Derivatives Markets

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1. Introduction

In this chapter we survey the development in derivatives markets over the last twenty years. In 1985 the American derivatives markets were visibly riding the crest of a wave of innovation that had started some ten years earlier with the introduction of exchange traded financial derivatives such as stock options, foreign exchange futures, interest futures and stock index futures. In Europe exchange traded derivatives were largely limited to the long-standing London markets in metals and soft commodities and the newly opened London International Financial Futures Exchange (LIFFE) that had been modelled on the big Chicago markets. It is true that European players were already deeply involved in the development of the swap contracts which grew out of the Eurodollar market.[2] However, at that time in Europe derivatives knowledge and experience were confined to a rather limited set of specialists.

Since the mid-1980's derivatives markets have developed dramatically world-wide, and we will see that Europe has played a very big part in that development. We have taken a European perspective in writing this chapter, but in doing so, we shed light on some of the key drivers of derivatives market growth world-wide. Some of the questions we address are:

- What has been the experience in European derivatives markets in the last 20 years in relation to the US and the global derivatives markets?
- What have been the major new markets that have developed over this period and what new markets appear to emerging?
- What have been the major innovations in organization and operation of derivatives trading during that period?
- Who are the users of derivatives and to what extent have derivatives become integrated in securities markets generally?
- What are the main public policy issues related to derivatives trading?

The scope of our study is fixed by our answers to two questions: What are derivatives? And what are markets? Like many simple questions they do not give rise to simple, definitive answers. We take a pragmatic line on these issues. By derivatives we have in mind forwards, futures, options, and kindred products. With respect to markets we include both organized exchanges and over the counter markets (OTC).

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We thank the British Bankers Association for making available to us its Credit Derivatives Survey.

[2] The first significant Eurodollar interest rate swaps were written in 1981. See, M. Stigum, *The Money Market.* 3rd ed. (1990), p.929.

The inclusion of OTC markets complicates our task because by their nature there are no simple limits to where the markets operate. However, given the enormous growth of OTC derivatives in recent times, any discussion of derivatives that omitted them would give a very misleading impression. As a practical matter we focus on those OTC derivatives for which public information is available. This involves the relatively more standardized segments of the market where there are well-established norms for documentation and clearing which make them more readily comparable to exchange-based markets.

The remainder of the chapter is organized as follows. In section 2 we trace the growth of the major categories of derivatives in the last twenty years and document the fact that the growth of OTC markets has been particularly strong. Section 3 is devoted to describing major product innovations. We highlight particularly developments in equity, energy and credit derivatives. Section 4 covers developments in the way derivatives markets operate. It describes the rise of electronic trading platforms and the effects these have had on competition among exchanges. In section 5 we look at the issue of how derivatives are being used and by whom. Some major regulatory changes are described in section 6, and section 7 concludes. It should be noted that we do not provide an introduction to the principles of derivatives pricing or the basic trading operations of hedging, speculation and arbitrage. The interested reader who is unfamiliar with these subjects is referred to standard textbooks.[3]

2. The growth of derivatives markets

Futures and options exchanges have long published information about volume of trading and open interest (i.e. contracts outstanding). The BIS has consolidated this information world-wide for financial futures including foreign exchange, interest rate derivatives, and equity related derivatives from 1986 until the end of 2004, thus giving us a perspective on the evolution of financial derivatives trading worldwide.

Open interest on futures and options exchanges worldwide went from 614 billion $US at the end of 1986 to 46,621 billion $US at the end of 2004, representing a growth rate of 27% annually.[4] Part of the story behind this very strong growth of financial derivatives has been the emergence of financial derivatives trading in Europe. In Figure 1 we graph evolution of the shares of financial derivatives open interest in four major regions. We see that European financial derivatives were negligibly small in world derivatives trading which was split between North America (84%) and Asia (14%). In 2004, the North American share had fallen to about 59% with Europe accounting for about 35%.

[3] A standard reference is J.Hull *Options, Futures, and Other Derivatives.* (5th ed.) Pearson,
[4] Source, BIS *Quarterly Review* (March 2005) Statistical Annex, Table 23.

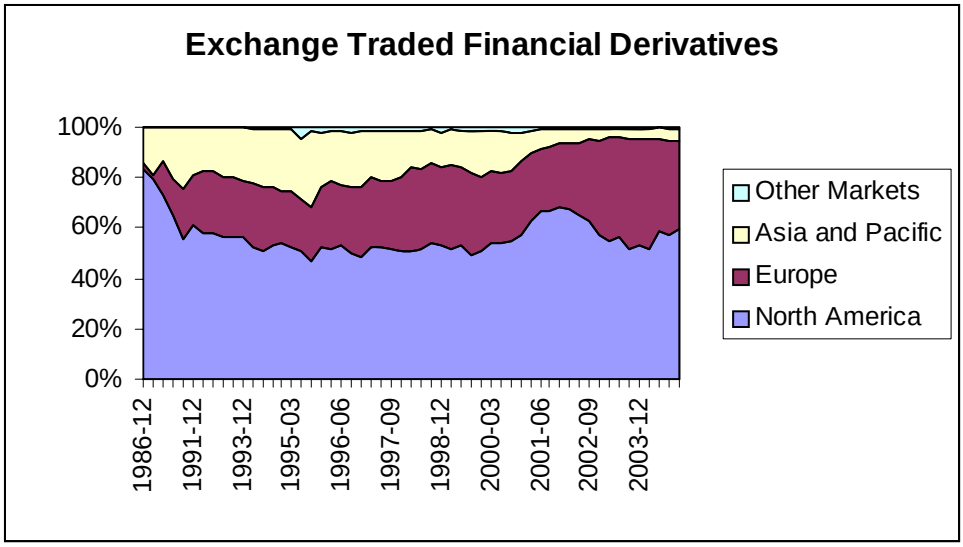

Figure 1: Exchange Traded Financial Derivatives (Percent of total open interest expressed in $US). Source: BIS

At 48% growth per year European financial derivatives have grown much more strongly than the overall world market trend. From Figure 1 we can see that some of that growth occurred between 1986 and 1991 a period that coincided with Big Bang in London and the completion of reforms of the public finances and monetary markets Western Europe. However, the deepening of exchange traded financial derivatives markets in Europe continued thoughout the 1990's.

The BIS data concentrate on financial derivatives. It might be thought that by omitting derivatives based on commodities such as metals or agricultural products we may be neglecting important developments in derivatives trading. In fact, since their emergence in the 1970's financial derivatives have dominated the trading on derivatives exchanges. This is reflected in Figure 2 which gives the evolution of open interest on futures exchanges for commodities and financials separately. Thus following the development of financial derivatives gives a good indicator of the factors driving the bulk of derivatives business. However, there have been interesting developments outside the areas of the now standard interest rate, foreign exchange and equity index products. We discuss these below. A second fact that emerges from Figure 2 is that there has been an upsurge in derivatives trading in 2003-2004.

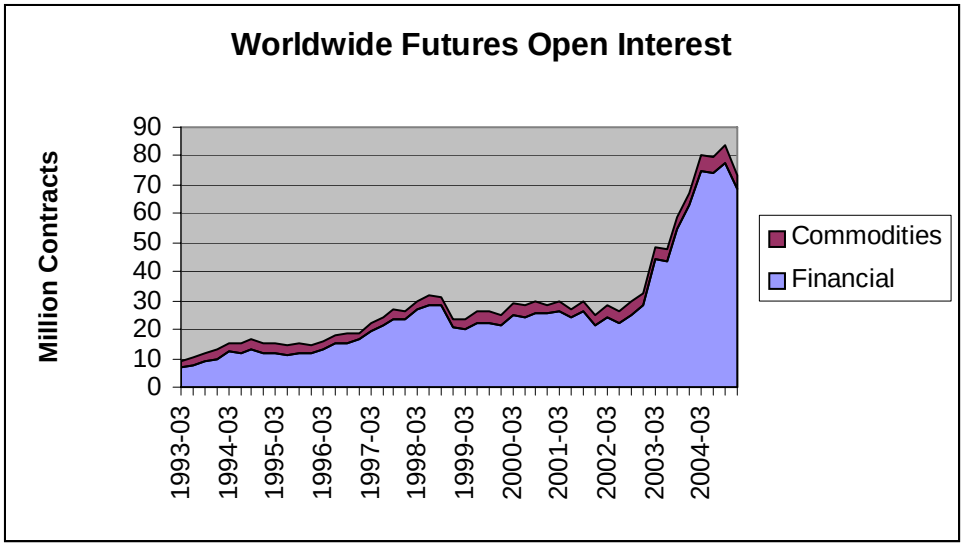

Figure 2, Source BIS

So far we have confined this discussion to exchange traded derivatives. In fact, since the introduction of interest rate and currency swap contracts, OTC derivatives trading has been an important part of the world-wide derivatives picture. During 1980's International Swap Dealers Association (ISDA) began to survey its members on their activities in swaps and other OTC interest rate and currency derivatives. More recently, the Bank of International Settlements (BIS) has compiled OTC derivatives data from reports from large banks in G-10 countries covering activity in foreign exchange, interest rate contracts based on a single currency, equity index products and bank traded commodity derivatives (notably gold). Combining these two data sources we present in Figure 3 the values outstanding of OTC and exchange traded financial derivatives since 1987.

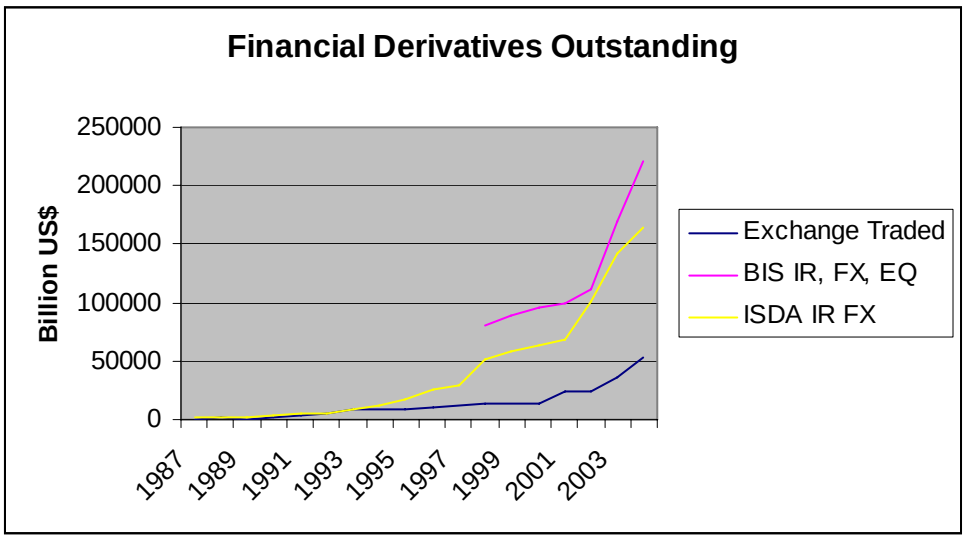

Figure 3: Financial Derivatives Outstanding (Million $US)
Open interest of exchange traded financial futures and options at year end except 2004 which is reported for June.
Notional amounts outstanding of OTC financial derivatives.
Source: BIS, ISDA

We see that amounts outstanding of ISDA reported OTC derivatives and exchange traded derivatives were comparable in 1987 ($US 865 bn versus $US 865 bn). Since then the growth of OTC has strongly outpaced that of exchange traded financial derivatives (35% annually versus 27% annually) so that by mid-2004 ISDA reported interest rate and FX derivatives outstanding of $US 164 tr versus $US 53 tr of open interest on financial futures and options exchanges. We see that since the mid-1990's financial derivatives as reported by the BIS tell much the same story, except that the total level of derivatives reported by BIS is greater reflecting their more comprehensive reporting base and their inclusion of equity derivatives. The net result is that the OTC market appears to dominate the exchange based market for financial derivatives--in June 2004 there were $US 220 trillion OTC financial derivatives reported versus open interest in exchange traded of $53 trillion.

In making this comparison we need to raise a note of caution in interpreting reports on amounts outstanding of OTC derivatives. This is best seen in comparing similar transactions, one executed on an exchange and another executed on the OTC market. Suppose a treasurer wishing to hedge a rate of interest on 3-month funds that will be available in 9 months time buys a Euribor contract on the Euronext.liffe market with contract maturity in 9 months. This transaction by itself will increase open interest by one contract or a nominal €1 million. If one month later the same treasurer comes to believe strongly that interest rates will rise, he may choose to lift his hedge and will sell one contract of Euribor on Euronext.liffe. This will liquidate his position and reduce open interest by one contract (€1 million). Suppose instead the treasurer did something comparable on the OTC market. Initially, he would shop around for the best deal on an Forward Rate Agreement (FRA) with loan initiating in 9 months time choosing to execute the FRA with the bank offering the highest rate. This is registered as an increase in OTC derivatives outstanding of €1 million. A month later after revising his expectations he would seek to sell an FRA with the same maturity date as his initial contract (now 8 months hence). After shopping for the lowest rate, he signs a sold FRA contract with a different bank. He now holds *two* FRA contracts, one bought and one sold. This gives him a neutral position on interest rates. However, OTC contracts outstanding are now €2 million (rather than 0 as in the case of the futures market transaction). And he faces counter-party risk with two banks. From this hypothetical example we see that in the process of closing out or otherwise dynamically trading a financial exposure using OTC derivatives a large notional position can be established which may represent a much smaller net exposure to the risk underlying the contracts. This fact is particularly applicable to long-dated OTC derivatives (e.g., 10 year interest rate swap contracts) where there is an increased chance that the exposure may be revised in light of major changes in market circumstances or business circumstances of the contracting party.

Another way of looking at the development of the OTC derivatives market is in relation to the underlying financial risk. Focusing on interest rate risk, in 1987 according to the BIS the total developed country debt outstanding was $US 795 bn whereas total interest rate swaps and options reported by ISDA were $US 682 bn, representing derivatives to underlying ratio of 86%. By 1997, the last year for which ISDA reported detail on interest rate swaps and options, developed country debt stood at $US 2556 bn; whereas, interest rate swaps and options were reported as $US 27,211 bn, that is, about 10 to 1. More recently, however, there are indications that the expansion of OTC interest rate derivatives relative to the underlying market has

levelled off. According to the BIS survey in 1998 the ratio of OTC interest rate derivatives to developed country debt was about 15 to 1. In mid-2004, this ratio was still 15 to 1.[5]

Finally, it should be noted that the development of OTC derivatives is a world-wide phenomenon and that Europe is very much a leader. According to the BIS survey on turnover in OTC derivatives, the market shares of total world turnover (in $US) in 2004 were 42.6% for the UK, followed by the US (23.5%), France (10.2%), Germany (3%), Italy (2.7%) and Japan (2.6%). Furthermore, the leading position of the UK has increased over time as reflected in the fact that in 1995 its share of world turnover was 27.4% (ahead of US with 19.6%).

The institutional change that lies behind the numbers we have presented on the growth of derivatives markets is that interest rate derivatives trading has become a highly developed adjunct to the normal functioning of fixed income markets. Issuers, investors, underwriters, and other participants routinely will use interest rate swaps, caps, collars and similar derivatives to shape their exposures to the underlying interest rate movements. The maturity of this market is such that practitioners refer to these products as "plain vanilla" contracts, implying a high degree of standardization with, as a consequence, greater competitive pressure squeezing margins of OTC derivatives market makers. A similar maturing process had occurred in foreign exchange markets where the inter-bank forward market had become the fully integrated with the underlying market for spot foreign exchange.

In order to expand and to find more profitable trades, the derivatives markets have needed to innovate into new areas. In the next section we will highlight some of the major innovations in derivatives markets in recent years.

3. Major product innovations

The development of the financial derivatives market was perhaps the major financial innovation of the 1970's. The enormous growth of financial derivatives since that time has brought with it a steady stream of new products which were innovative, at least to some degree. The US Commodity Futures Trading Commission (CFTC) has the mandate to approve exchange traded derivatives in the US; accordingly, CFTC approvals give some measure of the pace of innovation of derivative products. There were 174 new products approved or pending approval by the CFTC during the period 1998 though 2003.[6] Many of these new products were relatively straight forward modifications existing contracts, e.g., futures on new currency pairs. Others have been genuinely quite innovative involving substantially new risks that are traded and often requiring new pricing techniques. Outside the US innovations in exchange traded derivatives are harder to document, and in the world of OTC derivatives information is patchier still. In what follows we summarize our search through the literature, highlighting the most important areas of development where "important" is judged by our impression of the scale of impact the innovations have had among practitioners. In

[5] Based on BIS Quarterly Review, Statistical Annex Tables 11 and 19 and ISDA Market Survey.
[6] See, http://www.cftc.gov/dea/deacontract_approved_list.htm

particular, we focus on three areas: equity, credit and energy. We recognize that in so doing we may be omitting some innovations that reflect considerable imagination and pose interesting analytical puzzles that may still be unsolved.

Equity

Equity derivatives in our understanding go back to the 1970's introductions of single-name equity options traded on the Chicago Board Options Exchange and of futures on broad indices of US stocks, most importantly the on the S&P 500 index. Subsequently, in the 1980's similar products have introduced in many other geographic areas. Also during the 1980's the cash market began to modify its trading practices to accommodate trading of portfolios of stocks, so-called "basket trades", thus facilitating continuous arbitrage between derivatives and underlying equity markets.

More recently in the 1990's the equity derivatives market has deepened considerably with innovations in exchange-traded and OTC markets. In our view some of the most significant are:

- Futures on many more indices—This has allowed more targeted strategies, e.g., hedging a specific portfolio of shares

- Equity indexed structured products—The popularity of "portfolio insurance" in the 1980's demonstrated the appeal to investors of creating a floor for portfolio values while allowing the investor to benefit from equity price increases. After the failure in the October 1987 stock crash of strategies based on high-frequency dynamic trading, the name "portfolio insurance" is rarely still heard. However, investment funds which promise similar attributes as these strategies are still extremely attractive to investors. Since the late 1990's a number of fund managers have had considerable success with "structured products" which give capital guarantees plus a degree of equity market participation. Some of these products are implemented through a combination of bond plus stock index derivatives (futures and options) component with no direct equity market participation.

- Equity swaps – This involves the periodic (e.g., monthly) payment of the total return on a stock (or stock index) and receipt of an floating rate of interest (e.g., LIBOR). For the investor paying the equity return, it allows a hedge of an existing equity position without giving up ownership of the share, thus maintaining voting rights and avoiding possibly adverse tax consequences. For the investor receiving equity return, it creates equity exposure without actually taking ownership of shares.

- Single stock equity futures – These exchange-traded contracts began trading in the US in 2002. They allow equity market participation without actually taking possession of the shares, and are somewhat substitutable with equity swaps. These contracts can offer greater leverage to investors as compared to buying on margin and also facilitate short-selling of shares which can be difficult or costly in cash equity markets.

- Flex options for stocks on exchanges which allow the purchasers to determine strike price, maturity and other features much as they would be able to do with OTC stock options;

- Long-dated options—Long-term Equity Participation Securities (LEAPs) on the CBOE extended maturities to three years on American-style equity options;

- Options on managed funds -- (e.g., options on Vanguard VIPERS traded on the American stock exchange);

- Volatility swaps and futures – Since the late 1990's OTC volatility swaps have been traded in which a (periodic or single) return is paid that is the difference between a fixed volatility rate and the *realised* volatility within the period. More recently, futures on indices of *implied* volatility have been introduced on Eurex and the CBOE. Potential users of these contracts include options market makers who may often find that they are largely hedged against the direction of equity price movements ("delta neutral") but are exposed to changes in volatility.

It will be noticed from the above list that in many cases similar products are available both OTC and on exchanges. In fact, these OTC and exchanges compete with one another but they also complement each other. For example, a retail investor may find it convenient to buy a structured equity product rather than actively manage a futures position or buy options. However, the fund manager may well hedge his exposures using exchange traded options and futures.

Credit

One of the most important developments in derivatives markets in the last ten years has been the emergence of credit derivatives as a major tool for shaping credit risk exposures. Unlike other derivatives innovations, this is an area where exchange traded products have had very little impact. Instead, credit derivatives have emerged out of the techniques that banks have developed to structure commercial and industrial loans. As a pure OTC phenomenon, it is hard to fix a date to the birth of credit derivatives. However, in the second half of the 1990's a credit derivatives market was recognisable as reflected in the fact that in 1997 the US Federal Reserve Board began to include credit derivatives in its Call Reports.[7] A major step toward the development of a liquid market in credit derivatives was the adoption of standard contract forms following ISDA guidance, initially in 1999 and subsequently revised several times.[8]

[7] Federal Reserve Bulletin, (Dec 2003) p.490.
[8] See, D. Rule, "The Credit Derivatives Market: Its Development and Possible Implications for Financial Stability," *Financial Stability Review.* (Bank of England, June 2001) p.135.

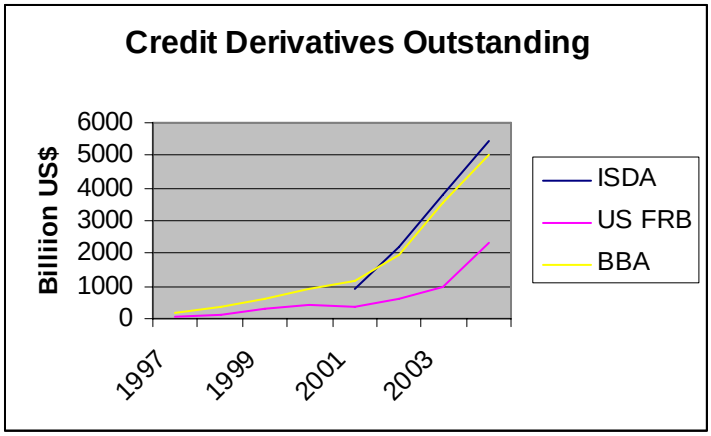

Figure 4: Sources, ISDA Market Survey, US Federal Reserve Board Call Reports, and British Bankers Association Credit Derivatives Surveys.

Figure 4 records the growth of the credit derivatives markets since 1997. In addition to the US data from the Federal Reserve Board, periodic surveys have been conducted by the British Bankers Association covering major banks internationally. More recently, ISDA began to track the credit derivatives market. The picture from all three data sources is one of extremely fast growth (60% annually based on BBA data and 70% annually based on FRB data). This market has come from a relatively minor adjunct to credit markets to become a central part of those markets used both as a pricing reference and as a tool for investment and hedging. A number of factors suggest that the high growth phase of the market is still far from being exhausted. There are still a relatively small number of major players in the market.[9] Furthermore, despite the rapid increase in the number of names covered by credit derivatives, there are still many large issuers of debt for which credit derivatives do not trade.

The essence of a credit derivative is a contract in which a credit protection seller promises a payment to a credit protection buyer contingent upon the occurrence of a credit event. The various types of derivatives differ according to the terms and conditions that govern the promised payment. The critical feature of credit derivatives is the definition of "credit event". In practice a number of definitions have been used including formal bankruptcy, default according to a variety of criteria, and, more recently, penetration of preset barriers by listed equity prices. In early stages of the market, significant problems emerged from the ambiguity of some contractual terms. For example, it was not clear if protection sold on debt issued by firm continued to apply once the issuer were transformed through merger or corporate restructuring.[10] This gave rise to a number of lawsuits over disputed claims. Revisions of the ISDA standard documentation for credit derivatives has eliminated many of the major sources of ambiguity that troubled earlier trades.

Table 1 indicates the relative market shares (of notional principal protected) for the major types of credit derivatives as reported in the British Bankers Association surveys. The most popular type credit derivative is the single name credit default

[9] In the 3rd Quarter of 2003 in the US 10 banks represented 97% of the credit protection sold. See FRB Bulletin (Dec 2003), p. 490.

[10] See the discussion of the National Power demerger contained in D. Rule, "The Credit Derivatives Market: Its Development and Possible Implications for Financial Stability," *Financial Stability Review.* (Bank of England, June 2001) p.135.

swap (CDS). In this contract upon the occurrence of a pre-specified credit event (e.g., default) the protection seller promises to buy at par from the protection seller a specified bond issued by name covered by the contract. Thus when Worldcom defaulted in June 2002 purchasers of Worldcom CDS's were able to deliver Worldcom paper worth about 10% of par in return for full payment by the CDS sellers, a net economic gain of 90% of the face value of the bond.[11] Prior to the credit event the protection buyer pays the protection seller a premium that reflects the participant's assessment of the probability of default (PD) and the expected loss given default (LGD). Other types of single-name credit derivatives include credit linked notes, total return swaps and asset swaps.[12]

Table 1: Fraction of credit derivatives outstanding by type.

BBA Survey	Single Name CDS	Portfolio CLOs	Credit linked notes	Total return swaps	Basket products	Asset swaps	Other
2001	45%	22%	8%	7%	6%	7%	5%
2003	51%	27%	6%	4%	4%	4%	5%

Source: BBA Credit Derivatives Survey, 2003-2004.

In contrast with single-named CDS's a variety of credit products are based on a portfolio of credit sensitive instruments. These products differs depending upon whether they are backed by bonds and other marketable securities or a portfolio of illiquid loans. They may be issued by a bank directly or they may involve the creation of a special purpose vehicle. The underlying portfolio may be static or it may be actively managed. Synthetic CLO's involve little or no capital but rather are backed by exposures taken in CDS's or other credit derivatives. The common feature of all of these vehicles is that typically create a hierarchy of among the creditors. The riskiest (most junior) category is the first-lost tranche which is the first to lose it's claim in the case some of the portfolio is defaulted upon. Next more senior is the mezzanine tranche which incurs losses once the first-loss tranche is exhausted. Several more senior tranches may intervene in similar fashion until the most senior tranche is met. Through this technique of tranching, a collection of debt obligations all bearing the same investment grade rating (e.g., BBB) may be transformed into a series of new obligations with credit quality varying from the highly speculative grade first-loss tranche to an almost risk-free grade of super-senior obligations.[13]

The success of credit derivatives is that they have attracted the participation of a wide group of institutions who use the products for hedging, investment (yield enhancement) and arbitrage. Table 2 gives an indication of the participation of various categories of participants. As might be expected banks are major buyers of credit protection. These tools allow them to reduce risks that may be concentrated in loan book positions to major clients. Credit derivatives allow the banks to keep on their books the loans granted thus maintaining a close client relationship while at the same time shifting some of the associated credit risks to other participants. It will be noticed that banks are as well major sellers of credit protection, reflecting their strategy of

[11] Based on recovery rates reported in *Credit Magazine*, http://www.creditmag.com/public/showPage.html?page=133193

[12] For a introduction to the principles of pricing CDS's and other credit derivatives see, D. Duffie and K. Singleton, *Credit Risk.* (Princeton U.P. 2003).

[13] For further discussion see Duffie and Singleton op.cit. and Rule op.cit.

trying to leverage their expertise to make markets in these derivatives as well financing some of their credit protection purchases by writing credit protection for names where the bank has relatively little exposure otherwise. After banks, the most important sellers of credit protection are insurance companies, in particular re-insurers and mono-line insurers.[14] Other active participants include securities houses and hedge funds for whom credit risk tends to be rather uncorrelated with their other risk exposures to major market factors such as equity prices and interest rates.

Table 2: Participation in credit derivatives markets
(by value, per cent of total at the end of 2003).

	Protection sellers	Protection buyers
Banks	38%	51%
Securities Houses	16%	16%
Hedge Funds	15%	16%
Corporates	2%	3%
Mono-line/re-insurers	17%	5%
Insurers companies	3%	2%
Mutual Funds	4%	3%
Pension Funds	4%	3%
Gov/ Agencies	1%	1%

Source: BBA Credit Derivatives Survey, 2003-2004

Energy

The third area where derivative product innovation has been notable in recent years is in the area of energy. While the number of new products that have been introduced is quite large, many have been unsuccessful. As a consequence, the sector has still not fulfilled the promise for development that many have been predicting. Indeed, the study of some of the set-backs in energy derivatives reveals a number of fundamental issues that are specific to energy products and which are not yet fully understood.

The first energy derivatives covered petroleum products and emerged after the fundamental restructuring of the world petroleum market in the 1970's. The major factors that gave the impetus to these developments were the emergence of OPEC, the opening of North Sea oil production, and the break-up of the dominance of the big, vertically integrated oil companies. In this context, a genuine spot market emerged with a wide variety of new participants. Upon this base, the development of forward contracting for Brent and other grades of crude was a natural next step. At roughly, the same time, energy products began trading on derivatives exchanges with crude oil, heating oil, and gasoline futures on the New York Mercantile Exchange (NYMEX) and gas oil and Brent crude on the International Petroleum Exchange (IPE)[15]. Since then derivatives for the petroleum complex have become an integral part of the market place and are regularly used by major participants.

[14] Mono-line insurers are specialized insurance institutions which provide credit guarantees used in a variety of securitized financial structures.
[15] Brent benchmark crude futures contracts began trading on the International Petroleum Exchange in 1988. https://www.theice.com/publicdocs/IPE_Brent_Crude_futures_contract_specification.pdf . The IPE began trading gas oil futures in 1980.

Based on the success of petroleum derivatives, there has been substantial interest in developing derivatives trading for other energy sources, in particular, natural gas and electrical power. The experience of these two sectors illustrate some of the important conditions in the underlying physical market that may favour or impede the development of derivatives trading. In the case of natural gas, a spot market emerged only after a significant deregulation of the sector in the 1980's. Natural gas futures were introduced on NYMEX in 1990 and proved to be a success. In Europe IPE natural gas futures are traded[16]; however, market development has been slowed by the continued prevalence of long-term contracting between large, vertically integrated producers. In particular, Western Europe depends heavily upon Russian gas supplied by the state monopoly Gazprom under long-term contracts with periodically negotiated prices.

The development of derivatives markets for electrical power has been particularly eventful. Interest in derivatives for electrical power started with the deregulation and privitisation of the industry beginning with Britain in 1989 and shortly followed by the Nordic Countries[17] and later imposed on the rest of Europe with the EU Single Market Electricity Directive in 1996.[18] In the United States the Energy Policy Act of 1992 promoted greater competition with the Federal Energy Regulatory Commission (FERC) implementing plans for wholesale competition in 1996.[19] This was motivated by the view that there was a potential for a competitive market in power generation once all participants would be given equal access to the power grid. In principle, greater efficiency could be gained through the workings of a competitive spot market for power. Once prices were free to fluctuate as a function of changes in supply and demand, derivatives trading was viewed as natural solution to managing the associated price risks.

The key feature of this deregulation was to separate the activities of power transmission and power generation.[20] While deregulation at the Federal level in the U.S. was aimed at creating wider market places, this has not always been facilitated by State regulators who were typically more concerned with regular supply and stable prices for consumers within their jurisdiction. The result has been a complicated patchwork of regional power markets that do not conform to a single design which are linked by limited (and often saturated) capacity of transmission across regions. In this context spot trading of electricity among wholesale market participants has grown up. Spot prices have proved to be extremely volatile when compared to a variety of markets for which derivatives are actively traded, as can be seen in Table 3.

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[16] The IPE natural gas contract based on UK delivery has been actively traded since 1997. In 2001 the IPE was acquired by the International Commodity Exchange (ICE) which operates an electronic platform for trading futures, options and OTC contracts for a variety of energy products.

[17] The UK's electricity market was 30% open by 1990 and fully open by 1998, Norway's market was completely opened by 1995, Finland by 1997, Sweden by 1998.

[18] "Electricity Deregulation Report Global", 2005, ABS Energy Research http://www.absenergyresearch.com/

[19] "Electricity Deregulation Report Global", 2005, p.189

[20] The key steps in toward power deregulation in the U.S. at the national level were the Public Utilities Regulatory Policy Act of 1978 and the Energy Policy Act of 1992 which created wholesale generators that were exempted from regulation and an obligation of regulated utilities to transmit power from a variety of qualified producers. See, ISDA "Restoring Confidence in Energy Markets", April, 2003.

It is not surprising then that a number of participants attempted to manage these risks by engaging in trading forward contracts and other OTC derivatives. While no systematic data on trading of OTC energy derivatives is available, it was clear that the market was very active by the late 1990's and was growing very rapidly in early 2000. Furthermore, futures and options for electrical power at a variety of locations had been introduced by NYMEX and the CBOT. This pattern of rapid development was brought to an abrupt halt by the end of 2000 when trading dried up amid signs of distress in the energy markets, most notably in the California market which experienced extreme price fluctuations and shortages. The credit worthiness of major players was a serious concern. These fears were confirmed as justified in December 2001 with the bankruptcy of the Enron, the largest player of all. In February 2002 NYMEX delisted all its electricity futures for lack of trading interest.

Table 3: Spot Price Volatitility (per year)

Electricity (California-Oregon Border, peak-load)	Natural Gas	Light Sweet Crude	S&P 500 Stock Index	Coffee	Soybeans
309%	78%	38%	15%	37%	23%

Source: Energy Information Administration, *Derivatives and Risk Management in the Petroleum, Natural Gas, and Electrical Power Industries.* Washington, 2002.

In the aftermath of the disruptions of power trading in 2000 and 2001, there were a number of analyses which focussed on a variety of obstacles to using derivatives in the electrical power markets.[21] First, physical characteristics of electricity are very different from other commodities for which derivatives are successfully traded. In particular, the fact that it is delivered virtually instantaneously and is not practically storable means that the basic mechanism of intertemporal arbitrage employed in most derivatives markets does not apply to electrical power. This combined with inelastic short-term demand create the extreme volatility of spot prices. Next, the transmission of power is governed by physical laws which create a high degree of interdependence among participants connected on the same grid. Thus even if agent A is willing to supply power demanded by agent B, his incremental power production may flow through the grid to other actors. This adds to the complexity of predicting effective supply and demand at any particular location. These physical characteristics are further complicated by the fact that many of the main actors in the industry remain highly vertically integrated, implying that spot trading in any region may be confined to the residual of power flows not covered by the major players. Finally, regulations remain differentiated across regions and are subject to change. All these features combine to make for a highly complex market place which is prone to becoming segmented on a temporary basis.

[21] See, EIA Energy Information Administration, *Derivatives and Risk Management in the Petroleum, Natural Gas, and Electrical Power Industries.* Washington, 2002; ISDA "Restoring Confidence in US Energy Trading Markets" (Energy White Paper), April, 2003;

Derivative contracts have been used to manage these risks. Several major exchanges provide a "spot" market for physical delivery in the near future and a "financial" market with contract maturities ranging between several days to years which are usually cash settled. However, the trading of power derivatives on exchanges is still in its infancy. To put volumes in perspective, European power consumption in 2004 was 2,911TWh ($199.2 bn).[22] The European Energy Exchange in 2005 traded 517TWh in its financial market and 85.7TWh in its spot market.[23] Nord Pool traded 590TWh in its financial market and 167TWh in its spot market. Its OTC clearing service cleared 1207TWh.[24]

The exchange traded futures and options only make up a small part of the energy trading markets with most of the energy trading occurring on a bilateral basis in the OTC markets. An FSA survey found that 1% of UK power volume was conducted on an exchange with negligible exchange volumes for continental European power. These markets allow for the trading of the plain vanilla forwards, futures, swaps and options as well as more exotic, tailor contracts including:

- Spark Spread Options: A cross-commodity derivative used to hedge the price difference between electricity prices and the fuel used to generate it;
- Callable and Putable Forwards: The callable forward allows the supplier of energy to interrupt supply if demand (prices) spike. Similarly the putable forward allows the holder to cancel delivery;
- Swing Options: A swing option gives the holder the right to specify the amount of power to be delivered at each exercise period (hence the 'swing' in the volume) subject to restrictions on the minimum and maximum amount at each interval and in total.

An FSA survey found that the forward physical markets dominate the financial markets in the UK with financial contracts representing only 3% of UK power volumes. In continental European power financial contracts comprised 18% of volumes. This suggests that the immaturity of global energy markets, the infrastructural obstacles which fragment markets, and difficulties in pricing many of these exotic contracts, the market for energy derivatives is still at relatively early stages of development.

The lack of an integrated spot market has meant that it has been difficult for exchanges to establish a single, liquid benchmark for trading and for which would allow trading to other regions with stable bases (i.e., differences between spot markets and a given reference futures). Instead there has been a strong preference for tailoring contracts to specific needs through OTC trading. This implied that the market could thrive only if the participants were viewed as mutually creditworthy. The perception of creditworthiness is very fragile and can disappear very quickly as the cases of Enron and, more recently, Refco have demonstrated. The other consequence of

[22] Datamonitor, "Electricity in Europe: Industry Profile" (August 2005)
[23] EEX press release, 12th January 2006
http://www.eex.de/publications/press_center/index_e.asp#20060112
[24] Nord Pool Press Release, 5 January 2006
http://www.nordpool.com/information/press_releases/2006-001.html

market segmentation is that the sector seems to be prone to manipulations such as market corners (intentional withdrawal of supply to benefit form price increases on existing long forward positions) and other abuses of short-term monopoly power.[25] Both the fragility of creditworthiness and the potential for market manipulations were aggravated in the case of the electrical power sector by the lack of transparency of OTC transactions. This was most evident when the activities of Enron were scrutinized following its collapse. It appears that opaque OTC derivatives trades may have been used to effectively disguise a high level of leverage which if recognized generally would have led counter-parties to downgrade Enron's credit quality.

In large part because of the experience of electrical power derivatives, there have been important developments in derivatives market regulation in the U.S. which may have deep and long-lasting effects on the future of derivatives trading for electrical power and for derivatives markets generally.[26] In particular, the Commodity Futures Modernization Act of 2000, cleared the legal status of a large variety of OTC transactions as being exempt from the many regulatory requirements applied to traditional exchanges that are open to a wide variety of participants. Furthermore, it paved the way for these OTC transactions to be cleared by clearing houses in much the same manner as exchange based trades. In the aftermath of the Enron collapse OTC clearing has proved to be a popular means of dealing with counter-party risk in the energy sector. This attractiveness may well mean that it could be adopted to trading for other products as well. An important by-product of OTC clearing is that once they are cleared as exchange based trades OTC trades fall under the regulatory oversight of the CFTC in matters of market manipulations. This has led to the CFTC pursuing fifty separate cases of false trade reporting or market manipulations in the energy sector.

It remains to be seen whether these changes of market structure suffice to address the difficulties posed by the particularities of the electrical power markets. The complexity of the power market itself has led some participants to turn their attention to dimensions of energy markets which while uncertain may be less volatile than power spot prices. One of these has been the trading emissions quotas that are allocated to power generators by regulation. This has proved quite successful with $4 billion of sulphur dioxide futures being traded in 2001. The other area that has received strong interest are weather derivatives, such as indices as number of heating days at a particular location, which correlate quite well with measures of energy usage.

4. Organization of derivatives markets

Until fairly recently, there has been a clear difference in the trading of derivatives on exchanges as compared to trading in over-the-counter (OTC) markets. Exchange traded futures and options were contracts with standardized delivery or settlement terms with price negotiated by open-outcry in a centralized physical marketplace ("the

[25] See, R.W. Anderson "Cornering the Market" in P.Newman et.al. (ed.) *The New Palgrave Dictionary of Money and Finance*. (Macmillan, 1992) and A. Kyle, "A Theory of Futures Market Manipulations," in R.W. Anderson, (ed.) *The Industrial Organization of Futures Markets.* (Lexington Books, 1984).

[26] These have recently been summarized by the chairman of the Commodity Futures Trading Commission, R. Jeffrey, "Market Integrity: A Shared Mission" speech to ISDA on 6 December 2005.

pit"). The trades negotiated on the exchange were publicly reported and were cleared in a clearing house associated with the exchange with the clearing house being party to all trades. Therefore, if, for example, the seller defaults, the clearing house still will be obliged to honor the trade by delivering to the buyer according to the agreed terms. The solvency of the clearing house was protected by marking all positions to market daily through a system of margins. The exchanges were typically not-for-profit, membership organizations with the purchase of a membership giving the right to carry out trades on the floor of the exchange. As a result decision making at exchanges was often dominated by the community of floor traders.

In contrast, the OTC market involved bilateral trades where all contract terms such as delivery quality, quantity, location and date as well as price were negotiable. Trades were arranged by telephone or other means of communication between principals, known to each and willing to assume the associated credit risk. Generally, transactions prices were not reported publicly.

Thus exchange-based and OTC derivatives were very different types of contracts carrying with them distinct sets of advantages and disadvantages. Exchange-based contracts tended to be more liquid and tended to minimize counter-party risks. However, since they involved standardized contracts they posed problems of basis risk, and marking to market means that hedging with derivatives may pose problems of arranging for short-term financing. OTC contracts tended to be less liquid both because they are not standardized and because trades are tied to specific counter-parties. Furthermore, they tend to be fragile markets in the sense that trading can become difficult if credit risks are perceived to be high. On the other hand they avoid problems of basis risk and short-term financing of mark-to-market positions.

In recent years this traditional pattern has been altered considerably, and the distinction between OTC and exchange-traded derivatives is becoming much less clear. In part, this is a reflection of competitive developments, and in part, it is a reflection of changing technology.

4a. Developments in OTC Trading

Some of the major complications of OTC trading included the trade confirmation process and issues surrounding creditworthiness of counterparties. To overcome these issues the International Swap Dealers Association (ISDA) was formed in 1984 to provide a standardized set of documentation and OTC market practices. The ISDA Master Agreement provides a standard contract for the ongoing relationship between counterparties with a Schedule detailing unique terms.[27] The standardization provided by ISDA documentation has helped to make it easier for more participants to access the OTC markets. It further makes the trade process simpler by providing the details of the ongoing OTC relationship and allowing for the only the terms of an individual trade to be reported on a short confirmation document.[28]

[27] http://www.isda.org/educat/pdf/ten-themes.pdf

[28] In addition, ISDA has worked closely with governments to ensure that their documentation will be upheld under the country's legislation. See ISDA "Financial Transactions in Insolvency: Reducing Legal Risk through Legislative Reform," 26 April 1996.

It seems likely that better documentation standards have encouraged the OTC markets to converge to conventional terms that aid in creating more liquidity. For example, suppose agent A enters into a forward contract to sell agent B a commodity according to the market's conventional terms regarding quality and delivery conditions and for a date and price mutually agreed upon. Suppose later agent A wishes to unwind his exposure, perhaps because he expects the price to rise. To do so he enters into a forward contract to purchase the commodity from agent C again using the market's conventional terms, for the same date as the previous contract and at a price agreeable to C. In this way A will have eliminated price level risk. Furthermore, since the delivery terms were identical for the two contracts, he has eliminated basis risk as well. If agents know that it is possible to eliminate both price level and basis risk through subsequent trading, they will be more willing to enter into the initial OTC contracts in the first place, and market liquidity will be promoted. Notice, however, that unlike in exchange-based contracts where the clearing house is a party to every trade, in the example we see that dynamic trading of OTC contracts counter-party risks are not eliminated. As a result, credit risk emerges as one of the most important risks associated with OTC derivatives. As the case of electrical power derivatives demonstrated, the increase in perceived risk in credit exposures can give rise to a market collapse.

Not surprisingly then, ISDA has also been active in trying to overcome the counter-party risk problems of OTC trading by developing standards for credit support. In part, this has occurred through the development of "close-out netting"—the process where, in the event of bankruptcy of one of the counter-parties, inflows and outflows of multiple contracts between the two counter-parties are netted against each other to prevent the solvent party from making a payment and not receiving his cash flow from the defaulted party. More recently, ISDA has been active in developing standards for collateralising relationships (see 2001 ISDA Margin Provisions). Finally, as we discussed in relation to power market above, increasingly OTC trades are being cleared through clearing houses in much the same manners as exchange-based contracts.

As was seen in Section 2, these developments have helped OTC derivative markets to increase in size rapidly in recent years both in absolute terms and in relation to exchange-traded derivatives. With the better documentation framework, the real benefit of the OTC—namely customization—has further driven volumes and innovations in derivatives. Another advantage of OTC is that it may be possible to execute greater size through an individual negotiation than by attempting to trade on standardized markets for maturities where trading is thin (or nonexistent).

The rapid growth in OTC markets has not been without its share of problems. We have already discussed the collapse of the electrical power derivatives markets in 2001-2002. More generally, while better documentation was created to help reduce operational risks, dealers have reported a backlog in uncompleted master agreements with as much as 5-20% of counterparties or more.[29] Furthermore, unconfirmed trades have been a problem. Automation of OTC derivatives confirmations had grown to the point that in 2004 reportedly one fifth of plain vanilla swaps and one third of credit derivatives were being confirmed on an automated basis. However, the growth of the

[29] BIS, OTC Derivatives: Settlement Procedures and Counterparty Risk Management, Sept 1998

credit derivatives market was so great in 2005 that the U.S. Federal Reserve System actively voiced its concerns with the growing backlog of uncleared trades.[30]

4b. Developments in Exchange Trading

Transition to Electronic Trading

The last twenty years, the time span we have dealt with in this survey, roughly coincides with the IT Revolution. It is not surprising then that one of the major themes in the derivatives world during this time has been the adoption electronic trading technologies. In general, the new market places that have developed since the 1980's, including most of those in continental Europe, have been early adopters of electronic trading. In contrast, exchanges that were established prior to 1985, especially the U.S. exchanges, have been slow to abandon older technologies such as open-outcry, floor trading.

In Europe, the trading of financial derivatives took off in 1982 with the opening of the London International Futures Exchange (LIFFE). LIFFE was modelled very much along the lines of the U.S. markets and adopted open-outcry floor trading. The continental financial derivatives markets entered somewhat later. While some, for example MATIF, adopted open-outcry floor trading as the transaction technology, others, such as the Spanish financial derivatives market, made an early commitment to electronic trading.[31] The exchange that really drove the charge was Deutsche Terminboerse (DTB). Founded in 1991, DTB adopted electronic trading at its outset. It introduced trading of futures on the Bund (German government bond) in direct competition with a contract already trading on LIFFE. By 1998 the DTB had wrestled the Bund contract away from LIFFE which was still floor-based. The DTB (merging with SOFFEX to become Eurex) grew to overtake the CBOT as the largest derivatives exchange in 1999.[32]

The success of the DTB was the catalyst which forced other exchanges to rethink their commitment to floor trading. The French MATIF completed the first transition from floor to electronic trading in only a short time during 1998. Also in 1998 LIFFE began its move to electronic trading with the development of the Liffe Connect platform. The American exchanges had been experimenting with a variety of electronic platforms to run alongside open outcry since the late 1980's. This transition accelerated in the late 1990's. In 2005 70% of the volume on the CME was executed electronically. At the CBOT electronic trading accounted for 65% of total volume in 2005.[33]

The advantages of electronic trading over floor-based exchanges may include factors such as transparency of the order-matching process, speed of execution, audit trails,

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[30] See, M. Mackenzie, "Credit-Derivatives Deadline Looms," Wall Street Journal, December 13, 2005.
[31] The Spanish financial derivatives market MEFF was established in 1989 and trades futures and options on Spanish government bonds and stock indices.
[32] "Eurex closes out the year 1999 as the world's largest derivatives exchange with 379 million contracts traded" www.eurexchange.com/about/company_info/milestones.html+&hl=en
[33] http://biz.yahoo.com/prnews/060103/cgtu024.html?.v=38 and http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/01-03-2006/0004241489&EDATE=

scalability, and anonymity.[34] All these factors affect the total costs of trading. Generally it appears that the direct costs of electronic trading are much lower than on traditional exchanges; the development of a new trading floor is estimated to be two to forty times the development cost of an electronic system which has far lower operating costs.[35] While this allows for lower direct costs, such as fees and commissions, (as well as the competitive effect on direct costs at other exchanges) it is much more difficult to measure the difference in the total costs of trading between the floor-based and electronic exchange. Domowitz and Steil (1999) review a number of studies on the differences between implicit trading costs for pairs of automated and traditional stock and derivative markets with overall results favouring the electronic markets. In the DTB/LIFFE fight over the Bund, studies have found that bid-ask spreads were at least as tight on the DTB. In general, Domowitz and Steil find that bid-ask spreads are "approximately the same across automated and traditional venues" and "[m]arket depth is generally found to be greater in the automated market."

Table 4 : Largest Derivative Exchanges (by number of contracts traded in 2004)

EXCHANGES	REGION	Contracts Traded (2004)		Stock Options	Stock Futures	Stock Index Options	Stock Index Futures	ST Interest Rate Options	ST Interest Rate Futures	LT Interest Rate Options	LT Interest Rate Futures	Currency Options	Currency Futures	Commodity Options	Commodity Futures	Floor-based Trading
Korea Exchange	Asia Pacific	2,586,570,860	29.8%			✓	✓				✓		✓			
Eurex	Europe	1,065,639,010	12.3%	✓		✓	✓		✓	✓	✓					
Chicago Mercantile Exchange (CME)	North America	805,341,861	9.3%			✓	✓	✓	✓			✓	✓	✓	✓	F
Euronext	Europe	790,385,210	9.1%	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Chicago Board of Trade (CBOT)	North America	599,994,385	6.9%			✓	✓	✓	✓	✓	✓			✓	✓	F
Chicago Board Options Exchange (CBOE)	North America	361,087,394	4.2%	✓		✓	✓			✓						F
International Securities Exchange (ISE)	North America	360,769,161	4.2%	✓		✓										
Sao Paulo SE	South America	235,349,478	2.7%	✓		✓										
MexDer	North America	204,170,751	2.4%	✓	✓	✓	✓		✓		✓		✓			
American SE	North America	202,692,231	2.3%	✓		✓										F
BM&F	South America	178,851,381	2.1%			✓	✓	✓	✓			✓	✓	✓	✓	F
New York Mercantile Exchange (NYMEX)	North America	163,157,807	1.9%											✓	✓	F
Philadelphia SE	North America	133,404,843	1.5%	✓		✓						✓				F
Pacific SE	North America	103,262,458	1.2%	✓		✓										F
Buenos Aires SE	South America	94,827,742	1.1%	✓						✓			✓			F
OMX Stockholm SE	Europe	94,690,499	1.1%	✓	✓	✓	✓		✓		✓					

Source: World Federation of Exchanges

Table 4 summarizes the volume and types of contracts traded on the largest derivatives exchanges worldwide for 2004 according to data collected by the World Federation of Exchanges (with volume in terms of numbers of derivatives contracts). It shows that Eurex continues to lead the CME by about 25%. The next largest exchange is Euronext created in at the millennium through the merger of Liffe with continental European derivatives exchanges. This shows that the formerly dominant Chicago derivatives markets have been more than equalled by their European rivals which have emerged only in the course of the 1990's.

A word is in order on the Korea Exchange which appears as the largest derivative exchange by numbers of contracts traded. This reflects the fact that over 97% of the

[34] Tsang, R. "Open outcry and electronic trading in futures exchanges". Royal Bank of Canada Review, Spring 1999.
[35] I. Domowitz (2001), "Liquidity, Transaction Costs, and Reintermediation in Electronic Markets", Federal Reserve of New York working paper, p.4

contracts traded were in the KOSPI 200 options and a further 2% in KOSPI 200 futures which both have small contract sizes aimed to appeal to retail investors. The Korea Exchange is an all electronic exchange.

The growth of the two big European exchanges has been very much a story of the success of electronic trading, and their success has been instrumental in forcing the North American exchanges to accelerate their adoption of electronic trading. However the decision whether to move to electronic trading is still not clear to all. While electronic exchanges may cut on transaction costs by disintermediating unnecessary brokers, there are still many functions which an electronic market cannot perform. For instance, electronic markets provide a simple trading algorithm which is typically anonymous and order driven. However, the human interaction which takes place on a trading floor can provide a much more sophisticated and valuable negotiating service. The non-anonymity of the floor provides better information on the quality of order flow. It also allows for negotiation beyond the strict rules of a trading screen such as better volume/size information and the ability of brokers to find customers when certain opportunities arise who may be willing to trade but not currently in the market. One exchange which is betting on this is Nymex who restored open outcry market to its London trading branch in late 2005. In addition, electronic markets have their share of problems such as service outages from attack/manipulation and trading mistakes which, when they happen, are much bigger in scale and harder to fix.

Trading platforms is another area within the development of electronic markets where Europe has been a leader. Europe's early foray into electronic trading required it to develop the first platforms. The success of these platforms was not matched by a similar success with the US platforms. With high development costs many exchanges now buy in sophisticated platforms from a number of providers including Liffe Connect, OM's Click, and the Eurex platform (e.g. the ISE, US's first fully electronic exchange in May 2000, uses OM's Click platform).[36]

Ownership/Governance Structure

We have already noted that there is a strong tradition of commodity derivatives exchanges being organized as member-owned cooperatives. This tradition was particularly strong in the U.S. where major decision-making positions were typically filled by powerful "locals", i.e., floor traders who trade for their own account as well as execute client trades. These traders are naturally concerned that market be organized in a manner that enhances the total profits that they derive from trading. Some observers complain that this structure prevents exchanges from adapting to competitive threats or from pursing opportunities that might benefit customers for fear that membership prices may suffer.

[36] Liffe Connect is used by the CBOT, the Kansas City Board of Trade, Minneapolis Grain Exchange, Winnipeg Commodity Exchange and Tokyo International Financial Futures Exchange. The OM platform is also used by Borsa Italiana's Italian Derivatives Market (Idem) and the Australian Stock Exchange.

The traditional approach to organizing derivatives exchanges was called into question when LIFFE lost its position in the Bund contract in 1997-8 to the electronic start-up DTB. It was argued at the time that the mutual structure had been an impediment to LIFFE adopting electronic trading and that the Bund contract was lost as a consequence. Accordingly, in 1999 LIFFE undertook to reorganize itself as a corporation where shareholder rights were split from trading membership. This corporate structure gave the exchange a single, clear objective—maximization of profits. LIFFE's demutualization sparked off a wave of other exchanges following suit. The ownership status of the major derivatives exchanges are summarized in the Table 5.

Table 5: Ownership Status of Derivatives Exchanges

Exchange	*Demutualization*	*Listed*
LIFFE	1999	Yes (acquired by Euronext)
Eurex	2000	No
NYMEX	2000	No
Euronext	2000	2001
CME	2000	2002
ISE	2002	2005
PHLX	2004	No
CBOT	2005	2005
CBOE	transition	No
AMEX	No	No

While many exchanges have begun or have completed the process of "demutualization", some still have not completely separated the trading right from the shareholding right. Such cases where the two components are required to be kept together is still a member owned and operated exchange. True demutualization occurs when the rights of owners and users are completely split, usually following an IPO.

Thus recent experience suggests that the case in favor of organizing derivatives markets a for-profits business is clear. Conceptually, however, the case is less clear-cut. Hart and Moore (1996) provide a framework to compare for-profits markets with member cooperatives. They show that both structures are can be inefficient. Outside ownership becomes relatively more efficient where variation of the membership interests become more polarized and where the exchange faces more competition.

This debate is important for at least two reasons. First, exchanges are entrusted with responsibility for self-regulation including monitoring of trading practices and dispute resolution. Under the cooperative structure here is a conflict of interest between the end-users want of a fair market and the member's interests. It may be that shareholders interests would be more closely aligned with those of the public.

Second, exchanges need to evolve to meet that competition. It is probably the case that members at exchanges which still have open-outcry floors have displayed the most resistance to a change in their ownership structure and have been the slowest to adopt electronic trading. Demutualization may provide the decision making ability and ability to raise capital for growth required in the more competitive exchange environment.

5. Users of derivatives

In our description of the growth of derivatives markets over the last twenty years we have documented the fact that derivatives trading has become thoroughly integrated in markets for foreign exchange, equity, government debt, and, increasingly, credit. This is manifested by the presence on derivatives markets of the major financial service firms including investment banks, fund managers, and commercial banks. The same is true of the treasury arms of governments, central banks and governmental agencies.

In contrast with banking and fund management, insurers have been relatively more reluctant users of derivatives. Cummins et.al. (2001) reports that in a 1992 sample of North American insurers 11 % of life insurers used derivatives and 7 % of property-casualty insurers participate derivatives markets. They reported that larger insurers and mutual insurers (as compared to unaffiliated companies) were relatively more likely to use derivatives. However, there are a number of signs that the worlds of insurance and derivatives are getting closer. This tendency was noted by Warren Buffett (no lover of derivatives) who wrote about General Re's (the major reinsurer) involvement in derivatives as follows, "…the reinsurance and derivatives business are similar: like Hell, both are easy to enter and almost impossible to exit."[37] One point of contact has been the catastrophe risk where large reinsurers have been active in organizing issues of catastrophe bonds and other catastrophe contingent claims. This is an area where the derivatives exchanges have attempted innovate as well (e.g., CBOT's catastrophe linked futures and options contracts) but with limited success until now. As we have seen above, insurance companies and reinsurers are major players in the credit derivatives markets, in particular as suppliers of credit protection. Table 6 presents total derivatives usage based on survey of large insurers and reinsurers.

Table 6: Derivatives positions held by insurers and reinsurers ($US mln)

Type of Contract	Held for Hedging		Held for Non-hedging		Total	
	Notional Amount	Fair value	Notional Amount	Fair value	Notional Amount	Fair value
Interest rate	118896	999	8998	128	127894	1127
Equity	13331	828	946	22	14277	850
Foreign currency	2186	82	2385	-69	4571	13
Credit derivatives	84	3	44947	-48	45031	-45
Other	40	1	1901	-25	1941	-24

Source: IAIS Global Reinsurance Market Report 2004

From these data we see that the heaviest derivatives use is interest rates and equity derivatives and is for hedging purposes. This is consistent with the fact that

[37] Berkshire Hathaway, Annual Report, 2002.

derivatives usage is relatively heavier for life companies, as these companies tend to have a significant mismatch between assets and liabilities that can be managed with these kinds of derivatives. The use of credit derivatives appears to be for return enhancement, as insurers appear to be predominantly providers of credit protection.

Until fairly recently it has been difficult to determine how widely derivatives have been used by non-financial firms. This has changed following changes in accounting rules requiring firms to provide information on derivatives usage. Accordingly academics have begun to explore these data to determine to what extent companies use derivatives and for what purpose. In particular, there have been some attempts at testing some of the qualitative arguments for why risk management by firms may increase firm value. These include reducing financial distress costs (Mayers and Smith, 1982), taxes (Smith and Stulz, 1985), and costs of external finance (Froot, Scharfstein, and Stein, 1993). Following changes in FASB rules on derivatives reporting Mian (1996) studied the annual reports for 1992 of a sample of 3022 US firms. Of this sample 543 firms (18 %) reported they used derivatives for hedging, and a further 228 firms (8 %) reported they used derivatives without indicating they were specifically used for hedging. Mian finds weak support for the idea that derivatives are used to reduce tax costs. Interestingly, the data do not support the idea that firms with greater growth options are more likely to use derivatives.

Other studies have explored managerial motives for derivatives use including those, such as managerial risk aversion, which may conflict with firm value maximization. In a study of a detailed data set on 48 North American gold mining firms between 1991 and 1993 Tufano (1996) finds little evidence that firms use derivatives for the value maximizing motives indicated above. Instead, he documents a systematic tendency for firms where managers hold options to not hedge (i.e., retain more gold price risk). In contrast, firms where managers hold stock tend to hedge. This is consistent with the view that because managers are risk averse when their compensation depends linearly upon firm performance they will use risk management to reduce the firm's idiosyncratic risk. However, when they are compensated with call options, a convex claim on firm performance, they will abstain from tools which reduce idiosyncratic risk. In a clinical study of foreign exchange hedging a single firm Brown (2001) finds that hedging may be used to align managerial incentives with firm objectives.

Bartram et. al. (2004) is probably the most comprehensive study to date of the uses of derivatives by non-financial firms. Their data covers 7263 firms from 48 countries including the US based on financial reports for either 2000 or 2001. In contrast with most previous studies they find that derivatives were widely used with 60 % of firms reporting some use of derivatives of which 45 % use foreign exchange derivatives, 33% use interest rate derivatives and 10 % use commodity derivatives. The higher level of derivatives found in this study may indicate that derivatives use has been growing over time; although, it could be a reflection of increasingly stringent reporting standards or the fact that the data set covers mostly large firms. They found derivatives use was positively related to firm leverage, and interpret the finding as indicating firms' desiring to minimize costs of financial distress. Interesting they found that the degree of development of local derivatives markets was positively associated with derivatives use.

6. Regulatory issues

In most markets derivatives trading is governed by existing contract and securities laws, and public regulation, as opposed to self-regulation by exchanges or professional bodies, is subsumed under general securities regulation. The most important exception to this general pattern is the United States where derivatives trading was traditionally dominated by commodity markets and where there has existed a strong body of regulations specifically aimed at derivatives trading.

The legislative foundation of US derivatives regulation is the Commodity Exchange Act of 1936. This act reflected the view based on the experience notably of grain trading that commodity futures markets were susceptible to manipulation through restrictions of deliverable supply and often giving rise to abusive price distortions. This gave rise to a system which monitors markets through reports on futures market open interest classifying large position as having either a speculative or hedging purpose. The CEA was modified significantly in 1974 by legislation creating the Commodity Futures Trading Commission which was endowed with "exclusive jurisdiction" to regulate commodity futures. One of the basic regulatory requirements was that all futures transactions were required to be executed on recognized exchanges, thus promoting transparency and helping the CFTC to obtain a comprehensive view positions on the market. This requirement clearly intended to facilitate the CFTC in pursuing its purpose of preventing manipulations. The development of exchange-traded financial derivatives in the 1970's created a problem for financial regulation in the US. These involved futures contracts which were generally regulated by the CFTC being written for securities such as stocks which were regulated by the Securities Exchange Commission (SEC). This gave rise to a well-documented "turf war" between these two US regulators.[38] The result over time has been a series of accommodations which left futures trading largely under the jurisdiction of the CFTC and option trading under the SEC.

The resolution of frictions between the SEC and the CFTC did not however resolve the rather ambiguous status of OTC derivatives which were growing strongly through the 1980's and 1990's. For many of these instruments it was not clear which set of regulations, if any, would apply. For example, do interest rate swaps, which are commonly hedged by holding portfolios of Eurodollar futures, fall under the jurisdiction of the CFTC, the SEC, neither or both? The CFTC's presumption of exclusive jurisdiction over derivatives was thrown into doubt by the case of forward foreign exchange contracts which had long been traded on a very deep international, inter-bank market. As other OTC markets were developing internationally among major financial institutions, the CFTC was forced to accept other exceptions to the precept of exclusive jurisdiction. The basic criteria that was adopted for a derivative to qualify as an regulatory exception were: (a) the contract was not standardized, (b) they were traded by specialist institutions rather than the general public, and (c) there was no "mutualization of credit risk", i.e., these were contracts where participating parties were knowingly assuming the credit risks involved.[39] These principles did not

[38] See a compendium of articles from the period, A. Peck (ed.) *Futures Markets: Regulatory Issues.* American Enterprise Institute. (Washingon, 1985).
[39] See, Pirrong "A Growing Market" *Regulation.* (Cato Institute, Washington, 2002).

really remove the ambiguous status of OTC contract. For example, we have seen that efforts to establish clear documentation standards was contributing to a greater degree of standarization than was previously associated with OTC contracts. Furthermore, the exceptions were established very much on a case-by-case basis leaving the status of any new market that might come along very much in doubt.

With the continued growth of OTC derivatives in the 1990's, fuelled by the development of electronic trading technologies there was growing pressure to come to some general resolution of the status of OTC derivatives. The result was the Commodity Futures Modernisation Act of 2000. This has changed derivatives regulation in the U.S. in the following ways: (a) OTC derivatives were deemed to fall outside the jurisdiction of the CFTC, (b) futures exchanges *and their associated clearing houses* were regulated by the CFTC, and (c) OTC derivatives transactions could under certain circumstances be cleared by regulated clearing houses. As we have seen the last two features have combined in the case of energy trading to mean that the CFTC has authority to monitor OTC energy transactions to the extent that such transactions have passed through clearing houses. This means that potentially OTC markets may be subject to monitoring and possibly remedies for market manipulations.

As has been already noted in Europe and other non-US markets, derivatives regulation has tended to be treated as a sub-category of general securities regulation. Accordingly in most non-US markets there nothing comparable to large trader reports or the range of judicial remedies to alleged manipulations which have long existed in the US.[40] Instead, national regulation has concentrated on the authorisation of institutions for taking customer business, suitability of persons working in the field, prudential standards such as capital requirements, and, in some cases, market transparency. To the extent that there is any concern for market manipulations it tends to fall under prohibitions against insider trading. Furthermore, attempts to create transparent markets have generally not gone so far as to establish monopoly of trading on a single centralised market place. This tolerance probably has been a key factor in facilitating the growth of OTC derivatives outside the US. In contrast, the US, despite its very highly developed derivatives exchanges, has over time tended to lose its dominant position as the OTC markets have grown in importance.

Probably the greatest regulatory challenge for derivatives trading in Europe was the fact that trading was potentially regulated by a large number of national regulators whose rules and enforcement practices differed. This obviously stood as an impediment to the development of deep international markets. The major breakthrough since 1985 have been the efforts at the European level to integrate banking and securities markets, notably through the 1989 Second Banking Coordination Directive and the 1993 Investment Services Directive which is to be superseded by the Markets in Financial Instruments Directive (MiFID). These maintained the authority of national regulators but established important limits to their effective control because financial firms were granted a single "passport" which allowed them to operate throughout the EU subject to the regulations of their home

[40] This point was made relative to UK and US regulations in R.W. Anderson, "Regulation of Futures Trading in the United States and the United Kingdom," *Oxford Review of Economic Policy*. 1986.

country. This creates a tendency toward a single standard in those dimensions of regulation in which regulatory competition is most effective.

7. Conclusion

We have documented the strong development of derivatives markets over the last twenty years. Building on the development of financial derivatives in the US during the 1970's, derivatives markets have expanded worldwide to the point where they are thoroughly integrated into the operations of debt and equity capital markets.

One notable feature of this growth has been the strong relative development of European derivatives markets as reflected in the fact that two of the five largest derivatives exchanges globally are European and that London is the largest center of OTC derivatives trading in the world. This strong European growth has been driven by the reform of European debt and equity markets, capital flow liberalisation within Europe, market integration and the introduction of the Euro. However, a key additional factor favoring European derivatives growth has been the development of electronic trading which allowed European exchanges to leap-frog their North American rivals.

Another feature of this experience has been the fact that the growth of OTC derivatives markets has outstripped that of derivatives exchanges. This also has been facilitated by the IT revolution. However, part of the development of OTC derivatives markets can be attributed to the efforts of the major players in global financial markets to establish common standards for documentation and trading practices. These factors are no where clearer than in the rapid rise of credit derivatives trading which has been almost entirely an OTC phenomenon.

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