-margined swap. The same set of results is shown for Scenario #2, with line [28] showing the difference between the net cash flow on this package and the net cash flow on a non-margined swap. The fact that

lines [17] and [28] are each zero in every period confirms that the combination of the margined swap and the contingent credit line replicates the cash flows to the non-margined swap. This example shows just two scenarios for the movement in the index underlying the derivative, but the principle is clear, and one can extend the example to any arbitrary movement. In all cases, the cash flow obligations of the non-margined swap, on the one hand, and the margined swap plus a contingent line of credit, on the other hand, are identical.

Tables 1, 2 and 3 show the cash flows to the company buying the swap. The dealer bank selling the swap is on the opposite side of these cash flows. Therefore, the dealer bank that offers a company a non-margined swap has the exact same cash flow payoffs as a dealer bank that offers the package of (i) a margined swap, plus (ii) a contingent line of credit to fund the margin.

A company that prefers the cash flow pattern of a non-margined swap can replicate it using a margined swap plus the contingent line of credit. Therefore, a margin mandate is nothing more than the requirement to make explicit the credit line embedded in a non-margined swap.

Credit Risk and the Cost of Hedging

Hedging is costly. But the real source of the cost is not the margin that is posted, but the underlying credit risk that motivates counterparties to demand that margin be posted. In Mello and Parsons (2000), we constructed a dynamic model of hedging and credit. A company has limited debt capacity and can hedge with a futures contract. There is no direct cost to using the futures contract. In particular, there is no formal margining and no margin charge. Nevertheless, the model shows that a company is very

conservative in its hedging. It hedges less than what would minimize the volatility of its cash flows or the volatility in its market value. Why? The answer is that, except in the extreme case when the hedge is perfect, hedging uses up the company's scarce debt capacity. In practice, all hedges involve a certain amount of basis risk, and there will be some circumstances when the dealer is exposed to default by the hedger. This cost increases as the scale of the hedging gets larger. The dealer must charge for this credit risk, and it is the price paid to cover the credit risk that constrains a company from hedging more. So credit risk is the real underlying factor making hedging costly, not the cost of posting margin. To emphasize that credit risk is the key, one can examine the model for the case in which the hedge is perfect. In that case, the hedge creates its own liquidity and becomes costless. It completely eliminates the company's limited debt capacity. The model therefore illustrates the fact that limited debt capacity and credit risk is the ultimate source of the cost of hedging. The practice of margining is just a channel through which the drain on the company's debt capacity is made apparent to the company. Cooper and Mello (1999) also demonstrate how it is the interaction of the structure of the hedge with the determinants of a company's credit quality that determines the optimal scale of hedging and the optimal structure of a hedge.

The Cost of a Margin Mandate

A mandate to margin all derivative transactions does not add any new cost to hedging. With a non-margined derivative, the company is procuring the two parts of the package rolled into one product: the credit is implicitly embedded in the terms of the contract. The margin mandate merely forces the credit to be marketed and accounted for

separately, as an explicit arrangement alongside the margined swap. The mandate does not add any cost to the company.

In the course of debating the provisions of the Dodd-Frank Act, and then again in the debate over the regulations to implement the Act, a number of industry sponsored studies produced large estimates of the costs that would be imposed on non-financial companies if margins were mandated.

For example, a Keybridge Research study commissioned by the Business Roundtable alleges that,

> … a 3% OTC derivative margin requirement might be expected to eliminate approximately 100,000 to 120,000 jobs economy wide. Keybridge Research (2011)

The study treats the 3% margin requirement as a pure supplemental cash drain on corporate finances, based on the unspoken premise that non-margined derivatives impose no claim on companies' available credit capacity. That is not a reasonable premise. Derivative dealers are surely charging for the credit risk they assume when offering non-margined derivatives.

In a similar fashion, the Natural Gas Supply Association and National Corn Growers Association asserted that,

> Mandating clearing of over-the-counter derivatives (by forcing trading onto an exchange or mandating centralized clearing and margining for over-the counter derivatives) could drain the U.S. economy of approximately $900 billion in productive capital that companies would simply have to post or set aside to insure their risk-management transactions. NGSA (2010).

This calculation, too, treats the non-margined derivatives as costless. The $900 billion is just the raw differential between the margin required under the mandate and the margin

without the mandate. It takes no account of the credit capacity consumed by a non-margined derivative.[2]

In January 2010, the Edison Electric Institute (EEI), together with a number of other lobbying organizations, assembled a package of illustrations of how a margin mandate would impact individual end-users operating in different sectors of the energy industry—EEI (2010). One of the examples is of a "large electric power company" seeking to enter into a fixed price power supply agreement with a utility for 300 megawatts of power in 2012.[3] Because of its credit rating and because of another derivative contract it has with its bank, the company posts no margin, according to EEI. But, under the margin mandate, it must post $6.6 million in initial margin and up to $66 million in potential variation margin. The example goes on to detail additional potential costs. The EEI then translates these margin costs to an 8% increase in power costs. This example, too, treats the non-margined derivative's drain on the company's credit rating as costless. And it assigns a zero opportunity cost to the positive balance swap used to justify the zero margin on the initial derivative. A more reasonable calculation would incorporate these costs. But all of the examples assembled in EEI's document overlook them.

To a first approximation, the cost charged for the non-margined swap must be equal to the cost of funding the margin account. This follows from the fact that the non-

[2] Back-up to the calculations provided in personal correspondence.

[3] The example cited begins on page 23.

margined swap just includes funding of the margin account as an embedded feature of the package. Therefore, the incremental cost to the hedger from a margin mandate is zero.[4]

Dynamic Adjustment

We have written that a non-margined swap is equivalent to a package of (i) a margined swap, plus (ii) a contingent line of credit to fund the margin. It is worth emphasizing the contingent nature of the line of credit. In our examples, we have shown only two scenarios for how the index underlying the derivative might move over the life of the contract. Looking at the two drawdowns of the credit line in Table 3, one can see the contingent character. The true range of potential drawdowns is much larger—as large as the range of movement in the underlying index. What is the size of the contingent credit line associated with the margined swap in Table 3, and how does it compare to the implicit contingent credit line embedded in the non-margined swap is Table 1? If the non-margined swap is truly a fully non-margined swap, then the dealer bank can calculate its maximum exposure, and this tells us what is the size of the implicit contingent credit line. In our example this is $820 million. For the package in Table 3 to fully replicate the non-margined swap, the credit line must have a limit of $820 million.

In practice, so-called non-margined swaps are actually accompanied by various limits on the size of the accrued liability, so that there is a much lower limit on the implicit credit line embedded in the swap. Once the limit is reached, the company will either have to start posting margin, liquidate the swap, or otherwise adjust the position.

[4] A study by the economics consulting firm NERA is unique in taking a somewhat different tack to estimating the differential cost of funding margin—NERA (2011). That tack has other problems as detailed in these two blog posts: http://bettingthebusiness.com/2012/01/22/phantom-costs-to-the-swap-dealer-designation-and-otc-reform/ and http://bettingthebusiness.com/2012/03/19/nera-doubles-down/.

In practice, a company using margined swaps and funding margin calls from a credit line is unlikely to fully specify all contingencies and the full scale of the potential call on a credit line up front. It will often start out with one credit limit, and then dynamically adjust the size of the explicit credit line as the line is drawn down or paid off. Consequently, one needs to take care in making comparisons between a specific non-margined swap and a specific margined swap funded with a credit line. In order for the two packages to be truly equal, the full dynamic structure of the position needs to be taken into account.

In the course of public debate on these issues, some critics of the margin mandate have been forced to acknowledge the ability of the financial system to supplement the margin mandate with a line of credit. But these critics have then attempted to make much of the contingent nature of the credit line. For example, the Coalition for Derivatives End-Users filed a July 2011 Comment Letter with various regulatory agencies repeating portentous calculations of the cost of margining like those cited above, but nominally addressing the possibility that the required margin could be funded with a line of credit that is comparable to the implicit credit embedded in the non-margined swap. But they argue that

> … end-users need certainty and liquidity to manage their balance sheets. But the amount of margin borrowed and costs associated with a margin lending facility cannot be known upfront. The amount cannot be known because it depends on market fluctuations. The costs cannot be known because lenders typically base credit fees on a floating interest rate, plus a credit spread. Thus, the total cost of a margin lending facility vary based on the unpredictable amount needed to be borrowed and the unpredictable interest cost of that borrowing.
>
> Second, lenders will typically limit how much can be borrowed, much like a credit limit on a consumer credit card. The exact limit must be high enough to cover at least two or three standard deviations worth of price movements in the underlying derivatives portfolio. Lenders, however, will want to pass on the higher costs associated with offering high limits. This creates an incentive for

> both lenders and end-users to agree on a lower limit that covers mark-to-market movements typically observed in normal market conditions. Should the margin requirement ever exceed the limit, however, as might occur in stressed market conditions, end-users will still face unfunded margin requirements that margin lending facilities cannot cover. Coalition for Derivative End-Users (2011).

But these and their other arguments miss the power of the equivalence argument we made above. We are not proposing credit facilities as a tool for partially amelioriating a cost created by a margin mandate. Rather, we are pointing out that the true cost is already embedded in non-margined derivatives as currently offered in the OTC market. Each of the concerns expressed about a new margin lending facility applies equally to non-margined swaps. When an end-user is negotiating a non-margined swap with a bank, the ultimate size of the credit that may be extended cannot be known because it depends on market fluctuations. Similarly, OTC dealers will typically limit how much can be borrowed through non-margined derivatives. The public debate often casually discusses the OTC swap market as if all swaps are non-margined and as if there are no limits. But this casual description belies the facts. A large portion of swaps do include margining, and virtually all swaps are negotiated under a master agreement that incorporates a total exposure limit! The danger that will face end-users in stressed market conditions is a danger they already face in a world without a margin mandate. End-users already occasionally find themselves bumping up against their exposure limits and forced to decide either to close out or modify a hedge, or to find extra funds to post as margin so as not to exceed exposure limits.

It is worth emphasizing one more time that a non-margined derivative is just a package of two components: a margined derivative and a contingent line of credit. Under a margin mandate, the only contingent credit line that an end-user needs is the very contingent credit line already implicitly embedded in the non-margined derivative. There

are no additional burdens, costs or constraints that are not already present in the OTC market without a margin mandate. Therefore, the dynamic feature of the problem does not create any costs for a margin mandate.

Cash and Non-cash Collateral

The way the margin mandate is structured, it has generally required that cash be posted as collateral. Before the mandate, the dealer bank could secure its derivative trades with a company using the company's business assets. Some opponents of the reform, especially the dealer banks, that this offered the companies a lower cost alternative. For example, Blythe Masters of J.P. Morgan explains that:

> Exposure to end-users that is either secured by assets that a clearinghouse can't accept (e.g. property, reserves, equipment, commodities) or is unsecured [,] does not pose a systemic risk. From the standpoint of the end-users, the ability to pledge this kind of collateral or to transact on an unsecured basis is very favorable, as it allows them to enter into risk management using the assets that they own in their businesses with no disruption to those businesses and without draining their liquidity to come up with cash. From the standpoint of the dealers, exposure to these end-users often is what is referred to as "right way risk" in that the exposure moves in the same direction as the value of the collateral or the overall business. For example, if a natural gas producer wants to hedge its production, it will enter into a natural gas swap with J.P.Morgan in which it pays J.P.Morgan a floating price and receives a fixed price, and it might pledge its gas reserves as collateral to secure the swap. If gas prices go up, J.P.Morgan has increased credit exposure on the swap, but the value of its collateral also has increased and the overall enterprise value of the producer has increased, so from a credit standpoint J.P.Morgan does not face increased risk. The mitigation from right-way risk applies to unsecured exposure as well – if an exposure is "right way" a dealer is more likely to extend unsecured credit because the client's overall credit-worthiness tends to improve as the exposure grows. Masters (2009).

This argument fails to address the fact that the margin mandate merely forces a separation of the transaction into component parts: the margined swap and a line of credit. The mandate only requires that the margin account be in cash, and says nothing about the terms of the line of credit. The bank is free to set those terms as it sees fit. It can

accept as security any of the assets mentioned (e.g. property, reserves, equipment, commodities). Or, it can leave the credit line unsecured, based on its assessment of the underlying "right way risk" in the company's line of business. So the margin mandate doesn't meaningfully restrict the financial services that can be sold to the company. It only requires that they be unbundled and accounted for separately. Indeed, since the reform has been underway, a number of dealers have begun marketing new financial products in which the company posts collateral in various forms and the bank funds cash margin accounts.

4. INSTITUTIONIAL PRACTICE

We have argued that a non-margined derivative is equivalent in economic substance to the package of (i) a margined swap, plus (ii) a contingent line of credit to fund the margin. Because they are economically equivalent, the true cost to the company seeking to hedge must be the same. However, this doesn't preclude there being secondary, institutional factors such that the two economically equivalent transactions are treated differently in important ways that result in the company paying different costs on a non-margined swap than it pays on a margined swap. Two key institutions to consider are accounting rules and bank regulations.

Accounting

Is there any difference in the accounting for a non-margined swap and a package of (i) a margined swap, plus (ii) a contingent line of credit to fund the margin? The focus here is on the accounting at the non-financial company hedging with the swap. Tables 4, 5 and 6 show the accounting impact of the three different hedges described in Tables 1, 2 and 3. Our focus is on comparing Table 4 and Table 6.

First, as the swap plays out over time, accruing either a mark-to-market loss or gain, in both cases the company's accounts will show these on the balance sheet. In this respect, the non-margined swap and the package of a margined swap with a contingent line of credit are identical.

Second, as shown in Table 6, the company with the margined swap will show the balance of its margin account as an encumbered cash asset, and there will appear an offsetting liability for the balance outstanding on the credit line. As shown in Table 4, the company with the non-margined swap will show neither of these entries. Therefore, although the net asset/liability position shown on the balance sheet is the same for the two companies, the gross values shown differ.

Third, and finally, as shown in Table 6, the company with the explicit contingent credit line will mention the unused portion of the credit line in the notes to the financial statement. The company in Table 1, with the non-margined swap that includes an implicit contingent credit line, will not report such information.

These two differences could lead management to prefer hedging using non-margined derivatives for a number of reasons. Management might be deceived about costs by the fact that the contingent credit associated with a non-margined swap is not explicitly recognized in the financial statements. Or, management might prefer that shareholders are not fully informed. The differential treatment might also have an impact through ratios embedded in bond covenants or other contractual relationships. It is hard to make a case that any group of market participants would be consistently deceived about value and cost; instead it is a case of whether parties have more or less information. A margin mandate forces a more explicit description of the company's credit situation. It is

hard to imagine a cogent public policy argument being made in favor of maintaining the less informative system of non-margined derivatives.

Bank Regulations

Probably the most important issues in how the dealer bank accounts for the two types of transactions pertain to the various capital regulations and other supervisory controls. Do the bank's supervisory authorities see the implicit credit line embedded in the non-margined swap? Is it treated the same as an explicit contingent line of credit? Is one channel for credit run through the banking book, where credit risk and the associated capital requirements are calculated one way, while the other is calculated in the trading book, where credit risk and the associated capital requirements are calculated in a different way. In that case, the cost to the bank of providing the credit might vary according to the channel through which the credit is offered.

It appears that in the past the authorities may not have taken full account of the volatile credit risk banks assumed when selling non-margined swap. The Basel Committee on Banking Supervision (2009) concluded that,

> …the regulatory capital treatment for counterparty credit risk was insufficient in the following areas.
>
> • Mark-to-market losses due to credit valuation adjustments (CVA) were not directly capitalised. Roughly two-thirds of CCR losses were due to CVA losses and only about one-third were due to actual defaults. The current framework addresses CCR as a default and credit migration risk, but does not fully account for market value losses short of default.
>
> • Initial margining typically was very low at the start of the crisis and increased rapidly during the turmoil. This had a destabilising effect on many market participants and sometimes caused or precipitated defaults. Capital based on Effective expected positive exposure (EPE) did not provide sufficient incentive for adequate initial margins to be required at all points of the cycle.

If regulators treat the credit risk associated with the non-margined swap more leniently than the credit risk associated with the contingent credit line funding a margin account, then obviously the cost charged to the company for the non-margined swap may be less than the cost charged for a margined swap. This is not a true social savings, since the cost of the credit risk is loaded onto the financial system and the taxpayer backstop. But nevertheless, it is a savings from the point of view of the non-financial company.

This last point needs to be acknowledged in the debate over how banking supervisors treat the implicit credit embedded in non-margined derivatives. In implementing the Dodd-Frank Act, a number of regulators in April 2011 proposed a rule regarding swap margin and capital requirements for dealers, as opposed to the margin requirement for end-users—Federal Reserve (2011). Many end-users, as well as the dealers, would like the banking supervisors and other regulators to allow the banks to sell non-margined derivatives to end-users without the banks themselves being forced to fully recognize the implicit credit embedded in the derivative and without having to maintain a corresponding capital cushion to cover the associated credit risk. This has motivated the U.S. House of Representatives to pass HR2682, directing banking supervisors to overlook the credit risk embedded in non-margined swaps sold to end-users and others. The Senate has not yet taken up this proposal. Were a bill like this to pass, it would create a real cost differential favoring the sale of non-margined derivatives over the sale of a margined derivative with an associated contingent line of credit. But the differential would reflect a cross subsidy stemming from the differential regulatory treatment and not a cost differential reflecting a true difference in social cost.

5. HISTORY OF MARGIN REGULATION

It is useful to put the current debate about derivative margin regulation into historical context. Many of the issues at the fore of the debate over the end-user exemption have arisen in another form in previous eras in the evolution of derivative markets. Although this paper is not the place for a comprehensive history of margin practice and regulation, we try to accurately characterize the key events and debates that will ring relevant to the current discussion. Looking back, we think there are three points that are relevant.

First, the practice of margining is a natural feature of derivative trading arising out of the need to assure the integrity of the contract and payments of obligations, but parties to individual transactions have often been given significant discretion to determine the margin they would require.

Second, mandatory minimum margins arise from the shift to central counterparty clearing at the turn of the 20th century, and also from the public interest in the stable functioning of derivative markets. Throughout much of the 20th century margining was mandated. The rise of the OTC swaps market brought a return to the discretionary practice that had prevailed in the 19th century and into the 20th century. The current reforms represent a shift back again to the practices that prevailed through much of the 20th century.

Third, there have been recurrent debates over whether margin requirements could be set in order to dampen speculation and volatility in derivative markets. These debates repeatedly confront the fact that the real issue is the availability of credit and whether the regulations governing margin are an effective constraint on traders. As the U.S. economy

has matured, regulators have tended to minimize the impact of margin rules on the level of derivative trading, so that the focus is returned to the integrity of the contract and the stable functioning of the derivative market. This matches our argument here which emphasizes that the margin mandate does not increase the cost of hedging since modern capital markets can readily substitute an explicit line of credit for the implicit credit embedded in the non-margined derivative.

Among the very first rules of the Chicago Board of Trade (CBOT) for which we have a record is one from May 1865 setting out the terms for posting margin. It reads:

> On all time contracts made between members of this association satisfactory margins may be demanded by either party, not to exceed 10% on the value of the article bought or sold on the day such margin is demanded, said margin to be deposited at such place or with such person as may be mutually agreed upon. Such margin may be demanded on or after the date of contract, and from time to time as may be deemed necessary to fully protect the party calling for same. Should the party called upon for margin, as herein provided, fail to respond within twenty-four hours thereafter, it shall be optional with the party making such call to consider the contract filled at the market value of the article on the day said call is made, and all differences between said market value and the contract price shall be settled the same as though the contract had fully expired. Taylor (1917) v. I, p. 325.

A nearly identical version of this rule was included as a part of the new system of General Rules and By-Laws passed at a special meeting in October 1865 that represented a key milestone in the development of standardized futures contracts. As commodity futures trading developed in other locations and for other commodities, these other exchanges developed similar margin rules. For example, records show that at least as far back as 1877, the Kansas City Board of Trade allowed members to charge a margin of 10% on trades.[5] An observer writing about commodity exchange operations in 1896 mentions margining as a feature of the New York Coffee Exchange, the New York

[5] Scott (1948), p. 99.

Cotton Exchange, the New York Produce Exchange and at exchanges in Chicago, St. Louis, Minneapolis, Toledo and elsewhere.[6]

Initially, exchange rules simply gave traders the right to demand margin, but this right could be exercised at their discretion as noted in the account of one observer in 1911,

> The actual practice of calling cash margins in grain transactions, as in the case of margin calls on stocks, depends largely upon the financial responsibility of the parties. In many trades between members, where each is perfectly confident of the other's financial stability, the calling of margins is unnecessary, and is often disregarded. The contract is allowed to run with very little attention paid to this matter. On the other hand, where the parties to the deal are not so responsible, margins are frequently called…When a member of the Exchange makes contracts for the account of an outside party it is customary to call upon the latter for the initial deposit of ten per cent and require him to keep this deposit good. The calling of margins does not depend upon any set rule, but is determined by the parties to each individual transaction.[7]

Hence, just as with OTC derivatives pre-Dodd-Frank, the parties could leave the contract un-margined.[8]

Elements of enforced standardization arise from two forces. First, there is the shift to central counterparty clearing that began in the late 19th century. Because the clearinghouse steps in as the counterparty to all member trades, it becomes necessary to develop a single set of rules governing the margins that members will post with the clearinghouse. In addition, the use of a common clearinghouse invites a collective decision among members about the margins that members will require from their customers. Second, there is the public interest in the significant economic role played by

[6] Emery (1896), p. 72.

[7] Harris (1911), p. 39.

[8] See also Federal Trade Commission (1920b), p. 161 and p. 206, and Boyle (1921) p. 85.

futures markets. Public debate naturally focuses on margin rules as an important determinant of the stability of the markets.

In 1891, the Minneapolis Chamber of Commerce was the first U.S. exchange to implement central counterparty clearing.[9] Exchanges in other cities gradually followed suit. As new futures exchanges were established, central counterparty clearing was often the chosen structure right from the start. This was the case at the Chicago Mercantile Exchange (CME), for example, established in 1919 for trade in butter, eggs and other products.[10] Nevertheless, the largest exchange of them all, the CBOT, remained a holdout against central counterparty clearing. But finally, in 1925, succumbing in part to government pressure, the CBOT, too, made the switch.[11] From this point, central counterparty clearing was standard practice for derivatives trading in the U.S., and remained so for the next 50 years, until the arrival of the OTC swaps market in the last quarter of the 20th century.[12]

In the early 1900s a few exchanges required that all members charge customers a minimum margin.[13] Beginning with the Great Depression, Federal authorities made a

[9] Federal Trade Commission (1920b), p. 227.

[10] Irwin (1954) pp. 39-42.

[11] Norman (2011), p. 103 ff. The Federal Trade Commission (1920b), favorably contrasts the Minneapolis Exchange's "more highly developed and more economical clearing house" with the CBOT's older system. The Federal Trade Commission (1926), p. 283, notes the CBOT's 1925 decision to adopt complete clearing with the comment that "The Chicago Board of Trade has been backward in adopting the complete clearing system."

[12] Hoffman (1932), p. 198 cites the Toledo Produce Exchange (seed futures) as an exception.

[13] Board of Governors of the Federal Reserve System (1984), pp. 55-56. Irwin (1954) pp. 34-35 reports that "By approximately 1900, the New York Mercantile Exchange had provided that sales of butter or eggs made on the exchange for future delivery should be evidenced by a standard contract signed by both parties and that margins equal to 10 percent of the contract price should be deposited by both parties with the Superintendant of the Exchange." and that "Then in July, 1916 the [Chicago Butter and Egg] Board voted almost unanimously to allow members to buy and sell for delivery at any time in the future, but that all contracts for more than ten days in the future must be in writing, signed by both parties, and that a margin

number of efforts to establish this practice at all exchanges. Despite some resistance and vacillation, by 1941 it had become the near universal practice for derivatives trading in the U.S., and remained so, until the arrival of the OTC swaps market in the last quarter of the 20th century.[14] The minimum level of margin required was set by the individual exchange and varied according to a number of things, including market conditions and episodic pressure from Federal authorities.[15] It is said that at least in the mid- to late-20th century most members charged customers more than the minimum, accepting the minimum only for a few particularly safe ones.[16]

The rules governing minimum margins charged to customers have generally made distinctions, notably differentiating the margin required for hedge, spread and speculative positions.[17]

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of approximately a cent per dozen (a cent per pound for butter) must be deposited with the treasurer of the Board." In 1919, when the Chicago Mercantile Exchange was established as the successor to the Chicago Butter and Egg Board, its rules mandated a minimum margin in all trades between members and customers. Irwin (1954), p. 41.

[14] In 1933, the Secretary of Agriculture convened a conference of the exchanges to discuss the recent collapse of grain prices, and the establishment of adequate margin requirements was decided upon as a means for limiting excessive price fluctuations. In 1934, the Code of Fair Competition for Grain Exchanges adopted under the National Industrial Recovery Act (NIRA) included a compulsory margin requirement of 10% adopted by 12 of the 14 grain futures exchanges. While the Supreme Court struck down the NIRA the year after, most of the exchanges continued to require a minimum margin from customers. However, the cotton exchanges and the CBOT, the largest grain exchange, did not. In 1938, the recently established Commodity Exchange Authority (CEA) again pressed for minimum margins, which most of the exchanges voluntarily instituted. Exceptions included the New York Wool Top Exchange and the Chicago Open Board of Trade. See the statement of Walter R. Scott, Executive Vice President, Kansas City Board of Trade, Kansas City, Mo., in U.S. Senate Committee on Agriculture and Forestry (1948), pp. 100-101, the Board of Governors of the Federal Reserve System (1984), pp. 55-56. Markham (1991), p. 72, citing a CEA report, U.S. Department of Agriculture (1941), Circular No. 604, Trading in Wool Top Futures.

[15] See Markham (1991).

[16] Board of Governors (1984), p. 73.

[17] See for example the 1933 margin rules described for the Kansas City Board of Trade in Scott (1948), p. 100.

Public attention to margin rules has also focused on the question of whether the level of margin required should be set to speculation and volatility in derivative markets.[18] As far back as the Federal Trade Commission's (FTC) 1920 report on Future Trading Operations in Grain, critics of the futures markets focused on the low margin requirements as the cause of destabilizing speculation.[19] While the FTC report led directly to the Grain Futures Act of 1922, that Act provided no authority to regulate margins. Instead, it focused on establishing designated markets, the reporting of positions and creation of a designated regulator. In 1934, in the midst of the Great Depression, President Roosevelt argued that "unregulated speculation in securities and in commodities was one of the most important contributing factors in the artificial and unwarranted 'boom' which had so much to do with the terrible conditions of the years following 1929." He specifically urged the regulation of margin so that speculation "will of necessity be drastically curtailed." Through the quirks of politics and history, he succeeded with respect to securities, but failed with respect to commodities: the Securities Exchange Act of 1934 gave the Federal government authority to regulate margins in stock trading, but the Commodity Exchange Act of 1936 provided no similar authority with respect to trading in commodity futures. However, efforts to introduce margin regulation for the purpose of limiting speculation in commodity futures markets continued. For example, testifying before the Senate in 1948, the Secretary of Agriculture pointed out that:

[18] The historical debate over margin regulations and speculation encompasses all types of trading, including trading by financial investors as well as financial intermediaries. The focus in this paper is on how margin rules affect the cost of trading derivatives by non-financial companies. Margin regulations can impact financial investors and financial intermediaries even if they do not significantly impact non-financial companies – for example, through the interplay with capital requirements and other constraints.

[19] Federal Trade Commission (1920b), pp. 156-157.

> The Commodity Exchange Act recognizes that excessive speculation may cause sudden or unreasonable fluctuation in prices. It provides authority for fixing limits on the amount and commitment of individual speculators. Such limits, however, can affect directly only the trading of large operators. They cannot be made low enough to affect the mass trading of the thousands of small speculators without impairing the hedging facilities of the futures market. … In a boom period increased margins curb the entrance of speculative buyers with inadequate resources. Adequate margins also provide a cushion against forced liquidation which accentuates subsequent price declines. Adequate margins also deter mass short selling in periods of falling prices.

However, once again, Congress granted no such authority. Markham (1991) reports that "Between 1948 and 1974, proposals to impose federal regulation of margins were raised in Congress and rejected on at least eight separate occasions."

From the 1970s, the debate continued, but with a new focus. Previously, derivative trading had been synonymous with commodities trading, so that a segregation of securities regulation and commodities regulation was workable. Then, in the 1970s and 80s, a futures industry with its origin the world of commodity trading successfully introduced financial futures and options, forcing the question of two disparate regulatory systems, one for securities and one for securities derivatives.[20] In particular, the stock market crash of 1987 highlighted the differential treatment of stocks and stock index futures. The Presidential Task Force created after the 1987 – the Brady Commission – reiterated the historic concerns of excessive speculative activity and concluded that margin levels should be rationalized across markets.[21] The SEC advocated strongly in

[20] In addition to different regulatory regimes, there is a different usage of the term 'margin' in equity markets and derivative markets. The different regimes and difference in usage sometimes leads industry participants to claim that there margins in the securities industry are completely different from margins in derivative markets. While the different usage means that one needs to take care in comparing statistics and rules, it is not correct to say that the two are completely different. In securities markets we are dealing with credit granted outright, while in derivative markets the credit is only contingent. Margin rules in securities markets govern how much credit can be granted, and in derivative markets margin rules determine how much contingent credit can be granted.

[21] Markham (1991) p. 118.

favor of this, but the CFTC continued to oppose it, along with the futures exchanges. In 1988, President Reagan established a Working Group on the issue, which sought inter-agency accommodation and avoided any new legislative action. If anything, the Working Group sided with the position of the futures exchanges that margins should be set to assure performance on the contracts and not to control the level of speculation. The mini-crash of 1989 sharpened the issue once again, but without bringing about any new resolution. Treasury Secretary Brady and SEC Chairman Richard Breeden again advocated for authority. The SEC Chairman claimed that leverage created by low margins in stock index futures encouraged "rampant speculation" and caused "excess volatility". However, the Chairman of the Federal Reserve, Alan Greenspan, expressed skepticism that setting margins higher than necessary to assure performance would "reduce excessive stock price volatility."[22]

In the early years of these various debates on margins and speculation, it was often taken for granted that raising margin requirements would decrease trading. In part that is because it was implicitly understood that credit extended by securities dealers and futures dealers was an important channel for credit that could not be easily replaced. But occasionally, the tie between the impact of margin requirements and the substitutability of alternative sources of credit was explicitly noted. For example, a 1938 Department of Agriculture report notes that "margin control would tend to restrict speculation," but that "there is the possibility that speculators will accumulate large lines [of credit] if the unanticipated profit appear to justify the advancing of large margins."[23] The connection

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[22] Markham (1991), pp. 119-122.

[23] Mehl (1936).

between credit regulation and margin regulation was also reinforced in 1980 when in response to the silver crisis precipitated by the Hunt brothers, the Federal Reserve attempted to discourage speculation in commodity markets by directing banks not to issue loans on speculative trades.[24]

The debate surrounding the rationalization of the regulations governing securities markets and futures markets forced the issue of the substitutability of alternative sources of credit to the addressed explicitly. In 1984, the Federal Reserve conducted a complete review of federal margin regulations, and its conclusions marked a major turning point on the issue. The Federal Reserve had long been responsible for supervising the margin regulations for the securities markets. It had insisted that its authority extended to futures trades in securities, although it had as yet not practically exercised that authority. However, while standing by the principle of its authority and its responsibility, the new study focused attention on how credit markets had evolved since the 1934 Securities Exchange Act had given the Federal Reserve authority over margin accounts on stocks. Specifically, it noted the increased availability of credit of various forms that dwarfed the volume of credit granted through margin accounts, so that regulation of margin accounts could no longer have the same impact on the total level of speculative activity. Therefore, the Federal Reserve found that rationalization of the system might very well be implemented by moving in the direction of lower margins designed primarily to assure performance on the trade.[25] The Treasury responded to the Federal Reserve Board study

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[24] Cited in Markham (1991), p. 89, fn. 202.

[25] Board of Governors of the Federal Reserve System (1984). See also the Volker letter cited by Markham (1991) pp. 98-99.

in like manner, stating that "whether or not the objectives of Congress in creating a system of federal securities margin regulation were valid in 1934, there no longer appears to be a need for such regulation today." [26]

6. CONCLUSION

We present a replication argument to show that a non-margined swap is equivalent to a package of (i) a margined swap, plus (ii) a contingent line of credit. A mandate to clear and therefore to margin derivative trades forces derivative dealers to market these two components separately, but otherwise makes no additional demand on non-financial corporations. Therefore, a clearing and margin mandate does not add any real costs to a non-financial corporation seeking to hedge its commercial risk.

Non-financial companies focus on the cost of posting margin. We point out, however, that this is just confusing the messenger with the message. Posting margin is costly, but the cost comes from the credit risk inherent in hedging. Non-margined derivatives embed this same cost in the price terms of the derivative. Margined derivatives force this cost to be priced separately and explicitly in the line of credit that must be raised.

The replication argument shows that the first-order cost imposed on non-financial corporations by a clearing and margin mandate is zero. However, there may be second order costs that arise if other institutions treat the credit implicit in a non-margined derivative different from the credit in a margined derivative. We discuss how accounting regulations and bank capital regulations may give rise to some differences. We also place

[26] Cited by Markham (1991) pp. 98.

the current debate in the context of the longer history of debate over the rules for margining derivatives.

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Table 1
Cash Flows on a Non-Margined Swap

Swap terms:

[1]	Trade date:	November 2010
[2]	Payment date:	February 2011
[3]	Floating price:	Oil futures price, contract for March 2011 delivery
[4]	Fixed price:	$82.00 (March contract price on trade date)
[5]	Notional quantity:	10 million barrels
[6]	Margin required:	None

Scenario #1: falling price

[7]	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[8]	March Contract Price	82.00	81.00	80.00	79.00	
[9]	MTM Value	0.0	-10.0	-20.0	-30.0	
[10]	Swap Payment	0.0	0.0	0.0	-30.0	-30.0

Scenario #2: rising price

[11]	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[12]	March Contract Price	82.00	83.00	84.00	85.00	
[13]	MTM Value	0.0	10.0	20.0	30.0	
[14]	Swap Payment	0.0	0.0	0.0	30.0	30.0

Table 2
Cash Flows on a Margined Swap

Swap terms:

[1]	Trade date:	November 2010
[2]	Payment date:	February 2011
[3]	Floating price:	Oil futures price, contract for March 2011 delivery
[4]	Fixed price:	$82.00 (March contract price on trade date)
[5]	Notional quantity:	10 million barrels
[6]	Margin required:	15 % of the notional value, less the mark-to-market value

Scenario #1: falling price

	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[8]	March Contract Price	82.00	81.00	80.00	79.00	
[9]	MTM Value	0.0	-10.0	-20.0	-30.0	
[10]	Swap Payment	0.0	0.0	0.0	-30.0	-30.0
[11]	**15% of Notional**	**123.0**	**121.5**	**120.0**	**0.0**	
[12]	**Margin Balance Required**	**123.0**	**131.5**	**140.0**	**0.0**	
[13]	**Margin Cash Flow**	**-123.0**	**-8.5**	**-8.5**	**140.0**	**0.0**
[14]	**Net Cash Flow**	**-123.0**	**-8.5**	**-8.5**	**110.0**	**-30.0**

Scenario #2: rising price

	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[16]	March Contract Price	82.00	83.00	84.00	85.00	
[17]	MTM Value	0.0	10.0	20.0	30.0	
[18]	Swap Payment	0.0	0.0	0.0	30.0	30.0
[19]	**15% of Notional**	**123.0**	**124.5**	**126.0**	**0.0**	
[20]	**Margin Balance Required**	**123.0**	**114.5**	**106.0**	**0.0**	
[21]	**Margin Cash Flow**	**-123.0**	**8.5**	**8.5**	**106.0**	**0.0**
[22]	**Net Cash Flow**	**-123.0**	**8.5**	**8.5**	**136.0**	**30.0**

Table 3
Cash Flows on a Margined Swap + a Contingent Line of Credit

Swap terms:

[1]	Trade date:	November 2010
[2]	Payment date:	February 2011
[3]	Floating price:	Oil futures price, contract for March 2011 delivery
[4]	Fixed price:	$82.00 (March contract price on trade date)
[5]	Notional quantity:	10 million barrels
[6]	Margin required:	15 % of the notional value, less the mark-to-market value

Scenario #1: falling price

	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[8]	March Contract Price	82.00	81.00	80.00	79.00	
[9]	MTM Value	0.0	-10.0	-20.0	-30.0	
[10]	Swap Payment	0.0	0.0	0.0	-30.0	-30.0
[11]	**15% of Notional**	**123.0**	**121.5**	**120.0**	**0.0**	
[12]	**Margin Balance**	**123.0**	**131.5**	**140.0**	**0.0**	
[13]	**Margin Cash Flow**	**-123.0**	**-8.5**	**-8.5**	**140.0**	**0.0**
[14]	**Credit Line Withdrawals / Payments**	**123.0**	**8.5**	**8.5**	**-140.0**	
[15]	**Credit Line Balance**	**123.0**	**131.5**	**140.0**	**0.0**	
[16]	**Net Cash Flow**	**0.0**	**0.0**	**0.0**	**-30.0**	**-30.0**
[17]	**Difference from Non-Margined Swap**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Scenario #2: rising price

	Date	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Total
[19]	March Contract Price	82.00	83.00	84.00	85.00	
[20]	MTM Value	0.0	10.0	20.0	30.0	
[21]	Swap Payment	0.0	0.0	0.0	30.0	30.0
[22]	**15% of Notional**	**123.0**	**124.5**	**126.0**	**0.0**	
[23]	**Margin Balance**	**123.0**	**114.5**	**106.0**	**0.0**	
[24]	**Margin Cash Flow**	**-123.0**	**8.5**	**8.5**	**106.0**	**0.0**
[25]	**Credit Line Withdrawals / Payments**	**123.0**	**-8.5**	**-8.5**	**-106.0**	
[26]	**Credit Line Balance**	**123.0**	**114.5**	**106.0**	**0.0**	
[27]	**Net Cash Flow**	**0.0**	**0.0**	**0.0**	**30.0**	**30.0**
[28]	**Difference from Non-Margined Swap**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Table 4
End-User Balance Sheet
January 2011
with Non-Margined Swap

	Assets	Liabilities	
Total cash	200	20	Gross derivative liabilities
Gross derivative assets	0	640	Other liabilities
Other assets	960	660	Total liabilities
		500	Equity
Total	1,160	1,160	Total

Notes to the Financial Statement:

Ratios:

Cash to Total Assets	17%
Liabilities to Total Assets	57%

Table 5
End-User Balance Sheet
January 2011
with Margined Swap

	Assets	Liabilities	
Cash in margin account	140	20	Gross derivative liabilities
Other cash	200	640	Other liabilities
Total cash	340	660	Total liabilities
Gross derivative assets	0	640	Equity
Other assets	960		
Total	1,300	1,300	Total

Notes to the Financial Statement:

Ratios:

Cash to Total Assets	26%
Liabilities to Total Assets	51%

Table 6
End-User Balance Sheet
January 2011
with Margined Derivative + Line of Credit

	Assets	Liabilities	
Cash in margin account	140	140	Used line of credit
Other cash	200	20	Gross derivative liabilities
Total cash	340	640	Other liabilities
Gross derivative assets	0	800	Total liabilities
Other assets	960	500	Equity
Total	1,300	1,300	Total

Notes to the Financial Statement:

Undrawn amount on line of credit:	680

Ratios:

Cash to Total Assets	26%
Liabilities to Total Assets	62%