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The Effects of OTC Derivative Clearing on Macroeconomic Stability

William Butler
John Carroll University, wbutler13@jcu.edu

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By: Will Butler

Advisor: Dr. Scott Moore

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Introduction

A derivative in its simplest terms is a contract between two parties about the value of an underlying asset. The parties can initiate these contracts in two ways, on large, standardized exchanges, or privately between two parties in the Over the Counter (OTC) market. Over the Counter derivatives have been identified as a contributing factor to the financial crisis in 2008. This is partially because the OTC derivatives market is exposed to a large amount of counterparty risk, or the risk that the other party involved in the contract will default on payment of the derivative contract. While counterparty risk in the OTC market might sound like it is simply the same type of default risk in other financial markets, the concentration of contracts around relatively few key financial institutions and size of the market make the economy increasingly subject to the risk of a default in this market (Shinasi, 2001). Figure 1 below shows the BIS estimates of the recent value of OTC derivative contracts outstanding. This value is more than 3 times the market value of US stock exchanges and is only slightly less than the Gross Domestic Product (GDP) of the world .

	Notional Amount Outstanding (in billions of USD) (BIS 2012)				
Instrument	**Dec-10**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**
Forwards and Forex Swaps	$ 28,433.00	$ 31,113.00	$ 30,526.00	$ 31,395.00	$ 31,718.00
Currency Swaps	$ 19,271.00	$ 22,228.00	$ 22,791.00	$ 24,156.00	$ 25,420.00
Options	$ 10,092.00	$ 11,358.00	$ 10,032.00	$ 11,094.00	$ 10,220.00
Total	$ 57,796.00	$ 64,698.00	$ 63,349.00	$ 66,645.00	$ 67,358.00
2011 World GDP (in billions of USD)	$ 69,988.00	(World Bank 2012)			
Market Cap of US Stock Markets	$ 18,668.00	(World Bank 2012)			

Figure 1 Size of the OTC Derivative Market (BIS 2012)

A prime example of the significance of counterparty risk in the OTC market was insurance giant American International Group (AIG), which, in 2008, had issued approximately $527 billion notional value in credit default swap contracts and accumulated these obligations while only posting a small percentage of the expected payment obligation as collateral. Because AIG posted little collateral per contract, it was able to issue contracts to such an extent that when called to increase the amount of collateral posted due to a drop in its credit rating, AIG teetered on the edge of bankruptcy until it was bailed out by the federal government in September of 2008 (Sjostrum, 2009). If this would have been a small business filing for bankruptcy and defaulting on obligations, there would be an economic loss to the stakeholders in that business. However, considering that the counterparties to AIG's credit default swaps are some of the world's largest financial institutions, such as Goldman Sachs and the Royal Bank of Scotland (MacIntosh, 2009), AIG's bankruptcy or default could cause a chain reaction of financial distress that affects the availability of credit to individuals and business around the world are able to receive (Shinasi, 2001).

In response to the 2008 financial crisis, the United States passed the Dodd-Frank Financial Reform Act of 2008, one of its most comprehensive acts of financial legislation in history. Emphasizing the significance of OTC derivatives as a contributing factor to the crisis, a key provision of the Dodd-Frank Act calls for increased restrictions on the OTC market. Although the details are still in the process of being implemented, a process known as "clearing derivatives" is present in Title VII of Dodd-Frank. Congress intended this provision to mitigate counterparty risk. The new clearing requirements aim to accomplish this in several of ways; requiring companies to post additional collateral, contribute to a default account, and settle the gains and losses periodically, so losses cannot accumulate on credit (Ernst & Young LLP, 2013).

While improving the clearing process may be successful at mitigating counterparty risk, it could also have unintended economic consequences. These additional requirements increase the costs of engaging in OTC derivative contracts. Thus, the new clearing requirements could reduce the extent to which firms use OTC derivatives to hedge against risk. Additionally, the agencies implementing Dodd-Frank's OTC derivative reforms are facing increased legal scrutiny for failing to sufficiently demonstrate the economic consequences of these regulations (Scalia, 2012), which has created an audience interested in literature that studies the relationship between derivatives and the economy. Currently, however, a majority of the literature has been confined to studying the effects of OTC derivative regulations on individual firms and not on its effects on the economy as a whole (Gerding, 2011).

This paper attempts to address the missing macroeconomic aspect to OTC derivative clearing literature and proceeds by providing a framework for analyzing the effects of reduced derivative hedging activity on the sensitivity of Gross Domestic Product (GDP) to shocks, or unexpected changes in macroeconomic variables. This paper draws on literature regarding the transmission of monetary policy to show how the initial shock to a given economic variable affects other variables and eventually affects components of GDP, consumer spending, investment spending, government spending, and net exports. This paper begins by providing a brief overview of OTC derivative contracts, and it then provides an analysis of why clearing requirements can be expected to reduce the extent to which firms use derivatives to hedge; the paper examines four transmission channels individually, the credit channel, exchange rate channel, equity price channel, and the money multiplier, and explains how a reduction in hedging activity may change the sensitivity of GDP to an economic shock. Finally, this paper provides suggestions for further research on the topic.

Overview of Derivatives

To understand the importance of clearing, it is helpful to understand the basic function of derivatives and the mechanics of their trading. At a basic level, a derivative is a contract in which two parties agree to fulfill an obligation in the future with respect to the condition of some underlying asset, and the value of the contract, or its market price, fluctuates according to the structure of the underlying asset (Gharagozlou, 2011).

One of the simplest OTC derivatives is a foreign currency forward. These contracts are used to hedge against a change in exchange rates that could alter the value of a company's cash flows denominated in another currency. The value of the forward contract depends on the value of these cash collections, which varies based on the exchange rate: as the value of the US dollar declines relative to the foreign currency, the contract becomes less valuable to the party buying it because the company could have exchanged its cash collections at a more favorable rate without the contract. The benefit to the company is the ability to lock in the exchange rate and reduce uncertainty about the value of its cash collections in the future by making the exchange rate risk itself tradable (Papaioannou, 2006). Forward contracts allow companies to more reliably forecast their earnings, making them very popular; it is estimated that 92% of Fortune 500 companies manage price risks using derivatives (Deutsche Boerse AG, 2008).

Another type of derivative contract is an option contract. In an option contract, the buyer of the contract has the right to buy or sell that asset at a specific time for a specific price. With a forward contract, both parties remain exposed to both unlimited risk of the underlying asset increasing and decreasing in price because they have the obligation to fulfill the terms of the contract. An option, on the other hand, provides the buyer simply with the right, not the obligation, to buy or sell the asset. This protects the buyer insofar as the maximum amount of downside risk is simply the fee associated with buying the option (Gharagozlou, 2011).

Another type of derivative contract is a credit default swap (CDS), which can be used to hedge against the risk of a change in creditworthiness of an underlying asset. For example, many large financial firms sought such protection from various assets using Credit Default Swaps (CDSs) issued by AIG, in which AIG promised to pay investors in the event that the credit status of one of their assets changed (Deutsche Boerse AG, 2008).

An important distinction among different types of derivatives is how they are originated and traded. Exchange traded derivatives are fully standardized, which means that the terms of the contracts are set by the exchange on which they are traded, and the contracts do not vary among different parties. OTC derivatives are directly negotiated between two parties without the presence of an exchange. These contracts have custom terms that differ significantly from commonly observable contracts. They are typically less liquid, meaning easily convertible to cash without significantly altering the price, because there is no large market where investors can observe their price and terms. This makes these contracts hard to price and sell, though it should be noted that most OTC derivatives are fairly standard and not subject to much liquidity risk (Deutsche Boerse AG, 2008).

The distinction between exchange-traded derivatives and OTC derivatives is important because we can expect clearing requirements to have different effects in the different markets based on their characteristics. The next section will expand on the likely implementation of OTC derivative clearing requirements in Dodd-Frank and analyze potential consequences for the OTC market.

OTC Derivatives and Clearing Requirements

Dodd-Frank contains a provision to enforce clearing in the OTC market in the same way as it is currently enforced in the exchange traded derivatives market. To accomplish this, a clearinghouse would act as the counterparty to both sides of the contract. The clearinghouse would require a number of additional steps to engage in a contract. Figure 1 below provides an outline of the proposed process (Russo, Hart, & Shoenenberger, 2002).

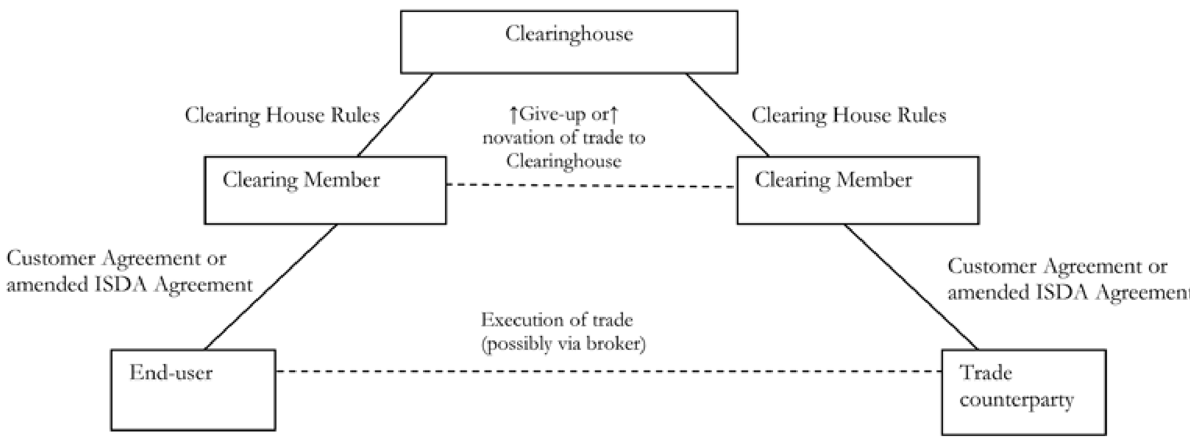

Figure 2: OTC Derivative Clearing Process (Sidney Austin, LLP, 2011)

Figure 1 shows how the formerly privately negotiated contracts would go through the clearing process. The end-user, the buyer of the contract, and the trade counterparty, the seller, both submit the contract to a central clearing party for approval before the trade is executed. The logistics of this process are intended to mitigate counterparty risk in several ways. First, this contractual agreement requires each party to post collateral in a settlement account at the clearinghouse. The role of this collateral is to make the agreement more secure, requiring each firm to place a certain percentage of the expected payment on the contract in an account at the clearinghouse helps ensure payment (Pirrong, 2009).

Parties are generally only required to post a portion of the settlement amount as collateral, but the clearinghouse re-computes the collateral requirements multiple times per day based on the current settlement amount of the contract. If a party is unable to meet the requirements of the contract, it is considered in default and its settlement account is cleared to ensure that the clearinghouse can party in the transaction. This feature helps to prevent the losses on contracts from accumulating and reduce the risk that the counterparty will not have capital available to make the expected payment. A second feature of the legislation requires the counterparties to post additional capital to a common default account. The clearinghouse can draw down this account to pay a counterparty in the case of a default. This adds a second layer of security to the clearinghouse (Pirrong, 2011).

While these new requirements may reduce counterparty risk, they also could reduce the optimal amount of hedging that firms engage in for several reasons. First, since firms are required to post a margin for the hedging contracts, it reduces the extent to which the firms' limited capital can be used to back derivative contracts. The clearinghouse has to maintain a default fund from which it will draw funds to compensate parties in the case of a default when the posted margin is not sufficient to cover the contract. The contribution to the default fund is usually based on the size of the individual margin account, which increases as the value of the contracts increase. Thus, as the amount of cash flow a firm needs to hedge increases, the more the firms must contribute to its clearinghouse default fund (Pirrong, 2009).

A third reason that clearing requirements would reduce the amount of hedging taking place is because the clearinghouse can refuse to clear certain contracts. Since clearinghouses would be exposed to default risk due to these new regulations, they may refuse to clear certain contracts that expose them to significant risk. If there is not a sufficient number of parties willing to take the opposite side of a transaction, the clearinghouse could be exposed to risk because if one side defaults, the clearinghouse would be responsible for compensating the other side, even if the payment on the contract continues to increase. Since OTC derivative contracts are highly customizable, it may be difficult for a clearinghouse to find a sufficient number of parties that take the opposite bet and would, accordingly, refuse to clear some of these contracts (Gharagozlou, 2011).

Although the new clearing requirements in Dodd-Frank could reduce counterparty risk, they may also lead firms to use derivative contracts less. Less hedging may mean less counterparty risk, but, as I argue below, it also has the potential to increase GDP volatility. The next several sections attempt to address this concern by providing a framework for analyzing the effects of a reduction in hedging on GDP variability similar to the channels through which shocks are transmitted. This can focus studies on a more narrowly defined set of questions about the effect of hedging on each channel. These channels include the credit channel, the exchange rate channel, the equity price channel, and the money multiplier. In each case, an economic shock would send output up or down is affected by the level of hedging undertaken by firms.

Hedging and the Credit Channel

The first channel through which shocks may be transmitted is the credit channel. This channel works through two effects, the cost of capital effect and a magnifying effect. Firms' hedging behavior influences of these mechanisms. Figure 3 below shows the steps in the cost of capital effect and how an interest rate shock can eventually affect the investment spending component of GDP (Bernanke & Gertler, 1995).

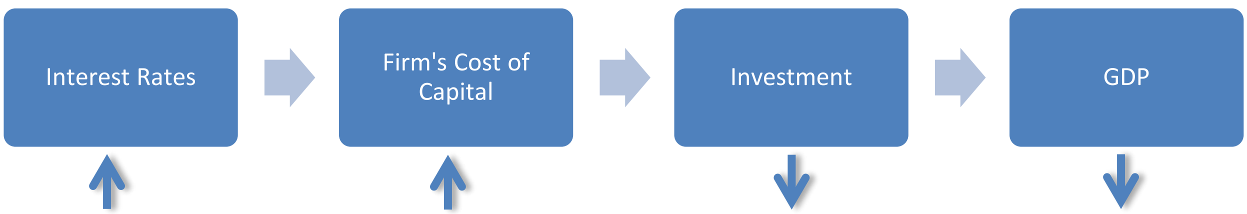

Figure 3 - The Cost of Capital Effect (Mishkin, 1996)

The cost of capital effect explains how an interest rate shock can alter the investment decisions of firms by changing their cost of capital. The general level of interest rates affects firms' cost of capital by changing a firm's cost of debt and cost of equity. A firm's cost of capital is a factor that determines whether or not a potential investment project can be expected to increase the value of the firm; thus, it influences the amount of projects in which firms are willing to invest. If an interest rate shock increases the cost of capital, we expect firms to engage in less investment spending because the funds are more expensive, and potential projects have to earn a higher return to provide potential investors in the company with the rate of return that they require. Similarly, if an interest rate shock decreases the cost of capital, we can expect investment spending to rise because the funds used to invest are cheaper and projects that earn a lesser return can still be attractive because they earn a higher rate of return than investors require (Fender, 2000).

Fender (2000) argues that asymmetric information in the credit markets can magnify the cost of capital effect, and he also argues that firms can mitigate this magnification by hedging their cash flows against the change in interest rates. To see this, it is useful to consider Fender's model. Fender assumes that a firm's cash flow is inversely related to the market interest rate. Without derivatives to hedge against the risk of interest rates rising, an unexpected increase in interest rates would cause the firm's cash flows to decrease (Fender, 2000).

Fender introduces asymmetric information in credit markets into the model by assuming the lender cannot observe the extent to which inputs are used in the production process. The firm, therefore, knows significantly more about whether or not it is going to be able to generate sufficient cash flows to pay interest on the loan, which imposes agency costs on the lender. To compensate for this uncertainty associated with the lending process, lenders typically charge higher rates of interest, which drives a wedge between the cost of internal funds and external funds (Fender, 2000).

Even if it were possible for lenders to observe different resource allocations and other information about the firm's cash flows, there would be transaction costs associated with this monitoring, which also results in a higher cost of external financing. The firm's investment decision is, thus, sensitive to the extent to which it has to rely on external financing, which is dependent on the level of internal cash flow, which is dependent on the general level of interest rates. Since an increase in the general level of interest rates, the firm's level of investment spending would decline not only because its cost of capital increased, but also because its reliance on external funds increased (Fender, 2000). Figure 4 provides a visual representation of the variables through which this channel operates.

Figure 4: The Financial Accelerator (Mishkin, 1996)

Fender argues, however, that a firm can more accurately predict the amount internal funds it will have to spend on investment projects. Hedging would allow the firm to reduce the uncertainty associated with its cash flows, enabling the firm to predict a constant level of external funds required to finance projects, which, in turn, enables the firm to reduce the cost of financing these projects and insulates its investment spending from the interest rate shock (Fender, 2000).

Fender (2000) argues that the presence of hedging with derivative contracts in this model reduces the credit channel to just the cost of capital effect. This is because when the firm facing interest rate risk can stabilize its cash flows in a given period, it is able to predict its reliance on external funding and make its decisions based on the expected cash flow, which will happen entirely independently of the movement of interest rates. Without the financial accelerator magnifying the change in the firm's investment decision with respect to the initial change in interest rates, the investment spending component of GDP should be less sensitive to changes in interest rates with hedging. Accordingly, reduction in hedging behavior should increase the effect of the financial accelerator and magnify the change in investment spending as a result of interest rate changes. This makes the investment spending component of GDP more sensitive to the initial interest rate shock, which could magnify the amount of systematic risk in the economy. If the economy experiences a negative interest rate shock, the resulting decrease in GDP could be more drastic in a world in which the Dodd-Frank clearing provision causes firms to hedge less.

Hedging and the Exchange Rate Channel

A second path through which shocks may be transmitted to the economy is the exchange rate channel. Hedging can be used in the same way as in the credit channel to reduce the final change in GDP components in response to an initial shock. Figure 5 below outlines the steps in the exchange rate channel.

Figure 5: The Exchange Rate Channel (Mishkin, 1996)

As Figure 5 outlines, this channel functions via the relationship between exchange rates and net exports: an increase in demand for the dollar causes an appreciation of the dollar relative to foreign currencies. This makes foreign goods cheaper relative to domestic goods.

Accordingly, the net exports portion of GDP can decrease when exchange rates increase (Mishkin, 1996).

Firms can use forward contracts to hedge against a change in the exchange rate. The forward contract can be used to lock in the price of a good that firms have to purchase in another currency by agreeing to exchange currency in the future at the forward rate with a counterparty. Accordingly, exchange rates can vary significantly between the time when firms purchase forward contracts and the time when they purchase assets denominated in the foreign currency without it changing the firms' purchasing decisions (Deutsche Boerse AG, 2008).

Because clearing can make using these contracts more expensive, it can reduce the extent to which firms can use these contracts to hedge against change in the exchange rate. This increases the variability of the prices of foreign goods relative to domestic goods and could, accordingly, increase the variability of the net exports portion of GDP.

Hedging and the Equity Price Channel

A third channel through which shocks are transmitted is the equity price channel. This channel works through two mechanisms, Tobin's q, and the wealth effect. Tobin's q measures the market value of the firm relative to the replacement cost of its capital (Mishkin, 1996). When the q ratio is high, a firm can replace its capital relatively cheaply and will, accordingly, engage in investment spending. On the other hand, when q is low, this means that either the market value of firms is low or replacement cost of capital is high, and in either case, it is likely that a firm could maximize its wealth by acquiring a company at lower market values and acquire its used assets rather than replacing the assets at a high replacement cost. Figure 6 provides a visual illustration of Tobin's q (Mishkin, 1996).

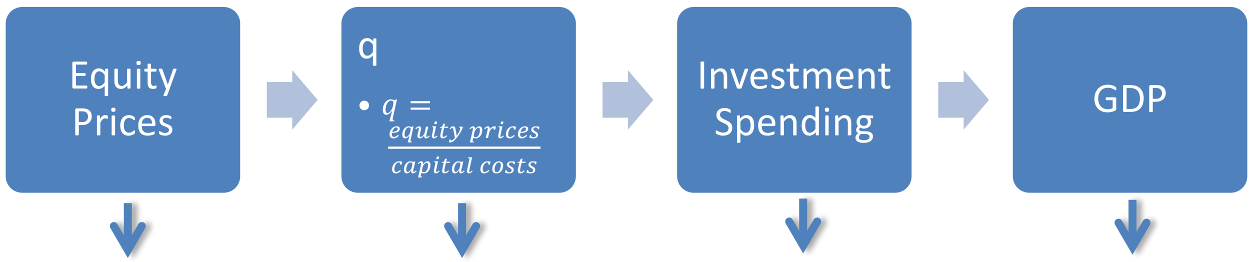

Figure 6: Tobin's q (Mishkin, 1996)

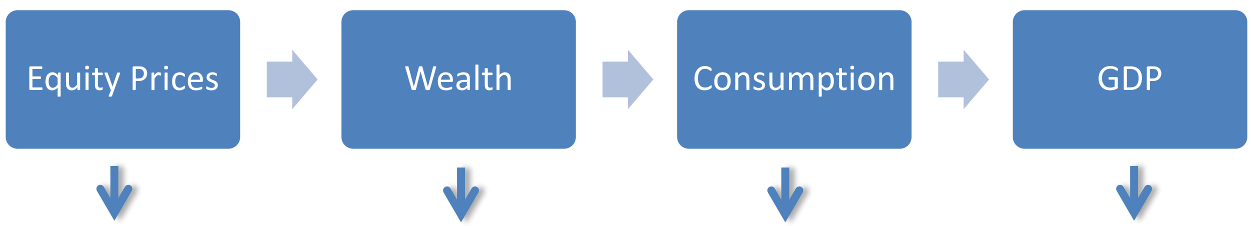

Figure 7: The Wealth Effect (Mishkin, 1996)

Figure 7 outlines the second mechanism whereby shocks are transmitted through the equity price channel, known as the wealth effect. Since both companies and individuals hold a significant amount of investment held in stocks, the price movements of these assets affect the extent to which companies and individuals feel wealthy, which alters their spending decisions. For example, when equity prices decrease, and reduce the value of individual retirement portfolios, the effected individuals typically do not feel as wealthy as they did previously, leading to a decrease in their consumption spending. Even though equity prices could then increase again, restoring the portfolio to its former wealth, in the meantime individual consumption decisions will be partially driven by this perceived lack of wealth (Mishkin, 1996).

Firms and individuals can use derivatives to hedge against changes in their net worth as a result of equity price changes in a number of ways that will make their individual investment and discretionary spending decisions less sensitive to equity prices. First, the firm can purchase derivative contracts, the value of which changes according to the general level of equity prices in the market depending on individual firm exposure. This would make the firm's spending and investment decisions less sensitive to changes in equity prices because its cash flows would change in proportion to the change in equity prices, which can serve to balance the increase or decrease in equity prices (Mishkin, 1996).

For example, if a firm's equity investment decreased in value, but its derivative hedge increased in value proportionally, there would be no change in net worth resulting from the change in equity prices, which would cause the firm to feel no wealthier and not change its spending decisions. Even if the firm was not entirely hedged against movements in equity prices, the presence of a hedge means that the net worth of the firm would be less sensitive to a movement in equity prices than it would absent the hedge, which should still result in less sensitivity of the firm's investment spending to the change in equity prices.

Hedging with derivatives can also make spending decisions less sensitive to changes in equity prices via the Tobin's q mechanism. Purchasing real options would allow a firm to keep its replacement cost of capital relatively low because it allows the firm to lock in the price of purchasing an asset for a period of time. In periods of rising prices, which is fairly common, the use of real options would tend to push q higher than it would otherwise be, suggesting that equity prices would have to decrease to a larger extent in order to provide incentives to forego investment spending in replacement capital and purchase another company instead. Further, high acquisition costs, combined with the use of real options to decrease costs associated with investing in replacement capital, makes this case even more convincing because it adds a significant amount of cost and complexity to purchasing another firm to acquire capital, making it more likely that the firm would simply purchase replacement capital (Mishkin, 1996).

Through both Tobin's q and the wealth effect, hedging is able to make the investment spending component of GDP less sensitive to equity price shocks. Accordingly, if clearing requirements reduced the extent to which firms hedged against the risk of equity price changes, GDP could become more sensitive to equity price shocks, which could amplify the normal fluctuations in the business cycle.

Hedging, the Money Multiplier, and Leverage

The last channel this paper will discuss is known as the money multiplier. Like the credit channel, it functions based on the extension of credit to individuals and institutions, but rather than changing the amount of investment spending through changing the cost of capital, this channel considers the change in the amount of credit that institutions are able to extend based on the amount of saving in the economy. Since financial institutions are only required to post a small amount of capital to cover the expected payment on contracts, they are able to use a finite amount of capital to finance a greater amount of credit extended. This leveraged condition creates a situation where a change in the amount of savings by individuals and corporations causes a greater change in the amount of credit extended to business (Gerding, 2011).

Current macroeconomic research (Gerding, 2011) suggests that the leverage created by derivatives functions very similarly to the traditional money multiplier effect and is another channel through which savings shocks are transmitted throughout the economy. Capital requirements are analogous to the reserve ratio in this case; the institution writing the derivative contract can be required to set aside capital on reserve to cover the expected payment on the contract but is not required to set the entire amount of the expected payment aside, which creates a similar situation to the required reserve ratio.

This is important because clearing requirements can be expected to increase the capital requirements on contracts. In this case, clearing can reduce the amount of derivative contracts that can be financed with a finite amount of capital to back them. If the amount of contracts is reduced, this could reduce the multiplier's magnification of an initial savings shock. Figure 8 below provides a visual representation of how the transfer of this process through the use of credit default swaps, denoted as CDS in Figure 8. While the example considers the transfer of credit risk using asset-backed securities, this is only one example of a means through which leveraged derivatives can increase the amount of credit extended to borrowers (Gerding, 2011).

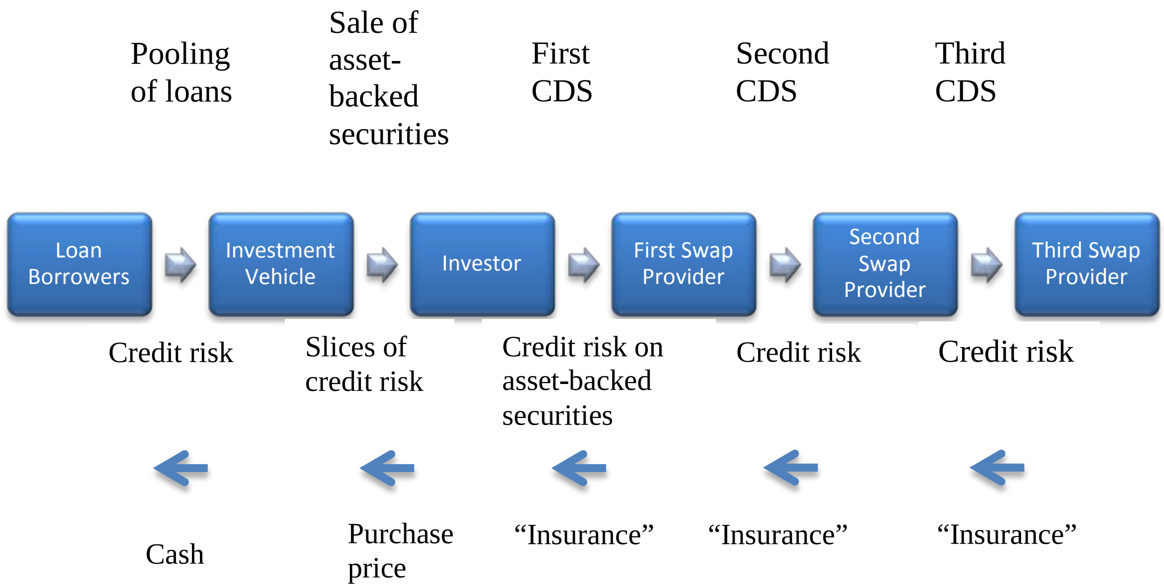

Figure 8: Derivatives and Leverage (Gerding, 2011)

The example in Figure 8 assumes that loan borrowers seek credit extended from an investment vehicle. In the first step of this process, the investment vehicle provides cash on credit to the loan borrowers who provide the investment vehicle with a promise to repay, creating the risk that the borrowers will be unable to repay the loan, referred to as credit risk. In the second step, the investment vehicle seeks to transfer this risk to investors using asset-backed securities, or securities that derive their value from the cash flows associated with various groups of the original loans. The investors provide the investment vehicle with the cash used to purchase the asset backed securities, and the investment vehicle promises to pay the investor a series of cash flows from the loans, which transfers a portion of the credit risk to individual investors.

The example in Figure 8 then assumes that the individual investors who purchase the asset-backed securities are also concerned about the credit risk they are assuming and want protection against the potential default of one or more of the original loan borrowers. To mitigate this risk, investors can use a credit default swap, which transfers the credit risk to the first swap provider. This process continues, creating a chain of credit default swaps that aim to transfer the original credit risk to second and third swap providers (Gerding, 2011).

So far we have been working through this model from left to right, demonstrating how the investment vehicle and other investors are able to distribute the credit risk created by the loans. If Figure 8 is examined from right to left, it demonstrates how capital requirements can magnify the amount of credit extended to borrowers resulting from a change in savings. If the swap providers are required to keep less capital on reserve to cover the expected payment to the investors, more capital is freed to back the issuance of additional credit default swaps. If the amount of available credit default swaps to provide insurance against loan defaults increases, investors will increase their demand for these securities because they can pass along some of the credit risk to the credit default swap providers (Gerding, 2011).

Further, if investors demand more asset-backed securities, the investment vehicle will have an incentive and ability to grant more credit to loan borrowers and package these new loans into asset-backed securities. Accordingly, if capital requirements are reduced, the amount of credit extended by the investment vehicle is increased, and if capital requirements are increased, the amount of credit extended by the investment vehicle is decreased (Gerding, 2011).

Shocks are transmitted through this channel and eventually magnified by the multiplier effect through the link between these institutions and capital markets. Much like in the bank example, we assume that an exogenous shock causes individuals to change their savings preferences, either increasing or decreasing their desire to save, but unlike the previous example, we now assume that they save some of this in capital markets to earn a return rather than keeping it in demand deposits at a bank. This increases the demand for instruments that the swap providers can use to finance their contracts, which reduces the borrowing rate of the swap providers.

Accordingly, the swap providers can finance more swaps, which provide more insurance to investors, who then increase their demand for asset-backed securities, which expands the amount of credit extended to the original loan borrowers. The new credit extended to loan borrowers is in excess of the amount saved in debt because each dollar saved can be used to finance more than one additional dollar of new credit default swaps due to the capital requirements discussed in the previous paragraph, creating the same multiplier effect (Gerding, 2011).

The requirement that OTC derivatives be cleared first amounts to increasing capital requirements, an intentional feature designed to mitigate counterparty risk, which also causes the amount of additional credit extended to the loan borrowers to be less sensitive to unexpected changes in savings preferences. Capital requirements would necessarily be increased by the clearinghouse because it requires that both parties post collateral in a margin account to cover a certain percentage of the expected payment on the contract, but it also requires that the parties contribute to an account that can be pooled with all other parties that deal with the clearinghouse to cover the losses associated with a default. Since it is likely that these capital requirements would be in excess of what most firms currently post, as it would not otherwise be an effective means of mitigating counterparty risk, requiring OTC derivatives to be cleared would effectively increase capital requirements (Ernst & Young LLP, 2013).

In Figure 8, raising capital requirements reduces the extent to which firms can free up capital to support additional derivative contracts, such as credit default swaps, which should reduce the multiplier effect. Accordingly, clearing in this sense could actually have the opposite effect on this channel as it has on some of the others: clearing could make movements in the economy less sensitive to savings shocks because the system is less leveraged.

Conclusion and Suggestions for Further Research

Although clearing requirements may reduce counterparty risk and make the economy less vulnerable to the default of a large lender, it also has important unintended macroeconomic consequences. Because clearing increases transactions costs associated with hedging activity, we can expect clearing to reduce the total amount of hedging occurring in the economy. This paper attempts to uncover some of the relationships between this reduction in hedging and the transmission of shocks throughout the economy and found that hedging can affect a number of channels through which these shocks are transmitted.

We can theoretically expect a reduction in the total amount of hedging to reduce the insulation of GDP from unanticipated changes in interest rates, exchange rates, and equity prices, but increase the insulation of GDP from unanticipated changes in savings preferences through the money multiplier. It is important to note, however, that the increased insulation against changes in savings preferences is because increased capital requirements lead to a reduction in the amount of credit extended to borrowers, which could negatively affect the investment spending component of GDP and counteract some of this increased insulation.

The next step in studying the existence of this effect is quantitative analysis. In order to quantitatively demonstrate these effects, both the relationship between clearing requirements and hedging, and the relationship between hedging and the elasticity of GDP components relative to shocks should be analyzed. Based on the findings of this paper, the relationship between clearing and hedging should be negative, and the reduction in hedging can be expected to correlate with a higher elasticity of GDP to shocks in the first three channels and a lower elasticity of GDP to shocks in the last channel.

First, the levels of OTC derivative trading before and after clearing would have to be analyzed to determine if there is a decrease in trading. This could be analyzed by looking to international derivative markets with different clearing rand capital requirements. In international markets, the volume of OTC derivatives being traded could be examined relative to clearing and capital requirements to see if there is a relationship. Also the derivative disclosures in publically traded firms' annual report could be examined, as they typically reveal the extent to which the firm is hedged against changes in various risk factors, such as macroeconomic variables.

The relationship between the level of hedging and the variability of GDP components can be analyzed in several ways. Models, such as the one presented in Fender (2000), can be extended to other channels to support a hypothesis to test in each. The hypotheses will be an expected relationship between either the volume of OTC derivatives being traded or the extent of firms' hedging positions and the components of GDP.

The discussion surrounding Dodd-Frank and the implementation of OTC derivative clearing requirements is leading to a burgeoning body of literature on potential economic consequences. Regulators can use this discussion as a whole to understand some of the unintended consequences of their legislation, and this paper attempts to provide the connection that will hopefully serve as the impetus for future statistical analysis on the topic to eventually determine if regulators should be concerned with the effects of clearing requirements on the transmission of shocks throughout the economy.

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