Comparative Study Of Natural Gas in OTC Market And Derivative Market

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Comparative Study Of Natural Gas in OTC Market And Derivative Market

A DISSERTATION REPORT

Submitted by

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CERTIFICATE

This is to certify that the dissertation entitled "Comparative Study Of Natural Gas in OTC Market And Derivative Market" which is being submitted in partial fulfillment for the award of Master of Science in Oil Trading by **Mr. Sanjeev Kumar** is a bonafide work carried out by him under my supervision and guidance. This work has not been published elsewhere or submitted for the award of any other degree.

5/5/07

Prof Shard Goel

(Program Director – MS (OT)

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Chapter 1

1.1 Executive Summary

Recent regulatory initiatives in the global market have again raised the issue of a "level regulatory and supervisory playing field" and the degree of competition globally between over-the-counter (OTC) derivatives and organized derivative exchange (ODE) markets.

This Dissertation models some important aspects of how an ODE market interrelates with the OTC markets. It analyzes various ways in which an ODE market can respond to competition from the OTC markets and considers whether ODE markets would actually benefit from a more level playing field. Among other factors, such as different transaction costs, different abilities to mitigate credit risk play a significant role in determining the degree of competition between markets. This implies that a potentially important service ODE markets can provide OTC market participants is to extend clearing services to them. Such services would allow the OTC markets to focus more on providing less competitive contracts/innovations and instead customize its contracts to specific investors' risk

1.2 Objective Of Study

- How one market influence other market
- Implication of changing risk
- Effect of competition on both market
- Relation between Liquidity and transparency

1.3 Methodology

Study contain of Qualitative research.

Data Collection Method

1. Internet
2. Books
3. Magazine

Data would be analyzed with the help of software tool MS-Excel

Chapter 2

Literature Review

1. Duffie and Jackson (1989) introduced a useful modeling framework to address issues of optimal financial innovations and transaction costs in an incomplete market setting.

Innovations are used in this strand of literature as a term to reflect the best additional contract given previous contracts. This contract/innovation/derivative is optimal if it spans as large a part as possible of a beforehand unspanned portion of the incomplete market. In reality however, markets will always be incomplete, due to risks that can never be hedged by a financial instrument.

The original model by Duffie and Jackson has been extended in at least two main directions.Tashjian and Weissman (1995) used the approach to analyze a futures exchange that can launch several contracts and how it affected trading volumes. Clearly, the futures market will always design the next new contract in such a way that it is likely to generate the highest additional revenue for the exchange, i.e., it will target those investors that have the highest unfilled demand for hedge weighed by their risk aversion.

2. Cuny (1995) enhanced the original model by taking into account the role of liquidity in the design of the optimal contract and the effect of competition between multiple exchanges over time. These extensions have been further generalized in a variety of papers as discussed by the useful surveys completed by Duffie (1992) and Duffie and Rahi (1995).

3. Santos and Sheinkman (2001), for example, ask whether competition between organized exchanges lead to excessively low standards in terms of the guarantees/collateral traders have to provide to transact. The authors argue that it has been claimed that the nature of market competition triggers a race for the bottom to maximize trading volume by requiring few performance guarantees/collateral. However, Santos and Sheinkman show in the context of a

theoretical two period model, which allows for default among traders but not for them to trade in multiple markets, that the use of guarantees/collateral is indeed constrained efficient in a competitive setting. Interestingly a monopolistic exchange would design its securities and guarantees in such a way that actually less collateral is provided..

4. Rahi and Zigrand (2004) analyzes the issue of market competition and financial innovation from the point of view of arbitrageurs/speculators. Rather than assuming, as is common in the literature, that exchanges design the innovations/contracts, Rahi and Zigrand argue that profit seeking agents that trade on the exchanges play an important role in the ultimate design of a financial contract. For example, an arbitrageur/speculator is not only interested in potentially hedging some random endowment but also to identify mispricing or provide liquidity and generate trading profits. These arbitrageurs/speculators differ from the typical investor by their ability to trade across multiple exchanges.

CHAPTER 3

INTRODUCTION TO DERIVATIVE AND ITS GROWTH

INTRODUCTION

The recent surge in the use of various forms of financial derivatives globally using various different markets and counterparties highlights the importance of further understanding how different types of derivatives markets compete with and complement each other. This is especially relevant given that most of the spectacular growth seen recently has taken place through an increased usage of OTC (over-the-counter, lightly supervised and self-regulated) derivatives. Many organized derivative exchange markets (liquid, supervised, and regulated) have argued that they are at a comparative disadvantage to OTC derivative markets, highlighting in particular the lack of a level playing field among them owing to differing regulatory and supervisory regimes. From a supervisor's perspective the trend of increased use of OTC derivatives, potentially at the expense of exchange-traded derivatives, raises systemic risk issues given the concentration of OTC derivatives among a few market participants and because these derivatives lack of transparency. Following a string of crises related to the use of OTC derivatives . The discussion among supervisors has come to focus on whether OTC derivatives should be more closely supervised, regulated, and if investors would have to set aside more capital when trading OTC. This report analyzes a few aspects of the interrelationship between the organized derivatives exchange markets and the OTC derivatives markets and the degree to which the different markets' micro structure matter. It will also address the issue of whether organized derivative exchange markets actually stand to gain from reducing the OTC market's risk aversion through various vehicles. matter. It will also address the issue of whether organized derivative exchange markets actually stand to gain from reducing the OTC market's risk aversion through various vehicles.

Contrary to the highly standardized and usually cleared contracts offered by traditional organized derivative exchange markets (ODEs), OTC derivatives can be individually customized to an end-user's risk preference and tolerance (see Schinasi and others (2000)). Although nearly two-thirds of the actual OTC derivatives traded are of a fairly simple contract structure (for example, a fixed for floating interest rate swap), their terms are still individually determined and highly flexible. An industry group defines OTC derivatives as contracts that are "executed outside of the regulated exchange environment whose values depends on (or derives from) the value of an underlying asset, reference rate or index

Clearly, the difference between an ODE derivative and an OTC derivative may concern not only where they are traded but also how. In the United States much attention has been placed on pure OTC derivatives that are privately negotiated between mostly large institutional investors and broker/dealer banks. To ease definitional problems, this paper will focus on some characterized extremes The increased importance of the OTC derivatives market has been a fairly recent phenomenon. Presently, a large majority of OTC derivatives are either related to interest rates (70 percent) or foreign exchange (15 percent). Other types of OTC derivatives linked to equities or commodities account for less than 3 percent. While the notional value of OTC derivatives outstanding is impressive, their gross market value or "replacement" value, that is, what the derivatives would be worth if they were marked to market, has grown much less and varies between 3 and 5 percent of the notional value. Nonetheless, this implies that the market value of all OTC derivatives reached US$3.8 trillion by the end of 2005.

While the outstanding notional value of OTC derivatives grew, the corresponding use of ODE derivatives remained broadly flat at US$14 trillion. Aggressive monetary policy easing by the U.S. Federal Reserve in 2005, however, triggered a wave of renewed hedge demand by many market participants leading to sharp increases in the use of both ODE and OTC derivatives. By the end of 2005, the share of ODE derivatives in the total amount of derivatives outstanding reached 17 percent. To a certain extent, the limited growth in the

notional value of ODE derivatives masks substantial competition between different ODE markets. By now famous examples include the rise of the EUREX market at the expense of the LIFFE regarding the trading of futures on German treasury bonds. In general terms, ODE derivatives can be split into two main groups in terms of the notional value outstanding: 90 percent are interest rate derivatives and 9.8 percent are linked to equities. Around 60 percent of these derivatives are traded in the form of options while the remainder consists of futures.

(In US$ billion)

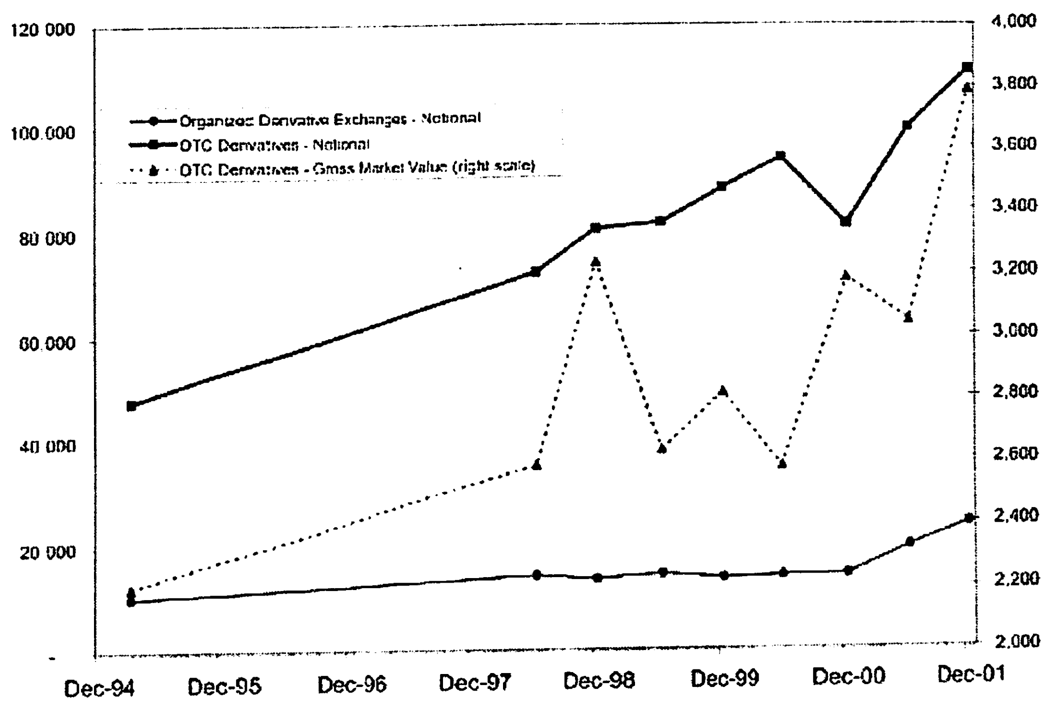


Fig 3.1 Evolution of derivative market(OTC & Exchange)

Moreover, as pointed out by Cuny , even ODE markets have been highly innovative regarding the launch of new contracts more closely customized to their end users' needs. While perhaps only a quarter of the new contracts "succeed," innovation continues to be an important strategy to counter the growth in the use of OTC derivatives. Another strategy is, of course, to strengthen ODE's market experience and comparative advantage regarding the clearing of transactions, thereby assisting OTC markets in mitigating counterparty credit risk. From a regulator's perspective, the increased clearing of OTC derivatives could help address the concentration of credit risk among the handful of large international banks that today are involved in the vast majority of OTC transactions OTC and ODE derivative markets can both complement and compete with each other. For example, the large broker/dealers of OTC derivatives frequently rely on a liquid ODE market to dynamically hedge their market risk. Conversely, organized futures and derivatives markets in the U.S. face competitive pressure from OTC markets, who are offering fairly similar contracts but are unburdened by regulatory and supervisory oversight. To a certain extent, the competition between OTC derivatives and ODE derivatives is determined by the structure of the contracts and what type of risk the end users would want to hedge. Hence, it may be useful to analyze how ODE markets can increase their comparative advantage in highly standardized and liquid derivatives while also providing clearing services for OTC derivatives. In trying to analyze how ODE markets can respond to the threat posed by OTC derivatives, more research is needed to model these markets' interrelationship. While a potentially relevant area for future regulation initiatives, very little research has been done on this topic.Rather, the main focus of the security design literature has been on competition between different stock exchanges or ODE markets. This paper takes a first step to analyze inter-derivative market competition in a multiple contract setting and draws some policy conclusions regarding how competition affects the contracts issued by the two markets, their transaction costs, and whether or not ODE markets would benefit from reducing OTC market risk aversion and investors' counterparty risk concerns while trading OTC. The main findings of this paper are that the two derivative markets can co-exist in equilibrium while exploiting their comparative advantages. Interestingly, the most useful approach for ODE markets to deal with the competitive threat posed by OTC markets is to lower transaction costs, target high variance risks to be hedged, and introduce mechanisms that can help reduce the counterparty credit risk exposure the OTC market faces. This could be achieved, for example, by providing customized clearing services, which would allow the OTC market to better target those investors with particular types of risks.

Growth and Development of Energy Derivatives

Introduction of the NYMEX Henry Hub natural gas futures contract on April 3, 1990, was a milestone event in the transition to open, competitive markets for the gas commodity and transportation. In the ensuing decade, trading in futures, options, and other "derivatives" has matured into a vital feature of the U.S. gas marketplace. The success of the NYMEX Henry Hub futures and options contracts is evident not only from the sustained growth in trading volume shown in Figure 1-1, but also in the credibility of contract prices and high levels of industry participation. Total daily volume exceeds seventy thousand contracts on active trading days, which translates into a market of roughly $1.75 billion in a given day.

It is well documented that, beginning in the late 70s, the introduction of deregulation dramatically increased the level of competition in the energy markets. This competition prompted the development of the first-ever exchange-traded energy derivative products. The success and growth of these new contracts attracted a broad range of new participants to the energy markets. The addition of new participants to the markets also led to the introduction of new and wider varieties of energy derivatives. Today, the NYMEX, other exchanges and over-the-counter markets worldwide offer futures, futures options, swap contracts, and exotic options on a broad range of energy products, including crude oil, fuel oil, coal, heating oil, unleaded gasoline, and natural gas.

The futures industry has experienced tremendous growth since the adoption of the CFMA in December 2000, a clear sign that the current regulatory regime is appropriate for these markets at this time. Trading volumes in 2005 for futures and options globally increased 300 percent over the 2000 volume levels. U.S. futures and options volume for the same timeframe increased over 200 percent. NYMEX's futures and options volume alone as of 2004 had increased over 50 percent since year 2000 volume levels. Individually, NYMEX's flagship futures contracts showed significant volume increases as well, including crude oil – up 43 percent, heating oil – up 34 percent, and gasoline – up 48 percent.

Total annual volume for NYMEX ACCESS® in 2006 was a record 8,239,700 contracts, breaking the previous record of 5,880,455 contracts set in 2005.

The CFMA, in addressing legal certainty for OTC derivatives, also permitted the clearing of OTC derivatives transactions by regulated futures exchanges. End-users and merchant energy companies that were existing customers of the NYMEX asked. During the initial period, 25 contracts were launched and currently the NYMEX ClearPort® program comprises over 175 products in the electricity, coal, NatGas, oil and emissions markets. Today, over 30 per cent of total NYMEX volume comes through the NYMEX ClearPort® system. This sustained growth can be linked to the addition of OTC clearing to NYMEX's range of services offered, which allows energy companies to mitigate their credit risks

Additionally, NYMEX's global expansion has recently included the addition of cleared futures contracts for Singapore Fuel Oil and clean petroleum products, and European Fuel Oil, Naptha and Gasoline. This new clearing service has restored confidence, transparency, and liquidity to the marketplace and has once again allowed the economic benefits of derivatives to benefit the marketplace as a whole.

Off-exchange contracts submitted to NYMEX for clearing are afforded the same protections available to other futures contracts. The clearinghouse provides market participants with protection against counterparty default and is backed by a $130 million guarantee fund and a $100 million default insurance policy. The advantages of doing business on a regulated market are now available to any business entity with credit or price exposure in the energy markets. The ability of energy companies to now mitigate their credit risk with cleared derivatives brings liquidity, transparency and market confidence back to the trading community.

As a result of the demand by customers to mitigate their counter-party risk through new clearing products, the parent holding company of NYMEX has recently launched a new exchange in London to trade Brent Crude oil via open outcry. Additionally, the Exchange has announced the creation of the Dubai Mercantile Exchange – DME. The DME will bring the mitigation of counter-party risk to new contracts that will be traded in the Middle East region. In Singapore, the NYMEX has begun to add liquidity to regional Fuel Oil contracts through the use of the existing NYMEX ClearPort® Clearing system. Combined, the global expansion of the NYMEX brings the ultimate level of counterparty protection, liquidity and transparency to derivatives and regulated futures contracts.

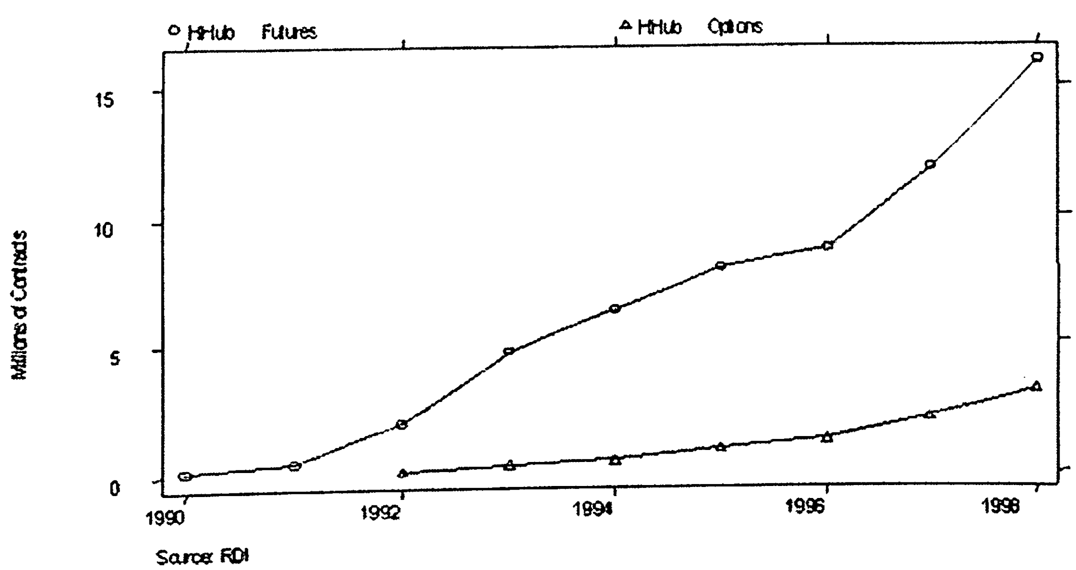


Fig 3.2 Growth of Derivative contracts

CHAPTER 4

NATURAL GAS A COMMODITY

Natural Gas

Natural gas is a mixture of hydrocarbon gases and is a colorless, odorless fuel that burns cleaner than many other traditional fossil fuels. It occurs deep below the surface of the earth in two principal forms- associated gas and non-associated gas. Associated gas is found in crude oil reservoirs, either dissolved in the crude oil or in conjunction with the crude oil deposits. Non-Associated gas occurs in reservoirs separate from crude oil wells. It is also termed as dry gas. Gas Condensate is the hydrocarbon liquid dissolved in saturated natural gas that comes out of solution when pressure drops below dew point.

Natural gas, in itself, might be considered a very uninteresting gas - it is colourless, shapeless, and odourless in its purest form. Unlike other fossil fuel, however, natural gas is clean burning and emits lower levels of potentially harmful by products into the air. It is this need that has elevated natural gas to such a level of importance in our society and in our lives.

Natural gas is a combustible mixture of hydrocarbon gases. Natural gas is formed primarily of methane; it can also include ethane, propane, butane and pentane. The composition of natural gas can vary widely. In its purest form, it is almost pure methane.

Natural gas occurs deep below the surface of the earth in two principal types:

Associated Gas is found in crude oil reservoir either dissolved in the crude oil or in conjunction with crude oil deposits. It is produced from oil wells along with the crude. It separates, or is separated from the oil at the casting head of the well (therefore, the term casting head gas).

Non Associated Gas occurs in reservoirs separate from crude oil wells. Its production is not incidental to the production of crude oil. It is called as Well Gas or Dry Gas.

Forms of Natural Gas

Natural Gas is traded in the following forms:

Liquefied Natural Gas is natural gas reduced to a liquid state by cooling it to 161°C. Once liquefied, the natural gas is more compact occupying 1/600th of its gaseous volume. Natural gas is liquefied because in gaseous form, it is extremely voluminous and cannot be transported to long distances as gas field are far from the user market. Liquefied form eliminates the need for more room for gas transportation.

LNG is transported in special tankers and brought to the receiving re-gasification terminals in another location. It is re-gasified at the terminal itself and transported through a pipeline.

Piped Natural Gas

This is one of the classifications of natural gas use where natural gas is used for domestic, commercial and institutional purposes at different pressures which range from 0.4 milibar to 4 bars.

Compressed Natural Gas (CNG)

CNG is a substitute for gasoline (petrol) or diesel fuel. It is considered to be an environmentally "clean" alternative to those fuels. It is made by compressing purified natural gas, and is typically stored and distributed in hard containers.

In response to high fuel prices and environmental concerns, compressed natural gas is starting to be used in light-duty passenger vehicles and pickup trucks, medium-duty delivery trucks, and in transit and school buses.

Properties of Natural Gas

Natural gas has the following properties:

It is Colorless

It is shapeless

It is odorless

It is clean burning fuel

Advantages of Natural Gas

The natural gas offers following advantages:

Minimizes the manpower and mechanical power required for handling the fuel.

Installation of ash precipitators and other equipment for pollution control are not required.

Risk of breakdown in fuel supply due to order processing delays to replenish fuel inventory is eliminated.

No storage yard required as gas is directly delivered at the end of pipe.

Energy spent for heating up the fuel oils is saved.

In some regions, natural gas suppliers transport LNG to communities and remote industrial plants from gas pipelines. Once delivered, LNG is stored in insulated tanks so that it can be vaporized and distributed as natural gas to the customers.

Reasons for the Growth of Natural Gas

Some of the reasons for the growth of natural gas as an alternate fuel are as under:

Clean Fuel: Natural gas is increasing emerging as the preferred fuel of the 21st century. Consumers are moving to natural gas because it is easy to handle, does not pollute the environment and has high efficiency. Dry natural gas generally contains 99.5% of methane, the simplest hydrocarbon, and traces of other heavier hydrocarbons. Natural gas is generally free of lead, sulfur etc. making it an ideal fuel/raw material for various industrial and domestic applications. More stable gas prices vis-a-vis oil:

Better R/P Ratio: The reserve-to-production (R/P) ratio measures the length of time current proved/established reserves would last if current production rates were maintained and no new reserves were added. Essentially, it measures the "ready inventory of gas". Oil has been the most widely used primary energy source for a long time as compared to natural gas. Better R/P ratio indicates longer availability of reserves.

Why Natural Gas Markets are Different from other Commodity Markets

Gas can be bought and sold like any other good, but its transportation is in most cases a natural monopoly: it is generally inefficient to build competing networks — particularly for local distribution — because of economies of scale, although some aspects of operating the network may not be monopolistic, e.g. metering. Thus, the supply of gas to end users will in most cases always involve an element of monopoly — even in a competitive market. Government has a responsibility to regulate natural monopolies to prevent abuse of market position.

Gas prices in a competitive market may diverge considerably in the short and long run. In the short term, prices will mostly be determined by the marginal value of gas in end-user markets. Storage may provide sellers an opportunity to hold gas off the market when end-user demand and/or prices are low. Prices will, in principle, tend to oscillate around long-run marginal cost, which includes a large element of upfront capital expenses.

End-user demand for gas for heating (mainly in the residential and commercial sectors) and to some extent in power generation (where there is significant heating or cooling load) is strongly correlated to the weather.

Many gas customers are captive, since they have no immediate alternative to using gas, so that overall demand may be price inelastic in the short term. Captive customers require uninterrupted supply at all times. Demand seasonality imposes additional supply costs. Non-captive customers with the ability to switch fuels or plant may be supplied under interruptible contracts, allowing supplies to be diverted to captive customers at times of peak demand.

NATURAL GAS MARKET PARTICIPANTS IN NATURAL GAS AND THERE ROLE

The important natural gas markets in the world are as follows:

United States of America

USA has been a major producer and consumer of natural gas over the past several years. USA produces 87% of the natural gas it consumes, with most of the remainder coming from Canada. However, given the natural gas consumption forecast of 33.8 TCF in 2020 in the EIA's Annual Energy Outlook 2002, the existing design capacity of just over 1 TCF per year at the four USA terminals and proposed expansion of about 0.4 TCF per year would be able to meet about 3.3 per cent of projected demand in 2020.

Canada

Canada's natural gas reserves are found mainly in the Western Canada Sedimentary Basin of British Columbia, Alberta and Saskatchewan, including parts of Manitoba and the Northwest Territories. British Columbia remains relatively unexplored compared to other established North America natural gas producing areas. Canada is the biggest exporter of natural gas to USA. Natural Gas consumption in Canada is projected to grow at the rate of 2.3% per year between 2001 and 2025. In 2000, approximately 53% of Canada's dry gas production of 6.3 TCF was exported to USA. By 2025, net exports of natural gas from Canada to USA are projected to be 5.3 TCF in the IEO2003 reference case, and Canada's own consumption is projected to be 5 TCF.

Western Europe

The European Union's legislation has played a significant role in the domestic energy policies of member countries, providing a framework for opening up both electricity markets and natural gas markets in member nations to competition. The EU has set a major goal to create a single market for all aspects of trade and commerce by 2010.

The Asia Pacific Market

Japan

Japan saw a 4% growth in natural gas use from 1999-2001. However, the demand is expected to slow down to 1% over 2001-2025. Japan consumed 77.4 bcm of natural gas in 2002 down to 2% compared to 2001. Japan imported 94% of its consumption as LNG accounting for 48% of world LNG trade. Most of the LNG is used either for electric power generation or as feedstock for petrochemical plants. Three Japanese companies Tokyo Gas, Osaka Gas and Toho Gas signed a contract in February'2002 to import natural gas from

Malaysia. The Japanese government has indicated that it plans to deregulate the retail natural gas sector over the next several years to promote increased competition and lower prices.

Middle East

Natural Gas consumption in the Middle East rose sharply in the 1990s, from 3.7 TCF in 1990 to 7.9 TCF in 2001 and it expected to increase to 13.9 TCF in 2025 at an annual average growth rate of 2.4. Oil-exporting countries in the Middle East are seeking to expand natural gas use domestically so that as much oil as possible could be exported. Saudi Arabia has been trying to spur natural gas development for the past several years through its strategic gas initiative.

Middle East countries are also planning to expand gas exports from the region. Although natural gas reserves in the Middle East are slightly higher than in EE/RSU, gas production lags far behind that of the EE/FSU region. In 2001, gas production in the Middle East totaled 8.3 TCF, less than 1/3rd of EE/FSU production. Nearly all natural gas exports from Middle East are in the form of LNG.

Qatar

Qatar's proved gas reserved increased by 9.2 percent in 2002 to 508.5 TCF. Qatar is the fourth largest LNG exporter in the world, totaling 18.59 bcm in 2002. Qatar has two LNG export companies: Qatar LNG Co (Qatar Gas) and Ras Laffan LNG Co (RasGas).

Both use gas from the country's North field, the world's biggest non-associated gas filed with total estimated reserves of 900 TCF. Qatar is aiming to triple its LNG capacity to 45 MMTPA by 2010. Qatar has long term contracts with buyers in Spain, Japan, South Korea, India etc.

Natural Gas Trading Models World wide

Trading Models in the Deregulated Natural Gas Industry

Trading mechanisms guide transactions in natural gas and transportation markets. They facilitate interactions among market participants with the objective of achieving simultaneous clearing of natural gas and transportation markets at minimum cost to the gas industry. Deregulation of the natural gas industry leads to separate trading of natural gas and transportation services, which increases the complexity of markets and imposes substantial requirements on market participants if they are to complete all their transactions at the minimum cost. While a vertically integrated gas company optimizes all transactions internally, participants in a deregulated gas industry must coordinate their natural gas and transportation transactions in an open market. The process of minimizing the total cost of natural gas and transportation to the industry must take place across thousands of decentralized transactions. Unless these transactions are guided by a trading model, they can result in sub optimal allocation of resources.

Bilateral trading model

The bilateral trading model is based on decentralized bilateral transactions. The model relies on competitive gas and transportation markets to generate efficient prices and minimize the cost of natural gas to the end users.

Decentralized spot markets

In the bilateral trading model market participants conclude all deals in bilateral negotiations and write contracts that address all issues relevant to a transaction. Demand for ways to minimize of transaction costs leads to the emergence of traders who complete transactions on behalf of other market participants. Spot markets develop as market participants require efficient pricing of natural gas at every moment. Spot markets are thus developed through the decentralized action of market forces.

Competitive spot markets generate signals about the market value of natural gas and give market participants the right incentives to complete transactions efficiently. As a result, decentralized bilateral trading among market participants achieves the outcome that is optimal for individual participants as well as for the natural gas industry as a whole.

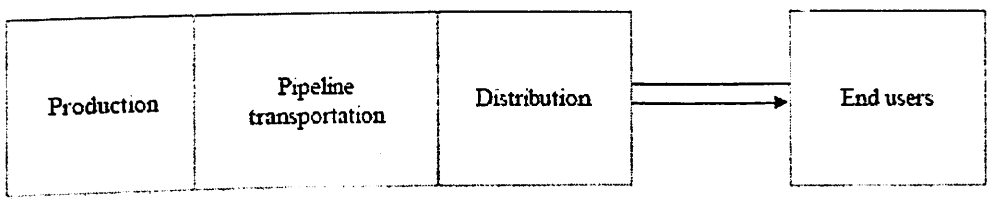
The Models are shown as :

Model 1 has a nonexistent wholesale market because all natural gas transactions are conducted internally by a single vertically integrated company that also monopolizes the retail market. The monopoly in market leads to the increase in the prices of gas.

Model 2 has limited competition in both the wholesale and the retail markets. Prices of natural gas in models 1 and 2 are regulated to prevent excessive pricing by the dominant gas utilities.

Models 3 and 4 have relatively competitive natural gas markets, and model 4 has a more competitive transportation market than model 3.

Figure 1 Model 1: Vertically Integrated Natural Gas Industry



—— Gas transportation —— Gas supply transactions

Figure 2 Model 2: Competition among Natural Gas Producers

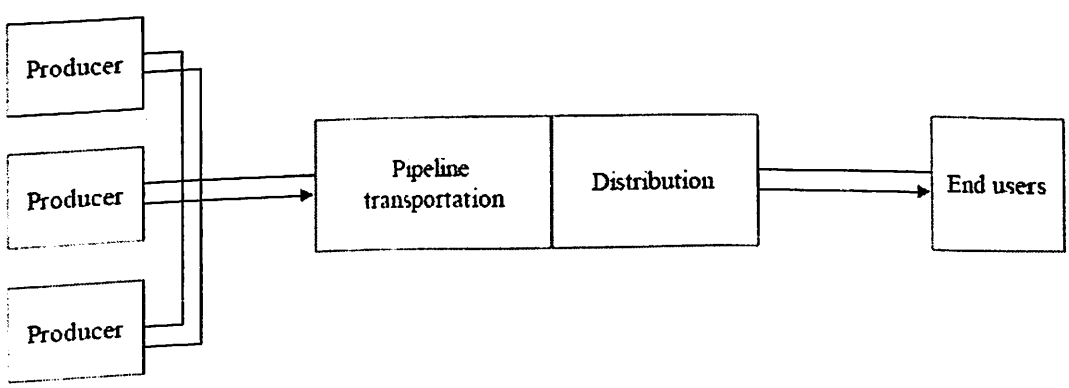


Figure 3 Model 3: Open Access and Wholesale Competition

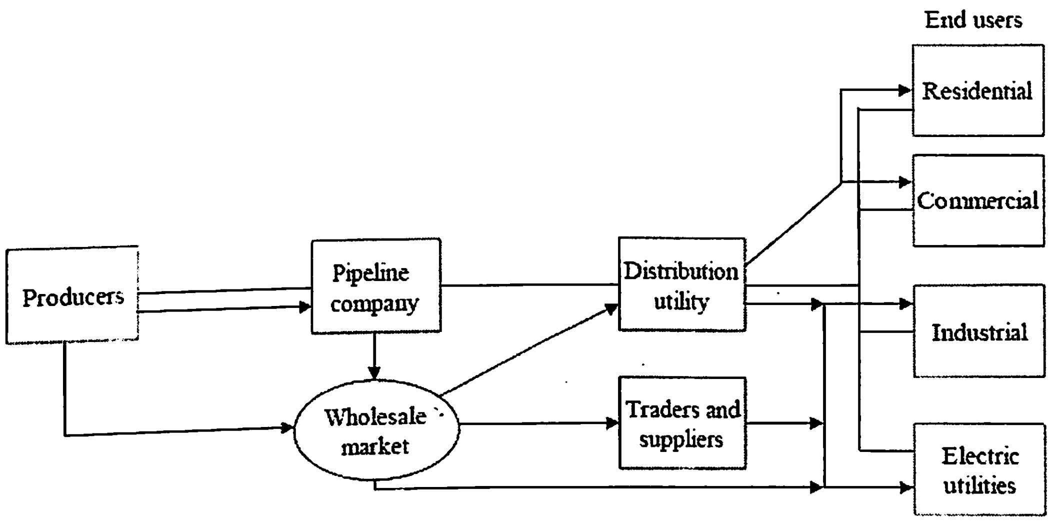


Figure 4 Model 4: Unbundling and Retail Competition

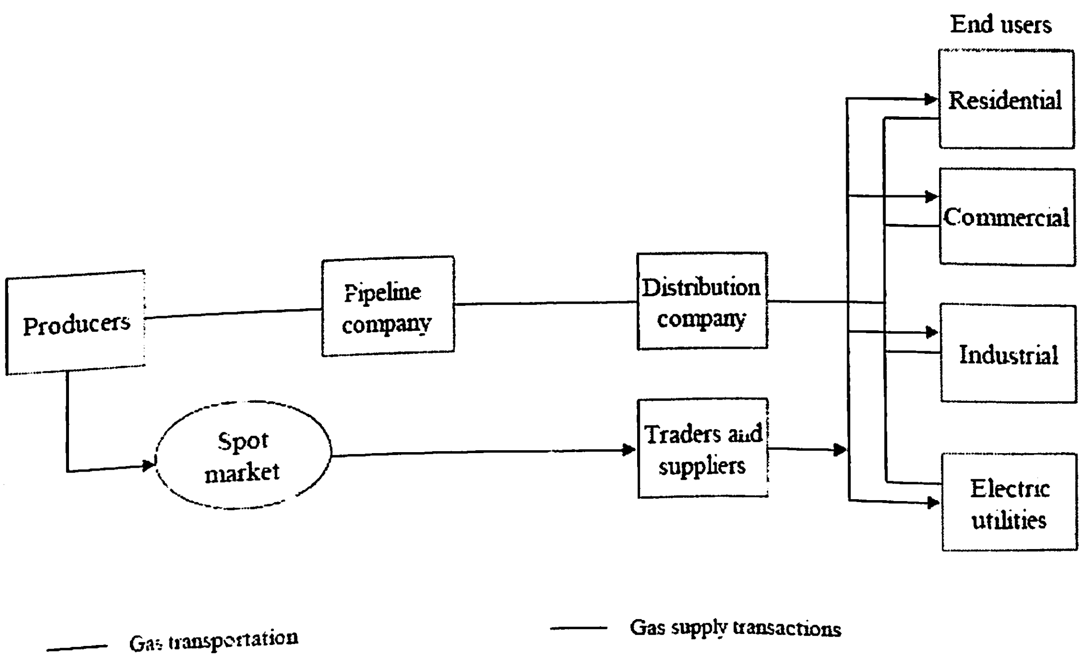
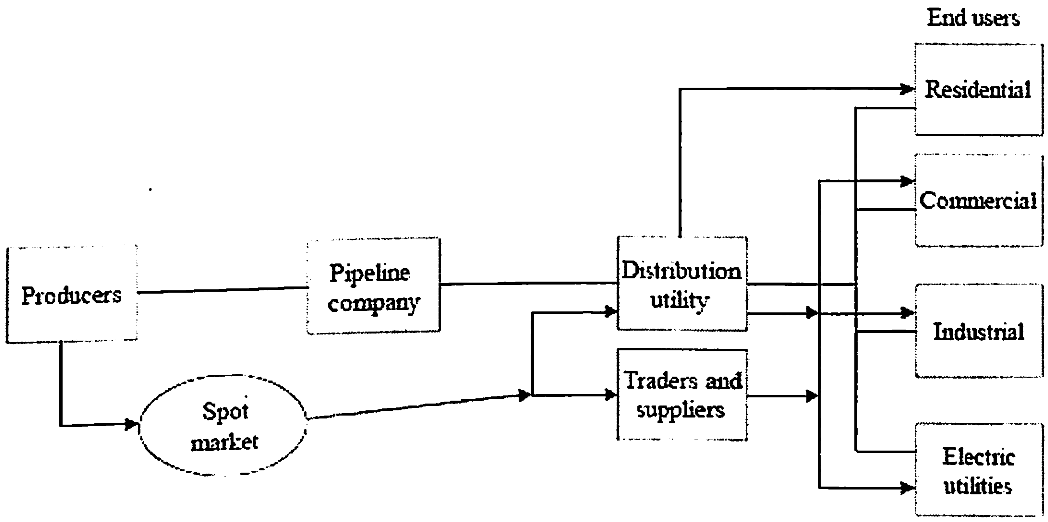


Figure 5 Transitional Model: Unbundling of Pipeline Transportation and Open Access to Distribution



CHAPTER 5

OTC DERIVATIVE AND ORGANISED DERIVATIVE EXCHANGE

OTC DERIVATIVE

The Oral Agreement and Terms Agreement. A typical OTC derivative transaction begins with a telephone call during which the basic economic terms of the transaction are established, together with any requirements for "credit support" (*e.g.*, collateral or margin, or a guarantee). The parties usually intend to be bound by the terms of the oral agreement. One party (or a broker if one is involved) normally prepares and issues a letter or, at least historically, telex to the other party which sets forth the basic economic terms of the transaction established in the oral agreement and asks for a confirming reply. Many of these terms letters and telexes specifically state that they are intended to be binding agreements. The terms letter or telex, assuming it contains either all material terms or only the quantity term (depending upon the applicable "statute of frauds" (legislation requiring certain contracts, or certain terms of contracts, to be in writing)), should be enforceable against the party issuing it.

Need for Superseding Documentation. Although most parties intend the initial exchanges of terms letters or telexes and confirmations to constitute binding agreements, these initial agreements typically do not contain all the non economic provisions that most parties require for arrangements that may last as long as 10 to 15 years. These initial agreements do not set the general ongoing legal and credit relationship between the parties. For example, the confirmation letter or telex often does not include provisions covering representations and warranties, covenants, events of default, liquidated damages, assignment, judgment currency, consent to jurisdiction and closing documents. Such letter or telex also does not contain express provisions for the netting of swap payment obligations. These provisions, together with provisions covering the economic terms of a transaction, are normally contained in the master swap agreement that incorporates the initial exchange of confirmation letters or telexes

OTC DERIVATIVE MARKETS

Early derivatives use was in the form of OTC contracts. Markets lacked depth and liquidity, which meant that early unwinding of a contract involved negotiating with your counterparty, frequently at unfavorable terms. In addition, contract defaults were commonplace, undermining the integrity of the market. Gradually, exchange-traded derivatives markets took over. Having a centralized market with standardized contracts and transparency provided needed depth and liquidity. Indeed, they could design any type of contract the customer wanted without the encumbrance of obtaining regulatory approval. The key attributes of OTC derivative contract markets: contract flexibility and the regulatory environment within which OTC derivatives markets operate. Discussions of the transparency and credit risk issues follow, along with descriptions to two actively traded OTC derivative contract designs.

Contract Flexibility

The chief virtue of OTC markets is contract flexibility. A customer can virtually be assured that he can find someone who is willing to tailor a derivatives contract to meet his needs.

Regulation

Aside from the self-imposed working standards of ISDA, OTC markets are unregulated. For OTC markets, the arguments regarding transparency are the opposite of what they were for exchanges. On one hand, trading participants in OTC derivatives markets do not have the extra layer of protection provided by a federal agency overseeing trading, making sure that everyone is operating according to the same set of rules and safeguarding against manipulative practices.

On the other, OTC markets can introduce new types of derivative contracts at the drop of a hat—an important competitive advantage over exchanges that must seek governmental approval. All that an OTC transaction requires is a

Risk Management

Generally, Risk Management is the process of measuring, or assessing risk and then developing strategies to manage the risk. In general, the strategies employed include

Transferring the risk to another party,

Avoiding the risk,

Reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk.

Hedging the risk.

Financial risk management

focuses on risks that can be managed using traded financial instruments. Regardless of the type of risk management, all large corporations have risk management teams and small groups and corporations practice informal, if not formal, risk management.

In ideal risk management, a prioritization process is followed whereby the risks with the greatest loss and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled later. In practice the process can be very difficult, and balancing between risks with a high probability of occurrence but lower loss vs. a risk with high loss but lower probability of occurrence can often be mishandled.

Commodity Risk Management

The process of risk management requires proper understanding, analysis and thinking. If the task of risk management is taken lightly without proper preparation and understanding, the consequences may be very harmful. If the right steps are taken in a logical manner with all of its seriousness, then one can expect to meet the desired results.

Risk of loss in commodity trading is present in many forms. Even purchase, sale and possession of goods entail risks like loss through pilferage, physical damage and spoilage due to flood or lack of proper protection may lead to serious financial loss. The major risk in commodity market is the financial loss due to price movements. Here the risk management measures should protect the business from adverse price movements while trying to profit from favourable ones.

Transparency

Market transparency refers to the amount of information provided about the derivatives being traded. Exchange markets are transparent in the sense that information about trade prices, volumes, and open interest figures are publicly disseminated. OTC markets, on the other hand, are privately negotiated transactions.

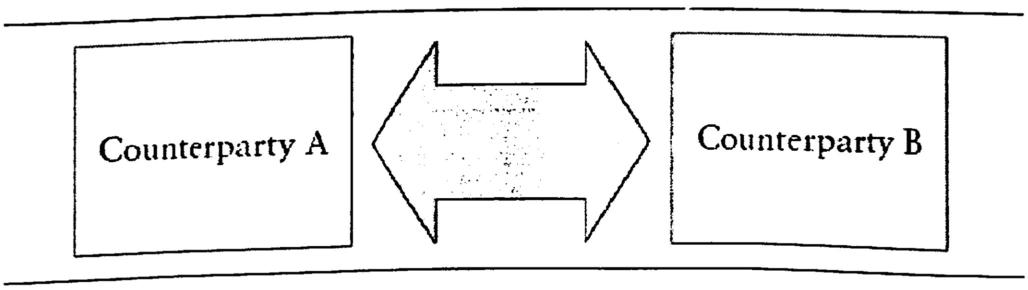


Fig 5.1 OTC Market Structure

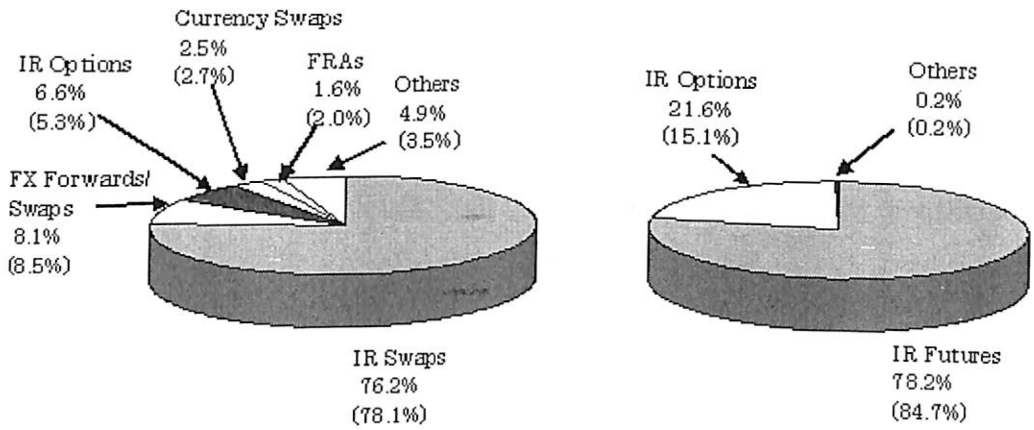
Trading Activity in Global Over-the-Counter Markets, 1998 and 2001 (Billion U.S. Dollars) Risk Category and Instrument	Notional Amounts		Gross Market Value	
	June 1998	December 2001	June 1998	December 2001
Total Notional Value	72,144	111,115	2,579	3,788
Foreign Exchange Contracts	18,719	16,748	799	779
Outright Forwards and Forex Swaps	12,149	10,336	476	374
Currency Swaps	1,947	3,942	208	335
Options	4,623	2,470	115	70
Interest Rate Contracts	42,368	77,513	1,159	2,210
Forward Rate Agreements	5,147	7,737	33	19
Interest Rate Swaps	29,363	58,897	1,018	1,969
Options	7,858	10,879	108	222
Equity-Linked Contracts	1,274	1,881	190	205
Forwards and Swaps	154	320	20	58
Options	1,120	1,561	170	147
Commodity Contracts	452	598	38	75
Gold	193	231	10	20
Other Commodities	259	367	28	55
Forwards and Swaps	153	217	—	—
Options	106	150	—	—
Other	9,331	14,375	393	519

Source: Bank for International Settlements.

Table 5.1

Shares by Instrument Type as of End-December 2006

OTC Contracts: US$18.7 trillion **Exchange Traded Contracts: US$8.5 trillion**



Note: Figures in parentheses represent the share of each instrument at end-June 2006.

Fig 5.2 **OTC Market And Exchange traded Contracts**

DERIVATIVE MARKET STRUCTURE

DERIVATIVE MARKET

Derivative securities can be traded on organized exchanges or through over-the-counter arrangements. There are a number of characteristics that are traditionally used to describe the broad differences between exchange traded (EXT) and over-the-counter (OTC) derivative markets. These are based on a number of considerations, including the standardization of instruments, the existence of a clearing house to deal with counterparty credit risk, the regulatory framework and the types of instruments traded in the different markets.

Futures markets provide important economic benefits. NYMEX energy futures are highly liquid and transparent, representing the views and expectations of a wide variety of participants from every sector of the energy marketplace. As derivatives of cash markets, they reflect cash market prices and as a result are used as a hedging and price discovery vehicle around the globe. The price agreed upon for sale of any futures contract trade is immediately transmitted to the Exchange's electronic price reporting system and to the news wires and information vendors who inform the world of accurate futures prices. In addition to continuously reporting prices during the trading session, NYMEX reports trading volume and open interest daily and deliveries against the futures contracts monthly. Transparent, fair and orderly markets are critical to the NYMEX's success as the most reliable hedging vehicle for physical transactions and financially settled Over-the-Counter (OTC) transactions.

A key attribute of these products is their leverage. For a fraction of the cost of buying the underlying asset, they create a price exposure similar to that of physical ownership. As a result, they provide an efficient means of offsetting exposures among hedgers or transferring risk from hedgers to speculators. The leverage and low trading costs in these markets attract speculators, who play a valuable role as liquidity providers enabling commercial traders to get in and out of the market as needed. As liquidity increases, so does the amount of information absorbed into the market price, leading to a more broadly based market in which the current price corresponds more closely to its true

Derivative Market Participants

Hedgers: Enter into derivative contracts to offset similar risks that they hold in an underlying physical market. In so doing, they transfer risk to other market participants, such as speculators or other hedgers. Hedging is the primary social rationale for trading in derivatives.

Speculators: Take unhedged risk positions in order to exploit informational inefficiencies and mispriced instruments or to take advantage of their risk capacity. Speculators are individual traders and companies willing to take on risk

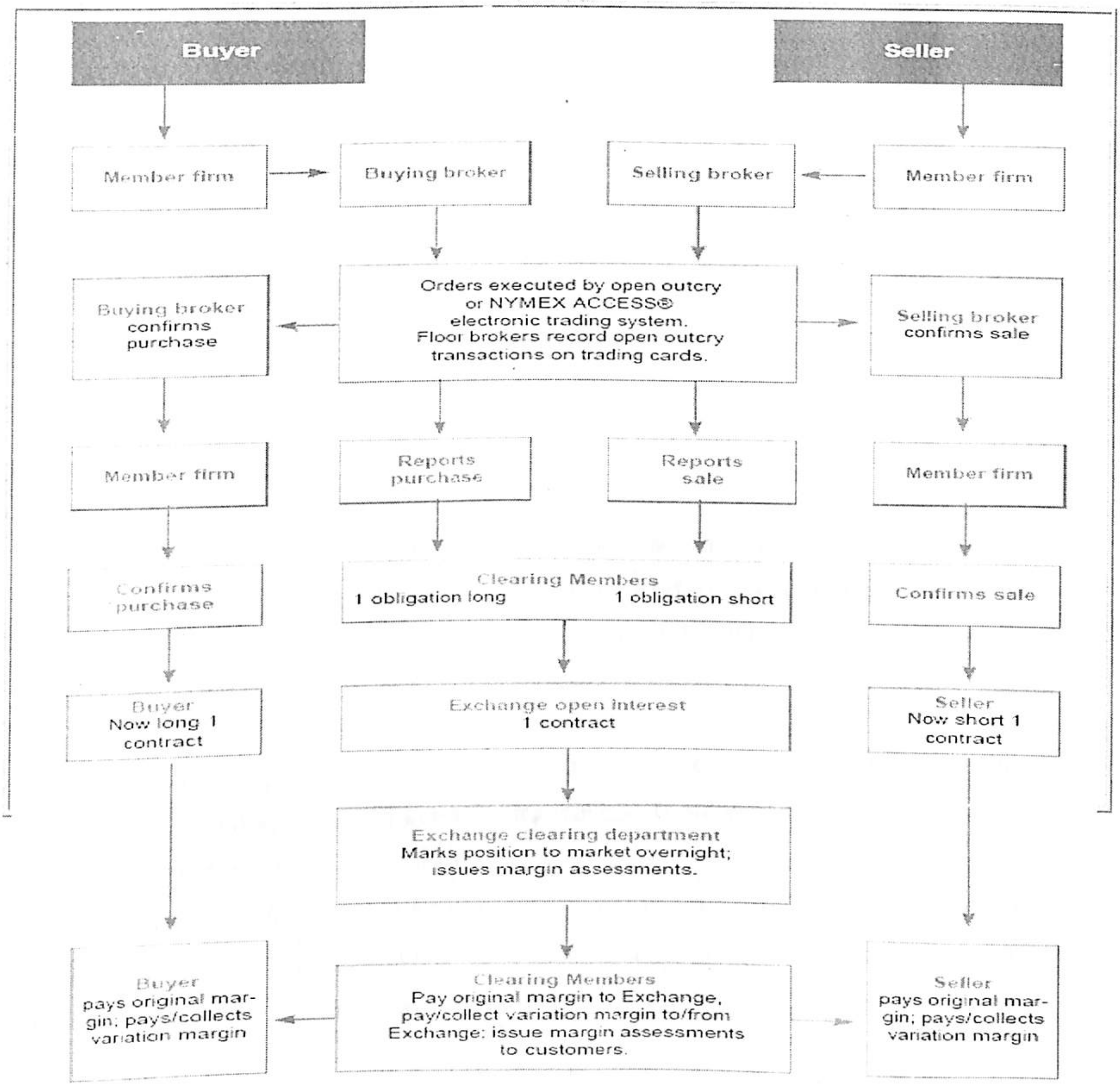


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Fig 5.3 Derivative Market Structure

Traditional market structure characteristics

Standardization

Exchange-traded contracts are generally thought of as having been standardized (with regard to maturity date, contract size and delivery terms), whereas OTC contracts are custom-tailored to the client's needs. Some exchanges, however, have recently introduced derivative instruments that can provide a significant degree of customization.9 Also, in practice, OTC markets may follow certain simplifying market conventions that provide a certain degree of standardization.

Market Risk in Derivative Market

The fundamental market risks include:

Absolute price or rate (or delta) risk. This is the exposure to a change in the value of a transaction corresponding to a given change in the price of the underlying instrument. n *Convexity (or gamma) risk.* This is the risk that arises when the relationship between the price of an underlying and the value of a transaction is not linear, as it is the case with options-based contracts. In effect, it is the sensitivity of delta risk to the price change of the underlying asset.

Volatility (or vega) risk. Associated with option-based instruments, this is the exposure to a change in the value of a transaction resulting from a given change in the expected volatility of the price of the underlying instrument. . The Group of Thirty (1993) also identifies 'operational risk' as a further general classification of the risks facing participants in OTC derivative markets. Operational risk is the risk of losses occurring as a result of inadequate systems and control, or human error..

Time decay (or theta) risk. This is typically associated with option based instruments and is the exposure to a change in the value of a transaction arising from the passage of time.

Basis or correlation risk. This is the exposure of a transaction to differences in the price performance of the derivatives used as hedges and the price performance of the underlying asset.

Discount rate (or rho) risk. This is the exposure to a change in the value of a transaction corresponding to a change in the rate used for discounting future cash flows.

Market liquidity risk. This is the risk that a large transaction in a particular instrument could result in a sharp move in the price and/or volatility of the instrument. The cost of hedging also increases as bid/ask spreads tend to be larger in illiquid markets.

MANAGEMENT OF RISK IN DERIVATIVE MARKET

The market risks involved in a single derivative transaction or in a portfolio are best analysed in terms of the fundamental risks associated with the two basic types of derivatives it may contain: forward based and option-based derivatives.

In the case of forward-based derivatives, market risks are relatively straightforward since the dominant risk is absolute price or rate risk.

Changes in the price of the underlying instrument result in proportional changes in the value of the derivative security. In this case, a hedge could be constructed using the underlying instrument or another forward-based derivative. The market risks inherent in option-based derivatives are, however, more complex. In particular, the relationship between the price of an option and the price of the underlying asset is not constant, as is the case with forward-based derivatives. The price sensitivity of an option's value changes with changes in the price of the underlying instrument. Changes in the expected volatility of the underlying and the passage of time will also affect the value of the option.

Thus, since the price sensitivity of an option varies with changes in the price of the underlying instrument, a position that is initially delta hedged must be adjusted as time passes, or prices change, if it is to remain hedged. The process of continuously hedging an option with a position in the underlying is known as 'dynamic hedging'. There are, however, two main risks associated with a dynamic hedge. The cost of hedging may turn out to be greater than expected because actual volatility is greater than anticipated and prices may move significantly before positions can be adjusted.

Hedging option-based derivatives is therefore a dynamic process, unlike the static nature of hedging forward-based derivatives. The alternative to dynamic hedging is to use options as hedges. The hedging of an option with another option is usually known as gamma or vega hedging. Here, the risks to changes in delta and changes in volatility are neutralized by offsetting changes in other options. Balanced portfolios can hedge options with options, while dynamically hedging the smaller residual risk arising from mismatches in the options portfolio.

It is worth noting that market participants typically use a variety of mechanisms to manage market risk. However, a strategy which seems to have become increasingly appealing is Monte Carlo simulations based on expected changes in market conditions. "Stress" tests, for example, measure market risk based on simulations of improbable, but potentially significant, market conditions.48 Through this approach, expected and maximum potential exposures of complex transactions or portfolio effects can be measured.

Settlement risk

Settlement risk refers to the potential loss that a party could suffer if prices moved in his favour and against the counterparty, resulting in the latter refusing to make payments on the settlement date. Some of the largest settlement exposures may occur on the settlement day itself when the value of the security can be at risk if delivery of the security and delivery of the payment are not synchronized. Although settlement risk can be considerable, a number of mechanisms are typically used to manage this type of risk. In particular, market participants often place a limit on the size of the allowable daily settlement with any one party. Bilateral netting arrangements (discussed in Section 6.3.1) could also reduce the settlement exposure of both counterparties. As well, there are arrangements under which parties deposit funds in a third party's escrow account until settlement is completed.

Counterparty risk

Counterparty (or credit) risk refers to the probability that a counterparty may default on a derivatives contract. While there can be credit risk considerations in EXT derivative markets when the financial soundness of the clearing corporation is questionable, counterparty risk is typically present, and can be very significant, in OTC derivatives trading. Credit risk is a dynamic concept that changes with the passage of time and movements in the underlying variables.

The loss due to counterparty default is the cost of replacing the contract with a new one. The replacement cost at the time of default is equal to the present value of the expected future cash flows. Thus, for a credit loss to occur, two conditions must co-exist: i) the counterparty defaults on a contract; and ii) the replacement cost of the transaction is positive. Whereas counterparty risk is two-sided in the case of forwards and swaps, counterparty risk in options is one-sided -- only the buyer of the option is exposed to the risk that the seller may default prior to fulfilling the commitment under the option.

The potential exposure for a portfolio of derivatives is significantly more difficult to calculate than that of individual transactions. Adding the potential exposure of each transaction in the portfolio may overstate the actual potential exposure of the overall portfolio as it does not take into account transactions in the portfolio with offsetting exposures, nor transactions that have peak maximum potential exposures that occur at different time periods.Moreover, the overall credit risk of a derivatives portfolio also depends upon the extent of diversification across specific counterparties and types of counterparties. Concentration of the portfolio with one counterparty (or type of counterparty) would increase the credit risk of the portfolio.

CHAPTER 6

ISSUE AND IMPACT IN OTC AND ODE

The model developed in this dissertation will base itself mostly on the Tashjian and Weissman two-period model. New contracts will be of a very stylized form and a zero interest rate is assumed. While the ODE market is limited to one contract and acts as an intermediary for transactions, the OTC market can issue as many customized contracts as needed as long as it is willing to take the offsetting position to that of the agent. In the original security design literature, short sales presented a problem , since it allowed all agents to replicate a potentially new contract without costs. The model developed here has no short sale restriction for neither the ODE contract nor the customized OTC contracts. Short sales are allowed as long as all the trading takes place through one of the markets. An important difference between the ODE and OTC market is, however, that the OTC market will hold positions of its own.

In game theoretic terms, the model developed represents a game between a single ODE market and a single OTC market. Both markets will simultaneously offer contracts to a group of agents/investors. Risk averse investors (hedgers and speculators depending on their initial risky endowments and risk tolerances) will buy or sell a contract depending on how attractive the contract is. The key difference between the two different contracts is that the OTC contract can be customized to various degrees to hedge an investor's idiosyncratic risk, something the standardized ODE contract cannot do. At the subsequent time period the risky payoffs are realized and the game ends. Note that it is not a zero sum game, but there is a maximum volume that can be traded because the number of agents in the economy and their endowments are finite. The pareto optimal equilibrium is reached by choosing a set of contracts that maximizes transaction volume and hence the amount of risk transferred. However, non-zero transaction costs, the OTC market's risk aversion, the agents' credit risk aversion, and the less than perfect competition between the two markets will ensure that global trading volume is less than pareto optimal. Only two markets are analyzed, making the resulting game fairly simple and tractable. Treating the OTC market as a single concentrated marketplace, which makes the decision of what contract to launch at what price is another simplifying assumption. In reality

OTC markets are more of a loose global network of large banks, where the vast majority of transactions are conducted between a handful of large participants.

Model Set Up

The construction of the basic version of the model will begin with the derivation of the agents' optimal demands for the different markets' contracts. Knowing these demands, they can then be aggregated across all the agents in the economy. These aggregated demands are the central variables in the markets' maximization problems. The motivation for customization being the key difference between the two markets, is that OTC market participants generally view the ability to off-load highly idiosyncratic risks as one of the key advantages of going to the OTC market. Moreover, small and medium investors with other transactional motives play, even on the ODE markets, a very small role. There are, of course, a number of additional market differences that are relevant, such as the ability to transact in relative anonymity on ODE markets, while the regulatory oversight and potential capital charges can be lower with transactions on OTC markets. These considerations, while relevant, are not directly addressed in this paper.

There are, in this model setting, K agents, where each individual agent k has its individual constant risk aversion, r_k. An agent is endowed, in some numeraire of consumption goods, with a random number of two risky future payoff vectors (assets) m and e_k . The first asset is the "systematic" part, m, (with a risky pay-off related to, for example, economy wide risks that all agents could face) and the second part is agent k's "idiosyncratic" risk, e_k (with a risky payoff related to, for example, non hedgeable basis risk or exposure to individual risks not common with other agents).

Here, *xk* denotes the endowment of risky asset *m*, for a given agent *k*, and *xe*
k is the endowment of risky asset *ek*.

Systematic risks and idiosyncratic risks are assumed to be uncorrelated.

The total endowment for an agent is equal to:

$X_k = x_k^m m + x_k^e e_k$

The variance of this endowment is:

$Var(x_k) = Var\{x_k^m m) + Var(x_k^e e_k) = \{^{XkVar}\{m) + (x_k)2\ Var(ek)$ (1)

For simplicity, it is assumed that the variance of the idiosyncratic risks are the same across agents, i.e., *Var(ek)* is equal to *Var(e)* and *Cov(ei,eJ)* is equal to zero.

Risk averse agent *k* has the choice of hedging his initial risky endowments by buying or

selling the ODE derivative contract, with the random payoff f_{ODE}, and/or the OTC derivative, with random payoff $f_{k,OTC}$. The amounts agent *k* chooses to buy or sell, are

denoted by $y_{k\ ODE}$ and $y_{k\ OTC}$. For each unit he buys or sells in the ODE market he has to pay a transaction cost of T_{ODE}. The OTC market does not charge a transaction cost as such, but rather generates revenues from the price offered to the agent (in the form of a bid/ask spread depending on whether the agent is buying or selling). Hence, the price agent *k* has to pay or receive are determined in equilibrium and are denoted by P_{ODE} and $P_{k,OTC}$. Since the OTC contract is customized for each individual agent it can be broken into its constituent parts, i.e., the risks that are being hedged against. Hence, it assumed that

$f_{k\ OTC} - f^{TM}_{OTC} + f^{e}_{k,Otc}$

and that the agents demand for the OTC contracts is

$y_{k,OTC} = y^{n}_{k,orc} + y^{e}_{k,orc}$ a t a Price °f$P_{k\ OTC} - P^{m}_{kOTc} + P_{kOTc}$ •

Given the presence of two financial markets, agent *k* is maximizing his utility by maximizing the next periods' payoff taking into account his risk aversion in he form of a mean variance type utility function subject to some individual level of risk aversion and with normally distributed payoffs.14 To capture an important difference between OTC markets and ODE markets and the fact that transactions in the ODE market are cleared, agents that transact in the OTC market face additional credit risk aversion *ck* for the exposure they face towards the OTC counterparty

$U_k(x_k) = E(w_k) - r_k Var(w_k) - c_k Var\{w^{otc}{}_k$

Agent k's maximization function is hence constructed by substituting k's pay-off function,

i.e., w_k, into the utility function.

$max\ U_k(X_k + y_{k,ODE}(f_{ODE}\ p_{ODE}) + y'_{k,OTC}(f_{k,OTC} - P_{k,OTC}) \sim y'_{k,ODE} * T_{ODE})$ (2)

Plugging (2) into the agent's mean-variance utility expression, the optimal demand of each contract will depend on how well the contract's payoff hedges *k's* risky endowment, which is determined by the contract's covariance. In the case of the ODE market, its contract can, by assumption only, hedge the systematic risk, which means that:

$Cov(x^e{}_k e_k, f_{ODE}) = 0$

$Cov(x_k, f_{ODE}) = Cov\{x^m{}_k m f_{ODE})$

After some derivation, the optimal volume bought or sold by a certain agent *k* in market ODE is equal to Similarly, the amount bought and sold of the OTC contract addressing m-risk can be

expressed by the below expression:

The optimal demand expressions show that an agent's desired amount to buy and sell the ODE contract and the OTC contracts depends on the variance of the contract's payoff, the covariances of the agent's risky endowment with the respective contract, the covariances between the contracts, the risk aversion of the agent to risk in general and OTC-risk in particular, the expected return of the contract, and the price of the contract. Moreover, the higher the transaction cost of the ODE contract the less that contract will be demanded.

Further analyzing (3) the first two terms in the main bracket are referred to as the hedging component", and the last two terms are referred to as the "speculative component" (based on Tashjian and Weissman, 1995). The first term of the "hedging component" has the effect of whether an individual agent tends to have a positive or negative demand for the contract, if the contract is positively correlated with the agent's positive endowment he tends to have a negative demand (i.e., supply). The second "hedging" term captures the effect of competition with the OTC contract hedging m-risk. The more the two competing contracts are correlated, and if the agent has already hedged some of his risk using the other contract, his absolute demand for the other contract is less. In the case of the ODE market, the premium/discount *(E(f0DE) - P0DE)* in the third term relates to how the equilibrium price of the contract encourages "speculators" to provide additional demand or supply to clear the market (i.e., to ensure that the net supply in equilibrium is zero). For example, in some cases there might be an imbalance between the agents interested in selling the ODE contract and the agents interested in buying it. In those cases the premium has to be increased to induce an increased supply from agents with a low risk aversion, which allows them to take on additional risk by supplying the contract and to be compensated for it by the premium. The agents that provide this additional supply in the ODE market (or demand if the imbalance is reversed) can be interpreted as "speculators." Finally the last term in equation (3) captures the effect of transaction costs on agents' willingness to transact in the ODE market's contract. If agent *k*has a negative risky endowment, he is likely to go long in the ODE contract. As a result *ak ODE* is equal to -1 and the transaction cost has a negative effect on the *k's* final demand for the contract. Turning to the OTC market, the role of the speculator is being played by the OTC market itself. Hence, since the counterpart is always the OTC market, that market will set the price that optimizes the market's return for each individual agent. However, its pricing power in the case of m-risk is limited by the competition effect provided by the ODE market, and the agents' counterparty credit risk aversion.

Comparitive Study

COMPARATIVE STATICS AND MODEL RESULTS

An important driving factor in the model is that the OTC contract can also hedge risks that the ODE contract can never address. This asymmetry provides interesting competition questions. For example, what is the volume traded in the ODE market in equilibrium, which market will have the lowest price/transaction cost, and how much does competition increase/lower the socially optimum volume of trading? Since in optimum both markets optimally offer a contract that is perfectly correlated with the underlying risky endowments, the main channel of competition is transaction costs more broadly. As a result, the optimal transaction cost expression for the ODE market has evolved in comparison to the previous literature, while the OTC market competes by price and discrimination between agents.

Comparative Statics

Increased competition, through a higher trading volume in the OTC market's contract hedging m-risk, will decrease the level of the ODE market's optimal transaction cost. Hence, in a non-competitive setting, where there is only one monopolistic financial market providing only contracts hedging m-risk, the optimal transaction cost would be higher (see conclusion for some numerical examples). For the OTC market, however, the choice is whether to use its scarce capacity to take on risky positions that are related to m-risk or whether it should only focus on providing a hedge against e-risk. In the model developed in the earlier sections, the OTC market has an obvious advantage in that it can hedge an orthogonal risk that the ODE market can never capture with its contract. Hence, in the absence of competition, the OTC market would provide the optimal contracts for both types of risks. An implication of this competition is that the ODE market's transaction costs, e.g., exchange and clearing fees, have to respond to the presence of a competing market and be reduced. Hence, as a core implication, the ODE market competes, all else being equal, through low transaction costs. However, the relationship between the different markets' transaction costs also depends on the structure of the endowments of the agents. Moreover, in a related decision, the OTC market has to decide to what an extent it wants to act as a "speculator" and take a net positive/negative position in m-risk (*V^e t*). The fact that it is willing to provide "liquidity" by helping to address any supply/demand imbalances in the endowment of the m-risk asset means that the price at which agents transact in the ODE market actually declines. In the absence of this "speculator" function, the price at which the ODE market clears is higher (if it is assumed that there is a net negative endowment of m-risk) than if some of the excess demand for hedge is covered through the OTC market. Table 3 provides some indications on the effects of changes in key variables (numerical examples are provided in the appendix) and some intuition behind the effects of adding a competition dimension.

Table 3. Comparative Statics of the Model

	r_k	c_k	r_{OTC}	T_{ODE}	$Var(m)$	$Var(e)$	$V_{OTC}^{m,net}$
$y_{k,ODE}$	-	..	..	-	-	..	..
$y_{k,OTC}^{m}$	$sign(V_{OTC}^{m,net})$	?	$-sign(V_{OTC}^{m,net})$	+	-	..	-
$y_{k,OTC}^{c}$	-	+	+	..	..	..	..
T_{ODE}	-	..	..	..	+	..	..
P_{ODE}	-	..	..	+	-	..	-
$P_{k,OTC}^{m}$	..	+	?	+	?	..	+
$P_{k,OTC}^{c}$	?	+	+	..	..	+	..
$V_{OTC}^{m,net}$	..	$-sign(V_{OTC}^{m,net})$	$-sign(V_{OTC}^{m,net})$	?	?	..	..
V_{ODE}	?	+	+	-	+	..	..
$V_{OTC}^{m,gross}$	..	?	-	+	-	..	-
R_{ODE}	?	+	+	?	-	..	..
U_{OTC}	+	-	-	+	-	+	?

Note: (..) implies that the comparative static is not relevant. (+) implies that an increase in a row heading causes an increase in the column heading. (-) implies that an increase in a row heading causes a decrease in the column heading. (?) implies that the sign is ambiguous dependent on parameter values.

As can be seen in the table, the higher the underlying variance of m-risk the higher the optimal transaction cost and trading volume and hence revenue for the ODE market. Hence, standardized derivatives hedging endowments of a high variance are of a particular attraction to the ODE markets facing a competitive threat from the OTC markets. For the OTC market the relationship between the variance of m-risk and trading volume is negative. This partly reflects, for a constant ODE transaction cost, the credit risk aversion agents face when transacting in the OTC market. Moreover, the OTC market's own risk aversion plays a role and affects the utility negatively of providing a contract hedging m-risk. An interesting result of the model is that the bid/ask spread the OTC market charges for the contracts hedging m riskis in the optimum the same as the transaction cost of the contract offered by the ODE market. This assumes that the endowment of the agent trying to sell m-risk and that of the agent buying m-risk is the same with the signs reversed. Also they must have the same risk aversions and the exposure constraint has to be non-binding. Moreover, it can be shown that the bid/ask spread the OTC market will charge in optimum for the contract hedging m-risk is equal to the transaction cost chosen by the ODE market. If there was no competition from the ODE market, however, both the optimal demand for the OTC contract hedging m-risk and the bid/ask spread would be different .

This bid/ask spread, depending on the gross endowments of the two agents going long versus short can be bigger or smaller than the ODE market optimal transaction cost in a competitive setting.

Turning to the variance of e-risk, the effect of a higher variance is the reverse of what it is for the OTC market in terms of m-risk. The intuitive reason for this result is that the OTC market is exploiting its monopoly power as much as possible in the e-risk market. Since it is the sole provider of an instrument to hedge the idiosyncratic risk, it can ask a high price for that service. Of course, a side effect of entering into a lot of fairly rewarding contracts hedging agents' individual e-risk is that the variance of those positions quickly add up and do not net out in the same sense as the positions the OTC market enters into regarding m-risk (where it is the net position that matters). If the OTC market has a high level of risk aversion it would relatively shift more of its exposure and transaction volume to the contract hedging m-risk than to the contract hedging e-risk. For example, if the OTC market's risk aversion is very high it can still transact in the m-risk market, while setting its net exposure to zero. Of course, the side effect in this case would be that the equilibrium price charged by the ODE market increases since the OTC market would not play any market maker function by assuming risk. In this example, the OTC market may therefore be unwilling to transact in any OTC contract hedging e-risk or only at such a high cost that agents do not want to hedge these risks (see the appendix for a quantification of this example). Such an outcome would have fairly large negative welfare effects.

Additional Model Results

So far the downside of customization has not been discussed in detail. Customization leads to an accumulation of credit risk, because neither the agents nor the OTC market can normally hedge its credit (or counter party) risk. Accumulating credit risk is clearly costly to the agent and the issuing OTC market. In the case of the ODE market, however, credit risk is dealt with through the clearing system. Agents transacting in the OTC markets do not generally have access to such clearing facilities. Therefore, it is reasonable to assume that in the case of the OTC markets, the more customized a contract is, and the higher the market value of it is, the larger is the subsequent credit risk exposure faced by the agent and the issuer. Customization also limits the possibility of a resale if the counterparty enters default. In the global OTC interest rate and foreign exchange swap markets, recently evolving bilateral and multilateral netting arrangements are potentially an efficient way to decrease the credit risk faced by a single participant.

Regardless of the ways in which the agents transacting in the OTC market try to mitigate their credit risk exposure, the maximum possible unhedgeable loss to the agent, i.e., the number of contracts times the contract's payoff, will be a key variable in the agents' utility functions. In general agents, as well as the OTC market, have to set aside some amount of capital against their net OTC counterparty exposure (in the case of international banks it would depend on the maximum loss according to the traditional BIS rules). Setting aside capital is costly, since it is not earning as much return as it could. Therefore, credit exposure incurs a cost for the issuing bank or organization. Several ODE markets are starting to offer successful ways to reduce the credit risk costs faced by the OTC markets by offering them tailor made clearing services. This fairly recent strategy exploits the ODE markets' long experience with clearing.

In the model developed in this report, some of the costs of customization are modeled by including the OTC market's general risk aversion and the agents' specific individual credit risk aversion, *ck*. Increased level of credit risk aversion among agents have a direct effect on their demand for the OTC contracts. Given the presence of competition in the case of the OTC contract hedging m-risk, a change in the credit risk aversion parameter does not change the OTC market's optimal bid/ask spread, which is still equal to the ODE market's transaction cost, but rather affects transaction volume. Similarly, the price spread for agents' hedging their e-risks, while having similar endowments and risk aversions, is also unchanged. Hence, the transaction demand for OTC contracts is rapidly negatively affected and the effect is especially pronounced for the OTC contracts hedging e-risk, given the higher marginal utility the OTC market, due to its monopoly position derives from this market and perhaps also the higher variance of the e-risk endowment. The ODE market, however, clearly stands to gain from the loss in competitiveness from the OTC market and both ODE market revenue and volume would respond positively. The overall utility of the agents trying to hedge their risks suffers, however, since the positive effect of market competition on prices and transactions costs are eroded.

A remaining and related variable to be analyzed is the importance played by the exposure restriction Q and its interplay with the other key variables, such as risk and credit risk aversion. The OTC market's ability to expose itself to market risk is limited. Depending on the size of the limit, this restriction will force the OTC market to make a decision between providing OTC contracts hedging m-risk or e-risk. In essence, this constraint implies that the OTC market has to rank each potential transaction by the utility it creates and then select the contracts that provide the highest utility whether they are hedging m or e-risk. If Q is set high enough, i.e., the constraint is largely non-binding, then $X_k = OVk$ and the OTC market can maximize freely (as is assumed in the numerical examples in the appendix). The more interesting case is when the constraint is sufficiently binding and the OTC market's risk aversion is high. In such a scenario, the market is now maximizing within the constraint and will provide mostly contracts hedging m-risk. If, however, the constraint was binding in the context of low OTC market risk aversion, the OTC market would largely only have provided contracts hedging e-risk. These results are, however, largely driven by the assumptions of the associated parameter values of the constraint and the risk aversions, but show that with an assumption of an economically binding constraint, the lower the OTC market's risk aversion, the more it will provide hedge for those agents with e-risk. This also means that in the case of the ODE market, and as noted in equation (14) and (16) and Table 3; its trading volume and revenue would increase when the risk aversion for the OTC market declines. If, however, the risk aversion of the OTC market is very high while the budget constraint is non-binding it is possible that small changes in the risk aversion have no significant impact on the degree of competition with the ODE market. This is the case, when as above, the OTC market decides to take a near net zero position in contracts hedging m-risk.

CHAPTER 7

ISSUE IMPACT IN NATURAL GAS MARKET

Liquidity and transparency in U.S Natural Gas Markets

Liquidity

Liquidity describes the sensitivity of price to trading. A liquid market has small price changes in response to orders. Fundamental demand for, and supply of, a commodity generates natural trading demands, while speculative trading provides liquidity and smoother prices. Speculators absorb information shocks, and an increase in speculation means that an information shock is distributed among more noise traders, mitigating any excessive price disturbance.

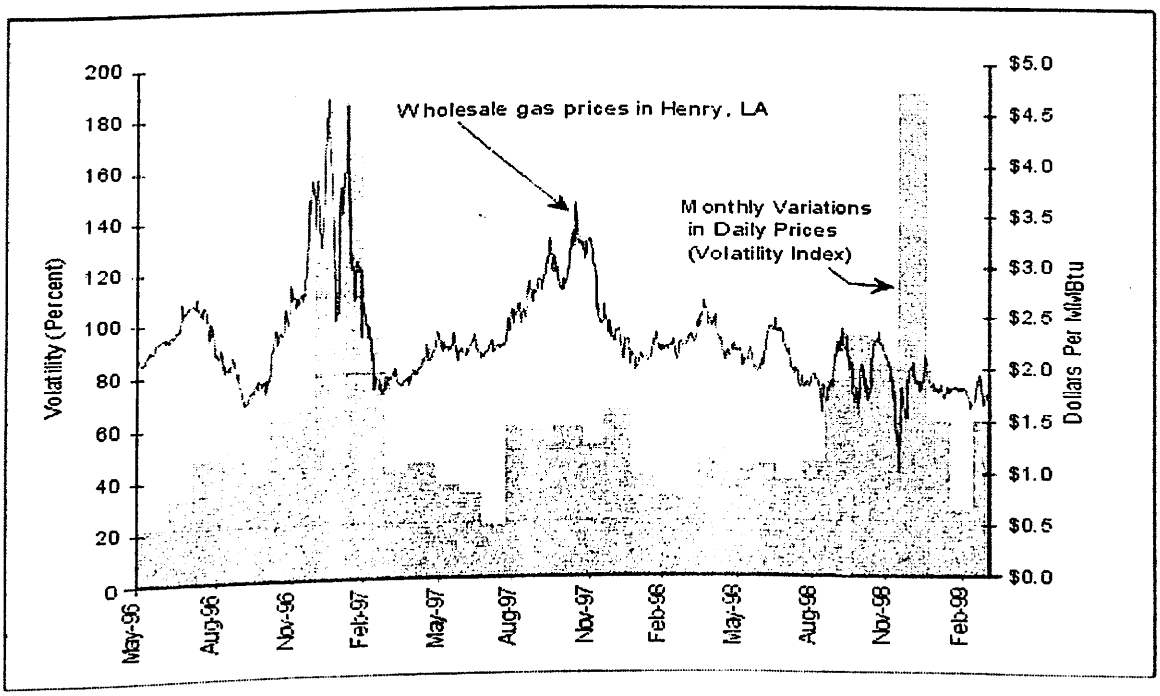


Fig 7.1 Volatility in natural gas market

Transparency

Transparency is the ability of market participants to view information associated with market orders and transactions. Traders naturally benefit from seeing other traders' information. Conversely, traders would naturally prefer that others not be aware of their own information. Thus, transparency involves a "free rider" issue, and exchanges evolve to solve this problem.

Some transparency occurs before a trade is executed, such as in the posting of bids or offers. Desired quantities may be also be revealed with these quotes. After a trade has occurred, various bits of information may be revealed. For example, ICE and NYMEX natural gas prices are reported instantly worldwide, making these markets as transparent in this facet as NYSE or NASDAQ. In addition, publishers such as *Platts* report price and volume information for physical natural gas trades from the previous day for many prominent trading locations.

A much rarer bit of information is revealing who has traded. Disclosure of participants to a trade may reveal proprietary strategies or positions. The great success of electronic trading venues such as the NYMEX or ICE natural gas futures markets, similar to NYSE of NASDAQ, is due to anonymity, placing all traders on a level playing field, protecting trading strategies and thus encouraging trading.

The Link between Liquidity and Transparency

Liquidity is a market characteristic which directly impacts individual trades, whereas transparency has a broader relationship with trading. Some markets are transparent and illiquid, while others are liquid with little transparency. Transparency may reduce liquidity by reducing participation. Some transparency will have the effect of revealing particular trading strategies, which would otherwise be valuable proprietary information. This will discourage participation and harm liquidity.

Anonymous trading, as in stocks, futures, and natural gas trading on ICE and NYMEX, provides a marketplace where traders need not fear revelation of their particular strategies when executing their trades. The main reason why these markets work so well is the fact that traders large and small come as anonymous equals, competing solely on the basis of price and time priority. Changes to required transparency will impact market liquidity and thus efficiency. In the extreme case, some traders may be driven away from exchanges to bilateral phone markets with extremely low transparency, or disappear into overseas markets.

NATURAL GAS EXCHANGES IN WORLD

Natural Gas Futures and Options are mainly traded in world on following exchanges.

New York Mercantile Exchange, NYMEX (http://www.nymex.com)

Nymex launched the world's first natural gas futures contract in April 1990. Options on natural gas futures were launched in October 1992. Open outcry trading is conducted from 9:30 A.M. - 3:10 P.M. After-hours trading in futures and options is conducted via the NYMEX ACCESS® electronic trading system from 7 P.M. to 9 A.M. on Sundays and 4 P.M. to 9 A.M., Mondays through Thursdays. All times are New York times. The market is traded in 10,000 million British thermal unit (BTU) contracts, with a minimum price fluctuation of 0.1 cents per million BTU indicating a change in value of $10.00 per contract.

The New York Mercantile Exchange, the world's leader in providing a market venue for trading physical commodities and managing their risk, is introducing a global, neutral, electronic trading platform destined to become the premier exchange for forward trading and clearing contracts in a wide range of energy and metals products. Enymexsm will provide a one-stop shop for commodity risk management, combining the best of on-Exchange trading with products that were previously only available over-the-counter. By capitalizing upon the Exchange's 128 years of market expertise and more than two decades of designing and offering standardized energy futures and options contracts, enymexsm will eliminate the opaque pricing, lack of liquidity, and counterparty credit risk that exists in the phone- brokered OTC market and on other trading systems.

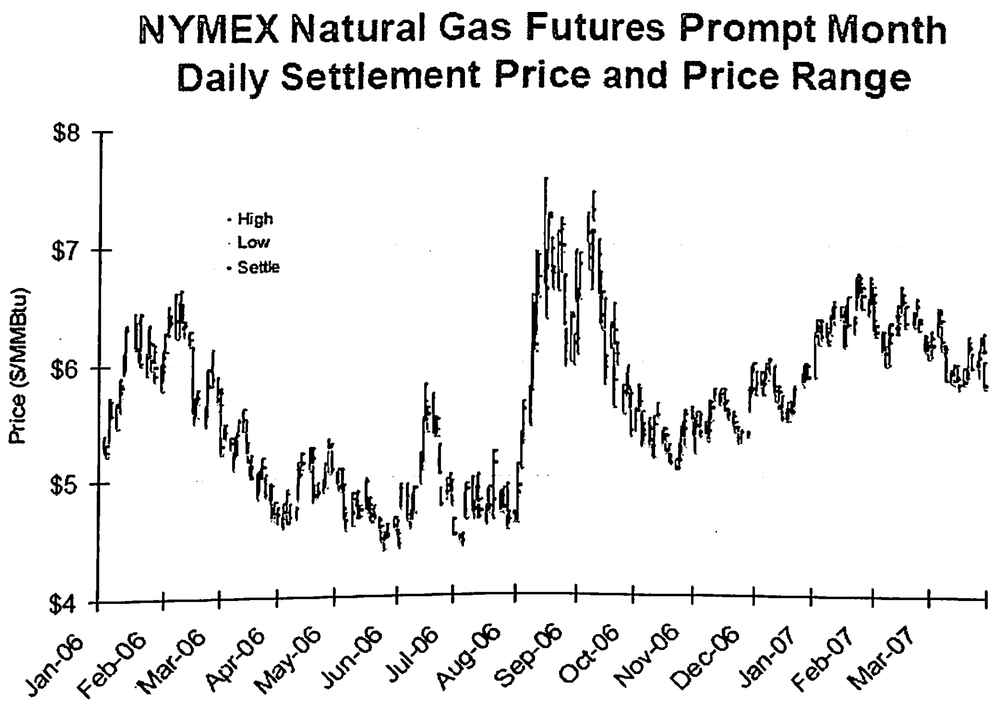


Fig 7.2 Natural Gas Future In Nymex

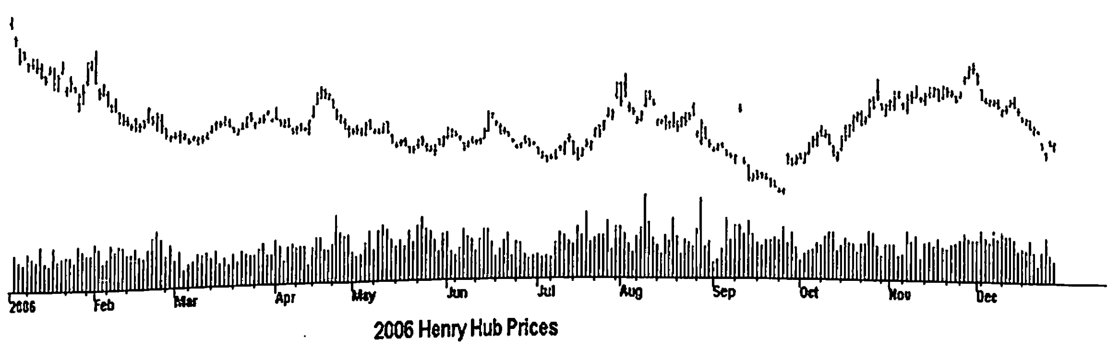


Fig 7.3 2006 Henry Hub Natural Gas Price

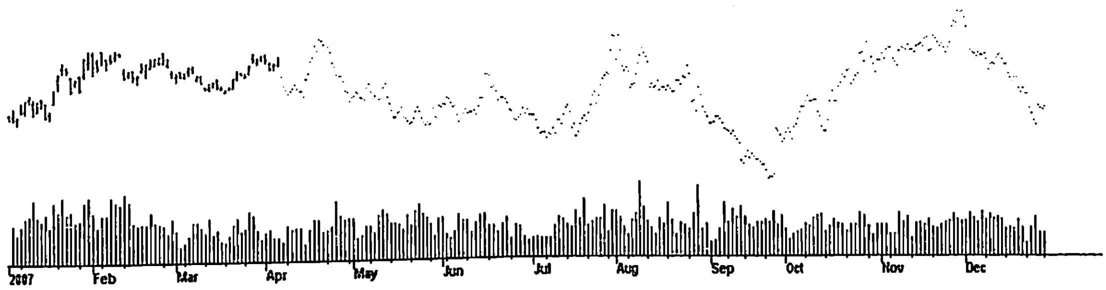


Fig 7.4 2007 Henry Hub Natural Gas Price

Kansas City Board of Trade (http://www.kcbt.com)

While natural gas futures originated at the New York Mercantile Exchange, the contract offered there was oriented to the eastern U.S. market, leaving western natural gas marketers--who faced supply and demand situations different from those in the east--without a risk management tool. The Kansas City Board of Trade, following requests from the natural gas industry, stepped in to fill out this vacuum by launching its western natural gas contract.

International Petroleum Exchange, IPE (http://www.theipe.com)

A group of energy and futures companies founded the IPE in 1980 and the first contract, for Gas Oil futures, was launched the following year. In 1997, despite the advantages of open outcry markets, the IPE moved away from tradition when launching its Natural Gas futures contract. This contract is traded through a revolutionary automated energy trading system (ETS) located within customers' offices. Many exchanges are looking into or introducing electronic trading systems in an effort to provide extra services to the market. The IPE is also looking to do this, for example, offering out-of-hours facilities for Members.

The IPE aims to become an integral part of the European natural gas market, as liberalisation and competition become established.

Other important exchanges in this area are:

Intercontinental Exchange (http://www.intcx.com)

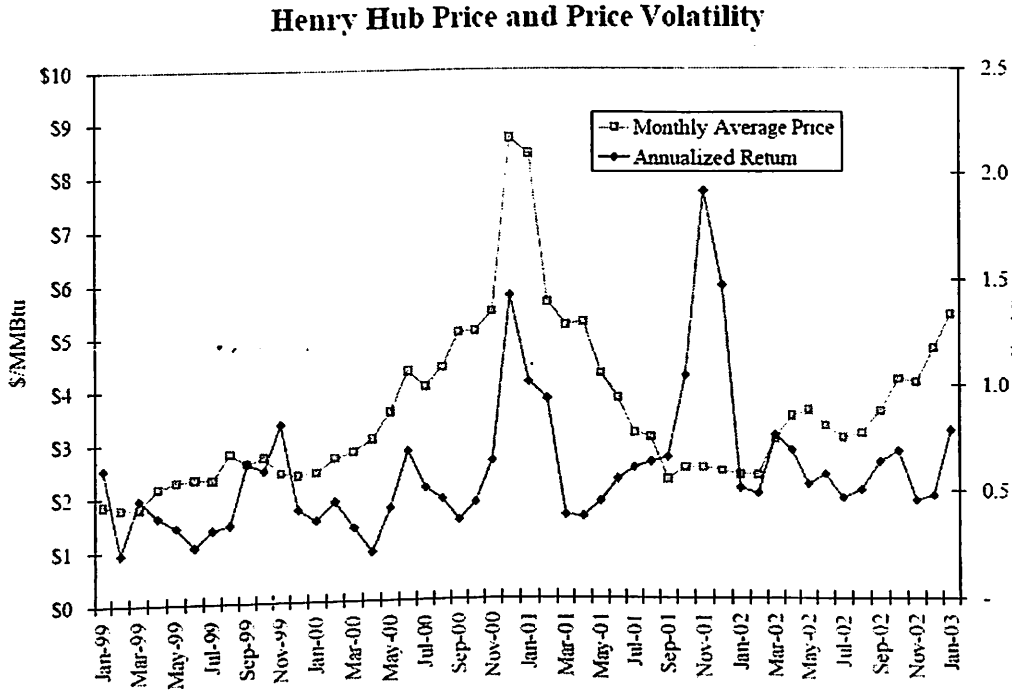
The Intercontinental Exchange is an Internet-based marketplace for the trading of over-the-counter energy. It represents the partnership of world leading financial institutions with some of the world's largest diversified energy and natural resource firms.

Natural Gas Exchange (http://www.ngx.com)

NGX, located in Calgary, Canada provides electronic trading and clearing services to natural gas buyers and sellers in Alberta, one of the largest and most significant production areas of natural gas in North America. Since its inception in 1995, NGX has grown to serve over 120 customers with trading activity averaging 200 BCF (211 000 TJ) per month. Among the customers at NGX are most of the major North American players at the energy market. NGX has quadrupled turnover since 1997 and is expected to grow fast in the future on the basis of a new clearing structure and a wider range of products. Electronic trading is provided at the AECO/NGX Intra-Alberta Market Centre, NGX Empress Market Centre and the NGX Union Dawn Market Centre. NGX acquired the AECO "C" & NIT Daily Spot, One-Month Spot, and Bid-Week Spot gas price indices (Alberta Gas Price Indices) from Canadian Enerdata Ltd. last September. NGX Canada Inc. (NGX) is a wholly owned subsidiary of OM AB (OM).

Altra Market Place (http://www.altra.co.uk)

Formerly known as Altrade™, the Altra Market Place offers real-time online electronic trading for energy commodities where traders actively view and exchange bids and offers quickly and anonymously. Accessible 24 hours a day, seven days a week, the Altra Market Place benefits traders by offering extensive market price and volume discovery, enhanced information about supply and availability, reduced administration costs and reduced transaction risk due to supply and payment guarantees.



Natural Gas Liquidity and Transparency

Natural gas liquidity and transparency compare quite favorably or surpass that of the above markets. The most liquid of the natural gas trading venues are the futures andforward exchanges, with global real time price transparency, identical to other futures and equity markets. Exchange competition (ICE v. NYMEX), historically absent in other commodity markets, also promotes efficiency and mitigates regulatory needs. The participants in the natural gas market mirror the participants in the equities and other commodity markets. Among these are producers and consumers of the molecules, who can trade in real time to obtain the best prices. There are also active dealers, who assist in moving the natural gas from production to consumption. Other entities, such as investment banks and hedge funds, absorb shocks to the system and respond to volatility.

While speculative traders and extensive transparency constrain natural gas price volatility across hubs and time, there are some distinguishing issues related to natural gas:

However, the resulting index is biased toward a potentially few fixed price traders, relative to the index takers, and this increases inefficiency and volatility in the index.

Speculative traders such as hedge funds seek profits from perceived inefficiencies in the natural gas markets. For example, if natural gas prices at two hubs differ by a substantial amount, then arbitrage trading will serve to bring the prices back to equilibrium. Similarly, if forward or futures prices fail to reflect market expectations and costs, inter temporal arbitrage will work to bring cash and futures prices into alignment.

An efficient market is one where resources such as natural gas are allocated to their highest valued use. In the case of natural gas, this means that the molecules are consumed in their highest valued uses, whether in heating, manufacturing, or conversion to electricity. This also means that the natural gas is extracted at an optimal rate. With huge uncertainties about the future demand for and supply of energy, futures prices are critical in directing the allocation of resources. The natural gas forward and futures markets offer a critical transparent forum for price discovery across hubs and across time.

This price transparency allows all traders to judge immediately whether these prices are in line with their expectations or information, and to trade appropriately. In the presence of volatile supply and demand from the end users or providers of natural gas, and trade restrictions, speculation provides needed liquidity to minimize price disruption across this matrix of prices. In other words, as unexpected supply or demand shocks hit the market, from hurricanes or freezes, or supply disruptions, speculators serve to help absorb these shocks and thus prevent unnecessary price swings. In addition, the fact that risk managers rely on the matrix of natural gas cash and futures prices to mark their books validates price efficiency. Even greater natural gas price efficiency could be obtained by encouraging more trading at fixed prices. By extension, a reduction in trading restrictions will not only increase price efficiency, but, would also tend to decrease speculative activity, since the inefficiencies which open the door for speculation will be lessened.

It is important to note that price efficiency in natural gas or other markets does not mean stable prices, and certainly does not indicate any particular price level. Instead, efficiency means that price reflects and is sensitive to changes in information. An efficient price will react quickly and strongly to new information, such as the rapid response of energy prices to hurricane warnings, threatened military actions, or supply discoveries. However, these times of large information shocks will typically correspond to a period of price discovery, and increased volatility. Speculative trading absorbs the risk associated with making the distinction between liquidity and information shocks, keeping volatility to a minimum and hastening price discovery.

Futures exchanges encouraged regulation which limited the trading of their contracts to the exchange's mechanism. This restriction minimizes the free rider problem, and increases the liquidity and efficiency of the futures price. The result is a price, often a single futures price, such as for oil or natural gas, corn, soybeans, or pork bellies, upon which to base many other trades. Today, if the price of oil, or natural gas, or soybeans, or corn, is discussed in the financial news, the price being discussed is futures price, such as the NYMEX oil or natural gas price, or the CBOT corn or soybean price, or the COMEX or LME copper price.

For the price to have utility, it must have a sufficient degree of price efficiency, and of course must be visible. Thus, price transparency, revealing prices around the world, allows the price, such as the NYMEX or ICE natural gas price, to be used as an indicator of market conditions. In turn, the transparency generates trading, which increases liquidity and price efficiency. This well known argument is necessarily circular.

Once the U.S. dollar was allowed to float there was an immediate market in currency forwards, futures and options. In fact this event helped ignite the financial derivatives industry. Similarly for natural gas, markets have evolved as prices have been freed.

Today natural gas prices are quick to reflect changes in information, reflecting great efficiency. On the surface, the evolution to market prices may appear to increase volatility. In fact, it is the increased volatility, in this case resulting from the prices quickly reflecting information, which leads to the demand for trading, the need for fundamental traders to hedge, and the important function of speculation.

CHAPTER 8

Analysis and Interpretation

ANALYSIS AND POLICY IMPLICATIONS

The first implication of the model is that by introducing an interrelationship between two different derivative markets changes the behavior of both the ODE market and the OTC market in very fundamental ways. The new contracts launched by each market and their costs have to now take into account the competitor's response. For the ODE market, the optimal contract is still of the classic Duffie and Jackson type, i.e., strictly geared towards hedging systematic risk. However, the ODE market's optimal transaction cost now reflects a competition dimension. A second implication is that the optimal transaction costs and prices for both markets are critically dependent on the agents' initial endowment structure. Moreover, an ODE market competes preferably with transaction costs, while the OTC market selects to launch an OTC contract hedging m-risk at a price that does not, in optimum, out compete the ODE market. Hence, in equilibrium, both contracts, which compete regarding their ability to hedge m-risk, will face some demand and both play a useful role in maximizing the transaction volume, lowering monopoly rents, and increase the degree of socially optimal hedging. The model also tries to capture a sense of counterparty credit risk, stemming from the costs of customization, which result in some additional interesting implications. Increased credit risk aversion decreases the demand for customized OTC contracts and reduces the beneficial impact on the agents of introducing competition between markets. Moreover, the interrelationship between the OTC market's risk aversion and its market exposure constraint is such that a reduction in risk aversion may allow the OTC market to focus more on providing agents with a hedge for their e-risk rather than hedging their m-risk. This leads to an important insight that is not directly captured in the model but is relevant for the real world, i.e., an ODE market has at least three options in responding to the competitive threat posed by the OTC markets, first it can decrease its transactions costs, second it could target only endowments with a very high variance, and third it couid make it cheaper for the

OTC market to customize OTC instruments by providing efficient clearing services and thereby reducing its overall risk. This implication is in line with the recent initiatives by several ODE markets to introduce tailor made clearing services for some OTC contracts. This means that the rapid growth of OTC markets does not need to necessarily be a threat to those ODE markets that are quick to adapt by providing clearing services and thereby grow with the OTC markets. Kroszner discusses an alternative mechanism, the so called derivative product company (DPC), through which participants in the OTC markets can limit counterparty risk. DPCs are generally separately capitalized special purpose vehicles with a high credit rating and are set up by one of the international banks. A significant share of the international banks' OTC transactions are channeled through DPCs, ensuring that any counterparty risk for the bank is with the DPC and that of the end-user is with the DPC as well. While the DPC approach mimics to a certain extent a clearing structure, it does net credit risk exposure for the bank, its main use has been to ensure that international banks with a relatively low rating can still take part in the OTC market through these special purpose vehicles. Hence, the use of DPCs has diminished over the last few years as banks have attained a higher credit rating.

It can further be surmised that any corporate entity could provide clearing services without being in itself an ODE market. Perhaps this is true, but existing ODE markets are likely to both benefit from significant first mover advantages and the fact that clearing is a business with large economies of scale. Hence, there seems to be significant, if increasingly tapped, potential for ODE derivative markets to evolve into clearing specialists, off loading and effectively managing the risks taken by OTC markets. From a supervisory perspective such a development should be rather welcome, since the authorities' main concern has been the systemic stability of the OTC market as a whole . In the U.S. voices have recently been raised for the regulation of the OTC markets and the deregulation of the ODE markets. This paper suggests that in addition to trying to deregulate themselves faster, ODE derivatives markets have other avenues to evolve their businesses, and supervisory institutions could ensure that expanding these markets clearing business is supported through perhaps regulatory incentives.

NUMERICAL EXAMPLES

This section presents a simple example of an economy consisting of 14 agents, deriving the optimal transactions costs and the optimal OTC contract. The example will show how the markets' revenues are affected by changes in transaction costs, contract weights and agents' endowments. The numbers and agent types are adapted from Tashjian and Weissman .

Setup The setup is the following, all the agents have the same risk aversion,

rk = 0.1,* = 1,...,14

and the same aversion to credit risk (this will be changed in some examples), i.e.,

ck = 0.1,* = 1 14

Each agent is either endowed with either *m* or *ek*, or a combination of both. The two endowment types are uncorrelated, and

Var{m) = 1

Var(ek) = 2

The variances are chosen in such a way that the non-systematic risk has a higher variance.

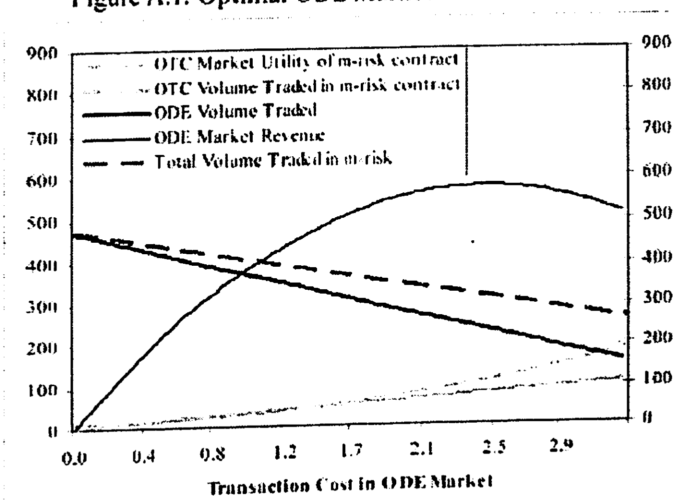
Agent		Endowment of m	Endowment of ek
	1	50	0
	2	-100	0
	3	0	50
	4	-30	-100
	5	30	30
	6	-30	-30
	7	30	30
	8	-30	-30
	9	30	30
	10	-30	-30
	11	30	30
	12	-30	-30

13	30	30
14	-30	-30

Optimal ODE Market Transaction Cost

Figure A.I. shows the relationship between ODE market's revenue and volume versus that market's choice of transaction cost. Initially a higher transaction cost more than offsets the decline in trading volume by generating higher per contract revenues. This works up to a

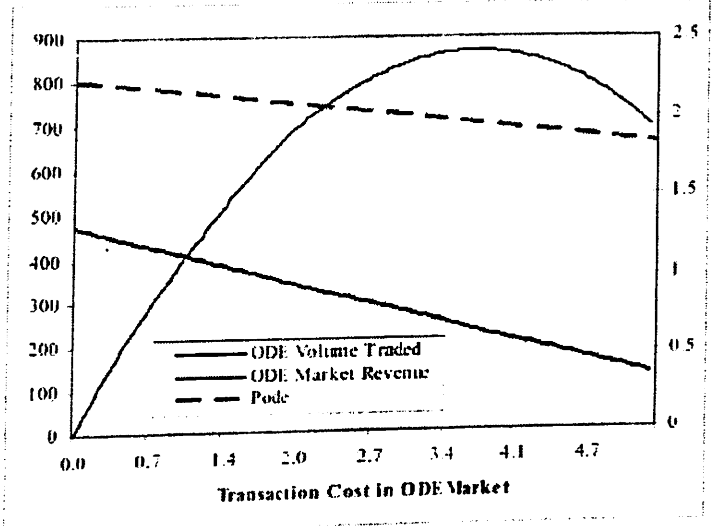
Figure A.I. Optimal ODE Market Transaction Cost



certain point, as more and more agents choose to instead transact in the OTC market (the increase in trading volume of the OTC contract hedging m-risk) or reduce their overall hedging demand (total volume traded in m-risk declines throughout). A higher transaction cost in the ODE market also allows the OTC market to increase the spread it charges agents to take the offsetting long/short positions. As noted in the comparative static section, the spread the OTC market charges is in optimum equal to the transaction costs charged by the ODE market. Hence, gradually both volume and revenue increases for the OTC market (volume increases linearly while utility rises more quickly). In this example the ODE market would choose a transaction cost of slightly below 2.5 to maximize revenues. The choice would mean that some transactions hedging m-risk are completed in the OTC market. Hence, rather than to set a transaction cost low enough such that there are no transactions in the OTC contract hedging m-risk the ODE market has some room to maneuver thanks to that trades in that market does not suffer from credit risk and that the market is risk neutral.

In the absence of an OTC market, Figure A.2 shows that the optimal transaction cost would be substantially higher at around 3.5. Since, the speculative position taken by the OTC

Figure A.2. Optimal ODE Market Transaction Cost If No Competition



market is no longer possible, the price to clear the ODE market is also higher than in the case of competition. As a result, the total volume traded is higher in a scenario in which there is competition between thė two markets, since the ODE market has to lower its transaction cost to compete more effectively.

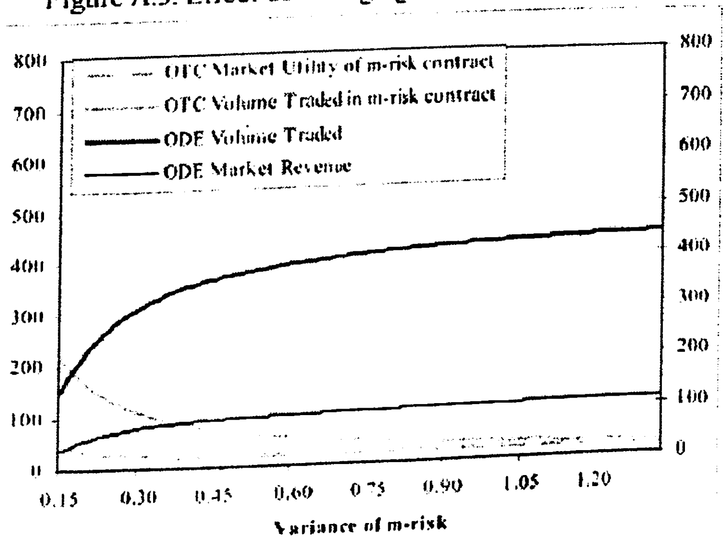
Implications of Changing the Variance of m-risk

It was argued in the comparative statics section that the higher the variance of m-risk the less beneficial it is for the risk averse OTC market to compete for transactions. To a certain extent this finding, while generally true, is subject to the assumption that there are no speculators with the exception of the OTC market itself.

Figure A.3. shows that the trading volume in the OTC market trading m-risk is strictly decreasing as the variance of m-risk is increasing. Meanwhile, for the ODE market the reverse is rue and both revenue and the agents' hedging demand in the form of their trading volume is strictly increasing with the variance of m-risk. While it is true that if the variance of m-risk is zero there is no transaction demand whatsoever for either contract, in this example since there is a fixed ODE transaction cost set at 0.25, the variance has to be above some minimum positive level to generate any demand for the ODE contract. In the case of the OTC market, since it doesn't charge a transaction cost per se but rather a bid/ask spread, it can still provide some hedge even if the variance of m-risk is very low.

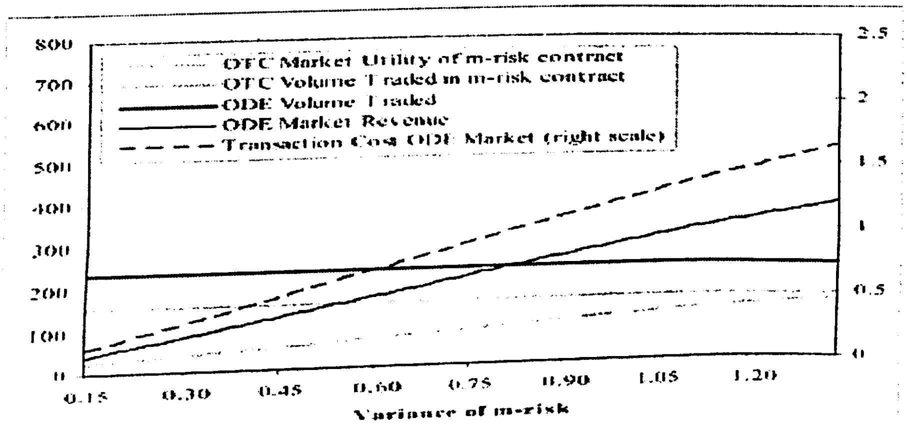
For Figure A.3. the ODE market transaction cost is held constant, but according to the modeling framework the ODE market would respond to lower m-risk variance by lowering its own transaction cost and still generate some revenue.

Figure A.3. Effect of Changing the Variance of m-risk



By adapting to the lower variance of m-risk, the ODE market can ensure that there is still some trading in the ODE contract (Figure A.4.). Only gradually will the ODE market raise its transaction costs, while still ensuring the same level of trading volume. Since the OTC markets optimal response is to set its bid/ask spread to the ODE market's transaction costs, its trading volume is also constant. Interestingly, and different to Figure A.3. and the comparative static section, the OTC market's utility from offering a OTC contract m-risk now increases with the variance of m-risk.

Figure A.4. Effect of Changing the Variance of m-risk while allowing T_{ODE} to Change

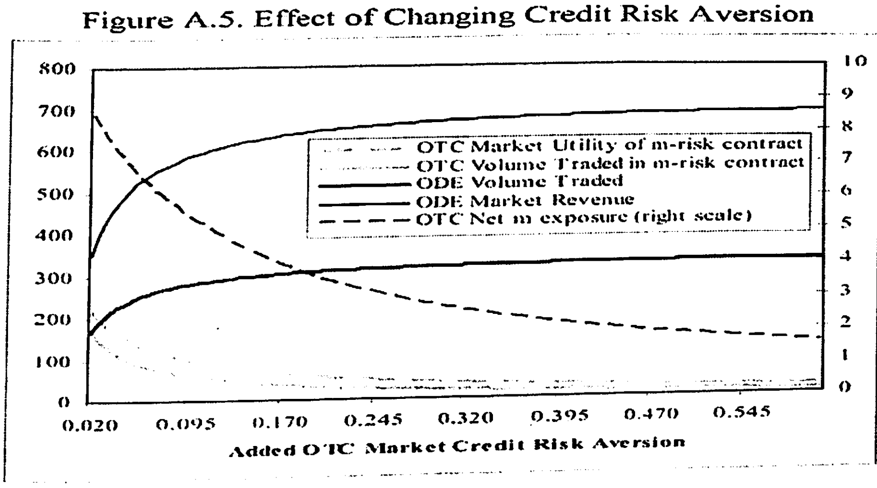


Implications of the Credit Risk Aversion Dimension

The implications of including a credit risk dimension can be exemplified in the context of redoing the earlier numerical examples. From the analysis in the modeling section it would be expected that the higher the agents' credit risk aversion the less they would like to trade in OTC contracts hedging m- or e-risk. The reasoning above, with respect to agents' credit risk aversion is shown in Figure A.5. Trading volume in the OTC contract hedging m-risk declines rapidly as agents react to the higher cost due to increased credit risk exposure. Simultaneously, the revenue and trading volume generated in the ODE market increases with a higher level of credit risk aversion due to that market's ability to net out credit risk through its clearing system. In light of the earlier discussion of transaction costs, a side effect of higher credit risk aversion, is that the OTC market is less effective as a competitor. Hence, the ODE market's optimal transaction cost increases and the total endowment of m-risk that is hedged declines. This implies that the higher credit risk aversion has welfare implications from a pareto perspective, since it decreases the aggregate trading volume and thereby reduces the total utility for the agents.

Another similar effect, is that the higher credit risk aversion also reduces the OTC market's willingness to act as a speculator by taking on net exposure. As shown in the figure the net supply of contracts hedging m-risk declines rapidly.

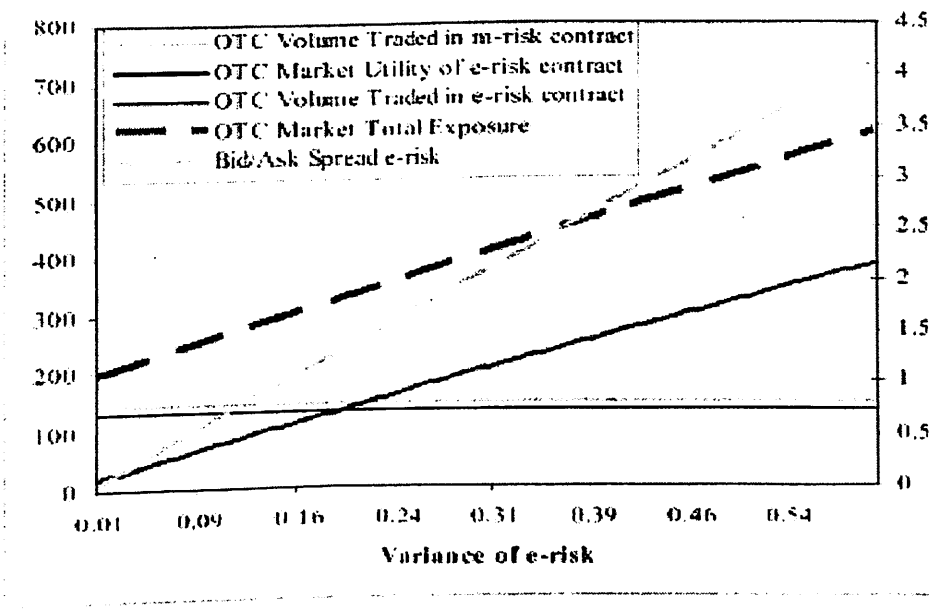
Figure A.5. Effect of Changing Credit Risk Aversion



Implications of Changing the Variance of e-risk and the OTC Markets Risk Aversion

The previous examples have focused on the interactions between the OTC market and the ODE market, but have left the trading volume of customized contracts hedging each individual unique e-risk unaddressed (Figure A.6.). Taking into account the endowment structure of the agents' e-risk, the individual demand and supply functions are easier to derive since they don't depend on the ODE market. If the variance of e-risk is equal to 0.0 then, as shown in equation (5') the optimal demand for a contract hedging e-risk is not determined by the model. Of course, the realistic answer is that for very low levels of variance of e-risk, agents are only interested in hedging themselves if the cost of doing so is very low. The bid/ask spread the OTC market charges an agent that is going long versus short the e-risk OTC contract is, therefore, very small for low levels of e-risk, but increases linearly thereafter. Similar to a monopoly exchange in an ODE market setting, the OTC market uses its pricing power (or the general cost to transact) to extract the maximum amount of revenue from the agents wanting to hedge their e-risk rather than trying to maximize the amount of e-risk hedged.

Figure A.6. Effect of Changing the Variance of e-risk



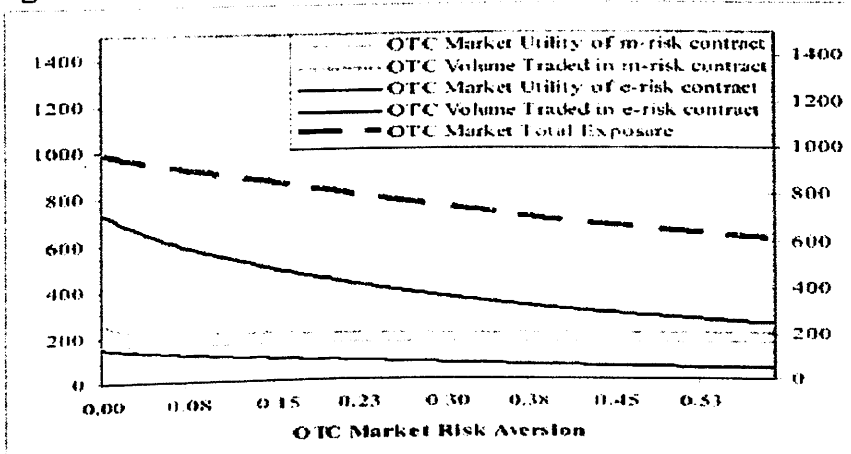
A key difference between providing OTC contracts hedging m-risk and those hedging e-risk is that, while the variance of the m-risk contracts largely net out, the variance of the e-risk contracts do not. The more transactions the OTC market engages in regarding contracts hedging e-risk the more it accumulates risk, since there is no netting. The OTC market's risk aversion, *r0TC,* has, therefore, a much bigger impact on the OTC market's willingness to provide hedges against individual agents' e-risk.

Figure A.7. shows for a given underlying variance of e-risk how quickly the utility of providing a hedge against it declines for the OTC market. Also note, that the effect on the utility derived from hedging m-risk is much less sensitive to changes in the OTC market's risk aversion, due to the assumption that the m-risk variance is largely netted out and that the variance of the e-risk is higher. It is clear that the OTC market is much more efficient when its risk aversion is well below that of the agents' whose endowments it is trying to hedge.

Exposure Limits, Credit Risk Aversion and the Demand for e-risk hedge

As noted in the OTC market's utility expression there is a limit to the maximum market risk exposure (Q in equation (19)) the OTC market can take on. This assumption, as noted earlier, intends to capture that there is some credit risk for the OTC market as well when it

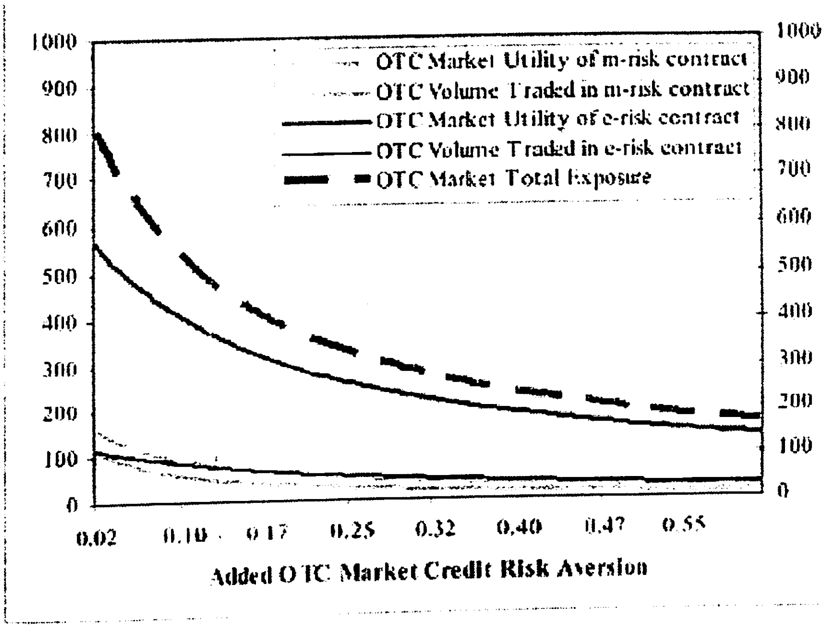
Figure A.7. Effect of Changing the OTC Market's Risk Aversion



assumes a lot of market risk based on the bid/ask spread it charges agents times the volume it transacts with the agents. Figures A.6. to A.8. all show the total exposure generated by the OTC market selling/buying contracts in an unconstrained fashion ($Ak = 0$). Of course, if an overall constraint is introduced and the market exposure of the OTC market intends to take on runs against this limit, the OTC market would have to discriminate between agents and only provide hedges to those agents adding the highest marginal utility. Depending on the variance of e-risk and m-risk and the agents' and the OTC market's risk aversion this may result in that either a OTC contract hedging m-risk or one hedging e-risk ends up being constrained. The effect on the ODE market depends on what contract is constrained at the margin.

Moreover, the demand for e-risk hedge by agents is also affected by their credit risk aversion. Similar to the OTC contract hedging m-risk, increased credit risk aversion among agents has a large impact on the utility the OTC contract generates by providing the hedge. The volume of OTC contracts traded that hedge e-risk is not affected as much, since rather than reducing the transaction volume the OTC market reduces the bid/ask spread at which the agent can transact.

Figure A.8. Another look at the effect of Changing Credit Risk Aversion



Limitation of study

- OTC Market Data is not available
- One factor influence other very much
- Natural factors are not considered

CONCLUSIONS

The model presented in this paper addresses the issue of the interrelationship between two different markets, the ODE market, and the OTC market. During the last few years, the competition between these markets has grown more intense and ODE markets are actively seeking alternative strategies to come to grips with the OTC markets, such as increased innovation, lower transaction costs, lobbying for the leveling of the regulatory and supervisory playing field, and launching clearing facilities for certain types of OTC contracts.

In this paper the main differences between these markets are modeled as, and argued to be, differences in the type of risk they can hedge against, their different risk aversions, and in how they can handle the agents' credit risk. The contracts considered are generally of a forward type that can either hedge systematic risk (m-risk) or an agent's idiosyncratic risk (e-risk). The modeling framework introduced is an extension of the incomplete markets financial contract model originally developed by Duffie and Jackson .

It is argued in the paper that OTC and ODE derivative markets can both complement and compete with each other. For example, the large broker/dealers of OTC derivatives frequently rely on a liquid ODE market to dynamically hedge their market risk. Conversely, organized futures and derivatives markets in the U.S. face competitive pressure from OTC markets, who are offering fairly similar contracts but are unburdened by regulatory and supervisory oversight. To a certain extent, the competition between OTC derivatives and ODE derivatives is determined by the structure of the contracts and what type of risk the end users would want to hedge. Hence, it may be useful to analyze how ODE markets can increase their comparative advantage in highly standardized, high variance, and liquid derivatives while also providing clearing services for OTC derivatives. In trying to analyze how ODE markets can respond to the threat posed by OTC derivatives more research is, of course, needed to model these markets' interrelationships. While a potentially relevant area for future regulation initiatives, very little research has yet been done on this topic. Rather, the main focus of the security design literature has been on competition between different stock exchanges or ODE markets. This paper takes a first step to analyze inter-derivative market competition in a multiple contract setting. The main findings of this paper are that the two derivative markets can co-exist in equilibrium while exploiting their comparative advantages. Competition is also clearly welfare enhancing and a better outcome for the agents trying to hedge their m or e-risk than in any one market setting. This result is shown to hold true even in a setting where the OTC market can issue multiple contracts, while the ODE market is limited to only one. Interestingly, to decrease competitive pressures, it is sometimes in the ODE markets' interest to help reduce the OTC market risk aversion. For example, in a U.S. setting ODE markets could avoid lending their support to increased regulatory pressure on OTC markets that could increase the cost for the OTC market to offer customized contracts. Instead, the most useful approach for ODE markets to deal with the competitive threat posed by OTC markets could be to lower transaction costs, target high variance assets, and introduce mechanisms that can help reduce the counterparty credit risk the OTC market takes on when transacting with counterparties. This could be achieved, for example, by providing customized clearing services, which would allow the OTC market to better target those investors with particular types of risks.

For further research purposes, an empirical paper would be very useful in quantifying some of the assumptions made in this paper. While it is clear that competition between the two market types is intense both in the United States and globally, from the ODE markets' perspective, there are no studies that compare, for example, transaction costs of similar OTC and ODE derivatives. A part of the explanation for the lack of research in this area is attributed to the difficulty of collecting what are often proprietary transaction data for the OTC markets.

In summary, this paper could serve as useful background information for understanding the competitive market microstructure between two different market types that issue 1 to multiple contracts. Hence, it can serve as a first cut at trying to better understand the relationship between these two very important derivative markets and informs the policy discussions about reforming and regulating ODE and OTC markets, especially in the United States, and abroad.

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