Price Risk Intermediation in the Over-the-Counter Derivatives Markets: Interpretation of a Global Survey

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Since the early 1980s, the financial derivatives markets have increasingly been used by market participants to unbundle and trade their exposures to foreign exchange rate risk, interest rate risk, and other types of price risk.[1] The markets have given firms that wish to shed unwanted price risk the ability to hedge their exposures at low cost while offering investors flexibility in structuring their trading and investment positions.

Derivatives contracts are especially efficient vehicles for unbundling the price risks embodied in assets and liabilities.[2] The contracts allow users to trade away the risks they do not wish to be exposed to while retaining other risk exposures. For example, in a financing relationship between a lender and borrower, an interest rate swap can be used to strip out the interest rate risk from the credit risk. Such an unbundling of risk can resolve differences in the risk preferences of the lender and borrower by passing the unwanted interest rate risk to others in the derivatives markets who are more willing to bear it.

Drawing on the results of a recent central bank survey of these markets, this article looks to answer questions about the role of derivatives markets in the intermediation of price risks—specifically, their role in the transfer and trading of price risk exposures in the financial system. For example, what is the scale of potential price and credit shocks that could be transmitted through the derivatives markets? Are the price risk exposures traded by the end-users of derivatives concentrated among derivatives dealers? What is the relationship between the over-the-counter and the exchange-traded derivatives markets?

The Central Bank Survey of Derivatives Market Activity

To provide interested parties with consistent and comprehensive data about the size and structure of the financial derivatives markets, in April 1995 central banks in twenty-six countries conducted the "Central Bank Survey of Derivatives Market Activity." The Bank for International Settlements (BIS) coordinated the survey and aggre-

gated the national survey data to produce global market statistics.[3] One of the most important contributions of the survey was the collection of global data on market values of derivatives contracts. These data, broken down by counterparty type and disaggregated by contracts with positive and negative values (from the perspective of reporting dealers), provided a unique view of the derivatives markets' intermediation of price risks.

Data were collected from banks and securities firms that trade in the over-the-counter derivatives markets. The reporting panel consisted of more than 2,000 reporters in twenty-six countries. However, most reporters were the local trading desks of large, internationally active parent companies. (Most parent companies had trading desks in many of the twenty-six countries.) The U.S. portion of the survey had fifty-one reporters with both domestic and foreign parents. The reporting panel in the United States was restricted to derivatives dealers, and affiliates of these firms were also reporters in other countries. The aggregation of market totals in the survey used an adjustment to avoid the double counting of transactions between reporters, both at the national and at the cross-border level.

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The survey collected data on new transactions (turnover) during April 1995 and outstanding contracts at the end of March 1995 in terms of activity in each participating country. Outstanding contracts were reported on the basis of contracts booked in each country (book location), and turnover data were reported on the basis of new transactions executed in each country (trade location). The U.S. portion of the survey, for example, collected data on outstanding contracts booked in the United States and new transactions executed there.

The survey data were broken down by counterparty type and product category. Reporters were asked to assign all their derivatives contracts to the product categories used in the survey (Table 1). In addition to the products listed in Table 1, exchange-traded futures and exchange-traded options (by underlying asset class), other over-the-counter foreign exchange derivatives, and other over-the-counter interest rate derivatives were included.

Truly Global Markets

The central bank survey data underscore the global nature of the over-the-counter derivatives markets.[4] A high proportion of the contracts in the survey represented cross-border transactions. For contracts booked in the United States, these transactions accounted for 50 percent of outstanding interest rate contracts and 60 percent of currency or exchange-rate contracts. In the global totals, the cross-border share was 55 percent for both currency and interest rate contracts. For trades between customers and dealers, the cross-border share was 41 percent for contracts booked in the United States and 48 percent for all contracts worldwide.

Another indication of the markets' global nature is the dispersion of derivatives activity across countries. Turnover volume in the United Kingdom—the country with the largest share—amounted to only 30 percent of global turnover volume, with 64 percent of that amount representing cross-border transactions. The combined turnover of the United Kingdom, the United States, and Japan—the top three countries—amounted to only 56 percent of global turnover volume.

The survey showed that derivatives activity is not only dispersed across countries but also has a decentralized structure. For example, a firm's traders may enter into trades in one location that are then booked elsewhere. One indication of this decentralization is the higher U.S. share of outstanding contracts relative to the U.S. share of turnover. Over-the-counter contracts booked in the United States amounted to 20 percent of the global totals, while the U.S. share of global turnover was only 14 percent. For over-the-counter interest rate derivatives alone, contracts booked in the United States were 23 percent of the global totals, but the U.S. share of global turnover was only 15 percent.

The global nature of derivatives markets and firms' participation in them suggests that a disruption in these markets could have wide-ranging effects that would be transmitted across national boundaries. How concerned should policymakers be? We now consider what the central bank survey reveals about the scale of potential shocks in the over-the-counter derivatives markets.

The Scale of Potential Price Shocks

The survey shows a high level of demand for products that are used to trade and hedge exposures to underlying financial risks, particularly those related to changes in foreign exchange and interest rates (Table 1).[5] For issues related to price risk, the notional amounts in Table 1 can be roughly compared to the principal amounts of cash market securities with similar maturities. For example, the interest rate risk

Table 1
Outstanding Over-the-Counter Derivatives Contracts

	Global Totals		Contracts Booked in the United States[a]	
Product Category	Amount (Billions of U.S. Dollars)	Percentage[b]	Amount (Billions of U.S. Dollars)	Percentage[b]
Panel A: Notional Amounts				
Foreign exchange forwards and swaps	8,742	72	1,264	47
Currency swaps	1,974	11	258	10
Currency options	2,375	16	1,114	42
Forward rate agreements	4,597	17	874	11
Interest rate swaps	18,283	69	5,558	68
Interest rate options	3,548	13	1,595	20
Equity forwards and swaps	52	9	8	22
Equity options	547	91	28	78
Commodity forwards and swaps	208	66	127	64
Commodity options	109	34	72	36
Total[c]	40,714		11,044	
Panel B: Market Values				
Foreign exchange forwards and swaps	602	70	94	59
Currency swaps	345	22	32	20
Currency options	69	7	32	20
Forward rate agreements	18	3	2.4	1
Interest rate swaps	560	87	130	85
Interest rate options	60	9	20	13
Equity forwards and swaps	7	14	1	37
Equity options	43	86	1.5	63
Commodity forwards and swaps	21	78	10	70
Commodity options	6	22	4	30
Total[c]	1,745		328	

Sources: Global totals were compiled by the Bank for International Settlements (1995c). Figures for contracts booked in the United States were compiled by the Federal Reserve Bank of New York (1995).

Notes: All figures in the table are as of the end of March 1995. The figures have been adjusted for double counting of trades between reporting dealers.

[a] The U.S. share in the global totals is smaller than the ratio of the two columns because of cross-border dealer trades.

[b] Percentage of each product within the corresponding product group.

[c] The totals include "other foreign exchange" and "other interest rate" products, which were a very small proportion of all currency and interest rate products (in terms of both notional amounts and market values). The global totals of foreign exchange forwards and swaps do not include contracts booked in the United Kingdom because data were not collected.

of a bond is comparable to that of an interest rate swap whose notional amount equals the principal amount of the bond (as long as both have equal maturities). The notional amounts in Table 1, however, are the gross trades in the markets and consequently overstate the amount of net price risk exchanged in the over-the-counter derivatives markets.[6]

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If we take these two factors into account, the notional amount of interest rate swaps and options worldwide, at $22 trillion, is comparable to the $24 trillion of outstanding *securities market* debt worldwide at year-end 1994.[7] Likewise, the $7 trillion notional amount of interest rate swaps and options contracts booked in the United States, though smaller, is of a comparable order of magnitude to the $17 trillion of outstanding *credit market* debt in the United States at the end of March 1995.[8] Although these are gross notional figures, their large size suggests that a significant amount of exposure to interest rate risk is being exchanged among derivatives market participants. Consequently, the role of the derivatives markets in transferring exposures to underlying price risks between market participants, between economic sectors, and between countries raises a question about the size of price and credit shocks (arising from changes in underlying exchange rates or interest rates) that could be transmitted through the derivatives markets.

From a market value perspective, the gross amount of wealth transferred between counterparties through outstanding over-the-counter contracts worldwide at the time of the survey amounted to $1,745 billion, as measured by the total market value of outstanding contracts in Table 1.[9] (The relationship between market values and notional amounts is explained in Box 1; Box 2 describes the aggregation of total market value in the survey.) Even though the market value is not a measure of price sensitivity to underlying risk factors, given the volatility of exchange rates and interest rates in the year preceding the survey, this sizable figure does provide some feel for the magnitude of the gross price shocks and wealth transfers that *could* be transmitted through the over-the-counter derivatives markets.[10]

PRICE SHOCKS

That having been said, the central bank survey in fact provides evidence that price shocks in the over-the-counter derivatives markets would *not* be inordinately large. To put the potential price shocks in perspective, we use data from the survey to compare the gross price sensitivity of outstanding over-the-counter interest rate derivatives with that of securities market debt (Box 3). Our estimates suggest that the price shocks transmitted through the interest rate derivatives markets, even on a gross basis, would be smaller than those in the debt securities markets. In addition, the combined effects of the shocks in the two markets would be smaller than their sum because some market participants have offsetting exposures in the two markets. (A large proportion of derivatives contracts are used for hedging and arbitrage; consequently, some of the price shocks in derivatives contracts and debt securities would be offsetting.)

Our estimates suggest that the price shocks transmitted through the interest rate derivatives markets, even on a gross basis, would be smaller than those in the debt securities markets.

While these estimates provide some reassurance about the scale of price shocks that might be transmitted

through the derivatives markets, the manner in which a price shock is distributed across market participants is another important concern. About half of all interest rate derivatives contracts are between dealers and customers (Table 2). If customers are equally represented on both sides of the markets, the wealth transfer passing through the dealers from customers on one side of the markets to customers on the other side will be only one-quarter (the product of one-half of one-half) of the gross price shock estimate in Box 3 (or between $130 billion and $200 billion for a 1-percentage-point change in interest rates).

The net price shock or wealth transfer in the *interdealer* part of the market (which comprises the other half of outstanding interest rate contracts) is also likely to be significantly smaller than one-half the gross price shock estimate in Box 3. This difference is the result of offsetting trades between dealers in their market-making role. We cannot determine from the survey, however, just how much smaller the net exposure will be.

Table 2
DEALERS' CONTRACTS WITH CUSTOMERS AS A PERCENTAGE OF ALL CONTRACTS

Product Category	Financial Customers	Nonfinancial Customers	All Customers
Foreign exchange forwards and swaps	40	13	53
Currency swaps	33	33	66
Currency options	29	12	41
Forward rate agreements	41	0.3	41
Interest rate swaps	34	14	48
Interest rate options	39	19	58
All foreign exchange and interest rate contracts	37	15	52

Notes: The table reports outstanding contracts booked in the United States at the end of March 1995. The notional amount of dealers' trades with customers is relative to the total notional amounts outstanding in each product. The remaining contracts are interdealer transactions.

BOX 1: NOTIONAL AMOUNTS AND MARKET VALUES

The notional amount of derivatives transactions is only a reference amount used to calculate the exchange of cash flows between counterparties. The market value of a derivatives contract is the net value of the cash flows to be exchanged between counterparties over the life of the contract. For a measure of the wealth transferred in the derivatives markets at a point in time, the market value of outstanding contracts is a better indicator than the notional amount because the relationship between notional amounts and cash flows varies across types of derivatives contracts. Nevertheless, notional amounts can be useful, as illustrated in Box 3. The market values of over-the-counter derivatives contracts are a small percentage of the notional amounts, at 3 percent for contracts booked in the United States and 4 percent for the global totals.

The market values as a percentage of notional amount are smaller for interest rate derivatives than for other products because of the lower volatility of interest rates relative to other underlying asset prices, such as exchange rates. As should be expected, products with longer maturities also have higher ratios of market value to notional amount. For contracts booked in the United States, the market value as a percentage of notional amount is smaller than it is for the global totals, in part because of the different currency and interest rate composition of the global totals and the contracts booked in the United States. For example, interest rate products tend to be booked in the United States to a greater degree than currency products, which have higher ratios of market value to notional amount.

TOTAL MARKET VALUE AS A PERCENTAGE OF NOTIONAL AMOUNT OF OVER-THE-COUNTER DERIVATIVES CONTRACTS

	Global Totals	Contracts Booked in the United States
Foreign exchange forwards and swaps	6.9	7.4
Currency swaps	17.5	12.5
Currency options	2.9	2.9
Forward rate agreements	0.4	0.3
Interest rate swaps	3.0	2.3
Interest rate options	1.7	1.2
Equity forwards and swaps	13.4	11.7
Equity options	7.8	5.7
Commodity forwards and swaps	10.1	8.1
Commodity options	5.5	6.1
All products	4.3	2.9

Sources: Global totals were compiled by the Bank for International Settlements (1995c). Figures for contracts booked in the United States were compiled by the Federal Reserve Bank of New York (1995).

BOX 2: TOTAL MARKET VALUE AGGREGATION

The total market value in the survey is the value of all contracts that had positive market values for the reporting dealers plus the absolute value of reporting dealers' contracts with nonreporters that had negative market values for the dealers (see table). This sum captures the market value of all contracts because all contracts in the market have a dealer on at least one side (end-users trade only with dealers, but not with each other). The sum of market values across all contracts is a measure of the gross amount of wealth transferred in the over-the-counter derivatives markets (the net wealth transfer may be smaller because of offsetting trades).

In the table, gross market value is defined as the market value of outstanding contracts before bilateral netting by counterparty. The positive and negative values are from the perspective of the reporting dealer. A typical dealer would have some contracts that have positive value and others that have negative value.

The amount *a* represents the value of contracts between reporting dealers. A contract between two dealers that has a positive value for one will have a negative value for the other (of equal amount), but that value should be included only once in the total market value. Hence, the amount *a* appears on both sides of the table but is included only once in the total market value.

While the reported values of *a* on both sides of the table should in principle be equal, in the survey they differed slightly (by less than 4 percent in the case of contracts booked in the United States). The discrepancy could be due to either differences between the valuation of the same contract by the two dealer counterparties or reporting errors in assigning contracts to the counterparty classes in the survey.

The amount *b* (*c*) represents the value of contracts between dealers and customers that have positive (negative) value for dealers. The market total should include both types of customer contracts.

MARKET VALUES OF CONTRACTS HELD BY REPORTING DEALERS BY COUNTERPARTY TYPE

	Gross Positive Market Value	Gross Negative Market Value
Reporting dealers	*a*	*a*
Others/customers	*b*	*c*

Total market value = $a+b+c$
(All values reported in absolute value)

Combining the estimates of the net customer and interdealer wealth transfers in the derivatives markets might reduce the figures in the left-hand column of Table A2 in Box 3 to less than $300 billion (or less than $500 billion in the case of the larger estimate). In sum, these considerations suggest that the price shock or wealth transfer in the derivatives markets arising from a large interest rate change might not be excessively large, especially when compared with price risks in the debt securities markets. Note, however, that this interpretation applies only to the scale of aggregate shocks in the market as a whole. At the level of an individual market participant, the relative size of a change in value of its derivatives contracts could be quite significant.

CREDIT EXPOSURES

Another potential channel for the transmission of shocks is the change in credit exposures between counterparties as a consequence of the change in value of their derivatives contracts. The derivatives markets' size and role as a conduit for price-risk transfers in the economy suggest that shocks that heighten settlement risks could have wide-ranging effects. These effects would include not only the higher credit risks themselves, but also market participants' elevated exposures to price risks if they faced settlement risks in contracts they had relied on as hedges. In addition, the markets' ability to intermediate price risks could also be disrupted if market liquidity were to be impaired by participants' reluctance to enter into new transactions for fear of settlement risk.

On these points, the central bank survey is again fairly reassuring. Although the survey did not collect data on credit exposures in derivatives contracts, the market value data do give some perspective on the scale of the credit exposures among all participants in the market.[11] If we start with the replacement value of dealers' contracts and then account for dealers' credit-risk-reduction practices (such as counterparty netting), we reach a global total for

dealers' credit exposures of about $600 billion. However, customers also have credit exposures to dealers. Thus, total credit exposures globally, including customers' exposures, might amount to roughly $1 trillion. Before we assess the size of this figure, we offer a more detailed account of how it was calculated.

Dealers' Credit Exposures

The use of bilateral counterparty netting and collateral might reduce the credit exposures of a large derivatives dealer to less than half of the replacement value of its contracts.[12] The dealers' replacement value is the sum of all contracts that have positive values to dealers, which amounts to about $1.3 trillion in the global totals. Half

BOX 3: APPROXIMATE PRICE SENSITIVITY

The price sensitivity approximation for interest rate derivatives is based on the notional amounts in text Table 1 and the maturity distributions in Table A1. Depending on the distribution of contracts within the maturity bands in Table A1, the weighted average price sensitivity might range between 2 and 3 percent of notional amount for each 1-percentage-point change in interest rates. (The notional amount in Table A2 includes "other products" not broken out in Table 1, a difference of 1 percent. See Bank for International Settlements 1995c.)

Table A1
MATURITY DISTRIBUTIONS OF OVER-THE-COUNTER DERIVATIVES CONTRACTS

	Up to One Year	One to Five Years	Over Five Years
Foreign exchange forwards and swaps	77	21	2
Currency swaps	26	51	23
Currency options	89	8	3
Forward rate agreements	90	10	0
Interest rate swaps	34	48	18
Interest rate options	31	54	15
Equity forwards and swaps	67	29	4
Equity options	67	33	0.1
Commodity forwards and swaps	70	29	1
Commodity options	87	13	0.4

Notes: The table reports outstanding contracts booked in the United States at the end of March 1995. The figures represent notional amounts by maturity as a percentage of total notional amounts in each product.

The price sensitivity approximations in Table A2 do not reflect the nonlinearity of the price sensitivity of options and structured products (for options, these estimates are overestimates). However, as Table 1 shows, options account for only a small proportion of outstanding contracts. With regard to leveraged derivatives, the small ratio of market value to notional amount in Box 1 suggests that these products are not consequential for the markets as a whole.

Note that the estimate of the price sensitivity of outstanding interest rate derivatives is of a comparable order of magnitude to the market value of those contracts, which amounted to $646 billion (Bank for International Settlements 1995c). This figure differs slightly (by 1 percent) from the total for the interest rate products in Table 1 because of "other products" not broken out in Table 1. While this amount is not a measure of the potential change in value of over-the-counter derivatives contracts relative to a 1-percentage-point change in interest rates, the figure is of a comparable order of magnitude because of the path of interest rates prior to the survey. In the twelve to fifteen months before the survey, long-term interest rates rose by approximately 2 percentage points in four out of five major currencies (Bank for International Settlements 1995b).

The price sensitivity estimate for security market debt assumes that the average price sensitivity of outstanding debt is between 4 and 6 percent for each 1-percentage-point change in interest rates. This estimate is based on a maturity distribution of security market debt in Bank for International Settlements (1995b).

Table A2
APPROXIMATE PRICE SENSITIVITY
Billions of U.S. Dollars

	Global Total of Over-the-Counter Interest Rate Derivatives	Global Securities Market Debt
Notional amount	26,645	
Principal amount		24,428
Change in value relative to a 1-percentage-point change in interest rates:		
Small price sensitivity assumption	530	980
Large price sensitivity assumption	800	1,460

this amount is roughly $600 billion. The figure of $1.3 trillion, derived from the data in Table 3, is the sum of the $894 billion value of interdealer trades and roughly half of the $848 billion value of customer trades. The sum incorporates half of the gross value of customer trades because these trades are about evenly split between contracts with positive and negative values from the dealers' perspective.

All Credit Exposures in the Markets

The total or gross market value of contracts with customers amounts to $848 billion (Table 3). Approximately half this figure is customers' credit exposure to dealers; the remainder is the dealers' credit exposure to customers, which is already included in the $600 billion of dealers' credit exposures. The sum of customers' credit exposure (half of $848 billion) and the dealers' credit exposure ($600 billion) equals approximately $1 trillion. This calculation gives an upper bound on credit exposures because the aggregation ignores collateral posted by dealers that would reduce customers' credit exposure to them.

To put the estimate of over-the-counter derivatives credit exposures in perspective, the outstanding amount of gross international bank loans was $8.3 trillion, while outstanding net international bank loans amounted to $4.2 trillion at year-end 1994 (Bank for International Settlements 1995b). In addition, the world's seventy-five largest banks—from whose ranks the banks in the survey were drawn—had $700 billion of capital ("*The Banker* Top 1000" 1995).[13] In contrast, our estimate of dealers' over-the-counter derivatives credit exposures amounted to only $600 billion, and customers' credit exposures were another $400 billion.

Table 3
MARKET VALUE OF DEALERS' OUTSTANDING CONTRACTS BY COUNTERPARTY TYPE
Billions of U.S. Dollars as of End of March 1995

Contract	Global Totals	Contracts Booked in the United States
Interdealer	894	149
Customer	848	180

Sources: Global totals were compiled by the Bank for International Settlements (1995c). Figures for contracts booked in the United States were compiled by the Federal Reserve Bank of New York (1995).

While the estimated credit exposure in the derivatives markets is not excessively large compared with the total amount of other credit exposures, it is not insignificant. Clearly, practices that further reduce credit and settlement risk in the over-the-counter derivatives markets would contribute to the markets' resiliency.[14]

DERIVATIVES DEALERS' INTERMEDIATION OF PRICE RISKS

The survey data also shed light on derivatives dealers' intermediation of price risks. At the center of the financial derivatives markets are derivatives dealers who trade exposures to price risks among themselves and with customers. When a price risk exposure is exchanged between a dealer and customer through a derivatives contract, the contract transforms the customer's exposure and leaves the dealer with the mirror image of the change in the customer's exposure. For example, a customer with floating-rate debt can convert its obligations to fixed-rate payments with an interest rate swap in which the dealer receives a fixed interest rate and pays a floating interest rate to the customer. In this case, the customer's transformation of its floating-rate debt exposure to a fixed-rate obligation has left the dealer with an exposure to floating interest rates.

Dealers usually offer to assume the price risk exposures customers wish to trade regardless of whether they can immediately offset the exposure through a trade with another customer. While dealers' willingness to absorb the credit and price risk generated by such market making has facilitated the markets' growth and liquidity, the exposures traded in the markets do not disappear. Hence, the survey attempted to answer the question, Are the price risks traded by the users of derivatives concentrated among derivatives dealers?

The survey findings indicated that for over-the-counter derivatives contracts booked in the United States, dealers in the aggregate had a small net market value exposure to end-users (Table 4).[15] As a percentage of the total market value of customer trades, that exposure was only 3 percent for currency products and 4 percent for interest rate products.

The small net market value of the aggregate dealer exposure suggests that end-users were well represented on

both sides of the market. Because U.S. dollar swap rates (three- and five-year rates) at the time of the survey were near their highest levels since 1991, the most likely explanation for the small net market value is that dealers as a group had roughly balanced long and short positions with respect to end-users. Thus, dealers in the aggregate were intermediaries between customers in the trading of price risks. Exposures from some end-users were ultimately passed through the market to other end-users, who demanded products with offsetting exposures. Therefore, at the time of the survey, dealers in the aggregate were taking relatively small price risk exposures to meet customer demand for over-the-counter derivatives.

The survey findings indicated that for over-the-counter derivatives contracts booked in the United States, dealers in the aggregate had a small net market value exposure to end-users.

However, this interpretation of dealers' intermediation of price risks should be considered with some caution. The conclusion applies only to dealers as a group, but not necessarily to an individual dealer. In addition, the market values were determined by the interest rate and exchange rate history at the time of the survey, and different paths of underlying asset prices might lead to different results. Moreover, market value does not reveal potential future exposure or price sensitivity. Definitive answers to questions about intermediation of price risks would require data on price sensitivity of exposures by counterparty class. Finally, the conclusions apply to the market for a risk factor as a whole (such as interest rate risk) and not necessarily to a particular product.

We have established that the trading in exposures to price risk between end-users and dealers in the over-the-counter derivatives markets has not led to a concentration of price risk among dealers in the aggregate. Still, for some dealers the net market value as a percentage of total market value of their contracts was significantly higher than for the market as a whole.[16] However, whether the higher net market value ratio of an individual firm's position represents significant price risk for that firm cannot be determined without taking into account the firm's offsetting cash market and exchange-traded futures positions. In any event, the net positive market values of some dealers were balanced by the net negative market values of others, resulting in the small net market value of the aggregate dealers' position.

The small net market value of the aggregate dealers' position suggests that demand for products that transfer price risk is sufficiently diverse to allow a dealer uncomfortable with its price risk exposure to trade that exposure back into the market. A dealer's exposure to price risk, therefore, would appear to be driven by its appetite for risk rather than by customer demand alone.

The survey data show that a large proportion of over-the-counter derivatives transactions (about 50 percent) are trades between dealers, suggesting that the intermediation of price risk in the derivatives markets occurs on two levels (Table 2).[17] First, a dealer serves as intermediary between its customers and, to the degree permitted by the

Table 4
NET MARKET VALUE STATISTICS OF DERIVATIVES CONTRACTS BOOKED IN THE UNITED STATES
As of End of March 1995

Contract	Total Market Value (Billions of U.S. Dollars)	Net Market Value as a Percentage of Total
PANEL A: DEALERS' OVER-THE-COUNTER DERIVATIVES CONTRACTS WITH CUSTOMERS		
Foreign exchange products	86	-2.7
Interest rate products	80	4.3
PANEL B: DEALERS' OVER-THE-COUNTER DERIVATIVES CONTRACTS WITH DEALERS OUTSIDE THE UNITED STATES		
Foreign exchange products	47	0.9
Interest rate products	48	-5.9
PANEL C: DEALERS' OVER-THE-COUNTER DERIVATIVES CONTRACTS WITH NONREPORTERS IN THE UNITED STATES[a]		
Foreign exchange products	133	-1.3
Interest rate products	128	0.5

[a] Nonreporters in the United States include dealers reporting in a foreign market center, financial customers, and nonfinancial customers.

balance in its customers' demands, the dealer offsets exposures to price risk taken from some customers with exposures from trades with other customers. However, the large proportion of interdealer trades implies that an individual dealer cannot perfectly offset its exposures from its customers internally. To manage its resulting residual exposure to price risk, the dealer may pass its net exposure from customer trades into the interdealer market. The exposure is then redistributed among dealers according to their risk appetites.

A feature of the survey data that supports this interpretation is the offsetting market values of trades with dealers located outside the United States and trades with customers (Table 4). In the case of interest rate products booked in the United States, transactions with customers had a positive net market value while transactions with dealers outside the United States had a negative net market value. This relationship suggests that derivatives dealers in the United States were transferring the price risk acquired from their customer business into the global interdealer market. The same relationship was also observed in the case of foreign exchange derivatives booked in the United States (except that the signs of the net market values were reversed).

The survey data suggest that price risk intermediation in these markets could be resilient under stress. The small net market value of the aggregate dealers' exposure implies that market making in large part takes the form of price risk intermediation between end-users, rather than between end-users and dealers' cash market positions. Thus, market making is less likely to be vulnerable to the fragility of leveraged cash market hedging of large derivatives positions. Given the size of the markets, if dealers were to hedge the bulk of their derivatives in the cash markets, that hedging would take the form of large-scale use of leveraged cash market positions. These leveraged cash market hedging positions, however, could be vulnerable to disruptions caused by the scarcity of securities in repurchase markets or the difficulty of rolling over cash market positions. Consequently, the two-sided nature of end-user demands in the derivatives markets may make the markets more resilient because the use of leveraged cash market hedging positions would be limited to the hedging of net exposures. (Although derivatives dealers do use leveraged cash market positions to hedge derivatives positions, their use appears to be limited to the hedging of residual, or net, exposures of their portfolios.)

Over-the-Counter Derivatives Markets and Exchange-Traded Markets

The central bank survey also provides some information about the relationship between the over-the-counter derivatives markets and the exchange-traded derivatives markets. Campbell and Kracaw (1991) argued that dealers that intermediate price risks in large swaps portfolios will create economies of scale that make it more efficient for end-users to trade with dealers than to trade directly in exchange-traded futures markets. For example, a dealer that benefits from offsetting exposures in its swaps portfolio will need to hedge only the portfolio's residual exposure. The dealer's transaction costs from hedging this residual exposure in the futures markets would be much smaller than the total transaction costs expended by the dealer's customers in the aggregate had they separately traded in the futures markets.

An implication of this argument is that dealers will have offsetting over-the-counter derivatives positions and exchange-traded positions. For dealers in the aggregate, this relationship is apparent in the survey results. In other words, over-the-counter derivatives dealers in the aggregate appear to use futures markets to hedge their net over-the-counter exposures (cross-market hedging).

Interest Rate Contracts

For interest rate contracts booked in the United States, dealers' over-the-counter derivatives positions in the aggregate had net positive market values (both for U.S. dollar interest rate products and for the sum across all interest rate products). In addition, at the time of the survey, rates on U.S. dollar interest rate swaps were near their highest levels since 1991. These two observations suggest that dealers' over-the-counter derivatives positions benefited from the rise in interest rates.[18] In the futures markets, however, dealers in the aggregate were net buyers of U.S.

dollar interest rate futures, which decrease in value as interest rates rise. These apparently offsetting exposures are consistent with the cross-market hedging hypothesis.

Equity Contracts

For equity contracts booked in the United States, dealers in the aggregate predominantly had U.S. equity market exposure, and the net market value of their over-the-counter equity derivatives was positive. Hence, given that the U.S. stock market at the time of the survey was at its highest level in the two years up to that point, dealers in the aggregate most likely had net long over-the-counter exposures to the U.S. stock market. Dealers' net position in U.S. equity futures, however, was net short. This relationship is also consistent with the cross-market hedging hypothesis.

However, the survey results supporting the hypothesis are not strong. For example, the aggregate of dealers' over-the-counter positions is well balanced: the difference between the positive and negative market values is so small that reporting errors could reverse the sign of the net value. In addition, reliable inferences about dealers' hedging activity would require data on their cash market exposures, which were not addressed by the survey. Moreover, the futures market data in the survey are highly aggregated. Finally, the results apply to the market as a whole and not necessarily to individual firms. The cross-market hedging relationship appears in interest rate and equity products but is not apparent in currency products. This absence is probably due to the large daily turnover volume and liquidity of the foreign exchange spot and forward markets, which make it unnecessary to hedge residual currency exposures with exchange-traded products.

The survey suggests that the over-the-counter derivatives markets and the exchange-traded futures markets might not be entirely in competition.

The survey suggests that the over-the-counter derivatives markets and the exchange-traded futures markets might not be entirely in competition. The products of the two markets are also complementary to the extent that over-the-counter derivatives activity generates hedging demand on futures markets. The flexibility of over-the-counter contracts allows dealers to structure a contract's cash flows and maturities to meet the specific trading or hedging demands of a customer at relatively low cost, thus generating the trading of exposures to price risk on a scale that would not otherwise occur. This larger trading volume in the over-the-counter markets thus creates demand for standardized and liquid exchange-traded derivatives as dealers hedge their net exposures from meeting customer demand in the over-the-counter markets.

Policy Issues

The large scale of derivatives activity reported in the central bank survey and the role of dealers in intermediating price risks support the hypothesis that the derivatives markets are important price risk intermediation vehicles that contribute to a more efficient allocation of risks in the economy. However, despite this reassuring market-level interpretation, the situation of any single market participant could be quite different. Thus, although the markets appear to function well by some criteria, initiatives that could improve their ability to operate under stressful circumstances would be appropriate.

Areas where improvements have been and will continue to be useful include firms' internal risk management, accounting and disclosure, and market practices affecting credit and settlement risks. Improved market practices in these areas could address problems introduced by financial derivatives without depriving market participants of flexibility in managing their risks. By contrast, increased regulation of derivatives markets and products might undercut their ability to reallocate or disperse financial risks in the economy, especially when the absence of regulation in the over-the-counter markets has enabled them to intermediate price risks in innovative ways.

To be sure, the ability of derivatives instruments to transform risk profiles can be misused. Some market

participants have used derivatives to evade investment guidelines or conceal risks from their principals, especially when risk management, reporting, and accounting practices are articulated in terms of product definitions and balance sheet concepts instead of in terms of risk exposures. Some market participants have also used the instruments to arbitrage inconsistencies in the accounting, tax, and regulatory treatment of different types of cash flows and risks.

At the same time, however, many other market participants have used the instruments effectively for hedging purposes. For those who have benefited from the appropriate use of derivatives, regulatory restrictions could be costly and counterproductive. Moreover, the central role of risk management failures in the occasional instances of dramatic losses suffered by market participants (spanning both cash market and derivatives products) suggests that efforts to strengthen firms' risk management practices would be more effective in reducing risk than regulatory prohibitions on the use of particular products.[19]

Practices that reduce credit risks will also improve the markets' ability to intermediate price risks, especially during periods of stress, because market liquidity would not be impaired by traders' reluctance to enter into new transactions for fear of settlement risk. In this regard, improvements in disclosure and accounting practices would be helpful.

The large-scale use of derivatives indicated by the survey reveals that the exposure to underlying price risks of a large set of firms and institutions cannot be known without also taking into account exposures embodied in their derivatives contracts. By the same token, however, focusing on derivatives apart from cash market exposures would also be misleading. Consequently, disclosures by firms about their exposure to financial risks should be articulated in terms of underlying risks instead of according to traditional product definitions and balance sheet concepts, which may have little relationship to risk.[20]

Other credit-risk-reduction techniques could include the use of adequate capital ratios, collateral, and robust netting arrangements. Practices that clarify the relationship between dealers and customers and make the risk and return of a derivatives contract more transparent to customers would also enhance the markets' ability to operate under stressful circumstances.

Conclusions

The large volume of activity apparent in the central bank survey results underscores the over-the-counter derivatives markets' importance and resiliency. The year leading up to the survey was a period of stress, with numerous anecdotal reports of market participants' reassessment of their derivatives usage and a scaling back of activity in highly structured products. Despite the concerns about these products, the over-the-counter derivatives markets are now a permanent feature of the global financial system. The markets have withstood the test of several interest rate cycles and episodes of large changes in exchange rates. Market volumes have remained high regardless of particular market circumstances, specialized product offerings, or other transitory factors.

Another indication of the markets' resiliency is the role of dealers in the aggregate as intermediaries. The survey data suggest that exposures to price risk from some end-users are ultimately passed through the markets to other end-users. The markets bring together diverse end-users with offsetting demands; therefore, dealers in the aggregate assume only small exposures to price risks in meeting customer demands.

Thus, dealers' price risk intermediation takes the form of intermediation between end-users themselves, rather than between end-users and dealers' cash market positions. This market structure suggests that the overall effect of the derivatives markets may be to modify and redistribute exposures to price risks in the financial system, rather than to leverage those exposures.

In addition, the survey data indicate that price shocks in the over-the-counter derivatives markets (even on a gross basis) will be smaller than price shocks in the cash markets. At the level of an individual market participant, however, the change in value of a derivatives contract could be relatively large because of the implicit leverage of derivatives contracts. The ability of derivatives contracts to leverage exposures and transform exposures from one risk

category to another underscores the importance of market participants' adoption of risk management and accounting and disclosure practices that can deal with such issues.

The analysis of the market value data from the survey provides only rough answers to questions about the role of derivatives in the intermediation of price risks in the economy. More precise answers require data on the price sensitivity of dealer positions by counterparty class. However, the production of such data in ways that would allow aggregation across dealers to produce market statistics may be too costly an exercise. Such statistics will not be feasible until dealers' internal risk management models are flexible enough to analyze exposures by type of counterparty.

Finally, we have not addressed the question of the ultimate impact of derivatives on the financial system. The large volume of activity apparent in the survey shows that a significant amount of price risk is being traded in the derivatives markets. But is this activity leading to a more efficient distribution of risks in the financial system and thereby contributing to the resiliency of financial markets? The survey data showing that dealers in the aggregate are intermediaries and that the market is two-sided (so that price risks are dispersed, rather than concentrated) lend support to an affirmative answer.

While inferences drawn from the survey provide some reassurance about the impact of derivatives on the financial system, other issues relating to the effects of the derivatives markets were not addressed. For example, the survey shed no light on the role of positive feedback in asset prices arising from dynamic risk management strategies (such as dynamic hedging and stop-loss limits). An issue here is whether a risk limit or stop-loss limit that is risk-reducing at the level of an individual firm has different general equilibrium properties for the markets as a whole. This and other issues regarding the general equilibrium effects of financial derivatives remain to be explored.

ENDNOTES

1. For additional discussion, see Chapter 2 of Bank for International Settlements (1995a) and Remolona (1992-93).

2. Their efficiency is due to their leveraged nature. In particular, the price risk exposure of a derivatives contract can be replicated by a position in a cash market asset (or assets) financed by a loan. Hence, the user of a derivatives contract can acquire exposure to underlying assets without investment of principal in those assets.

3. The U.S. part of the survey was conducted by the Federal Reserve. For additional details and results, see Bank for International Settlements (1995c) and Federal Reserve Bank of New York (1995).

4. The global figures in this section are from Bank for International Settlements (1995c).

5. The market size figures in the survey are larger than some other estimates. One reason for the difference is the comprehensive coverage of the survey. Another is the survey's inclusion of internal arm's-length transactions between affiliates, which are internal trades between affiliates that would otherwise have been made with an unrelated party. To the extent that some reporters experienced difficulty separating arm's-length interaffiliate trades from other trades with affiliates, the market totals in the survey could be larger than they should have been. Despite the differences among the various estimates of the markets' size, all estimates point to large markets.

6. For instance, some market participants will have contracts that offset their exposures in other contracts. Consequently, the total amount of all contracts, as in Table 1, will overstate the actual exposures in the markets. In the over-the-counter markets, a trader's offsetting contracts are not always extinguished, especially when each has been transacted with different counterparties. By contrast, for products traded on a futures exchange, two offsetting contracts of a trader are extinguished.

7. These figures are from Table 1 and Bank for International Settlements (1995b).

8. Credit market debt includes both securities market debt and bank loans. These figures are from Table 1 and Board of Governors of the Federal Reserve System (1995).

9. The replacement value of contracts with customers as reported by dealers is less than the market value of those trades as reported here because dealers typically focus on their own credit exposure (credit extended to customers). From a market perspective, however, the replacement value from the customer's view is also relevant. Consequently, the market value aggregation in the survey (Box 2), which also includes contracts that have positive value to customers, will be larger than the replacement value as reported by dealers.

10. The market value of outstanding over-the-counter derivatives contracts in large part reflects the change in the value of the contracts caused by changes in underlying risk factors, principally interest rates and exchange rates, since the contracts were originated. This relationship applies only "in large part" for two reasons. First, as is apparent from Table 1, equity and commodity derivatives represent only a small proportion of the over-the-counter derivatives markets. Second, some products, such as options, have an initial market value at origination, and the current market value would reflect but not equal the change in value since origination. Nevertheless, options represent only a small share of outstanding contracts.

11. The estimate of credit exposure here accounts for only the current credit exposure or replacement value of derivatives contracts (the amount at risk if default occurred today). The credit exposure in a derivatives contract also includes potential credit exposure, which is a measure of the potential increase in the current credit exposure caused by changes in the underlying asset price or risk factor over the remaining life of the contract.

12. See "Banks Are Succeeding" (1995) and year-end 1994 annual reports of derivatives dealers.

13. In addition to commercial banks, some securities firms were included in the survey.

14. While collateral can reduce credit exposures, the collateralization of all derivatives exposures could generate large demands for securities and funds for use as collateral. To the extent that some of the liquidity supporting collateral might be supplied by bank credit lines, some credit exposure would merely be shifted from one place to another.

15. Net market value of outstanding contracts is defined as the gross positive market value minus the gross negative market value of contracts, from the perspective of reporting dealers.

16. The variability of exposures at the level of individual firms is apparent in the dispersion of firms' net market value ratios. These ratios are the net market value of a firm's contracts as a proportion of the value of either the positive or the negative market value contracts, whichever is smaller in absolute value. For over-the-counter interest rate contracts booked in the United States, one-quarter of the reporting firms had a net market value ratio of 4 percent or less; at the other extreme, one-quarter of the firms had a net market value ratio of 50 percent or higher. The degree of balance in a firm's position was related to its size. For the

ENDNOTES (*Continued*)

Note 16 continued
25 percent of reporting firms with the largest books, the net market value ratio was 15 percent on average. However, for the 25 percent of reporting firms with the smallest books, the net market value ratio averaged 42 percent (after dismissing one outlier).

17. This proportion, however, seems large even after consideration of intermediation issues. Other explanations for the large interdealer share would include the dealers' own use of derivatives for hedging in their nondealer or traditional banking activities and proprietary trading.

18. This line of argument assumes that maturity differences between long and short positions were not significant. This assumption is consistent with the maturity data that were available in the survey.

19. See, for example, Group of Thirty (1993), Board of Governors of the Federal Reserve System (1993), and Basle Committee on Banking Supervision (1994).

20. See, for example, Bank for International Settlements (1994) and Federal Reserve Bank of New York (1994).

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