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Corporate Refinancing in the 1990s

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U.S. corporations have floated stocks and bonds in unprecedented amounts in the past year. Private firms going public, public firms growing fast, and mature firms running losses have all sold shares on Wall Street. And as long-term interest rates have dropped, corporate treasurers have flooded underwriters with notes and bonds even though short-term borrowing has remained much cheaper.

Last year's full-scale return of U.S. firms to their traditional role as sellers of equity decisively reversed seven extraordinary years of firms' buying their own and one another's equity. After 1984 only the most conservative corporations refrained from increasing leverage. Indeed, management often found it in its own interest to pile on debt in order to discourage corporate raiders from boot-strapping their way into the executive suite with borrowed money.

The about-face of corporate treasurers from retiring to floating equity in 1991-92 has caught the attention of policymakers trying to understand the anemia in the U.S. economy since the Gulf War. Observers have pointed to the preoccupation of U.S. firms with reducing debt as the chief source of the firms' extraordinary caution in planning fixed investment, in managing inventories, and especially in taking on new employees. Obsessed with the risks of debt, many firms use higher business cash flows produced by any spending impulse in the economy to pay down debt faster rather than to invest or to hire. For example, the 5 percent rise in consumer spending in the first quarter of 1992 did not lead to a surge in production and employment.

This article looks beyond aggregate equity issuance to identify firms selling equity and the factors motivating them. It then assesses the progress of corporate refinancing by quantifying the interest savings achieved through equity issuance, bond calls, and bond sales. Particular attention is given to the relative effectiveness of corporate refinancing and lower short-term interest rates in easing the interest burden on U.S. corporations' cash flows.

We find that surprisingly few of the corporations now tapping equity investors are seeking funds for the purpose of expanding business operations. Many firms have returned to the equity market because the debt they took on in the late 1980s has proved difficult to manage. When bankruptcies surged and bond investors and banks tightened credit to highly leveraged firms, organizers of leveraged buyouts welcomed new equity investors. In addition, unprofitable firms, especially industrial firms that built up finance company subsidiaries in the 1980s, have sold equity to offset weak cash flows and to retain their access to commercial paper funding. Thus, much of the record financing has served to strengthen corporate balance sheets, to unburden cash flows of the weight of debt service, and to forestall costly credit rating downgrades.

Our analysis further suggests that in the aggregate, corporate refinancing has only modestly eased the interest burden on corporate cash flows. Equity sales and bond calls alone would have reduced the claim of interest by 1 percent of cash flows. But because corporate treasurers have replaced bank debt with tens of billions of bond debt at a time when long-term rates stand at twice short-term rates, they have given up much of the interest savings from equity sales and bond calls.

The reduction of interest rates, rather than corporate

restructuring, has done the heavy lifting in unburdening corporate cash flows of interest payments. Indeed, lower rates have done ten times the job of corporate refinancing. Put differently, corporate refinancing at its 1992 rate is lowering the interest burden of corporate America only as much as a (permanent) 45 basis point cut in short-term rates.

Behind the record-breaking flotation of stocks, therefore, we find corporate treasurers trying to cope with the debt buildup of the 1980s. Their activities in the stock and bond markets, however, have partially offset each other. As a result, lower short-term interest rates over the last two years have freed up corporate cash flows much more than the labors of corporate treasurers and their investment bankers.

Motives for restructuring

Estimating how long financial restructuring will continue requires an understanding of the short-term and long-term motives behind the process. U.S. corporations have seized the opportunity to infuse equity into their capital structure in 1991-92 both for cyclical reasons and for reasons relating to the extraordinary developments in U.S. corporate finance in the 1980s. The 1991-92 period resembles 1982-83, the corresponding phase of the prior business cycle, in two respects: stock prices rallied to mark the end of a recession, and corporations, including heretofore private firms, issued equity aggressively. But 1991-92 also differs from the earlier period in important features. In the 1980s many U.S. corporations leveraged up, and some firms rapidly expanded into financial services through their finance companies. These developments carried unusual risks, which manifested themselves in 1989-90 and motivated treasurers to delever their firms' finances aggressively.

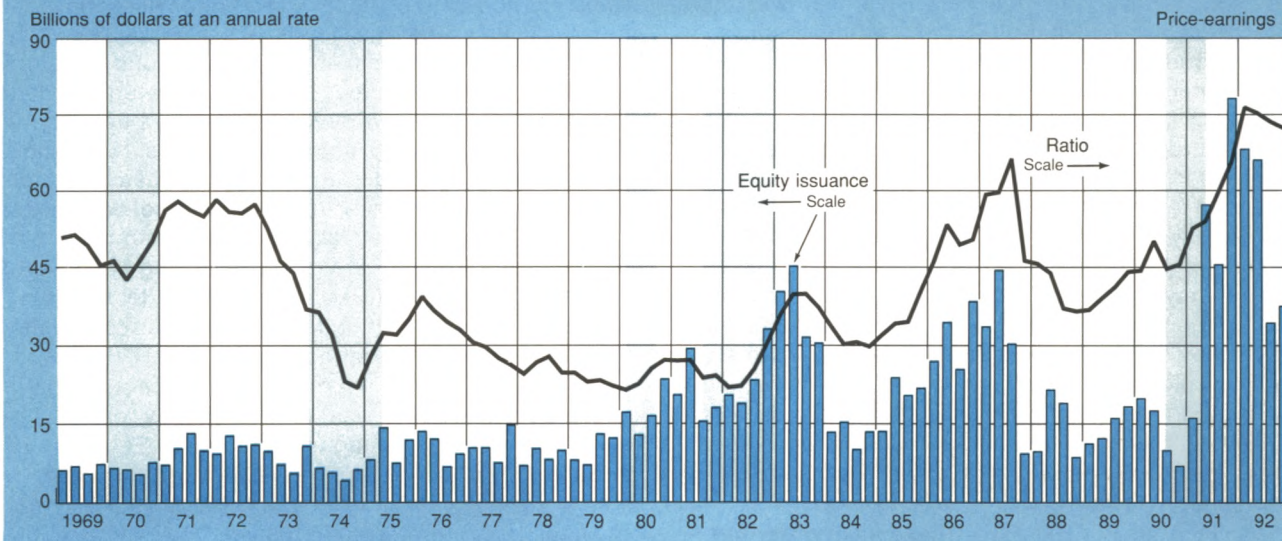
Cyclic influences: the 1982-83 record

Both demand- and supply-side forces contribute to the rise in equity issuance when a recession ends. On the demand side, stock market investors, anticipating an upturn in the economy and an associated surge in earnings, bid up prices relative to current earnings. Declining interest rates reinforce the effect of higher anticipated earnings on price-earnings ratios as investors capitalize anticipated earnings at a higher rate. On the supply side, corporate treasurers readily issue shares into a more buoyant market to augment cyclically low cash flows.

Chart 1

Gross Public Equity Issuance and Price-Earnings Ratio of the Standard & Poor's 500 Companies

U.S. Nonfinancial Corporations



Source: Board of Governors of the Federal Reserve System.

Note: Shaded areas indicate recession periods designated by the National Bureau of Economic Research.

After the 1981-82 recession, these forces combined to produce an unusually timed burst of equity issuance (Chart 1) that reduced the burden of interest payments on U.S. corporations' cash flows. With little equity being withdrawn through debt-financed mergers or share repurchases, U.S. nonfinancial firms' net equity issuance ran at an annual rate of $15 billion in the eighteen months between July 1982 and December 1983. This issuance of equity, given the high interest rates then prevailing, saved the issuers some $3 billion in interest payments by the fourth quarter of 1983, and sliced ½ of 1 percentage point off the ratio of interest to cash flow.

U.S. corporations' resort to equity finance in 1991-92 bears some resemblance to equity issuance in 1982-83. The rates of gross and net equity issuance are about double those of the earlier period, but taking account of economic growth and inflation in the intervening years narrows the difference. Owing to the higher interest rates prevailing in 1982-83, the interest saved in relation to corporate cash flows during the earlier cycle was comparable to that saved in the recent period. The current surge of equity issuance is distinguishing itself, however, by its composition and longevity, and by the high price-earnings ratios underpinning it.

The hangover of the leveraging of the 1980s

The outsize accumulation of corporate debt in the 1980s, the greater than anticipated difficulty of servicing it, and the resulting unprecedented pileup of business bankruptcies have also spurred treasurers to issue equity in the 1990s.[1] After the leveraging wave of the 1980s, many managers of large U.S. firms sought protection under Chapter 11 of the bankruptcy code. In 1990, the number of large company bankruptcies—that is, those involving more than $100 million in liabilities each—reached twenty-four and accounted for an aggregate of over $27 billion in liabilities (Chart 2). The number of large filings rose in 1991 to thirty-one bankruptcies, although total liabilities fell off to $21 billion. In 1992, the third year of extraordinary attrition of large companies, the number of large bankruptcies declined sharply but the debts involved only edged down.

Our attempt to piece together a comprehensive measure of default across the whole corporate sector shows an arresting departure from the difficulties faced by corporations in the previous business cycle. In 1982 and 1983, corporate defaults on bonds, bank loans, finance company loans, and other liabilities reached the range of ½ to 1 percent of liabilities and stayed there through 1987 as recession rolled through the farm belt and oil fields (Chart 3). But in 1991, the default rate almost doubled its earlier peak.[2]

Evidence suggests that in 1990-92, U.S. corporations found managing their debt in a period of weak cash flows more difficult than anticipated. Perhaps managers took seriously the argument that highly leveraged firms with weak cash flows could generally reorganize their debt without resorting to bankruptcy.[3] This argument held that creditors would grab the controls and pull highly leveraged firms out of a nosedive while considerable value still remained in the firm. That is, because creditors of a very leveraged firm would, by definition, be exposed to loss early on as the value of a firm dropped, they would have more incentive than the creditors of an unlevered firm to intervene early in a troubled firm. The argument concluded that creditors would avoid the deadweight losses of bankruptcy by collectively reducing their claims without resorting to the courts. The argument ignored the difficulty of forging an agreement among different classes of creditors, a problem that was worsened by the proliferation of creditor classes during the leveraging boom of the 1980s.

Recent research has confirmed that the strategic interaction of multiple classes of creditors has made it harder for firms to manage their debt. A study of distressed firms that had issued junk bonds in the 1970s and 1980s found that the weakness of cash flow had no power to predict Chapter 11 filings. The complexity of the capital structure, as measured by the number of public debt issues outstanding or the number of priority tiers among claimants, had considerable predictive

[1]See Edward J. Frydl, "Overhangs and Hangover: Coping with the Imbalances of the 1980s," Federal Reserve Bank of New York *Annual Report 1992*; and Edward J. Frydl, ed., *Studies on Corporate Leveraging*, Federal Reserve Bank of New York, September 1991.

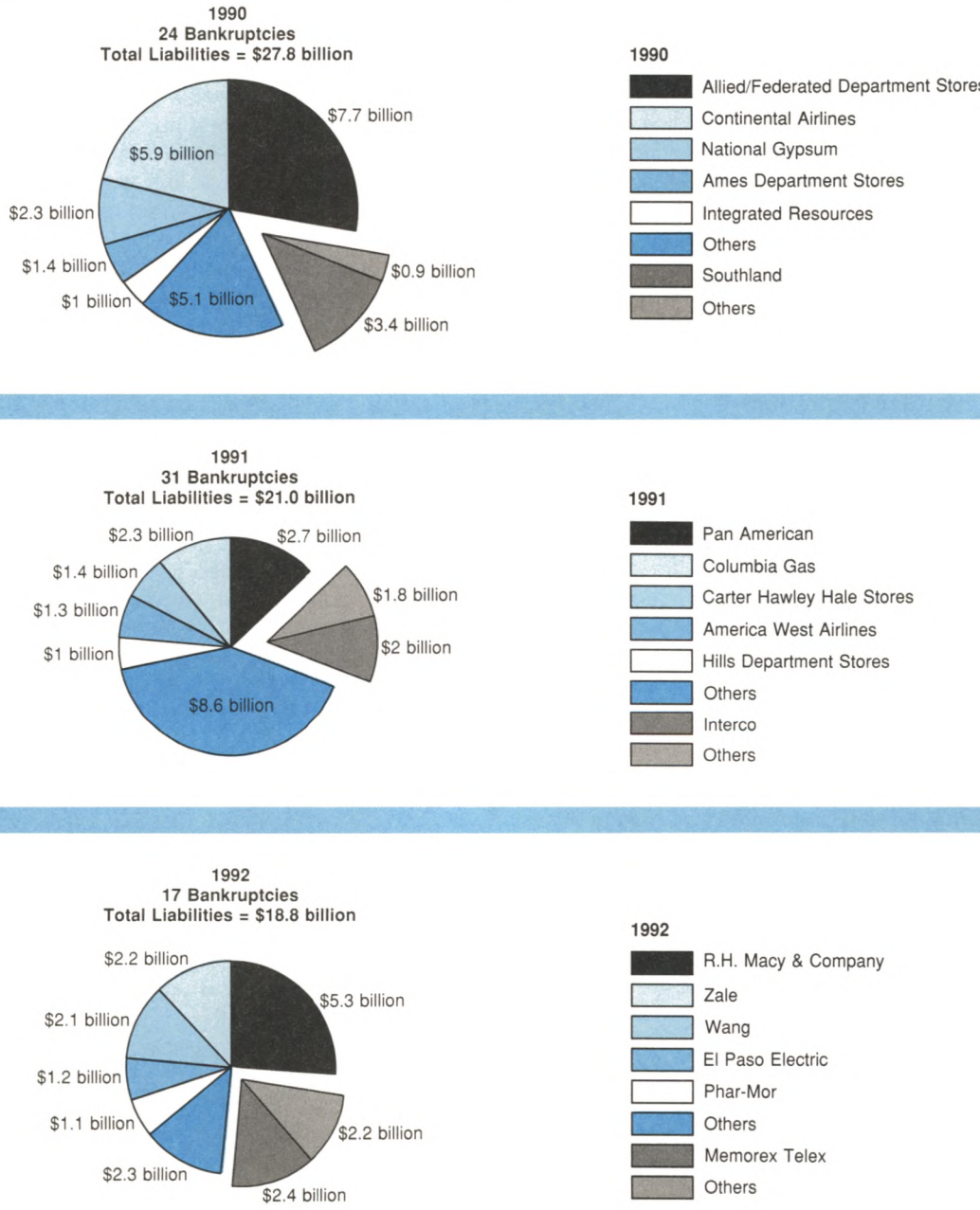
[2]The numerator, nonfinancial corporate defaults, combines data from two sources: Dun & Bradstreet's *Monthly Business Failures* and First Boston's annual *High Yield Handbook*. Dun and Bradstreet's publication provides data on business failure liabilities (which do not include any long-term, publicly held obligations) by industry. The first component of nonfinancial corporate defaults consists of Dun & Bradstreet's annual total for U.S. failure liabilities less the annual totals for finance, insurance, real estate, and agriculture. The second component is the difference between the total value of bonds going into default and the defaults of bonds issued by financial firms. First Boston's *Handbook* contains the data for bond defaults. For the years 1977-88, First Boston provides one default total, covering the entire period, for each business sector. The 1977-88 total for financial sector defaults constituted 5.1 percent of all defaults for the period; therefore, the value of bonds issued by financial firms was estimated as 5.1 percent of the value of bonds going into default each year over this period. After 1988, First Boston gives sector totals on a year-by-year basis. Chart 3 shows the sum of the adjusted Dun & Bradstreet and First Boston data as a percent of the sum of total credit market instruments and total trade debt for nonfinancial corporate business as reported in the flow of funds data issued by the Board of Governors of the Federal Reserve System.

[3]Michael C. Jensen argued that bankruptcy had been privatized in testimony before the House Ways and Means Committee, *Tax Policy Aspects of Mergers and Acquisitions: Hearings*, 100th Cong., 1st sess. (January 31; February 1,2; March 14,15, 1989), pp. 412-14.

Chart 2

Major U.S. Corporate Bankruptcies, 1990 to 1992

Liabilities over $100 Million



Note: Separated portion of each pie represents prepackaged bankruptcies.

power, however.[4] Junk bond issuers and their investment bankers appear to have misjudged how multiple creditor classes would jinx workouts in the event of distress.

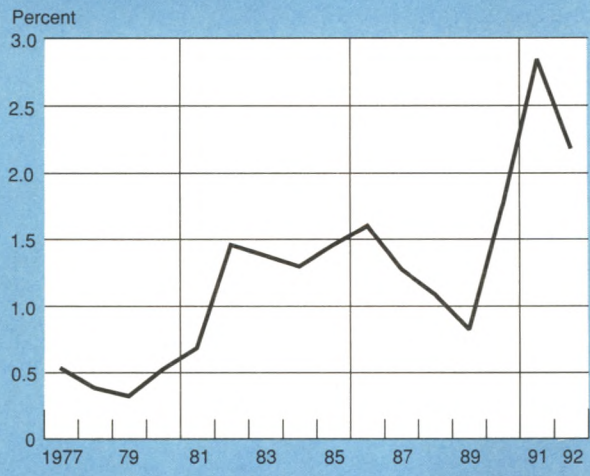
The rise of the prepackaged bankruptcy (Chart 2) attests to the difficulty of achieving the near-unanimity among creditors necessary for less costly debt restructurings outside of bankruptcy. When a leveraged firm with a complex debt structure encounters difficulty in servicing its debt, bondholders are asked to exchange their claims for new ones that can more readily be serviced. When too many creditors in one or more classes hold out, blocking the restructuring, the firm enters bankruptcy with a prepackaged plan of reorganization that can be enforced under the bankruptcy court's majority rule provisions. Although the prepackaged bankruptcy may force a minority of holdouts to accept a deal, it nevertheless burdens firms with legal costs and disrupts business relations.

In response, perhaps, to accumulating experience, corporate treasurers gave signs as early as mid-1989 that they were backing away from borrowing and share repurchasing as strategies for boosting their share prices. A survey conducted then of 118 firms with revenues in excess of $1 billion listed strategies for creating shareholder value in three categories and asked which ones the firms had pursued in the past and which they were currently contemplating.[5] In the capital structure category, 66 *had* chosen to "expand utilization of debt in capital structure" but, going forward, only 45 contemplated so doing. Similar reactions to "inaugurate/expand a share repurchase program" were recorded: 63 had pursued this course but only 46 foresaw so doing. The author of the survey concluded, "surprisingly, interest in reducing the cost of capital through expanding the use of leverage is waning. And less reliance is being placed on stock repurchase programs as a future avenue to enhance value." The record of defaults makes the change of attitude on the part of corporate treasurers unsurprising.

[4]Paul Asquith, Robert Gertner, and David Scharfstein, "Anatomy of Financial Distress: An Examination of Junk Bond Issuers," unpublished paper, July 1992.

Chart 3

Nonfinancial Corporate Defaults as a Share of Total Liabilities



Sources: Dun & Bradstreet, *Monthly Business Failures*; First Boston, *High Yield Handbook*; Board of Governors of the Federal Reserve System, Flow of Funds data; Federal Reserve Bank of New York staff estimates.

Notes: Estimate for 1992 annualizes total high-yield defaults as of June 1992 as well as current failure liabilities and total liabilities as of 1992-III. Defaults combine Dun & Bradstreet "failure liabilities" and First Boston bond defaults by nonfinancial firms. For the years 1977-88, financial sector defaults are assumed constant at 5.1 percent of total bond defaults.

Firms with major finance companies and access to commercial paper

Another important reason for the extraordinary current burst of equity issuance is the need felt by a minority of industrial and commercial firms to buttress the balance sheet condition of their finance company affiliates. Finance company balance sheets generally grew faster than the economy in the 1980s, and finance companies owned by industrial firms tended to grow faster than their parent firms.[6] At the same time, finance companies' reliance on credit markets for funds increased in the 1980s. These developments combined to heighten the importance of retaining a high credit rating to keep access to the most credit-sensitive bond portfolios and, critically, to the commercial paper market.

Chrysler's experience illustrates the costs of a credit downgrade. When Chrysler Financial's commercial paper was downgraded to the second tier of prime, the firm had to turn to its banks for financing, at an immediate cost of something like ½ of 1 percentage point on the funds formerly raised from the commercial paper market. And when it came time for Chrysler to renegotiate its bank credit, the cost rose even further. The lesson was not lost on other financially strained firms with finance company affiliates.

[5]Allen J. Schneider, "How Top Companies Create Shareholder Value," *Financial Executive*, May-June 1990, p. 38. Precise data from the survey were provided by Schneider.

[6]See Eli M. Remolona and Kurt Wulfekuhler, "Finance Companies, Bank Competition, and Niche Markets," this *Quarterly Review*, vol. 17 (Summer 1992), pp. 25-38.

Tighter supply of credit for heavily leveraged firms

The junk bond market's seizure in late 1989 not only eliminated a source of leveraged finance but also increased the incentive for equity issuance owing to the structure of outstanding junk bonds. The largest leveraged buyout, that of RJR Nabisco, provides a telling example. Part of its debt consisted of so-called reset notes. This instrument promised to trade close to par owing to the periodic resetting of its interest rate. In late 1989, however, with junk bonds selling at a deep discount, the interest rate required at reset threatened to climb so high that it would push the firm into default. The need to refinance these notes spurred the issuance of equity by RJR Nabisco in February and April of 1991. In short, engineered into the stock of junk bonds were features that presumed the junk bond market's health;[7] that market's malady forced leveraged companies to resort to unexpected equity issuance.

The crisis in the junk bond market was reinforced by the tightening of bank credit in 1990. Banks with substantial claims on troubled real estate projects, as well as undercapitalized or downgraded banks, started to restrict commercial and industrial loans.[8] For companies seeking loans, this tightening of bank credit meant wider spreads over banks' cost of funds, stiffer collateral requirements, and in some cases sheer difficulty in obtaining funds. Equity finance then became more attractive on grounds of price and availability.

U.S. corporations' return to net issuance of equity

Through mergers and acquisitions, leveraged buyouts, and share repurchases, U.S. nonfinancial corporations removed more equity from the stock market than they issued into it from 1984 to 1990 (Charts 4 and 5). During that seven-year period, a net $640 billion dollars of equity was retired. Net retirements peaked at an annual rate of almost $200 billion, or about 7.5 percent of the total outstanding equity, in the fourth quarter of 1988.[9]

Positive net issuance returned in the second quarter of 1991 and totaled $18.3 billion for the year. For the first three quarters of 1992, U.S. nonfinancial corporations issued equity at a $31 billion dollar annual rate. This sum reflects not only a surge in gross new issuance but also a decline in debt-financed mergers and acquisitions, including a virtual disappearance of the leveraged buyout, and much-reduced share repurchasing. We first consider briefly the falloff in equity retirement through mergers and repurchases, and then take a

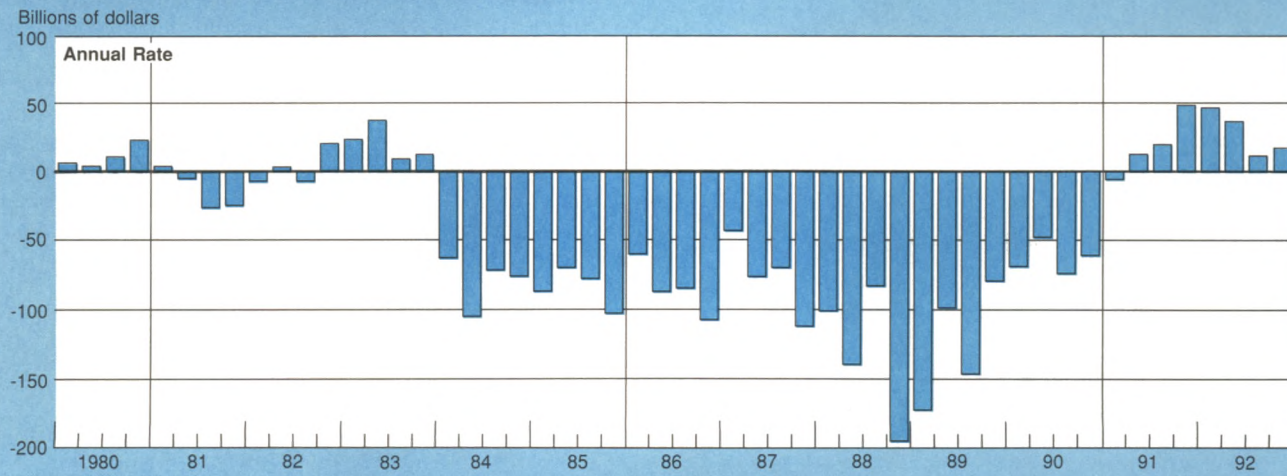
[7]See Andrew E. Kimball and Jerome S. Fons, "Coupon Events in 1991," Moody's Investor Service, February 1, 1991.

[8]Ronald Johnson, "The Bank Credit 'Crumble,'" this *Quarterly Review*, vol. 16 (Summer 1991), pp. 40-51.

[9]For a detailed analysis of equity retirements in the 1980s, see Margaret Pickering, "A Review of Recent Corporate Restructuring Activity, 1980-90," Board of Governors of the Federal Reserve System, Staff Study no. 161, May 1991.

Chart 4

Net Equity Issuance by U.S. Nonfinancial Corporations



Sources: Board of Governors of the Federal Reserve System, Flow of Funds data; Federal Reserve Bank of New York staff estimates.

close look at the extent and nature of equity issuance.

U.S. corporations' slackened retirement of equity

As U.S. corporations chip away at the overhang of debt built up in the late 1980s, the pace of decapitalization through mergers and acquisitions has slowed to rates observed before the break in behavior in 1984. By contrast, share repurchases, while also much reduced, give evidence of becoming a more enduring means of managing leverage and putting cash into shareholders' hands.

Debt-financed mergers and acquisitions

High share prices and tight credit for leveraged deals have curbed mergers and acquisitions involving the replacement of equity by debt. Well-capitalized firms account for much of the remaining merger activity, and with share prices high, treasurers are more inclined to use share exchanges in mergers. For example, ATT has paid for its acquisition of NCR with shares.

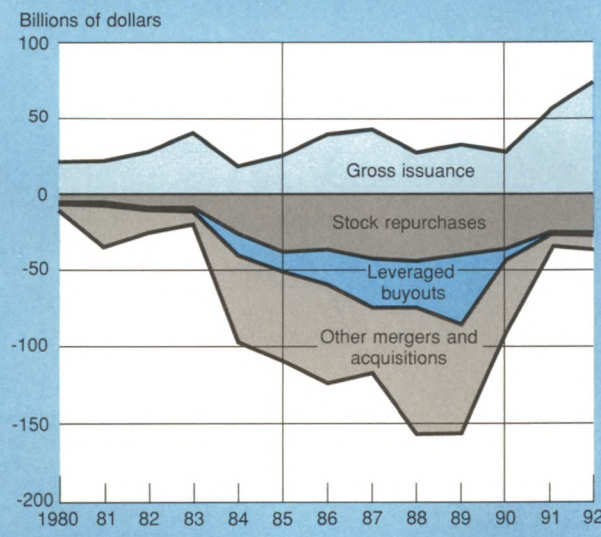
Leveraged buyouts. In a leveraged buyout (LBO), a small investor group, typically consisting of an LBO firm and a management team, takes on a large amount of debt to purchase the public equity of a company. In the largest and most publicized transactions of this type, a public corporation is taken private. Between 1984 and 1990, over 18,000 U.S. nonfinancial corporations underwent leveraged buyouts, and the total dollar value of these deals exceeded $250 billion (Chart 6). Of this sum, approximately $165 billion in equity, or about two-thirds of the total, was replaced with debt or otherwise retired.[10]

Since the peak in 1989, LBO activity has fallen off sharply—the result of a collapse in the junk bond market, the tightening of bank credit, and the surge in the ratio of stock prices to earnings or, more important, stock prices to cash flow. Transaction volume in 1990 was comparable to that in 1984 and 1985, but much less equity was retired in 1990 than in those earlier years. In the first half of 1992, the dollar value of LBO transactions was about $2.3 billion; at this pace, LBOs in 1992 amounted to only 7 percent of the 1989 level. Moreover, the deals appear to be somewhat less leveraged than they used to be, probably for the same reasons that explain the fall in activity. LBO activity is estimated to have retired about $1 billion in equity in 1992.

[10]Pickering, "A Review," p. 2.

Chart 5

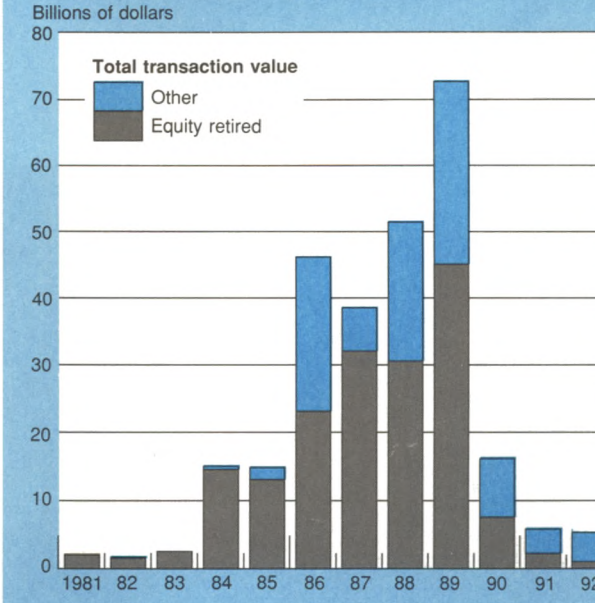
Components of Net Equity Issuance by U.S. Nonfinancial Corporations



Sources: Margaret Pickering, "A Review of Corporate Restructuring Activity, 1980-90," Board of Governors of the Federal Reserve System, Staff Study no. 161, May 1991; Board of Governors of the Federal Reserve System.

Chart 6

Equity Retired by U.S. Nonfinancial Corporations through Leveraged Buyouts



Sources: Securities Data Company; Board of Governors of the Federal Reserve System.

Other acquisitions. The total dollar volume of non-LBO mergers and acquisitions of U.S. nonfinancial corporations exceeded $1.2 trillion between 1984 and 1990 (Chart 7). Of this total, about $420 billion of equity, or roughly one-third, was retired.[11] Mergers and acquisitions other than LBOs have fallen off since 1989, though not as sharply as LBOs. Like LBOs, other mergers and acquisitions are now relying less on debt for their financing. Equity retirements from non-LBO mergers and acquisitions are estimated at $11 billion to $12 billion in 1992.

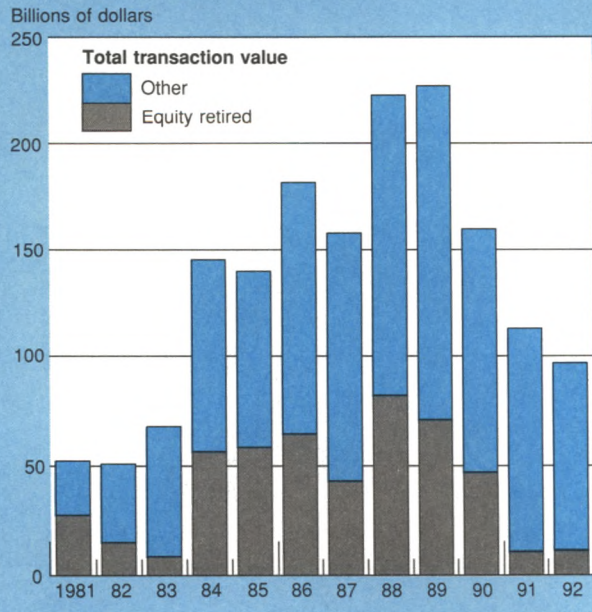
Stock repurchases

Share repurchases took off in 1984 as a defense against takeovers but give evidence of having found a broader, more lasting role in corporate finance. Repurchases, mostly quiet market operations but sometimes tender offers and occasionally greenmail at above-market prices, jumped from less than $10 billion per year in 1983 to $35 billion to $45 billion in 1984-90 (Chart 8). By 1991, however, defensive repurchases had become rare. Still, such disparate firms as Philip Morris and General Dynamics, apparently enjoying stronger cash flows than investment prospects, continue to repurchase shares in quantity to put cash in the hands of shareholders and to manage their leverage.

[11]Pickering, "A Review," p. 2.

Chart 7

Equity Retired by U.S. Nonfinancial Corporations through Mergers and Acquisitions



Sources: Securities Data Company; Board of Governors of the Federal Reserve System.

Notes: Acquisitions exclude leveraged buyouts but include asset takeovers and partial takeovers.

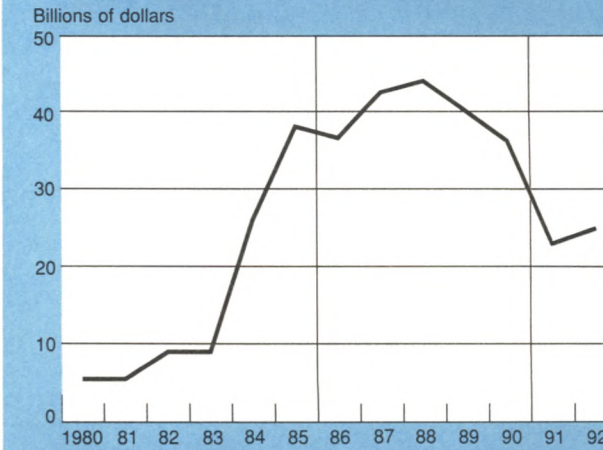
U.S. corporations' record flotation of new equity

U.S. corporations are taking advantage of the relatively high valuation of current earnings in the stock market. U.S. nonfinancial corporations issued $45 billion of new equity in the public markets in 1991 and $48 billion in 1992. The rate of equity issuance appears to have responded promptly to the market's valuation of a given stream of earnings (Chart 1). In particular, surges in gross equity issuance coincided with rising price-earnings ratios in 1982-83, 1985-87, and 1991-92. Both seasoned public corporations and firms issuing public stock for the first time (commonly termed initial public offerings or IPOs) tend to time their offerings to receive the most favorable prices for their shares.

While rising valuations have supported heavy stock issuance both in this cycle and in many previous ones, forestalling financial distress has emerged as a new motive in the recent surge of stock issuance. The spate of reverse LBOs (IPOs that partially unwind the high leverage of earlier LBO deals) and the heavy volume of both common and preferred share issues by firms running losses set the 1991-92 cycle apart from earlier cycles.

Chart 8

Stock Repurchases by U.S. Nonfinancial Corporations

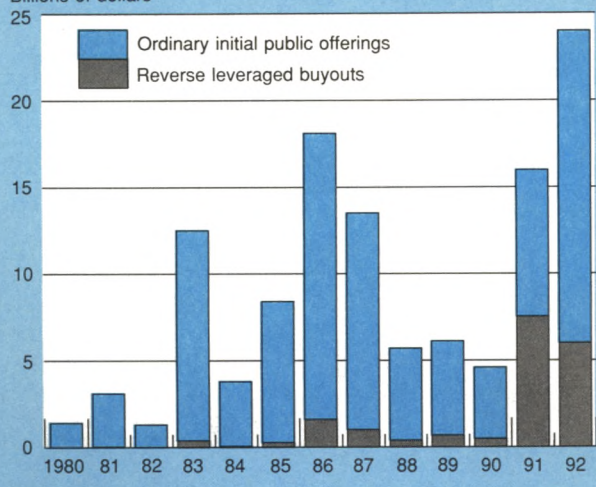


Source: Board of Governors of the Federal Reserve System.

Chart 9

Gross Proceeds of Initial Public Offerings and Reverse Leveraged Buyouts

Excluding Closed-End-Fund Initial Public Offerings



Source: Securities Data Company.

Ordinary IPOs

Gross proceeds of initial public offerings reached $16.5 billion in 1991 and a record $24 billion in 1992; ordinary IPOs (as opposed to reverse LBOs) accounted for $9 billion in 1991 and $18 billion in 1992 (Chart 9).

Even within a record year, the timing of IPOs closely tracked the market. Thus, IPO issuance stalled midyear owing to the weak performance of recent IPOs and growth stocks in general, as measured by the NASDAQ index (Chart 10). Consequently, many firms postponed, canceled, or repriced their offerings. IPOs surged after the election in November, when small and medium-sized firms' share prices jumped.

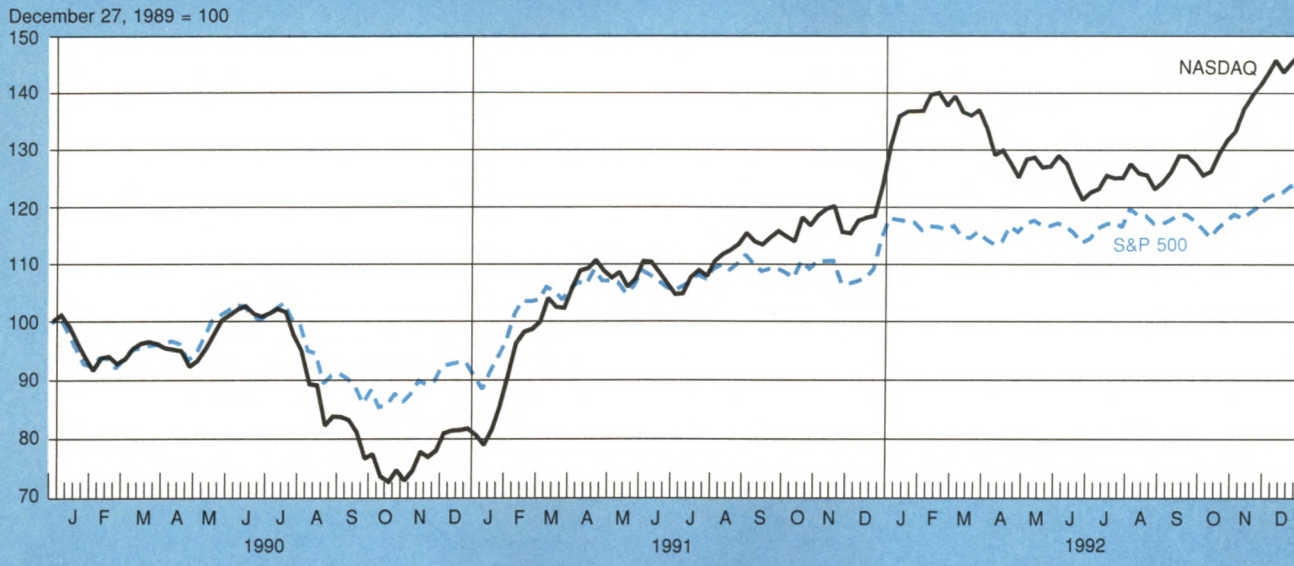
IPOs are generally thought to provide growing corporations with new funds for expansion and to offer private investors, such as venture capitalists and top management, a means of liquidating their holdings. An analysis of IPOs, excluding reverse LBOs, by U.S. nonfinancial corporations in 1991 and the first half of 1992 confirms this conventional view (Chart 11).[12] About 31 percent of

[12]We computed the allocation of proceeds by obtaining from Securities Data Company the following items for each offering—gross proceeds, offering price, underwriting spread, legal and administrative expenses, the number of primary shares, and a listing of the use of proceeds. We first determined expenses of the

Chart 10

Stock Price Performance

NASDAQ and S&P 500 Indexes



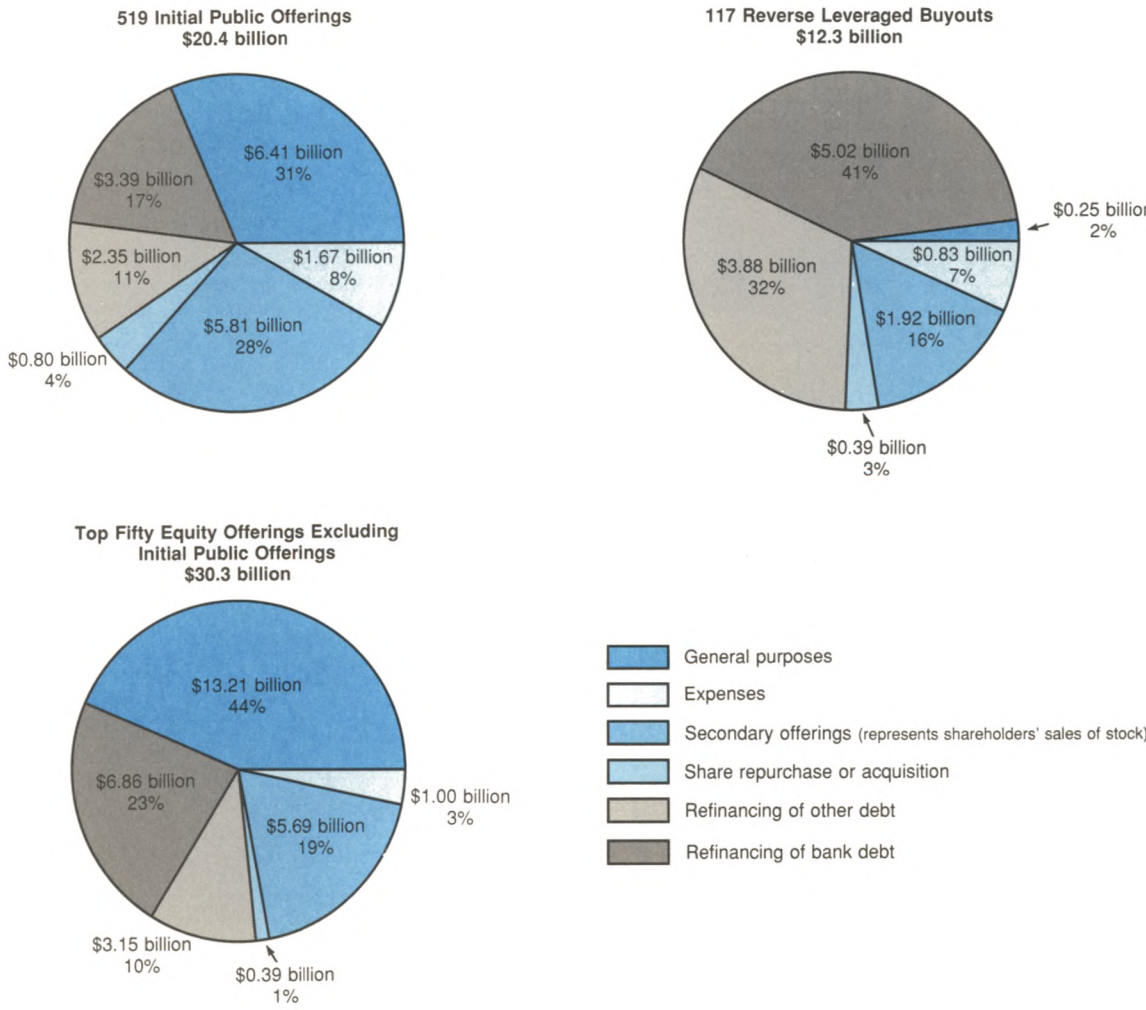
Sources: *Wall Street Journal*, *New York Times*, Standard & Poor's Corporation.

Footnote 12 (continued)
offering by adding legal and administrative expenses to the product of the gross proceeds and the underwriting spread, expressed as a percentage of the offering price. These expenses were assumed to be allocated pro rata among the primary and secondary components of the offering. Next we determined the net primary proceeds by multiplying the number of primary shares by the offering price and subtracting the portion of expenses that was allocated to the primary component. Net secondary proceeds were determined by subtracting expenses and net primary proceeds from gross proceeds. Lastly, we allocated net primary proceeds evenly among the primary uses listed. Therefore, if an offering with net primary proceeds of $100 million had listed "general corporate

Chart 11

Uses of Proceeds from Public Stock Offerings by U.S. Nonfinancial Corporations

1991 - June 1992



Source: Securities Data Company.

Note: Grey-shaded areas represent portion of proceeds devoted to refinancing.

gross proceeds were reportedly devoted to "general purposes," which includes new hiring and investment in new plant and equipment. About 28 percent of the offering value was "secondary," meaning that this fraction of the proceeds took out existing shareholders and thus was not available to the offering firms. In addition, about 28 percent of the proceeds went towards the retirement of debt (deleveraging).

Reverse LBOs

Reverse LBOs are distinguished from ordinary IPOs by more than the financial history of the issuer. The proceeds of the $7.5 billion raised in 1991 and the $6 billion raised in 1992 from reverse LBOs served very different purposes than the funds raised by ordinary IPOs. Only 2 percent went to general purposes, while almost three-quarters went to pay down debt. These observations confirm that the primary motivation for IPOs by LBO companies is the retirement of debt taken on in going private.

It was probably not the original intent of those taking companies private via LBOs to reverse them under the circumstances in which many such companies found themselves during the early nineties. Earlier reverse LBOs—such as that of Gibson Greeting Cards in 1983—cashed out the existing LBO partners. In recent reverse LBOs, by contrast, little of the proceeds was used to cash out existing shareholders. In particular, only 16 percent of the proceeds went to existing shareholders on average—much less than for regular IPOs or for the more successful LBOs in the past. Difficulties in meeting debt payments, in refinancing junk bonds, and in selling assets at planned prices, combined with a window of opportunity in the stock market, seem to have led to premature public equity issuance by the recent LBOs.

Loss-incurring and deleveraging firms as issuers of seasoned public offerings

The composition of seasoned equity issuance in the past two years also has its unusual aspects. New offerings of stock by U.S. nonfinancial firms that were already public totaled almost $30 billion in 1991; in 1992, such issues amounted to $24 billion.[13] Approximately two-thirds of the transaction value for the period January 1991 through June 1992 was concentrated among the top fifty deals (Table 1). An analysis of those deals shows that approximately 44 percent of the gross proceeds went toward general corporate purposes, much more than the 31 percent of IPO proceeds directed toward the same end (Chart 11). Nevertheless, this finding does not imply that seasoned companies are investing more in plant and equipment than are IPO companies.

The largest group of the seasoned firms offering equity consists of firms losing money at the time of issuance, epitomized by the auto makers. In these cases, funds devoted to "general corporate purposes" are probably being used to make up for sub par cash flows, not to finance expansion.

We argued above that unprofitable firms owning major finance company subsidiaries faced particularly sharp incentives to sell equity to protect their prime commercial paper ratings and thereby to maintain their access to commercial paper funding. We observe that no fewer than five firms with a sizable finance company subsidiary appear on the list of unprofitable stock issuers (Table 1). To test the relationship between profitability and equity issuance among firms with major finance companies, we arrange industrial and commercial companies that owned any of the fifty largest finance companies by profitability and stock issuance (Table 2).[14] No less than five-sixths of the value of equity sales of this group were by firms suffering losses. By number, firms running losses were as likely as not to issue equity, while only one profitable firm among twelve did so.

Deleveraging has been another force driving equity issuance. Among the top fifty seasoned issuers of stock, high-leverage companies—those with a ratio of debt to book equity above 70 percent—represented the second largest group. These firms were undoing all the various modes of leveraging observed in the 1980s. Some of these firms had swelled their debt by acquisitions (Time Warner), others were following up on well-received reverse LBOs (Safeway and Duracell), and still others were paying down debt incurred in massive and defensive repurchases (Goodyear).

Ordinary motives are represented by secondary issues and by issues for expansion. When stock prices are high in relation to earnings, founding families cash out, as at Reader's Digest. Or a rapidly growing firm

Footnote 12 (continued)
purposes" and "refinancing bank debt" as uses, $50 million was assumed to be allocated to each, although in actuality any allocation of the $100 million would have been possible. The size of the errors, in percentage terms, produced by this approximation is lessened by the large number of observations and by the fact that almost two-thirds of the offerings listed only one use of proceeds. Offerings that listed no primary use of proceeds were assumed to allocate those proceeds as did other offerings of the same type (IPO, reverse LBO, or other offering).

[13]Securities Data Company.

[14]Drawing on the list of the fifty largest finance companies that was published in the December 11, 1991, issue of the *American Banker*, we examined the profitability of twenty-two industrial and commercial parents of twenty-three finance companies (Ford owns two finance companies). We eliminated Macy's both because it sold its credit card affiliate to General Electric and because it entered bankruptcy.

Table 1

Composition of Top Fifty Equity Issues by Seasoned Firms, January 1991 through June 1992

Firm or Transaction Type	Ranking by Size	Firm	Date	Type†	Amount
Losses	2	General Motors	May 20, 1992		2,150
	3	Ford Motor	November 13, 1991	p	2,128
	5	General Motors	February 11, 1992	p	1,350
	7	Delta Air Lines	June 24, 1992	p	1,050
	9	General Motors	December 5, 1991	p	1,000
	11	General Motors	June 26, 1991	p	641
	12	Westinghouse Electric‡	June 3, 1992	p	559
	13	Tenneco‡	December 17, 1991	p	516
	20	USX-Marathon Group§	January 14, 1992		461
	21	Westinghouse Electric	May 9, 1991		451
	24	Federated Department Stores	May 20, 1992		437
	27	Delta Air Lines	April 8, 1991		416
	30	AMR	January 30, 1992		371
	33	Chrysler	October 2, 1991		349
	38	Texas Instruments	September 11, 1991		306
	43	Burlington Northern‡	November 19, 1991		257
	48	Viacom‡	June 4, 1991		239
	49	Texas Utilities	January 31, 1991		218
	50	AMR	January 24, 1991		210
				Subtotal	13,109
Deleveraging	1	Time Warner	July 5, 1991		2,760
	4	RJR Nabisco	November 1, 1991	p	2,025
	6	Sears Roebuck	February 20, 1992	p	1,075
	10	Dillard Department Stores‖	April 3, 1991		789
	17	York International Corporation	March 26, 1992		478
	18	International Paper	January 16, 1992		466
	19	Goodyear Tire & Rubber	November 13, 1991		465
	22	Freeport-McMoRan Resource	February 4, 1992		449
	29	Black & Decker	April 24, 1992		398
	32	IBP‖	September 5, 1991		360
	34	Sears Roebuck	November 1, 1991		325
	35	Santa Fe Pacific‖	June 4, 1992		319
	39	Colgate-Palmolive	November 19, 1991	p	300
	40	Safeway	April 9, 1991		287
	41	Duracell International	October 21, 1991		276
	45	The Vons Companies	May 30, 1991		251
				Subtotal	10,736
Secondary offerings/repurchases	14	ConAgra	September 26, 1991		507
	15	National Health Laboratories	April 30, 1991		501
	16	Reader's Digest Association	June 10, 1991		499
	23	Tandy	February 14, 1992	p	443
	25	ConAgra	May 28, 1992	p	425
	28	Marlon Merrell Dow	May 12, 1992		410
	31	Long Island Lighting	May 21, 1992	p	363
	37	Reebok International	December 10, 1991		310
	42	National Health Laboratories	February 13, 1992		259
	47	Santa Fe Pacific	October 8, 1991		242
				Subtotal	3,959
Expansion	8	K Mart	August 16, 1991	p	1,012
	26	Amerada Hess Corp.	June 9, 1992		425
	36	Home Depot	April 12, 1991		315
	44	MGM Grand	July 16, 1991		256
	46	Browning-Ferris Industries	June 10, 1992		244
				Subtotal	2,252
				Total	30,056

Sources: Securities Data Company, Compustat, Reuter's Textline.

†*p* indicates preferred.
‡Debt retirement is listed as use of funds.
§Losses are at consolidated level.
‖Parent company used funds to retire debt.

such as K Mart comes to market for the wherewithal to open new stores and to hire more people. But stock issues by such firms account for less than a third of the top fifty issues.

This look at the top issuers of equity indicates that loss-incurring and quite leveraged firms bulk large on the list. In the next section, we take a look at the largest 600 firms, some of which issued equity while others did not, and find that 1991 did introduce a change in the character of equity-issuing firms.

Equity issuance, leverage, and profitability

To test the hypothesis that the recent boom in equity issuance has been part of a general deleveraging trend, we drew selected operating and balance sheet statistics for the largest U.S. nonfinancial corporations from the Compustat data base. For each year from 1988 through 1991, the 600 firms with the largest assets were singled out. They were then broken up into three groups—the 50 with the largest positive net equity issuance, the 50 with the largest negative net equity issuance, and the other 500.

For each company and each year, six ratios were constructed. To measure the leverage of each company, we took the ratio of interest to cash flow and the ratios of interest-bearing debt to the book and market values of equity. To measure the profitability of each company, we took the ratios of net income to book and market values of equity. However, to the extent that the rank of a company's income to market equity differs from the rank of its income to book equity, the former may more accurately serve as a proxy for the cost of capital. Finally, to measure the magnitude of investment in plant and equipment, we took the ratio of capital expenditures to assets.[15]

Table 3 presents the median of each statistic for each group in each year. For the two extreme groups of 50 each, we also present the *p*-value corresponding to the nonparametric Wilcoxon rank sum test of the null hypothesis that the ratio for the group of 50 is the same as the ratio for the middle group of 500 (Table 3). The *p*-value is the probability that, given the observations, the medians are the same. Consequently, *p*-values close to zero indicate significant differences, with almost no probability that the medians are the same.

The largest net issuers do not appear to have differed consistently from other large firms in their profitability or debt burden from 1988 through 1990. In 1991, however, notable differences emerge between the largest net issuers and the rest of the pack. The large issuers are shown to be significantly less profitable and more highly leveraged by all

[15]The ratios of capital expenditures to fixed assets could have been used, but it would have "normalized" for the capital intensity of operations. The intent was to capture those companies that invested heavily, whether or not they were in capital-intensive industries.

Table 2

Industrial Firms with Finance Companies: Profitability and Equity Issuance in 1991-92

	Firms reporting a profit†	Firms reporting a loss†	
Firms not issuing stock	General Electric	IBM	
	ITT	Deere & Co.	
	AT&T	Caterpillar	
	Xerox	Greyhound	
	Philip Morris	Navistar	
	McDonnell Douglas		
	Pitney Bowes		
	J.C. Penney		
	Textron (Avco Financial Services)		
	Whirlpool		
	GATX		
Firms issuing stock (Amount issued in parentheses)	Sears Roebuck & Co. ($1.4 billion)	General Motors	($6.9 billion)
		Ford	($2.1 billion)
		Chrysler	($0.3 billion)
		Westinghouse	($0.5 billion)
		Tenneco	($0.5 billion)
		(Total)	($10.3 billion)

Notes: Computed chi-square statistic is 4.77 with 1 degree of freedom. A statistic in excess of 3.84 allows the rejection of the null hypothesis that the equity issuance of a firm and its profitability are independent factors with a probability of error less than .05. Equity issuance by General Motors includes $0.5 billion in Hughes Aircraft shares.
Sources: *Wall Street Journal*, *New York Times*, Securities Data Corporation.
†1991 net income.

measures. These observations lend strong support to the claim that equity issuance has been concentrated among those companies that need it most.

In 1991 a behavioral symmetry arises—large equity issuers and repurchasers are mirror opposites in profitability and debt burden. For each year from 1988 through 1991, those companies that were the largest net repurchasers of equity show significantly more profitability as measured by the ratio of income to book equity and a significantly lighter debt burden as measured by the ratio of interest to cash flow. However, these companies appear to be no more profitable than average if the ratio of income to market equity is used, except perhaps in 1989. This seeming anomaly arises because income to market equity better proxies the cost of capital than profitability. The explanation would then be that while the largest repurchasers were more profitable, they did not have to meet a higher required rate of return on equity than other companies. In 1990 and 1991, the large net repurchasers also show a significantly lighter debt burden as measured by the ratios of debt to equity. Given these observations, it would appear that, of those companies that remained public, the ones that engaged most in stock repurchases were in fact the ones that could best afford it. It is also interesting to note that net equity retirements by more profitable and less leveraged companies continued through 1991, even as a general deleveraging trend took hold in the rest of the corporate sector.

Finally, large issuers and large repurchasers do not consistently differ from the average in the intensity of their capital expenditures. This finding lends support to the claim that equity financing since the late 1980s has been directed primarily toward financial restructuring as opposed to investment.

Interest savings from equity issuance at its current rate

As noted above, net equity issuance for U.S. nonfinancial corporations reached $18.3 billion in 1991, its first positive showing since 1983. Since equity replaces debt, the interest savings at an annual rate by the end

Table 3

Leverage, Profitability, and Investment by Magnitude of Net Equity Issuance

Sample: Six-hundred Largest U.S. Nonfinancial Corporations

		1988	1989	1990	1991
Debt burden measures (ratios)					
Interest/ cash flow	50 largest net issuers	18.06% (0.100)	20.96% (0.802)	18.32% (0.147)	49.89% (0.000)
	Middle 500	23.44%	24.05%	25.72%	25.82%
	50 largest net repurchases	14.00% (0.004)	14.52% (0.002)	16.07% (0.000)	10.26% (0.000)
Interest-bearing debt/ book value of equity	50 largest net issuers	69.39% (0.130)	89.80% (0.448)	96.32% (0.725)	154.68% (0.000)
	Middle 500	83.11%	90.93%	93.19%	90.55%
	50 largest net repurchases	77.87% (0.663)	74.54% (0.090)	59.04% (0.007)	49.31% (0.000)
Interest-bearing debt/ market value of equity	50 largest net issuers	38.07% (0.107)	46.08% (0.871)	48.19% (0.081)	86.02% (0.012)
	Middle 500	59.96%	53.58%	73.96%	58.07%
	50 largest net repurchases	44.96% (0.122)	35.37% (0.030)	35.61% (0.000)	19.02% (0.000)
Profit measures (ratios)					
Net income/ book value of equity	50 largest net issuers	14.22% (0.486)	11.28% (0.075)	12.98% (0.278)	6.04% (0.001)
	Middle 500	13.48%	13.10%	11.78%	10.33%
	50 largest net repurchases	18.00% (0.000)	16.87% (0.000)	15.04% (0.000)	17.71% (0.000)
Net income/ market value of equity	50 largest net issuers	7.30% (0.183)	6.14% (0.069)	5.94% (0.029)	3.16% (0.000)
	Middle 500	8.88%	7.11%	7.67%	5.14%
	50 largest net repurchases	9.04% (0.432)	8.62% (0.025)	7.47% (0.880)	4.55% (0.958)
Investment intensity (ratios)					
Capital expenditures/ assets	50 largest net issuers	6.90% (0.977)	7.54% (0.875)	8.72% (0.023)	5.78% (0.162)
	Middle 500	6.29%	7.24%	6.96%	6.50%
	50 largest net repurchases	6.92% (0.975)	7.00% (0.699)	7.47% (0.251)	7.02% (0.451)

Source: Compustat

Notes: The table shows median values. The *p*-values of Wilcoxon rank sum tests for difference of medians are in parentheses. The *p*-value is the probability of observing a value as different from the middle 500's median under the null hypothesis that the medians of the two groups are the same. Consequently, *p*-values close to zero indicate significant differences in median values.

of the year can be calculated as the product of $18.3 billion and the marginal interest rate of 8 percent, or $1.5 billion (Table 4). For 1992, the net issuance of equity is estimated to have been $32 billion, yielding annualized interest savings of $2.4 billion when an average marginal interest rate of 7.5 percent on new debt is assumed (Table 4).

These measures of the savings from equity issuance do not attempt to capture the full savings on debt that result from equity issuance. For instance, when an industrial firm that owns a finance company sells equity and succeeds in maintaining its access to the commercial paper market, it saves more interest payments than those associated with the debt directly replaced by equity. This "saving" does not actually show up in observed interest payments, however: interest payments would have gone up without the equity issue. By contrast, our measure of the savings from junk bond calls, described below, does capture some effects of equity issuance. For instance, RJR Nabisco could call its 17 percent bonds and refinance them at 10.5 percent in the spring of 1991 not so much because of generally lower rates but because of the firm's sale of equity.

Debt restructuring

In several respects, corporate treasurers operated in the credit markets in 1991-92 in a manner fairly typical of an early recovery. Net issuance of debt weakened; bank loans and commercial paper contracted while outstanding bonds continued to grow. Between 1984 and 1990, U.S. nonfinancial corporations issued a net $1.2 trillion worth of debt, divided almost equally between bonds and all other forms of debt, including loans and commercial paper (Chart 12). In 1991, net borrowing fell to $29 billion, or about 17 percent of its average rate in 1984-90. This drop was entirely due to $50 billion in net retirements of bank loans, commercial paper, and other debt; net bond issuance maintained its average 1984-90 rate of about $80 billion. In the first three quarters of 1992, net issuance of bonds kept that pace, but net retirement of other debt decreased to about $35 billion.

The relatively steady growth of corporate bonds outstanding appears hard to square with the flood of new bonds that corporate treasurers are selling to Wall Street underwriters. Indeed, estimated public issuance of bonds reached $153 billion in 1992 and broke the record 1986 issuance of $116 billion. Just as corporate

Table 4

Contribution of Refinancing and Lower Short-Term Interest Rates to U.S. Corporate Interest Savings in 1991-92

Billions of Dollars at an Annual Rate

	1991	1992	1991-92
Refinancing	**0.4**	**2.4**	**2.8**
Net equity issuance†	1.5	2.4	3.9
Fixed income	−1.1	0.0	−1.1
Bond calls	0.8	1.6	2.4
Investment grade‡	0.3	0.9	1.2
Junk§	0.5	0.7	1.2
Maturity extension‖	−1.9	−1.6	−3.5
Direct effect of lower short-term rates††	**14.1**	**13.2**	**27.3**

Sources: For net equity issuance—Board of Governors of the Federal Reserve System, Flow of Funds data for nonfarm nonfinancial corporate business; FRBNY estimates. For investment grade bond calls—Salomon Brothers Corporate Bond Research, "Notice of Corporate Bonds Called," Industrials' Utilities; Bloomberg data base. For junk bond calls—First Boston High Yield Research. For maturity extension—Board of Governors of the Federal Reserve System, Flow of Funds data. For effect of short-term rates—Board of Governors of the Federal Reserve System, Flow of Funds data and *Federal Reserve Bulletin*.

†Estimates assume that $18.3 billion in equity replaced 8 percent debt in 1991 and that $32 billion in equity replaced 7.5 percent debt in 1992.

‡Estimates are based on $28 billion called in 1991 and $78 billion in 1992.

§Estimates are based on $10 billion called in 1991 and $24 billion in 1992.

‖We estimate that $47 billion in net fixed rate debt replaced floating rate debt in 1991 and that $40 billion net fixed rate debt replaced floating rate debt in 1992.

††Estimates assume that one-fourth of net short-term debt is repriced each quarter.

treasurers sell equity into surging stock markets (Chart 1), so too they sell bonds into surging bond markets (Chart 13). What reconciles the steady growth of outstandings and the explosion of bond issuance is maturing bonds and especially calls of bonds.

Savings from bond calls

Bond calls over the last two years have been encouraged by the convergence of two trends—lower interest rates and less erosion of corporations' credit standing.[16] The latter trend is a consequence of lower interest rates and net equity issuance.

We estimate that a face value of $106 billion in investment grade bonds and $34 billion in junk bonds has been called in 1991-92.[17] We base our interest savings calculation on samples of called investment grade bonds and junk bonds. The current pace at which U.S. nonfinancial corporations are calling and refinancing their bonds is saving $1.6 billion a year in interest payments.

The savings from calls of investment grade bonds stem from strong refinancing activity and relatively modest average savings. A sample of 153 issues called between January and May 1992 with an aggregate face value of $10.3 billion[18] provides a weighted average original coupon of 9.3 percent, call price of $102, and a refinancing cost of 8.04 percent. These averages indicate interest savings of $1.10 per $100 of face amount called: the difference between the original coupon (9.3) and new coupon scaled by the call price premium (8.04 times 102 divided by 100). This finding suggests that the annual interest savings on $28 billion of called investment grade bonds in 1991 and $78 billion in 1992 were $0.3 billion and $0.9 billion, respectively. Our calculation is biased on the side of greater savings because it neglects the higher principal repayment of refinancing implied by the call price premium.

The savings from junk bond calls stem from more modest refinancing activity and very considerable average savings. Companies like RJR Nabisco, which sold

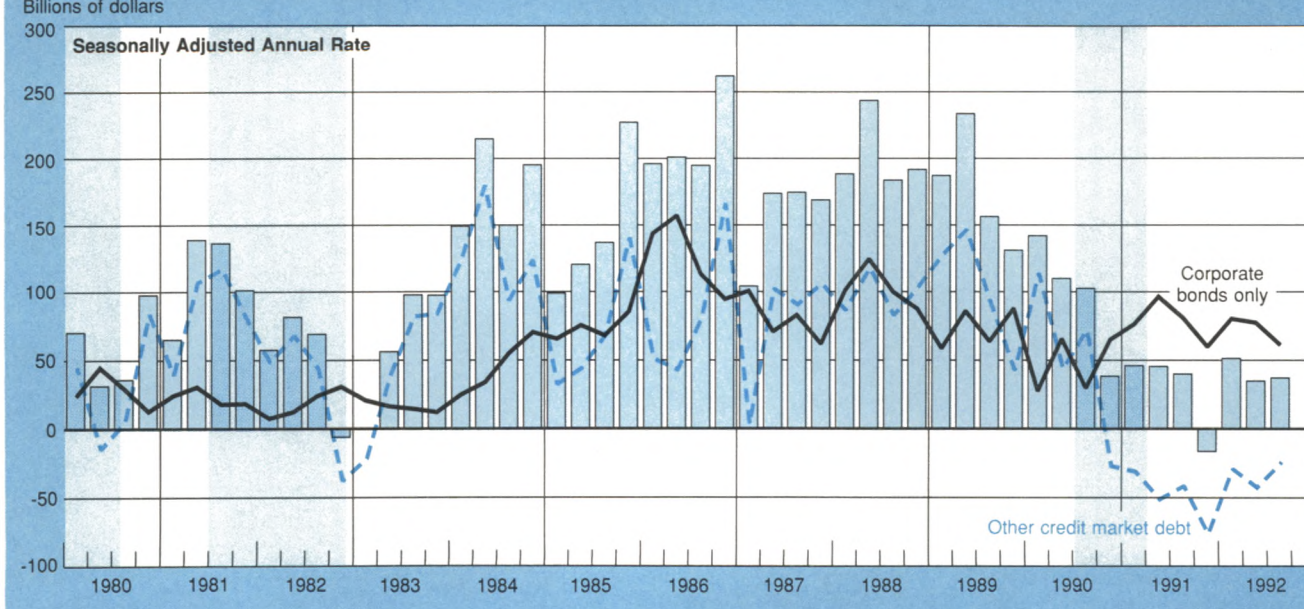
[16]Andrea Bryan, "Corporate Credit Quality Erosion Eases," *Standard & Poor's Creditweek*, January 4, 1993, p. 39.

[17]Amount of junk bonds called is based on First Boston High Yield Research data. Amount of investment grade bonds called is based on Salomon Brothers' *Monthly Statement of Bonds Called* for 1991 and through November 1992, annualized.

[18]Bloomberg data base, 153 issues called, January-May 1992.

Chart 12

Net Debt Issuance by U.S. Nonfinancial Corporations



Source: Board of Governors of the Federal Reserve System, Flow of Funds data.

Note: Shaded areas indicate recession periods designated by the National Bureau of Economic Research.

new equity to improve its credit standing so as to refinance its debt at lower interest charges, derived significant benefits from refinancing. Thus, savings on junk bond calls arise from credit upgrades as well as lower interest rates for a borrower of a given credit.[19] A sample of $3.7 billion junk bonds called in 1991[20] gives a weighted average original coupon of 15.1 percent, a call price of $101.8 per $100 of face amount, and a refinancing coupon of 10.1 percent (Table 5). Taking the difference between the original coupon (15.1) and the new coupon scaled by the call price premium (10.1 times 101.8 divided by 100) yields an interest savings of $4.78 per $100 of face amount called. This finding translates into annual interest savings of $0.5 billion on $10 billion in called junk bonds in 1991. Junk bond calls accelerated in 1992 but proved on average less lucrative. First Boston High Yield Research reports that in the first half of 1992, the average coupon on new issues replacing those that were called or tendered was about 300 basis points lower.[21] We estimate therefore that the $24 billion called in 1992 saved $0.7 billion in annual interest charges.

The costly extension of debt maturities

A large offset to these interest savings arises from the normal cyclical funding of commercial paper and bank debt with bond debt in the face of an extremely steep yield curve. Of course, if long-term interest rates simply represent the average of short-term rates over the relevant period, the extra interest paid now simply saves higher interest payments down the road. However, the power of long-term rates to predict future short-term rates has proven weak in the past. Corporate treasurers often view securing long-term, fixed rate financing as insurance against swings in short-term interest rates, but such financing also introduces the risk that a drop in inflation will leave the firm saddled with a very high real interest rate.

In keeping with our focus on net interest payments, we consider corporate liabilities net of financial assets. At the end of 1990, U.S. nonfinancial corporations had

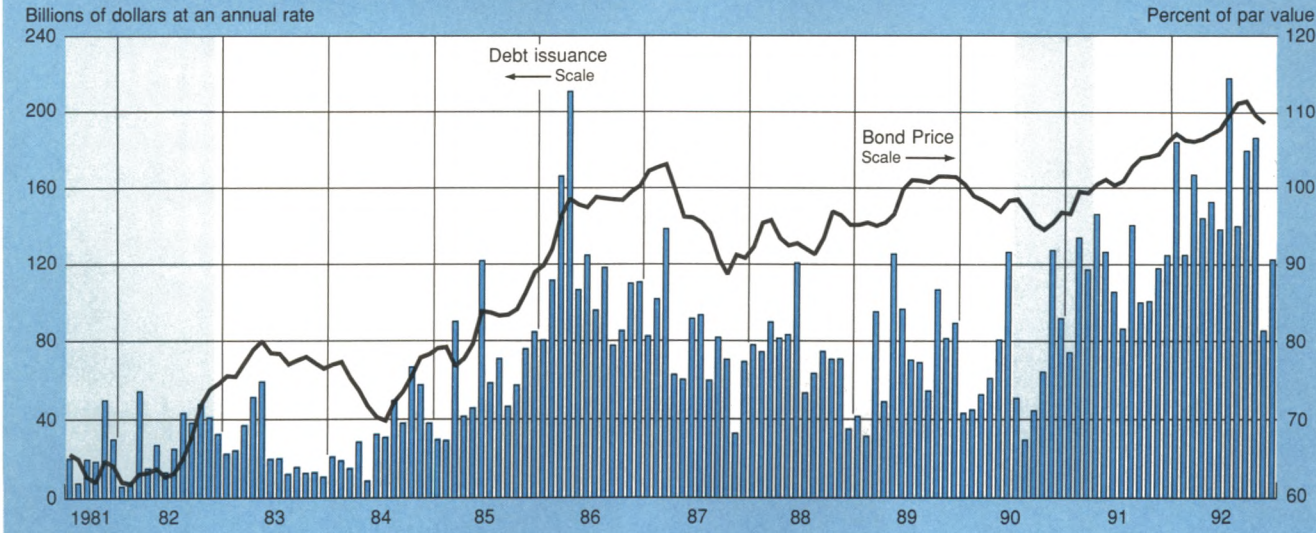
[19]"Restructurings and refinancings allowed issuers with outstanding debt to achieve higher credit quality. Among high-yield issuers in 1992, there were 98 upgrades totaling $51 billion and 96 downgrades totaling $37 billion. By contrast, in 1991, downgrades almost doubled upgrades. There were 75 upgrades totaling $62 billion and 133 downgrades totaling $81 billion" (Diana Vazza, "High-Yield Market Sets Record For Issuance in 1992," *Standard & Poor's Creditweek*, January 25, 1993, p. 33).

[20]Sample from First Boston *High Yield Handbook*, January 1992, Appendix III.

[21]First Boston High Yield Research, *1992 Mid-year Review*, July 28, 1992, p. 3.

Chart 13

Gross Public Debt Issuance by U.S. Nonfinancial Corporations



Sources: Board of Governors of the Federal Reserve System; Moody's.

Notes: Bond prices refer to hypothetical fifteen-year Baa bond with 10 percent coupon. Shaded areas indicate recession periods designated by the National Bureau of Economic Research.

$1,240 billion in fixed rate debt (net of fixed rate assets) and $677 billion in net floating rate debt outstanding.[22] At year-end 1991, these outstandings were about $1,287 billion and $594 billion, respectively. In 1991, the corporations reduced the ratio of net floating rate debt to total debt from 35.3 percent to 31.6 percent, partly by shifting about $47 billion worth of that debt from a floating rate to a fixed rate and partly by paying off loans with internal cash flows. This recent behavior is consistent with the historical relationship between maturity shifts and changes in interest rates. During periods of declining interest rates, corporations tend to shift from floating to fixed rate debt to lock in favorable interest rates. Such moves occurred in 1970-71, 1975-76, and 1985-87. Conversely, when interest rates rise, as they did in 1973-75, 1979-81, and 1983-84, corporations tend to shift into floating rate debt to avoid locking in unfavorable interest rates (Chart 14).

As U.S. nonfinancial corporations shifted out of floating rate debt and into fixed rate debt in 1991 and 1992,[23] they undertook higher interest obligations. Although

[22]Net floating rate or short-term debt is defined in flow of funds classifications as the sum of bank loans, commercial paper, and other loans minus all liquid assets excepting currency and checkable deposits, U.S. government securities, and tax-exempt securities. Net fixed rate debt is defined as corporate bonds minus U.S. government securities and tax-exempt securities.

[23]The growing use of interest rate swaps by U.S. nonfinancial corporations makes balance sheet data less reliable when the analyst tries to gauge the relative importance of fixed and floating rate funds. The most common interest rate swap involves the exchange of floating payments, usually based on LIBOR, for predetermined fixed payments on a notional amount of debt. Hence a nonfinancial firm borrowing short-term or floating rate funds may enter a swap that effectively creates a fixed rate liability. However, since swaps are off-balance-sheet items, the balance sheet (and the flow of funds data) would still show an exposure to short-term interest rates.

To estimate the effect of interest rate swaps on the composition of debt, the analyst must know the gross positions in both fixed-to-floating and floating-to-fixed rate swaps of U.S. nonfinancial corporations. If U.S. nonfinancial corporations are net fixed rate payers, then the effective ratio of floating rate to total debt would be somewhat lower than flow of funds data indicate, and vice versa.

According to the International Swap Dealers Association, the value of interest rate swaps outstanding stood at more than $3 trillion at the end of 1991, up from about $680 billion just four years earlier. Of this total, U.S. nonfinancial corporations were end users of about $260 billion, up from $76 billion in 1987, according to the Bank for International Settlements. Although the data are insufficient to estimate the aggregate effect of swaps on nonfinancial corporations' exposure to short-term interest rates, there is some evidence that these firms tend to be net fixed rate payers in swaps. See Eli M. Remolona, "The Recent Growth of Financial Derivative Markets," in this issue of the *Quarterly Review*. Our estimates of the cost of maturity extension from balance sheet data will understate the true effect if firms are increasingly swapping into fixed rates.

Table 5

Interest Savings on Junk Bonds Called in 1991

Company	Month	Coupon (Percent)	Amount (Millions of Dollars)	Premium over Par	New Coupon (Percent)	Dollar Savings (Millions of Dollars)	Percent Savings (Percent)
Century Communications	Oct.	12.750	200	101.00	11.875	1.5	0.76
Ferrellgas Inc.	Dec.	13.375	61	106.69	11.375	0.8	1.24
Ferrellgas Inc.	Dec.	12.750	149	104.78	11.375	1.2	0.83
FMC	Jun.	12.500	150	106.25	7.500	6.8	4.53
Illinois Central	Aug.	15.500	150	100.00	10.210	7.9	5.29
Kelsey Hayes	Nov.	13.250	124	100.00	11.375	2.3	1.88
Maxxam Group	Nov.	13.625	140	100.00	12.750	1.2	0.88
Owens-Corning Fiberglass†	Dec.	15.000	208	100.00	7.400	15.8	7.60
Playtex Apparel	Dec.	14.000	182	110.89	11.625	2.0	1.11
RJR Holdings Group	Jun.	17.000	1,500	100.00	10.500	97.5	6.50
Safeway Stores‡	Nov.	14.500	420	102.90	7.930	26.6	6.34
Safeway Stores	Dec.	11.750	250	104.61	9.650	4.1	1.66
Viacom Inc.	Aug.-Oct.	15.500	200	100.00	10.250	10.5	5.25
Total/weighted average		15.081	3,734	101.77	10.127	178.4	4.78

Sources: Reuter's *Textline*; Moody's; First Boston *High Yield Handbook*; Euromoney Loanware; *International Financing Review*.
Notes: Amount indicates the amount of the call that could be attributed to a recent debt issue or bank loan. Percent savings are calculated as the difference between the old coupon rate and the new coupon rate adjusted upwards by the ratio of the call price to 100. Dollar savings are the percent savings multiplied by the amount.
†Bond was refinanced with a bank loan. New coupon assumes a spread of 75 basis points over LIBOR on the loan converted into an equivalent fixed rate using the mid-December 1991 five-year interest rate swap spread. Seventy-five basis points was the average spread over LIBOR on syndicated loans for a sample of Baa3-rated borrowers in 1991.
‡Bond was refinanced with a bank loan, as in the case of Owens-Corning. New coupon assumes a spread of 83 basis points converted into an equivalent fixed rate using a seven-year swap spread to match the maturity of the Safeway syndicated loan. Eighty-three basis points was the average spread over LIBOR for a sample of Ba2- and Ba3-rated borrowers in 1991.

this shift may have had the beneficial effect of locking in lower long-term rates, the immediate effect has been to increase interest expense. The slope of the corporate yield curve, defined as the difference between the commercial paper rate and the yield on Baa-rated bonds, has been about 4 percentage points. Therefore, the estimated increase in annualized interest expense resulting from the maturity shift that occurred in 1991 is $1.9 billion. The first three quarters of 1992 saw further shift in debt composition from floating to fixed rate debt of about $40 billion at an annual rate. Thus, the increased interest expense for 1992 is estimated to be $1.6 billion.

In summary, corporate treasurers' operations in the debt markets have served not only to pare interest payments through bond calls but also to lock in higher payments through maturity extension. Our calculation of the net cash flow benefits of these operations only attempts to capture immediate, not ultimate, effects. Interest rates may rise to leave discounted interest payments unaffected by the maturity extension. Or interest rates may rise somewhat less but leave corporate treasurers content that the benefit of stable and predictable interest payments matches the ultimately higher cost of fixed rate finance. By contrast, if inflation continues to remain subdued and interest rates decline, the maturity extension could prove more expensive ultimately than immediately.

Short-term interest rates and the interest burden

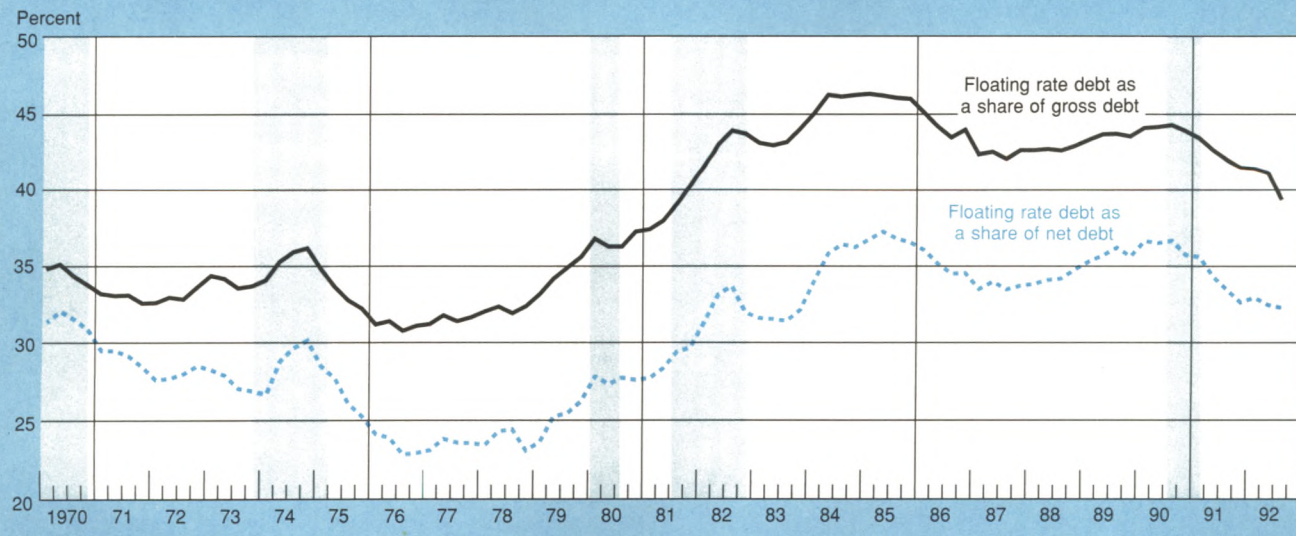
Financial restructuring has contributed to reducing the interest burden of U.S. nonfinancial corporations. But the decline in short-term interest rates since 1989 has unburdened corporate cash flows quite apart from any refinancing. This influence takes effect as interest charges on floating rate debt are reset to prevailing market rates on a monthly, quarterly, semiannual, or annual basis. To compare the effects of refinancing activity and lower short-term interest rates, we need to quantify the relation of lower rates to corporate net interest payments.

Lower interest payments on short-term and floating rate debt

If almost all floating rate assets and liabilities are reset at least once a year, then the savings from lower rates should be roughly equal to the product of the change in interest rates and the dollar amount of net floating rate debt outstanding. We employ both simple arithmetic and regression analysis to estimate interest savings.

Chart 14

Ratio of Floating Rate Debt to Total Debt for U.S. Nonfinancial Corporations



Source: Board of Governors of the Federal Reserve System, Flow of Funds data.

Notes: Floating rate debt includes bank loans, finance company loans, and commercial paper. Net floating rate debt is floating rate debt minus all liquid assets except currency, checkable deposits, government securities, and tax-exempt securities. Net debt is gross debt minus all liquid assets except currency and checkable deposits. Shaded areas indicate recession periods designated by the National Bureau of Economic Research.

Box 1: Regression Analysis of the Pass-through of Short-Term Interest Rates to Corporate Interest Payments

The results of our regression analysis are reported in the table. The product of the quarterly change in the three-month commercial paper rate and the lagged quarter-end level of net floating rate debt effectively predicts the change in seasonally adjusted annualized net interest payments. As the table shows, the estimated relationship is significant both contemporaneously and lagged three quarters.† Moreover, the null hypothesis that the four coefficients on quarterly lags add up to one can be accepted at any reasonable level. In other words, a change in short-term rates exerts its full impact within a year. Finally, the null hypothesis that the transmission of short-term market interest rates to corporate interest payment occurs smoothly (one-quarter per quarter) can be accepted.

The regression also confirms the linkage of net debt levels and net interest payments. A proxy for the change in net interest payments resulting from increasing levels of debt is computed as the sum of two products: (1) the change in net floating rate debt outstanding multiplied by the short-term interest rate, plus (2) the change in net fixed rate debt outstanding multiplied by the long-term interest rate. Absent any changes in interest rates, net

†The product using the first and third lags is significant at the .5 percent level (the critical value [c.v.] for the two-sided t-test is 2.70), the product using the third lag is significant at the 2 percent level (c.v. = 2.42), and the contemporaneous product is significant at the 2.5 percent level (c.v. = 2.02).

Effects of Short-Term Interest Rates and Debt Accumulation on Interest Payments by U.S. Nonfinancial Corporations: Results of Regression Analysis

Quarterly Data

Dependent variable: change in seasonally adjusted annualized net interest payments (billions of dollars at an annual rate)

Independent variables: change in net floating rate debt times the three-month commercial paper rate plus the change in net fixed rate debt times the corporate bond yield (billions of dollars)

Intercept suppressed

	Change in Commercial Paper Rate times Floating Rate Debt				Change in Net Debt times Interest Rate	Memorandum: Sum of Commercial Paper Coefficients
	No Lag	One-Quarter Lag	Two-Quarter Lag	Three-Quarter Lag		
Coefficient	0.205	0.338	0.27	0.358	0.839	1.175
(t-statistic, H0: x=0)	(1.88)	(3.17)	(2.65)	(3.63)	(6.86)	—
(t-statistic, H0: x=1)	—	—	—	—	(1.31)	(0.84)
(t-statistic, H0: x=.25)	(0.42)	(0.83)	(0.24)	(1.09)	—	—
R squared	0.604					
Adjusted R squared	0.564					
Observations	44					
Degrees of freedom	39					
Durbin-Watson	1.98					

Independent variable: change in quarterly average three-month commercial paper rate times net floating rate debt outstanding (billions of dollars)

	Change in Commercial Paper Rate times Floating Rate Debt				Change in Net Debt times Interest Rate	Memorandum: Sum of Commercial Paper Coefficients
	No Lag	One-Quarter Lag	Two-Quarter Lag	Three-Quarter Lag		
Coefficient	0.219	0.346	0.265	0.365	Held at 1	1.194
(t-statistic, H0: x=0)	(2.03)	(3.29)	(2.58)	(3.76)	—	—
(t-statistic, H0: x=1)	—	—	—	—	—	(0.94)
(t-statistic, H0: x=.25)	(0.29)	(0.91)	(0.15)	(1.18)	—	—
R squared	0.587					
Adjusted R squared	0.556					
Observations	44					
Degrees of freedom	40					
Durbin-Watson	2.05					

Box 1: Regression Analysis of the Pass-through of Short-Term Interest Rates to Corporate Interest Payments *(Continued)*

interest payments should increase by an amount roughly equal to this sum. Consistent with this simple hypothesis, the expected coefficient value for this variable is one. As the table shows, the data appear to confirm this hypothesis.‡

To isolate the effect of changes in interest rates, we repeated the regression, this time holding the value of the coefficient on the leveraging variable at one (see table). Because the results were similar to those for the unconstrained regression, the coefficients from this second regression were used to estimate the effects of changes in short-term interest rates on aggregate interest expense.

‡The intercept in the regression was forced to be zero on the assumption that no factor other than the accumulation of debt and changes in interest rates would systematically influence the level of interest payments. This assumption is not challenged by the data. The intercept in the unconstrained regression (not reported) is not significantly different from zero.

If we assume that one-fourth of net short-term debt is repriced each quarter, the savings owing to lower short-term rates (measured by the change in the three-month commercial paper rate) amounts to $27.3 billion in 1991-92 (Table 4). Regression analysis supports the assumption that changes in short-term rates transmit themselves to net interest payments fairly smoothly over four quarters (see Box 1).

As a result of falling interest rates in 1990 and 1991, annualized net interest paid by U.S. nonfinancial corporations in the fourth quarter of 1991 was an estimated $14.1 billion lower than it would otherwise have been. Similarly, the fall in interest rates in 1991 and 1992 is expected to lower the interest burden by an additional $13.2 billion by the fourth quarter of 1992. An additional $2.8 billion in savings should flow through in 1993 given current short-term rates. If we measure interest savings from 1989, when short-term rates were about 9 percent, the decline in short-term rates by about 6 percentage points has lowered corporate interest payments by $36.5 billion.

Comparing lower short-term interest rates and corporate refinancing

Summing the effects of corporate activity in the stock market and in the debt markets shows the net impact of corporate refinancing (Table 4). In 1991, treasurers extended the maturity on so much debt while facing such a steep yield curve that the effect of the $18 billion in net equity issuance was almost nullified. In 1992, the extension of maturities appeared to slow, so that the $32 billion in net equity issuance served to reduce net interest payments by about $2.4 billion per year.

Our calculations suggest that in 1991-92, lower short-term interest rates played a dominant role in lowering corporate interest payments. The immediate relief that lower rates afforded U.S. nonfinancial firms in lightening the interest burden in 1991-92 was ten times the relief that refinancing provided: $27.3 billion as against $2.8 billion.

Another way to juxtapose the two effects is to draw an equivalence between a (permanent) change in short-term interest rates and the effect of refinancing activity at its 1992 pace. Each year that corporate treasurers restructure their capital at the current rate provides only as much relief to their cash flows as a permanent cut of 45 basis points in short-term corporate rates.

The relative effectiveness of lower interest rates and corporate refinancing in unburdening corporate cash flow can also be demonstrated by decomposing the total change in the aggregate ratio of interest payments to cash flow in the seven quarters since the end of 1990 (Chart 15 and Box 2). This ratio ratcheted up to a record vulnerability before the start of the recent recession as firms replaced equity with debt. By the end of 1990, the ratio had reached 24.25 percent, a level indicating that in aggregate, cash flow covered interest payments only four times over. The apparently low level of this ratio (or the apparently comfortable interest cover) does not by itself fully reflect the fragile state of corporate finances, since it must be understood as an average that includes many firms unable or barely able to cover their interest payments. By the third quarter of 1992, this ratio had fallen 3.85 percentage points to 20.4 percent.

Three forces have worked together to bring down this ratio: macroeconomic factors, lower short-term interest rates, and corporate refinancing (Chart 15). Macroeconomic factors include the growth of cash flow and the need for outside finance. As cash flow increased 6.6 percent over the seven quarters from 1990-IV to 1992-III, the wherewithal to meet interest payments grew and the ratio declined. Partially offsetting the growth of cash

flow, however, was the need for outside finance—that is, the gap between retained earnings and depreciation charges, on the one hand, and investment spending, on the other. Filling this gap with new debt would tend to raise interest payments and offset the effect of higher cash flow in bringing down the ratio. These two macroeconomic factors jointly have reduced the burden of interest payments on cash flows by about 1 percent (Chart 15).

Lower short-term rates did the job of reducing the ratio by about 2½ percentage points through the third quarter of 1992. Moreover, at present levels of short-term interest rates, corporations can expect to benefit from even lower interest payments in 1993 as short-term debt rolls over and is repriced at current interest rates.

The net effects of refinancing activity account for a surprisingly small share of the decline in Chart 15. Equity issuance and bond calls alone would have driven the ratio down by another ¾ of 1 percentage point. But the extension of maturities from short-term debt to higher cost long-term debt has offset much of the savings from equity issuance and bond calls.

Conclusion

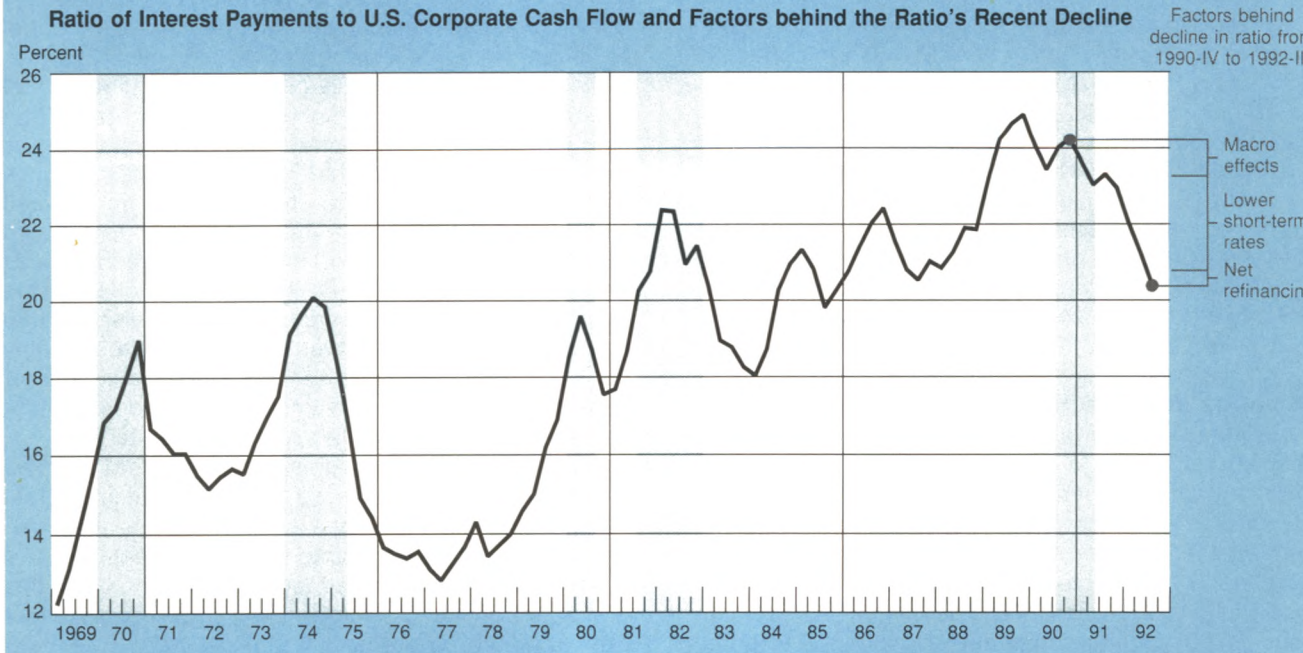
This article finds that in the aggregate, lower interest rates have far surpassed corporate refinancing in relieving the burden of interest charges on cash flows. This finding depends on an often-overlooked feature of corporate refinancing: the current expense of corporate treasurers' replacing bank debt with bonds wipes out much of the savings from new share issues and bond calls.

The timing in the business cycle of the 1991-92 surge in equity issuance has a precedent in 1982-83, but the classes of firms selling shares bear witness to the particular risks introduced by corporate leveraging in the 1980s. Firms running losses, especially parent firms of major finance companies, assumed unusual prominence among equity issuers. And quite mature businesses that had been put through leveraged buyouts showed up in the corporate nursery in the "initial" public offering market.

To be sure, restructuring has improved the financial health of those firms undertaking it. Equity issuance has kept some firms out of bankruptcy and has shored up the commercial paper credit ratings of others. Never-

Chart 15

Ratio of Interest Payments to U.S. Corporate Cash Flow and Factors behind the Ratio's Recent Decline



Sources: Bureau of Economic Analysis, *Survey of Current Business*, National Income and Product Accounts tables; Federal Reserve Bank of New York staff estimates.

Note: Shaded areas indicate recession periods designated by the National Bureau of Economic Research.

Box 2: The Changing Burden of Interest on Cash Flow

This box defines the ratio of interest to cash flow and decomposes its decline from the end of 1990 through the third quarter of 1992. This ratio fell 3.85 percentage points, from 24.25 percent to 20.4 percent, in the seven quarters. The exercise is fairly straightforward in concept, although it requires some baseline from which to measure the contribution of equity finance. Our approach here is to take zero equity finance as the baseline. If, on average over long periods, U.S. corporations have had a modest resort to equity finance, our baseline may overstate the size of corporate refinancing somewhat.

Defining the ratio of interest to cash flow

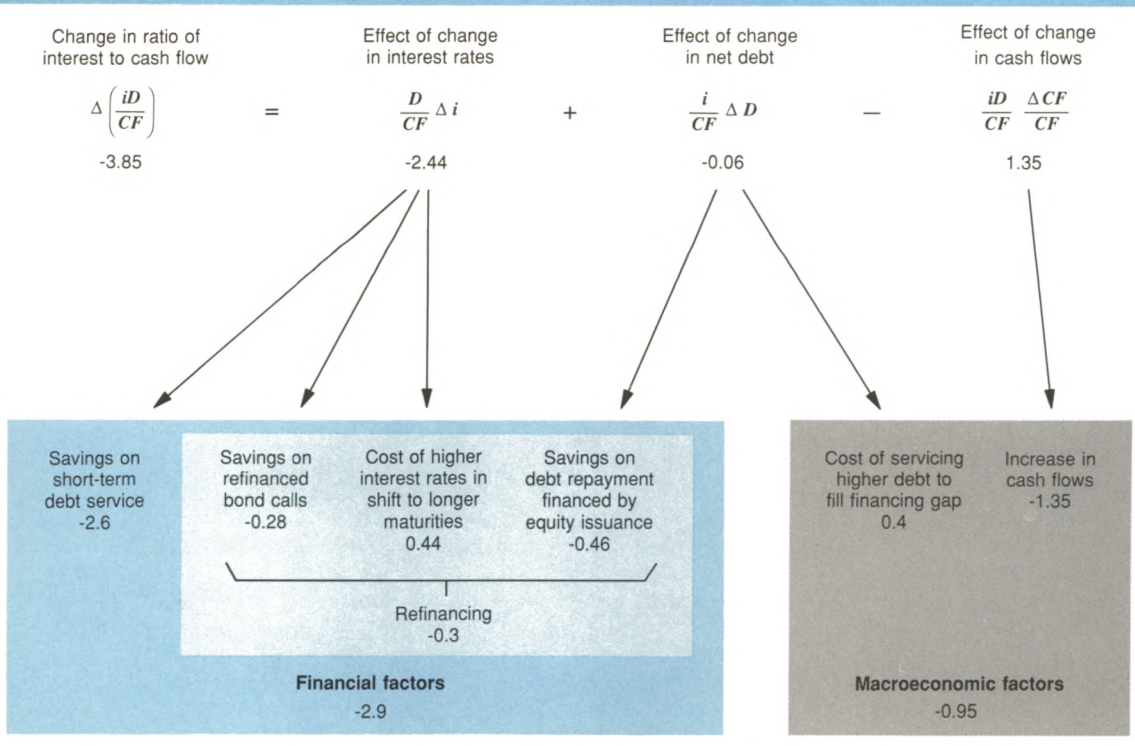
This ratio is constructed to indicate the burden of net interest payments on cash flows. The measure has been shown to predict corporate distress and bankruptcy.

The numerator is net interest payments of nonfinancial corporate business as reported in the National Income and Product Accounts. We exclude imputed interest receipts associated with non-interest-bearing deposits from total interest receipts on the ground that they are noncash, in-kind receipts that cannot be used to avert default.

The denominator, also drawn from National Income and Product Accounts data, is earnings before interest, taxes, and depreciation (EBITD), adjusted for the effect of inflation on inventories. These earnings are operating cash flows available to pay interest. It is important that net interest payments be included in the denominator if the effect of economic growth on cash flows is not to be confused with the effect of lower short-term rates on interest payments. Consider a company with EBITD of 5 and net interest payments of 2 falling to 1. We would measure the ratio of interest to cash flow as 2:5 falling to 1:5. If net interest payments are excluded from cash flow, however, the ratio would be measured as 2:3 falling to 1:4, with cash flows apparently rising by a third.

Decomposition of Change in Ratio of Interest to Cash Flow from 1990-IV to 1992-III

Percentage points



Box 2: The Changing Burden of Interest on Cash Flow *(Continued)*

Decomposing the change in the ratio of interest to cash flow

The ratio can be decomposed into three partial effects: the effect of lower interest rates, the effect of lower debt, and the effect of stronger cash flows (see chart). The effect of lower interest rates itself is a compound of lower short-term rates, lower long-term rates on called or maturing bonds, and the effect of a shift in the mix of floating rate and fixed rate debt. The effect of lower debt may be thought of as a compound of debt growth (under the assumption that external financing exclusively takes the form of debt) and the separate effect of any net equity issuance.

It is useful to regroup terms into the economic forces bearing on the ratio. The two macroeconomic factors are economic growth's influence on cash flow and the financing gap's influence on the need for external debt financing. The two financial factors are the direct impact of lower short-term interest rates on net floating rate debt and the effect of corporate financial restructuring on the stock of net debt, the rates on long-term debt, and the composition of debt.

The chart shows the contributions of each of these factors to the change in the ratio of interest to cash flow from the end of 1990 through the third quarter of 1991. We estimate that macroeconomic factors reduced the ratio by just under a percentage point. The growth in cash flows reduced the ratio 1.35 percent, but the decrease was partially offset by the effect of the corporate sector's financing gap, or its need for external funds. This need would have raised the ratio 0.4 percent had it been filled entirely by debt finance. Financial factors lowered the ratio 2.9 percentage points, largely owing to direct effects of short-term rates, which accounted for 2.6 percent of the decrease. Refinancing activity, the other main financial factor, reduced the ratio by 0.3 percentage point. Among the refinancing factors, the retirement of debt with equity shaved 0.46 percentage point off of the ratio, bond calls saved 0.28 percentage point, but maturity extension cost 0.44 percentage point.

These calculations clarify the relative importance of macroeconomic and financial factors. Essentially, financial factors did three-quarters of the job of relieving the interest rate burden over the seven quarters, while macroeconomic factors did a quarter of the job.

Box 3: The Ratio of Net Interest to Cash Flow—Projected Future Values

by Richard Peach

Although the ratio of net interest to cash flow for the nonfinancial corporate sector declined substantially through 1992-III, it now stands just slightly below its average level for the 1980s (20.7 percent), a period of relatively high debt growth and interest rates. Some observers contend that given today's relatively low inflation and more conservative attitudes toward debt, the ultimate goal of corporate treasurers is to reduce this ratio much further, perhaps to as low as the average level of the 1970s (15.8 percent). Assuming that this is the goal, how long would it take to achieve? With interest rates held constant, optimistic but not implausible projections for cash flow, total debt, the cost of debt, and other relevant parameters suggest that achieving that result would take until the year 2000 (see chart). Moreover, no plausible set of parameter values is likely to achieve this goal over the next few years.

The accompanying table sets forth the parameters required to project this ratio and a "baseline scenario" or most likely set of values. Each of the parameters is discussed below.

Growth of total debt

Over the past thirty-five years, the total net debt of the nonfinancial corporate sector has increased at an average annual rate of 8.9 percent, 1.0 percentage point faster than the average growth rate of nominal GDP over the same period. In contrast, over the past three years of balance sheet restructuring, total net debt has increased at an average annual rate of just 1.5 percent. In the future it is quite likely that the growth of debt will accelerate, but perhaps remain below that long-run average. Under the baseline scenario it is assumed that total net debt increases 1 percentage point slower than the long-run growth of GDP, or 4½ percent, a rate that presumes a continued rapid pace of equity issuance.

Ratio of short-term to total debt

Over the twenty-year period from 1956 through 1975, the ratio of short-term to total net debt averaged 30 percent and varied relatively little from that average. During the second half of the 1970s it declined to an average of 26 percent, reaching a low of 24.3 percent in 1976-III. Dur-

Box 3: The Ratio of Net Interest to Cash Flow—Projected Future Values *(Continued)*

ing the 1980s this ratio increased substantially, averaging 35 percent and reaching a high of 38.3 percent in 1985-I. From its most recent peak of 36.9 percent in 1990-I, this ratio has fallen to 31.1 percent in 1992-III. Under the baseline scenario, it is assumed to decline to 30 percent by 1993-IV and then remain constant at that value.

Cost of debt

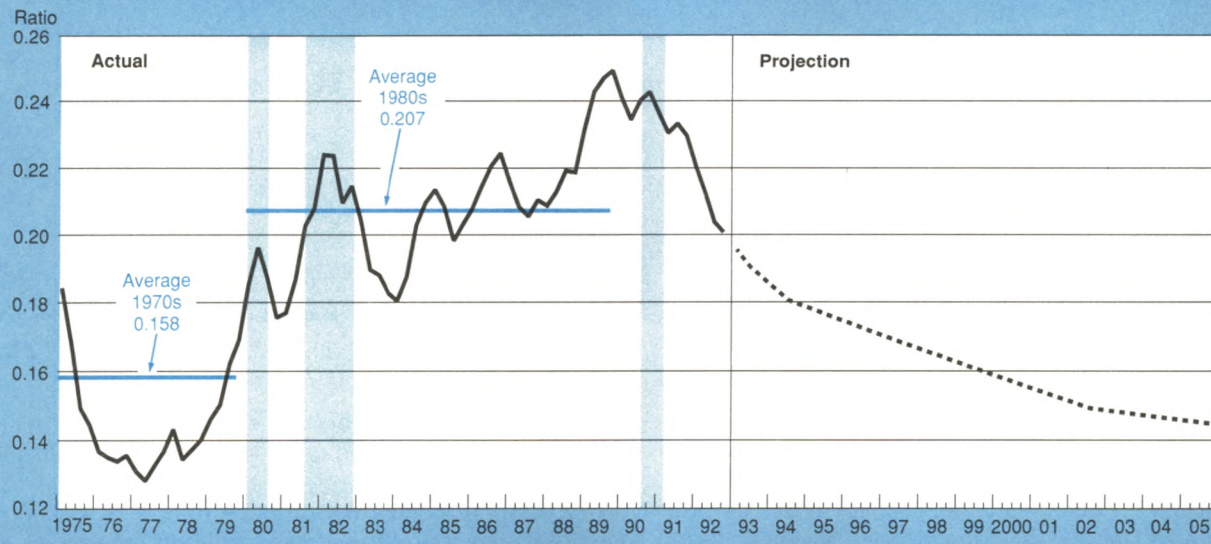
The cost of debt is determined by the level of interest rates and the rate at which the stock of debt is repriced. The baseline scenario assumes that both short-term and long-term interest rates remain constant at their 1992-III levels. Nonetheless, the cost of debt will continue to fall as earlier interest rate declines are realized through repricing of the stock of debt. Given the estimated $5 billion to $6 billion decline in interest on short-term debt due to expected repricing over the period from 1992-IV to 1993-III, the cost of short-term debt is assumed to decline 70 basis points (17.5 basis points per quarter) by 1993-III and then remain constant at that level. It is also assumed that the stock of long-term debt will be gradually repriced over the next ten years, with the average cost of long-term debt declining a total of 150 basis points (3.75 basis points per quarter) by 2002-III and then remaining constant.

Growth of cash flow and GDP

Over the past thirty years the cash flow of the nonfinancial corporate sector expressed as a percentage of nominal GDP has been on a gradual decline, averaging 14.1 percent in the 1960s, 13.7 percent in the 1970s, and 13.6 percent in the 1980s. This percentage also varies over the business cycle, rising during expansions and declining during contractions. During expansions, because cash flow represents a rising proportion of GDP, the growth rate of cash flow tends to be quite strong. In contrast, during a contraction, because cash flow represents a declining proportion of a slowing economy, the growth rate of cash flow is often negative. During the four preceding recoveries (excluding the brief recovery of 1980-81), cash flow as a percentage of GDP had risen an average of 1 percentage point. Most recently, cash flow bottomed out at 12.4 percent of GDP in 1992-I, while as of 1992-III it had risen to 12.6 percent. The baseline scenario assumes that cash flow will rise a cumulative 1 percentage point of GDP, reaching 13.4 percent by 1994-III, and then will remain constant. Accordingly, through 1994-III, cash flow will increase 60 percent faster than GDP. Beyond 1995, as cash flow reaches a stable share of GDP, cash flow and GDP will increase at the same rate (5.5 percent).

As both the table and the chart demonstrate, under the baseline scenario it would take eight years or until 2000 for the ratio of net interest to cash flow to decline to the average level of the 1970s. This result is quite sensitive to the assumed parameter values, particularly the growth

Ratio of Nonfinancial Corporate Net Interest to Cash Flow



Box 3: The Ratio of Net Interest to Cash Flow—Projected Future Values *(Continued)*

rates of total debt and GDP and the cost of debt. To highlight this sensitivity, the table shows alternative projections based on changes in individual parameter values. For example, if net debt were to increase 1 percentage point faster than the long-run growth rate of GDP, or 6.5 percent (Alternative A), the ratio would decline to 19.6 percent by 1995 and then begin a very gradual ascent. If the cost of short-term debt were to decline an additional 50 basis points (for a total decline of 120 basis points) by 1994-III while the cost of long-term debt declined an additional 50 basis points (5 basis points per quarter for a total decline of 200 basis points) by 2002-III (Alternative B), it would take six years to reach the goal. In contrast, if the long-run growth rate of GDP were 5 percent rather than 5½ percent, it would take ten years (Alternative C).

One implication of this exercise is that it may be difficult to bring the ratio of net interest to cash flow down to the average level of the 1970s within a few years. For example, to achieve that result by the end of 1994 would require that GDP grow 6 percent per year, the cost of short-term debt decline 90 basis points (at the rate of 10 basis points per quarter), the cost of long-term debt decline 135 basis points (at the rate of 15 basis points per quarter), and the ratio of short-term to total debt remain constant at its 1992-III value of 31.1 percent. Such an outcome appears unlikely. For one thing, a higher rate of nominal GDP growth than assumed in the baseline would most likely induce higher interest rates because of upward pressures on inflation. Moreover, even if the assumed declines in interest rates were to occur, the implied rapid rate of turnover of the stock of long-term debt is implausible.

Parameters Affecting Projected Future Values of the Ratio of Net Interest to Cash Flow for the Nonfinancial Corporate Sector

		Alternative Scenarios		
	Baseline Scenario	A	B	C
Growth of total debt	4½%	6½%	4½%	4½%
Ratio of short-term to total debt	Declines to 30% by 1993-IV	Same as baseline	Same as baseline	Same as baseline
Cost of debt[1]				
Short-term	Declines 67 basis points by 1993-III	Same as baseline	Declines another 50 basis points by 1994-III	Same as baseline
Long-term	Declines 150 basis points by 2002-III	Same as baseline	Declines another 50 basis points by 2002-III	Same as baseline
Long-run growth of GDP	5½%	5½%	5½%	5%
Years until ratio reaches 15.8%	**8**	**Never**	**6**	**10**

[1]The cost of debt is determined by the level of interest rates and the rate at which the stock of debt is repriced. The baseline assumes that interest rates remain at or near recent levels, that the stock of short-term debt will be completely repriced by 1993-III, and that the stock of long-term debt will be repriced by 2002-III (at the rate of 10 percent of the stock per year).

theless, reducing the aggregate corporate interest burden will take time. If the burden of interest on cash flows is to be lightened to the 19 percent characteristic of 1983, it will require another two to three years for corporate refinancing at its present rate to do the job alone. If the burden is to be reduced to the 15 percent characteristic of the late 1970s, then refinancing activity will take over ten years. (For a consideration of how cash flow growth or interest rate declines could affect the outlook, see Box 3.)

Such conclusions are, of course, fraught with uncertainty. Corporate treasurers may be targeting a lower or higher burden, so that the restructuring would take more or less time. Equity market developments could

accelerate or slow down the process of restructuring. Corporate treasurers may cease to extend maturities, a move that would render refinancing more potent. A further bond market rally could make the refinancing of fixed rate debt more effective in easing interest burdens; a bond market sell-off would slow the process. Monetary policy could further reinforce the restructuring process or begin to work at cross-purposes. On present trends, however, the process that started in earnest in 1991 will take until 1995 to reduce corporate interest burdens to their level in 1983.

The Recent Growth of Financial Derivative Markets

by Eli M. Remolona

Recent years have seen phenomenal growth in financial derivative markets. Financial derivatives are instruments that derive their prices from the performance of underlying cash markets, specifically money and bond markets, the foreign exchange market, and stock markets. This article examines the patterns of growth exhibited by the various types of derivative markets and contracts and seeks to deduce from these patterns the fundamental forces driving growth.

Financial derivatives have grown strongly in both organized exchanges and over-the-counter (OTC) markets. Interest rate contracts, notably futures in exchange markets and swaps in OTC markets, dominated the growth of derivatives in the last six years. During the same period, growth in exchange-traded currency futures and options slowed, while in the last four years growth in new equity index options surged in both exchange and OTC markets. The most successful exchange-traded derivatives appear to be those that added liquidity to the underlying markets, while the most successful OTC derivatives were probably those that offered new configurations of risk and return.[1]

Financial derivative markets as a whole seem to have grown much the way any financial innovation might be expected to grow as it finds increasing acceptance among users. But the direction and speed of the derivatives' spread have been governed critically by particular demands for liquidity-enhancing and risk-transferring tools. This article identifies four developments giving rise to such demands: sustained shifts and temporary surges in market volatility, the emergence of important but relatively illiquid cash markets for government bonds, new inducements for financial institutions and nonfinancial firms to deal with interest rate risks, and the international diversification of institutional equity portfolios.

Patterns of growth in derivative markets

Growth by type of market

The stock of financial derivatives outstanding worldwide, as measured by open interest and notional principal,[2] multiplied fivefold in five years to approach $10 trillion by the end of 1991 (Chart 1). In organized exchanges, open interest in financial derivatives rose an average of 36 percent a year from 1986 to reach $3.5 trillion at the end of 1991. Even so remarkable an expansion was apparently surpassed by the growth of financial derivatives in OTC markets; here total notional principal grew an estimated 40 percent a year during the period to soar above $6 trillion by the end of 1991.[3] As explained below, however, it is hard to compare the

[1]This article emphasizes the functions of derivatives as liquidity-enhancing and risk-transferring innovations; see Bank for International Settlements, *Recent Innovations in International Banking*, Study Group Report, Central Banks of the Group of Ten Countries, April 1986.

[2]Most OTC derivatives involve no actual exchange of principal, but payments are computed on the basis of the "notional principal" amounts specified in the contracts.

[3]Forward rate agreements (FRAs) make up the largest estimated component. These are agreements on future interest rates that involve no exchange of principal amounts. Surveys by the Bank for International Settlements suggest that forward rate agreements represent a third of interest rate swaps outstanding in the United States and two-thirds of interest rate swaps outstanding in Europe. We exclude from our estimates the very large traditional market for foreign exchange forward contracts, which appears to be very much a part of the foreign exchange cash market.

size of the two markets, in part because the unwinding of positions adds to notional principal in OTC markets while it adds to turnover in exchange markets.

Exchange markets

Organized exchanges such as the Chicago Board of Trade (CBOT) and the London International Financial Futures and Options Exchange (LIFFE) trade standardized financial futures and options contracts. An important feature of these trades is the interposition of a clearinghouse as a counterparty to reduce the credit risk in each transaction. The arrangement has the virtue of providing for clearinghouse offset, a mechanism that allows a participant to close out a position simply by undertaking an opposite trade.[4] Closing out a position reduces open interest in the market. More important, the standardization of contracts together with clearinghouse offset serves to limit transactions costs and thus fosters high degrees of liquidity in exchange markets.[5]

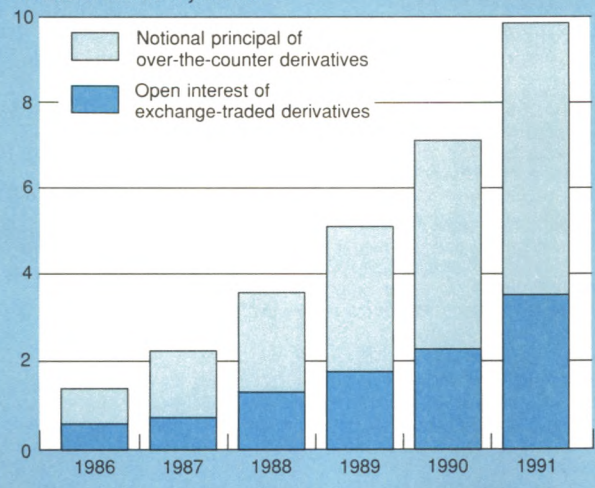
[4]First introduced at the Minneapolis Grain Exchange in 1891, the mechanism for clearinghouse offset has become a standard feature of organized exchanges in derivatives.

[5]It has been said of futures contracts, for example, that they "are designed and introduced by exchanges with basically one consideration in mind: low-cost trading." See Merton Miller, "Financial Innovations and Market Volatility," a talk given in London, England, at a seminar sponsored by Dimensional Asset Management, Ltd., March 24, 1987.

Chart 1

Exchange-traded and Over-the-Counter Derivatives

Trillions of dollars at year-end



Sources: For exchange-traded derivatives, Bank for International Settlements (BIS); for over-the-counter derivatives, International Swap Dealers Association, Federal Reserve Bank of New York staff estimates, and BIS estimates.

Indeed, as argued below, the primary economic function of exchange-traded derivatives appears to be the provision of liquidity in excess of the liquidity in the cash markets.[6] If these derivatives succeed primarily by serving as a source of liquidity, then trading volumes rather than open interest would be the more relevant measure of market size.

The trading volumes of financial derivatives in exchange markets have always dwarfed changes in open interest, a pattern that reflects the markets' liquidity and the fact that most positions are closed out before maturity. In 1992, more than 600 million contracts were traded in organized exchanges around the world. This figure represents an increase in turnover exceeding 11 percent a year since 1986 (Chart 2). The total value of such trading volumes exceeds $35 trillion per quarter, roughly a hundred times the change in open interest over the quarter.

OTC markets

OTC markets trade customized swaps, options, and forward contracts in bilateral deals without the interposition of a clearinghouse. The customized contracts and lack of clearinghouse offset both inhibit liquidity in OTC markets. Indeed, unlike the derivative exchange markets, the OTC derivative markets tend to be less liquid than the underlying cash markets. It appears that OTC derivatives are designed primarily to reconfigure market risk rather than to provide liquidity.

When an OTC participant unwinds an initial position by means of an opposite trade, the original contract typically remains in place and the new transaction adds to total notional principal in the market.[7] Thus the portion of notional principal growth in the OTC markets that consisted of trades to unwind positions would be more akin to the growth in trading volumes in exchange markets than to the growth in open interest.

[6]Derivatives, of course, vary in the degree to which they serve the functions of liquidity and risk transformation. The liquidity of the underlying cash market helps determine the use of a derivative. The spot market for foreign exchange, for example, is itself so liquid that risk transformation is probably a more important function of exchange-traded currency derivatives than of other exchange-traded derivatives.

[7]Netting rules currently under development for the OTC markets would allow the offsetting of contracts between two counterparties but only in the event of default. Some OTC contracts provide for early termination, but the difficulty of pricing contracts after origination seems to make it easier to unwind a position by taking on another contract.

Growth by type of contract

Interest rate contracts

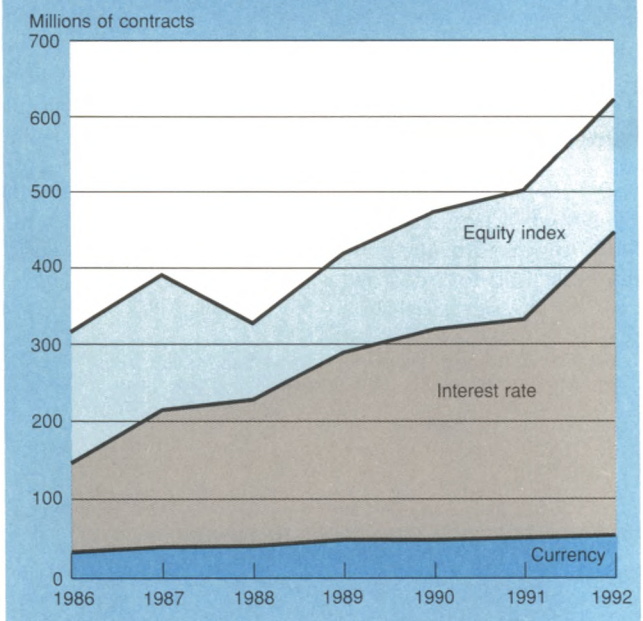
In both organized exchanges and OTC markets, the growth in derivatives has been dominated by contracts based on interest rates. The contracts on short-term interest rates have as their underlying cash markets the various money markets around the globe, most notably the Eurocurrency markets and the short-term sterling market. The underlying markets for derivatives on long-term interest rates are the world's major bond markets, most notably the U.S. Treasury bond market, the French government bond market, the Japanese government bond market, the German bund and Treuhand market, and the U.K. long gilt market.

In exchange markets, turnover in interest rate contracts grew 21 percent a year from 1986 to 1992 and accounted for 90 percent of the absolute increase in total exchange market turnover (Chart 2). The great bulk of this growth came from futures contracts, most notably futures on three-month Eurodollars at the International Money Market (IMM) of the Chicago Mercantile Exchange (CME), futures on the notional French government bond at the Marché à Terme International de France (MATIF), and German bund futures at LIFFE and the Deutsche Terminbörse (DTB).[8]

Chart 2

Exchange-traded Derivatives

Annual Trading Volume of Futures and Options Contracts



Sources: Bank for International Settlements; Futures Industry Association; Options Clearing Corporation; Philadelphia Stock Exchange.

Note: Values represent combined global volume of exchange-traded futures and options.

As in the exchange markets, most of the derivatives growth in the OTC markets consisted of interest rate contracts (Chart 3). Interest rate swaps, the dominant OTC derivative from the outset, grew an average of 41 percent a year in notional principal from 1986 to 1991 and alone accounted for possibly half of the absolute increase in total notional principal of all OTC derivatives during the period (Chart 4).[9] We estimate that forward rate agreements (FRAs) grew roughly as fast as interest rate swaps and accounted for perhaps another quarter of the total market increase. Option-like interest rate contracts, including caps, floors, collars, and swaptions, probably grew the fastest of all OTC contracts, with notional principal rising 81 percent a year during the period to account for 10 percent of the total increase in the OTC market.[10]

Currency contracts

Next to interest rate contracts, currency contracts contributed the most to the growth in derivatives, albeit in a comparatively small way. The underlying cash market for these contracts is the global foreign exchange market. In organized exchanges, trading in currency contracts rose about 8 percent a year and accounted for less than 7 percent of the absolute increase in total exchange market turnover from 1986 to 1992 (Chart 2).

In the OTC market, currency swaps more than kept pace with interest rate swaps by growing 42 percent a year from 1986 to 1991, but traditional currency options probably expanded at only a fraction of that rate (Chart 3). Currency swaps may have shown much stronger

[8]Three-month Eurodollar contracts are also traded at LIFFE, the Singapore Mercantile Exchange (SIMEX), the Sydney Futures Exchange (SFE), and the Tokyo International Financial Futures Exchange (TIFFE).

[9]A popular new type of interest rate swap is the "diff" or "quanto" swap, which exchanges payments based on interest rates in two currencies but makes both payments in a common currency. For example, firm A pays the Eurodollar rate while firm B pays the Eurolira rate less a spread, but all payments are made in U.S. dollars.

[10]Options on less developed country (LDC) debt are one of the fastest growing segments of this market. The International Monetary Fund estimates that annual turnover in the secondary market for this debt exceeds $200 billion, and market participants estimate that turnover in the options may be a tenth of this amount. See Richard Waters, "Derivatives Rush to Catch Up with Emerging Markets," *Financial Times*, December 29, 1992; and International Monetary Fund, *Private Market Financing for Developing Countries*, December 1992. Note that LDC debt options may be more like equity options than bond options because LDC debt is commonly used for equity investments in the debtor country through debt-equity swaps.

growth than other currency contracts because they are in part interest rate contracts, involving the exchange of fixed rate payments in one currency for floating rate payments in another.

Equity index contracts

Equity index contracts remain a small part of the whole derivatives market, but their recent growth has been so explosive that they promise to become a major part of the market in the near future. These index contracts have as their underlying markets the major stock markets around the world, most notably the New York, Tokyo, and Frankfurt stock markets.

Exchange trading in equity index contracts showed no expansion over the period 1986 to 1992 as a whole because the turnover in U.S. exchanges declined sharply after the October 1987 stock market break (Chart 2). Since 1988, however, equity index contracts have recovered so strongly that turnover in these contracts has grown faster than turnover in interest rate contracts. From 1988 to 1992, trading volumes in equity index contracts increased 14 percent a year. Even with growth coming from a small base, index contracts still accounted for a quarter of the absolute increase in total exchange market turnover in the four-year period. The recovery was led by new index contracts, notably Nikkei Index futures and options at the Osaka Securities Exchange (OSE) in Japan, options on the Deutsche Aktienindex (DAX) at DTB in Germany, Swiss Market Index options at the Swiss Options and Financial Futures Exchange (SOFFEX) in Switzerland, and Bovespa Stock Index futures at the Bolsa de Mercadorias e Futuros (BM&F) in Brazil.

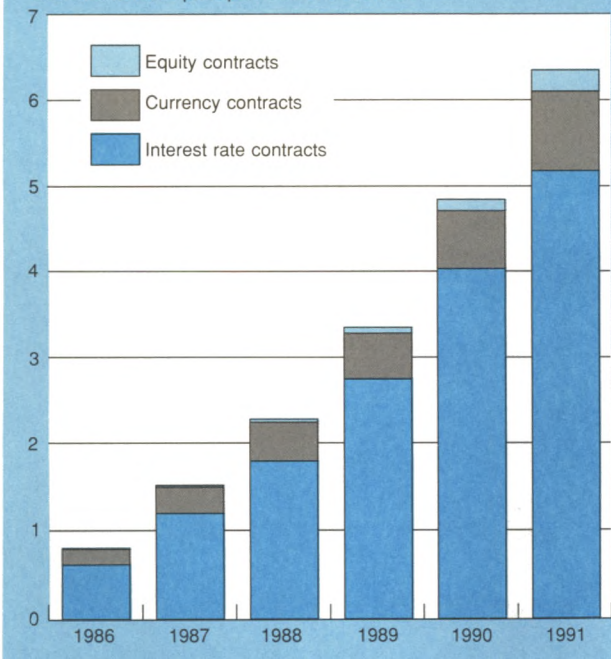
In the OTC market, equity index options and equity swaps made up a small fraction of the market, but the last few years witnessed such tremendous growth in these contracts that they accounted for perhaps 5 percent of the absolute expansion of notional principal in the OTC market from 1986 to 1991 (Chart 3). The OTC equity derivative market has two segments, the "off-the-peg" and the "bespoke" segments. In the off-the-peg segment, the older market, investment houses write covered equity warrants not specifically requested by investors.[11] In the bespoke segment, the newer and

[11]The Swiss Bank Corporation, for example, offers guaranteed return

Chart 3

Over-the-Counter Derivatives

Year-end notional principal in trillions of dollars

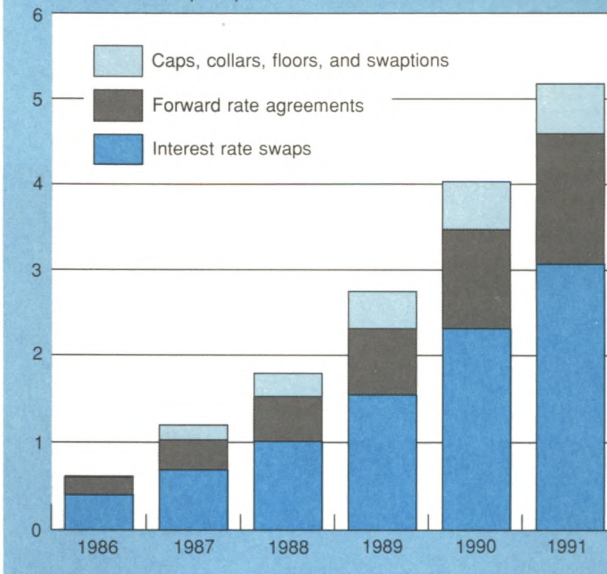


Sources: International Swap Dealers Association; Bank for International Settlements; Federal Reserve Bank of New York staff estimates.

Chart 4

Over-the-Counter Interest Rate Derivatives

Year-end notional principal in trillions of dollars



Sources: International Swap Dealers Association; Bank for International Settlements; Federal Reserve Bank of New York staff estimates.

apparently faster growing market, some dealers offer equity swaps but most concentrate on highly customized equity index options, predominantly Nikkei Index options.

Geographical growth

The geographical growth of financial derivatives manifested itself largely in the opening of new derivatives exchanges and the widening share of nondollar currencies in OTC derivatives.

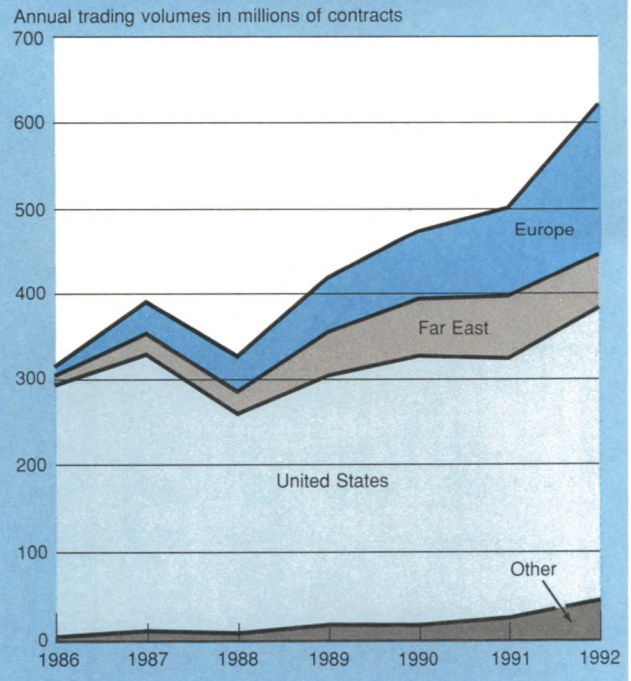
New derivatives exchanges

The growth in the turnover of exchange-traded derivatives was concentrated in exchanges outside the United States, most of them new ones (Chart 5). Between 1986 and 1992, a period when turnover on U.S. derivatives exchanges was barely growing, turnover in European exchanges rose 47 percent a year and contributed the largest share of the growth in turnover worldwide. Turnover in exchanges in the Far East grew 29 percent a year during the period and contributed the next largest share of global turnover growth. The turnover increase was spurred by the opening of new exchanges and the launching of interest rate and equity index derivatives (Chart 6). Since 1985, at least eighteen new derivatives exchanges have been organized around the world, including already established stock exchanges that only recently began trading derivatives (Table 1). Trading volumes at the MATIF, established in 1986, have catapulted it to the ranks of the world's five largest derivative exchanges. Other major new exchanges are the Tokyo International Financial Futures Exchange (TIFFE) in

Footnote 11 continued
on investment contracts (GROIs), which have the structure of portfolio insurance or put options on a stock market index. Eli Remolona and Stephen King analyze such contracts in "The Pricing and Hedging of Market Index Deposits," this *Quarterly Review*, Summer 1987.

Chart 5

Exchange-traded Derivatives by Region

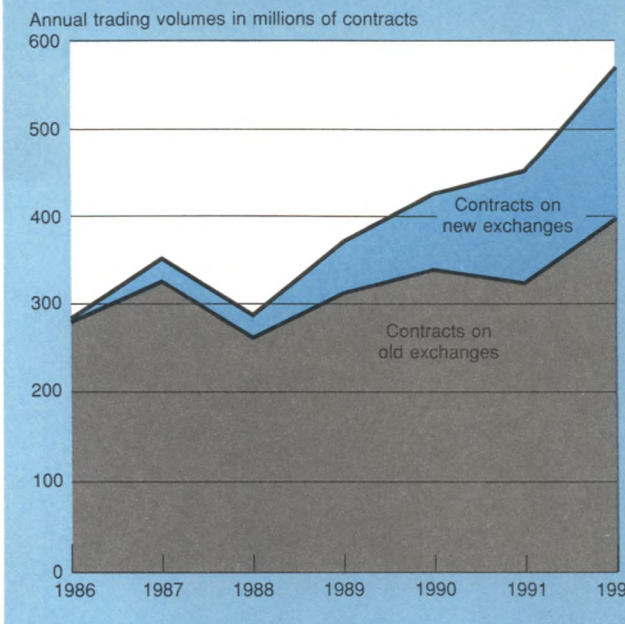


Sources: Bank for International Settlements; Options Clearing Corporation; Futures Industry Association; Philadelphia Stock Exchange.

Notes: The Far East comprises Japan, Hong Kong, and Singapore. "Other" comprises Australia, Brazil, Canada, and New Zealand.

Chart 6

Interest Rate and Equity Index Contracts by New and Old Exchanges



Sources: Bank for International Settlements; Options Clearing Corporation; Futures Industry Association; Philadelphia Stock Exchange.

Note: New exchanges are exchanges founded after 1985 or exchanges that opened trading in financial derivatives after 1985.

Japan, DTB in Germany, and SOFFEX in Switzerland.[12]

OTC derivatives in nondollar currencies

The OTC markets operate internationally over telephone lines without the benefit of a central clearinghouse to fix geographical locations. Transactions made in London may well be booked in Frankfurt. Nonetheless, the increasing importance of nondollar currencies in OTC contracts indicates the geographical diffusion of these derivatives.[13] The share of the nondollar sector in interest rate swaps widened from 20 percent in 1986 to 51 percent in 1991. The Japanese yen has been the most important nondollar currency; its share of interest rate swaps has doubled since 1987 to 16 percent in 1991. The pound sterling and German mark have been the next two most important currencies.

[12]The trading systems used by the new exchanges appear to indicate a trend away from trading pits toward floorless electronic systems. The largest exchanges, however, have continued to open new trading pits, convinced that the open outcry is still the most effective system for active trading. London's LIFFE did develop its own electronic system for futures trading, called Automated Pit Trading (APT), but uses it only to supplement pit trading activity. The CME, CBOT, and Reuters use their electronic system, GLOBEX, in a similarly supplemental fashion.

[13]The Bank for International Settlements provides a careful discussion of the share of nondollar currencies in "Derivative Financial Instruments and Banks' Involvement in Selected Off-Balance-Sheet Business," *International Banking and Financial Market Developments*, May 1992, pp. 22-26.

Forces driving derivatives growth

The growth and geographical diffusion of financial derivatives seemed to follow the pattern set by earlier innovations that found increasing acceptance among users. But the derivatives' spread was rooted in specific demand forces that largely determined the direction and speed that the spread took.[14] The analysis below suggests that the growth in exchange-traded derivatives arose primarily from the demand for liquidity-enhancing innovations and the growth in OTC derivatives from the demand for market-risk-transferring innovations.[15]

At least four broad developments gave rise to these demands. First, sustained shifts and temporary surges in market volatility differentially affected the demands for the various derivatives. Second, the emergence of important cash markets for government bonds and the

[14]Supply factors, of course, contributed to the spread of derivatives. Such factors include advances in communication and information-processing technologies and the development of option pricing and simulation models. The fact that currency option models were developed before fixed-income option models, for example, may help explain why currency options seem to have found acceptance sooner than bond options. Nonetheless, demand factors appear to have been more significant in the recent growth of derivatives.

[15]These are two of five types of financial innovation discussed in Bank for International Settlements, *Recent Innovations*. The other types are credit-risk-transferring, credit-generating, and equity-generating innovations. In their early stages, interest rate and currency swaps may be viewed largely as credit-generating innovations.

Table 1

Derivatives Exchanges Established after 1985

Exchange	Country	Date	Trading System
Bolsa de Mercadorias & Futuros (BM&F)	Brazil	1986	open outcry
European Options Exchange (EOE)†	Netherlands	1986	open outcry‡
Marché à Terme International de France (MATIF)	France	1986	open outcry
Stockholm Options Exchange (OM)	Sweden	1986	electronic
Swiss Options & Financial Futures Exchange (SOFFEX)	Switzerland	1986	electronic
Financial Futures Market Amsterdam (FTA)	Netherlands	1987	open outcry‡
Finnish Options Market (FOM)	Finland	1988	electronic
Guarantee Fund for Danish Options (FUTOP)	Denmark	1988	electronic
Irish Futures & Options Exchange (IFOX)	Ireland	1988	electronic
Osaka Securities Exchange (OSE)†	Japan	1988	electronic
Tokyo Stock Exchange (TSE)†	Japan	1988	electronic
Marché des Options Négociables de Paris (MONEP)†	France	1989	open outcry
Tokyo International Financial Futures Exchange (TIFFE)	Japan	1989	electronic
Deutsche Terminbörse (DTB)	Germany	1990	electronic
Mercado Español de Futuros Financiers (MEFF)	Spain	1990	electronic
Belgian Futures & Options Exchange (BELFOX)	Belgium	1991	electronic
Austrian Futures & Options Exchange (OTOB)	Austria	1992	electronic
Mercato Italiano dei Futures (MIF)	Italy	1992	electronic

†EOE, OSE, TSE, and MONEP existed before 1985, but TSE began trading bond futures in 1988, while EOE, OSE, and MONEP began trading equity index contracts in the indicated years.
‡EOE and FTA have announced plans for an electronic system.

growth of OTC derivatives fostered a demand for the liquidity provided by exchange-traded interest rate futures. Third, interest rate risks faced by financial institutions and nonfinancial corporations created a demand for risk-transferring OTC interest rate contracts. Finally, the global diversification of institutional equity portfolios led to a demand for risk-transferring OTC stock index options.

The life cycle of innovations

The acceptance and spread of new products can be said to follow a life cycle composed of different stages. Trading volumes in Treasury bond futures at the CBOT—the world's most actively traded contract—illustrate what may be the typical shape of an innovation's life cycle (Chart 7). The growth in the bond contract's turnover since its introduction in 1977 appears to follow the S shape of a logistic growth curve.[16] In general, growth in the use of a contract begins slowly, then surges as the contract becomes popular, and finally slows down as the contract matures and saturates its market.

Thus a derivative's growth rate may depend simply on the date of its introduction and consequently on the stage it has reached in its life cycle. The growth rates in the turnover of U.S. exchange-traded derivatives do seem to fit a rough life cycle explanation. The CME launched its currency futures and options in 1972; having been introduced early, these contracts may now be growing slowly because they have reached the stage of market saturation. The CBOT started trading its Treasury bond contracts in 1977 and the CME its Eurodollar contracts in 1981; these interest rate contracts may now be surging because they are still at the stage of gaining popularity and capturing new users. Finally, the Chicago Board Options Exchange (CBOE) launched its S&P 100 options and the CME its S&P 500 contracts in 1983; growth of these equity index contracts may now be accelerating because they are so new.

The life cycles of derivatives, however, have not been uniform. Demand factors have shaped and stretched the various S curves to cause some contracts to grow much faster and others much slower than might be indicated by a simple life cycle explanation.

Shifts and surges in market volatility

The volatilities of underlying markets in the last six years have not shown a sufficiently steep rising trend to explain the recent growth of financial derivatives. But major shifts in volatility that occurred in certain markets years ago do help to explain the differential performance of currency contracts and interest rate contracts. In addition, more recent temporary surges in volatility have clearly boosted the growth of exchange-traded interest rate and equity index derivatives.

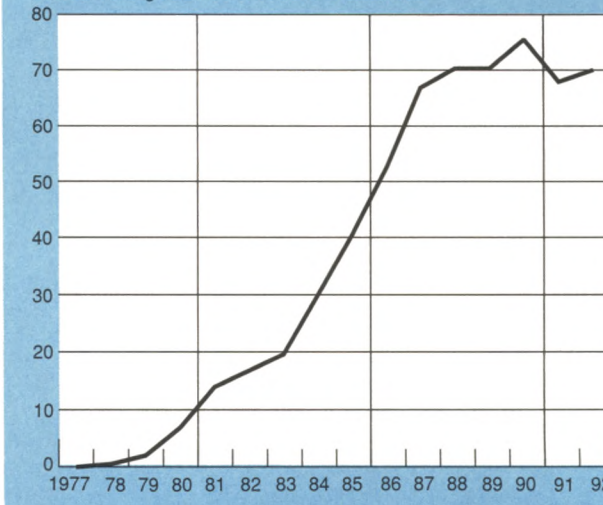
Sustained shifts in volatility

The timing of volatility-inducing shifts in policy regimes helps explain why currency contracts reached the slow-growth stage so much earlier than interest rate contracts. These policy shifts brought volatility first to the foreign exchange market, then to the money and bond markets. In the foreign exchange market, the advent of floating exchange rates in 1973 ushered in a new era of volatility (Chart 8). In the money and bond markets, the Federal Reserve's shift to targeting monetary aggregates rather than interest rates in October 1979 was the watershed event that lifted interest rate volatility to unprecedented levels (Chart 9). Market volatility, as measured by the standard deviation of Treasury bond returns, rose from an average of 8 percent a year in the 1970s to 15 percent in the 1980s. Thus the currency contracts gained popularity first and now appear to have reached the slow-growth stage of maturity, while

Chart 7

Growth of U.S. Treasury Bond Futures

Annual trading volumes in millions of contracts



Sources: Chicago Board of Trade; Futures Industry Association.

Note: Only contracts traded on the Chicago Board of Trade are included.

[16] Zvi Griliches finds that this S-shaped pattern applies to the use of hybrid corn, new farm equipment, new drugs, and new ideas; see "Hybrid Corn: An Exploration in the Economics of Technological Change," *Econometrica*, October 1957; also Nathan Rosenberg, ed., *The Economics of Technological Change* (Middlesex, England: Penguin Books, 1971), pp. 211-28.

the interest rate contracts are still gaining popularity and continuing to grow strongly in trading volumes.

Temporary surges in volatility

Temporary surges in volatility often induce temporary surges in turnover. It is also conceptually possible that a temporary volatility surge can increase demand permanently by bringing new converts to the market. Dramatic political events in 1991 sharply increased turnover in equity index options at the European Options Exchange, SOFFEX, the MATIF, and the Stockholm Options Exchange (Chart 10). Global turnover in equity index contracts grew 10 percent in 1991, but the 4 percent growth in 1992 belies the possibility of a permanent increase in demand. Similarly, the currency turmoil of September 1992 produced record turnover in interest rate contracts at LIFFE, the MATIF, and DTB (Chart 11).[17] Having grown 4 percent from 1990 to 1991, interest rate contracts grew 41 percent from 1991 to 1992. It remains to be seen whether such increases in turnover will be sustained in 1993.

In one case, an extreme surge in volatility seems to have actually reduced turnover permanently. Specifically, the October 1987 stock market break was followed by a sharp decline in the turnover of equity index contracts in U.S. exchanges. The demand for such transactions was driven in large part by portfolio insurance programs that relied on index futures and options for dynamic hedging. When the stock market crashed, the abrupt loss of liquidity in the cash and derivative markets made the large trades required by the programs hard if not impossible to execute. Since then, concerns about execution risk have dampened trading in index contracts in U.S. exchanges.

The demand for liquidity

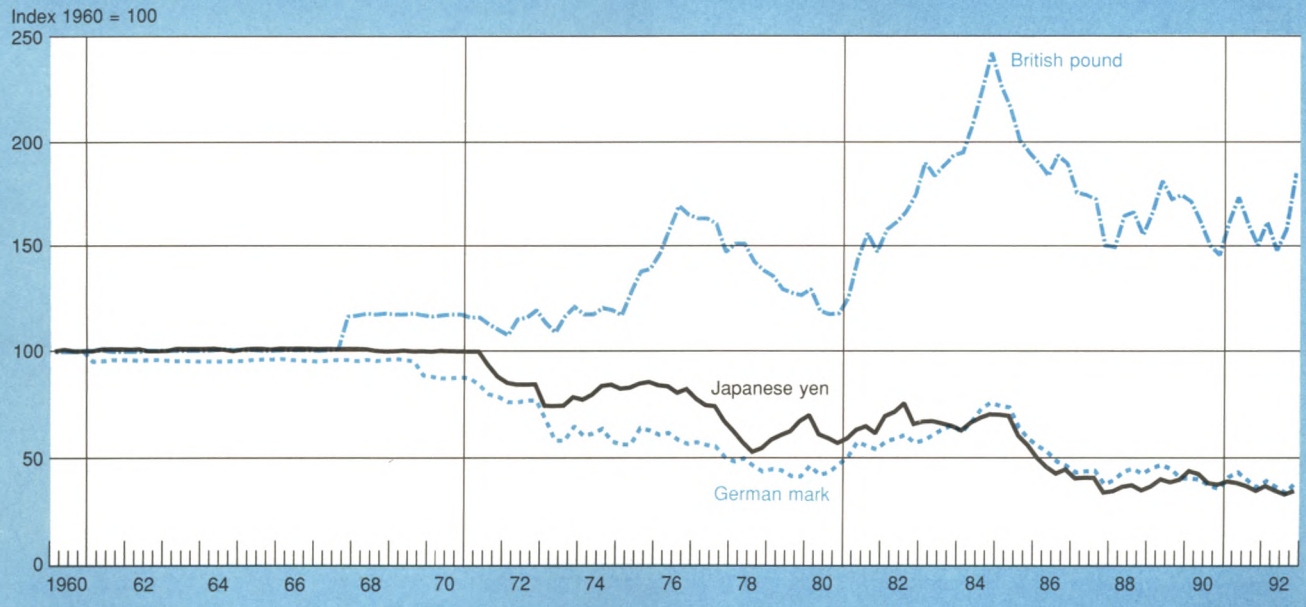
Demands for liquidity help explain the strong growth of futures on both long-term and short-term interest rates

[17]Somewhat surprisingly, activity in exchange-traded currency contracts seemed little affected by the event. Accounts of the actions of major players suggest that they took most of their positions in the spot foreign exchange market and in fixed-income and equity markets. See, for example, Thomas Jaffe and Dyan Machan, "How the Market Overwhelmed the Central Banks," *Forbes*, November 9, 1992, p. 40.

Chart 8

Exchange Rates

Value of the U.S. Dollar in Terms of Foreign Currency



Source: Board of Governors of the Federal Reserve System.

and the weak growth of currency futures, although these contracts are, of course, also used for transforming market risk.

The function of exchange-traded derivatives

The primary economic function of exchange-traded derivatives seems to be to provide liquidity.[18] Liquidity is the ability to alter exposure to market movements cheaply and quickly. This ability would depend on transactions costs, including commissions and bid-ask spreads, and the market's capacity to absorb large trades with small price movements. Derivatives exchanges use technology, clearinghouse and margin arrangements, and dealer competition to minimize transactions costs.[19] The market's capacity to absorb large trades would depend on the market-making capability of dealers, the depth of both the cash and derivatives market, and the effectiveness of arbitrage between cash and derivatives. In general, exchange-traded derivatives allow only a less than perfect replication of positions in the underlying market, but they are useful precisely because their liquidity makes it easier to change those positions.[20]

The most dramatic advantage in transactions costs seems to be provided by exchange-traded equity index derivatives, which have found enormous success in spite of an underlying cash market that is itself largely an exchange market and apparently rather liquid. Equity index contracts sharply reduce the cost of transactions motivated by market events rather than by company-specific events. The savings in transactions costs are delivered in part by trading a standard basket of stocks as defined by the index. One study, for example, has estimated that the commission and spread costs of a transaction in the stocks making up the S&P 500 Index were thirty times the comparable cost for the

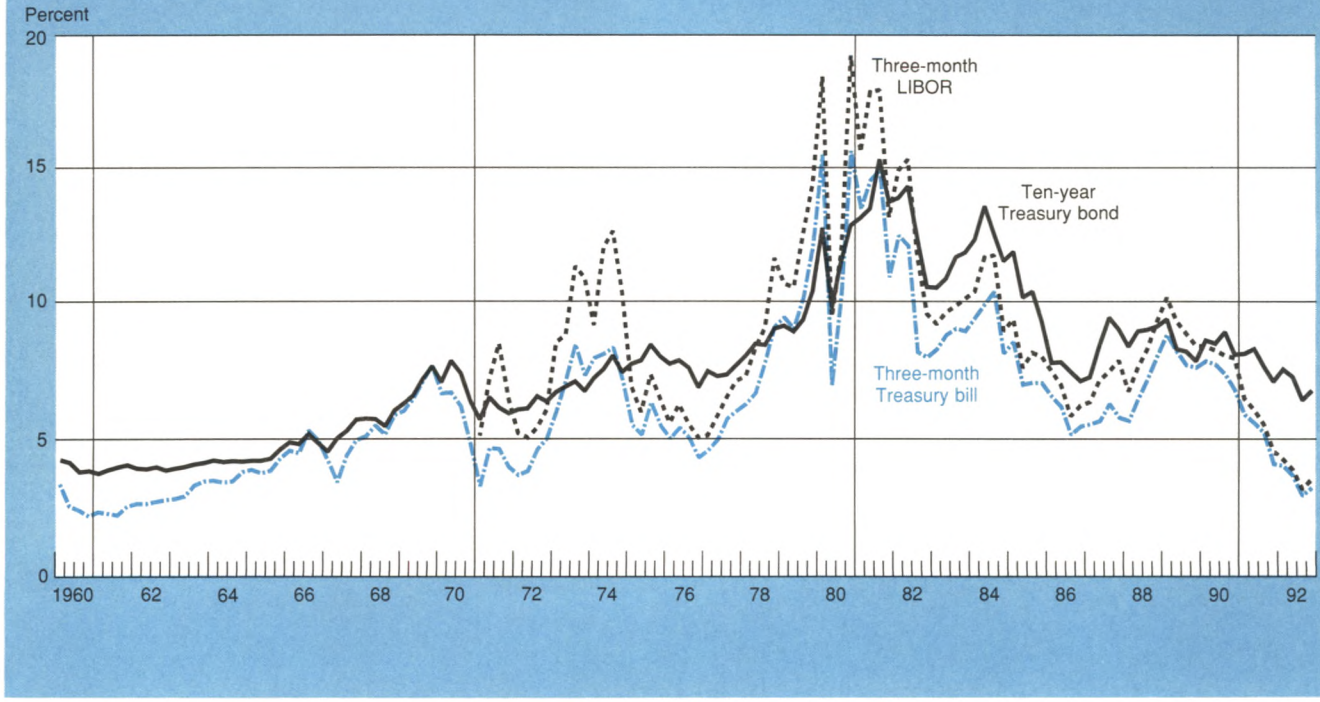
[18]These derivatives also offer investors the opportunity to take leveraged positions. A futures contract, for example, is structured to have zero value at origination, while call options are equivalent to positions in the underlying securities financed partly by borrowing. These contracts do not merely save on the transactions costs of borrowing but also reduce the credit risks entailed by an equivalent leveraged position in the cash markets.

[19]William Silber, for example, emphasizes that transactions costs are much lower in exchange-traded derivatives than in the cash markets. See "The Economic Role of Financial Futures," in Anne E. Peck, ed., *Futures Markets: Their Economic Role* (Washington, D.C.: American Enterprise Institute, 1985), pp. 83-114.

[20]The less-than-perfect replication of cash positions is reflected in the "basis," the difference between the derivative's actual price and the theoretical price implied by cash market prices.

Chart 9

U.S. Interest Rates



equivalent position in index futures at the CME.[21]

Liquidity in government bond markets

The liquidity provided by exchange-traded derivatives has recently found a place in two newly important cash markets. Trading in the cash markets for French and German government bonds was relatively inactive when interest rate futures for these bonds were introduced, suggesting that these markets lacked liquidity at that time. Table 2 reports a rough measure of liquidity, the ratios of secondary market transactions to amounts of government bonds outstanding in several of the major markets.[22] The ratios indicate that liquidity in the French and German government bond markets has been lower than in the U.K. market, and liquidity in the U.S. and Japanese markets higher than in the European markets.

The strong demand for bond futures

Thus a pent-up demand for liquidity in the new government bond markets helps explain the strong growth of exchange-traded futures on long-term interest rates. The growth of such contracts has been strongest where the underlying cash market seems most deficient in liquidity. In absolute terms, the fastest growing such contracts in terms of turnover have been the futures on

[21]Interest rate futures are estimated to save 40 percent of the transactions costs of the equivalent positions in the cash markets. See Arnold Kling, "Futures Markets and Transactions Costs," *Financial Futures and Options in the U.S. Economy*, Federal Reserve System staff study, December 1986, pp. 41-53.

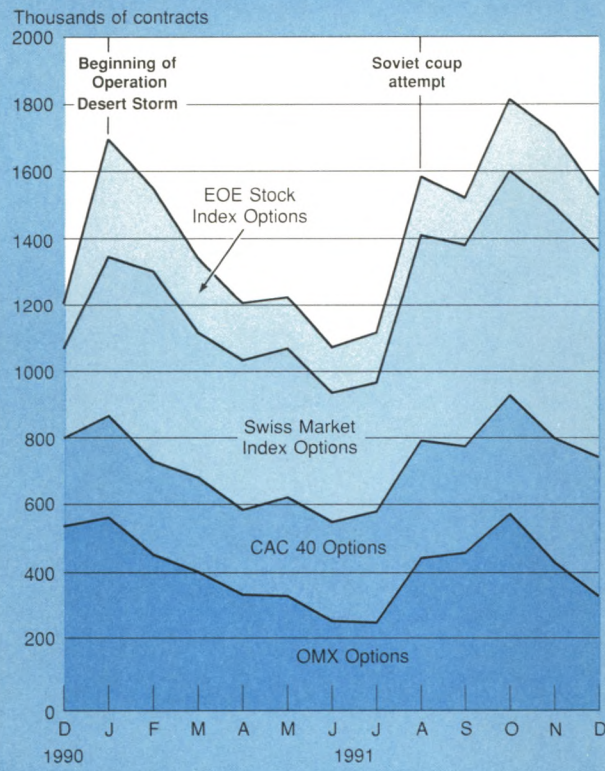
[22]Data are available only for secondary market transactions in the

Footnote 22 continued
home country. French and German bonds are actively traded also in London. Nonetheless, even doubling the amounts reported for France and Germany to account for foreign activity would not change the general pattern across countries.

Chart 10

Impact of 1991 Events on Exchange-traded Derivatives

Monthly Volumes of the Most Affected Major Contracts

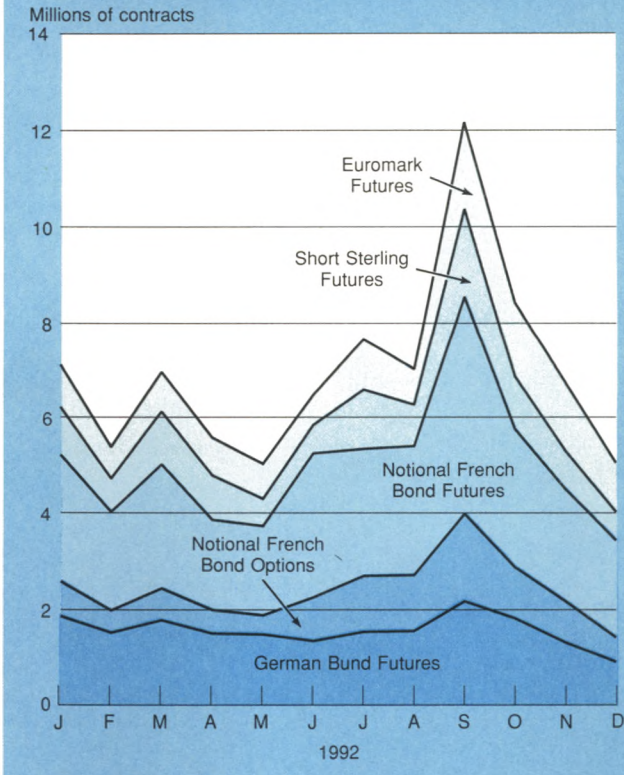


Source: Futures Industry Association.

Chart 11

Impact of September 1992 Currency Turmoil on Exchange-traded Derivatives

Monthly Volumes of the Five Most Affected Major Contracts



Source: Futures Industry Association.

Note: Figures on bund futures combine trading at LIFFE and DTB.

the notional French government bond and those on the German bund. In relative terms, the ratio of futures turnover to cash market turnover has been highest for the French and German markets and lowest for the U.S. market (Chart 12). Note that growth in the use of bond futures was accompanied by a decline in cash market transactions relative to bonds outstanding in Japan, France, and the United Kingdom from 1987 to 1991 (Table 2).

The strong demand for short-term interest rate futures

The growth of OTC derivatives has also helped boost turnover in certain exchange-traded derivatives. The liquidity of exchange-traded derivatives generally makes them convenient hedging tools for OTC derivatives dealers. In particular, the strong growth of Eurodollar futures and other interest rate futures may be traced to their use by swap dealers for hedging temporary positions in interest rate swaps. Turnover in Eurodollar futures has come to overshadow turnover in U.S. Treasury bill futures, not least because most dollar floating rate payments in swaps are based on LIBOR instead of Treasury bill rates.

The weak demand for currency futures

Liquidity also seems to be a factor in the poor growth of currency futures relative to interest rate futures. The spot market for foreign exchange is apparently already so liquid that it has created little need for the liquidity enhancement of exchange-traded derivatives. It is a telling fact that for the most part OTC dealers hedge their currency option positions in the spot market instead of the futures market.[23]

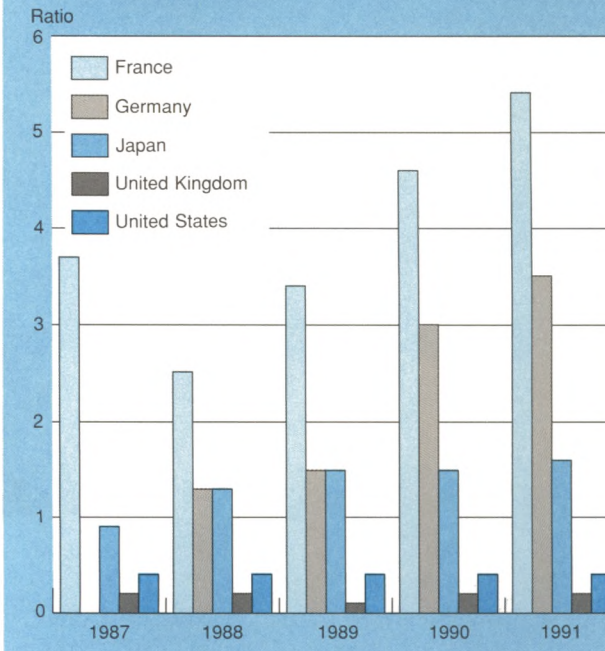
[23]Certain hedging strategies may still call for the use of exchange-traded options. In general, options can be hedged in either the cash or futures market by a technique called dynamic hedging or "delta" hedging. The technique requires frequent changes in positions to respond to changes in the sensitivity of the option price to the underlying asset price. These position changes can become costly during periods of high volatility, but exchange-traded options can be used to further hedge against the adjustment costs with a technique called "gamma" hedging.

The demand for new ways to transfer interest rate risk

It appears that demands by both financial and nonfinancial firms for new ways of dealing with interest rate movements help explain the huge expansion in interest rate swaps, just as demands for liquidity help explain the growth of certain exchange-traded derivatives.

Chart 12

Ratio of Futures to Cash Transactions in Government Securities



Source: Bank for International Settlements calculations.

Table 2

Ratio of Transactions to Amounts of Government Debt Outstanding

	1987	1991	Securities Included
United States	14.4	13.5	Treasury notes and bonds
Japan	22.1	8.9	Long-term interest-bearing government bonds
Germany	3.3	3.3	Bunds, railways, and post office bonds
United Kingdom	10.4	7.6	Long-term government and government-guaranteed securities
France	1.9	1.4	Central government marketable debt

Sources: Board of Governors of the Federal Reserve System, Bank of Japan, Deutsche Bundesbank, U.K. Central Statistical Office, London Stock Exchange, Bank for International Settlements, Banque de France, and Federal Reserve Bank of New York estimates.

The function of OTC derivatives

OTC derivatives have served to transform market risk, or equivalently, to provide new ways of transferring that risk.[24] Interest rate swaps, for example, were innovative because they functionally allowed the exchange of two notes paying two different types of interest streams—most commonly a floating-rate note and a fixed-rate note—without an exchange of principal amounts. The swap was designed essentially to allow a transfer of interest rate risk that entailed no credit risks associated with the principal.[25]

The rapid growth in OTC interest rate contracts, particularly swap contracts, may be attributed to financial institutions' and nonfinancial corporations' desire to deal with interest rate risks in new ways. Financial institutions turned to these derivatives to replace traditional hedging operations executed in the cash market, while nonfinancial corporations, some facing increased leverage, turned to the derivatives for general hedging and positioning purposes rather than just for saving on borrowing costs.

Development of the swap market

A movement towards greater market integration promoted the rapid rise of interest rate swaps. Throughout most of the 1980s, the swap market seems to have divided itself between a short-term segment (of maturities up to three years) catering largely to financial institution end-users and a long-term segment (of maturities longer than three years) catering to mainly nonfinancial end-users. In recent years, however, the division has blurred as nonfinancial end-users have increased their share of the market (Table 3) by migrating to the short-term segment, which has thus grown faster than the long-term segment (Chart 13).

The broadening of the market has been supported by stronger market-making activity, a trend evident in a wider share of interdealer swaps relative to end-user swaps and in narrower bid-ask spreads. Swap intermediation evolved from a business of simply bringing end-users together to one in which dealers acted as the counterparty to each side of a swap transaction. Assuming the role of counterparty allowed dealers to take swaps before matching positions could be found and to sell parts of the transaction to other dealers who could reach matching customers. As the market grew, the customers themselves began to see the importance of a dealer's credit rating, so that the business became increasingly concentrated in the highest rated intermediaries.[26]

[24] In the terminology of finance theory, the function of derivatives is to help "complete" financial markets. Stephen Ross, for example, demonstrates that in a world of uncertainty, options may often be the most effective way to widen investors' range of choices. See "Options and Efficiency," *Quarterly Journal of Economics*, vol. 90 (February 1976), pp. 75-89.

[25] In fact, credit risks are only associated with *net* interest payments. Katerina Simons simulates these risks in "Measuring Credit Risk in Interest Rate Swaps," *New England Economic Review*, November-December 1989.

[26] The importance of credit ratings has led investment houses to form triple-A-rated subsidiaries to deal in OTC derivatives. Although

Table 3

End-Users of Interest Rate Swaps

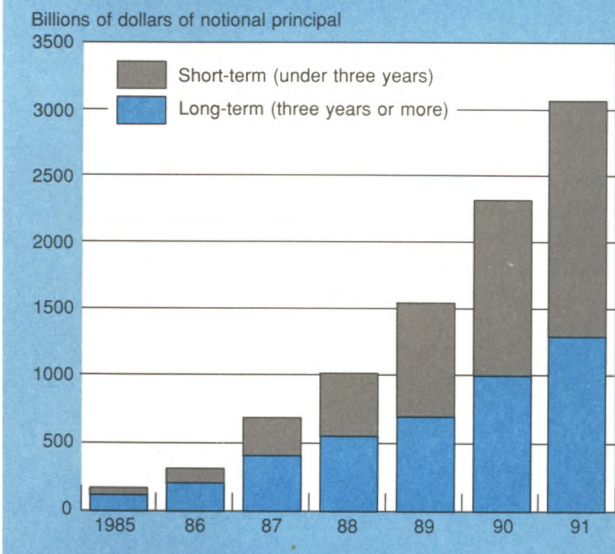
(Percent Share of Total Notional Principal)

	1989	1991
Corporations	24	31
Financial institutions	62	57
Government	7	11
Other	7	1

Source: International Swaps Dealers Association

Chart 13

Interest Rate Swaps by Maturity



Source: International Swap Dealers Association.

Note: Values for 1985 and 1986 are estimates based on reports by fifteen dealers.

Credit market arbitrage

Some analysts have argued that borrowers most often turn to swaps to obtain the cost savings from arbitrage between credit markets.[27] Fixed rate debt markets are seen as demanding higher credit risk premiums relative to the floating rate debt markets. Thus interest rate swaps would lower borrowing costs through specialization by comparative advantage: a higher rated borrower would issue in the fixed rate market and a lower rated borrower in the floating rate market, each seeking the market where it was relatively favored. They would then switch interest payments net of a spread.

Such credit market arbitrage, however, fails to explain a surge in swaps issuance that goes well beyond the gross issuance of all Eurobonds and U.S. corporate bonds (Chart 14). The swap market has developed to the point where good opportunities for credit market arbitrage come only in occasional windows, so that swaps are now more often used for general hedging and positioning purposes than for saving on borrowing costs. Indeed the perceived savings in borrowing costs through swaps may now merely compensate for the added credit risk taken on by the swap counterparties.[28]

Swaps by financial institutions

End-user swap activity grew as financial institutions started using swaps for their own risk management and positioning purposes. The increased importance of funds management from the mid-1980s on and new regulatory capital standards later in the decade prompted many banks to turn to swaps as a way to deal with increased interest rate risks.

Footnote 26 continued
dealers themselves may need high credit ratings, they can still choose to serve customers with lower ratings or even unrated customers.

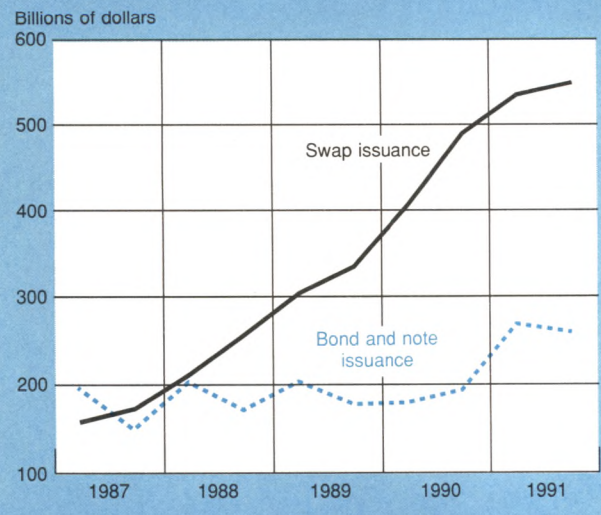
[27]D.K. Hargreaves, "Swaps: Versatility at Controlled Risk," *World Financial Markets*, Morgan Guaranty Trust Company, April 1991; J. Bicksler and A.H. Chen, "An Economic Analysis of Interest Rate Swaps," *Journal of Finance*, July 1986.

[28]A fixed rate borrower, for example, has two alternatives: (a) it may borrow directly in the fixed rate market, or (b) it may borrow in the floating rate market and swap into fixed rates. Alternative (b) may offer the lower all-in cost of funds, but unlike (a), it will also entail some credit risk from the swap counterparty.

Chart 14

Bond and Swap Issuance

Notional Value of Gross Interest Rate and Currency Swap Issuance and Gross Eurobond and U.S. Corporate Bond Issuance



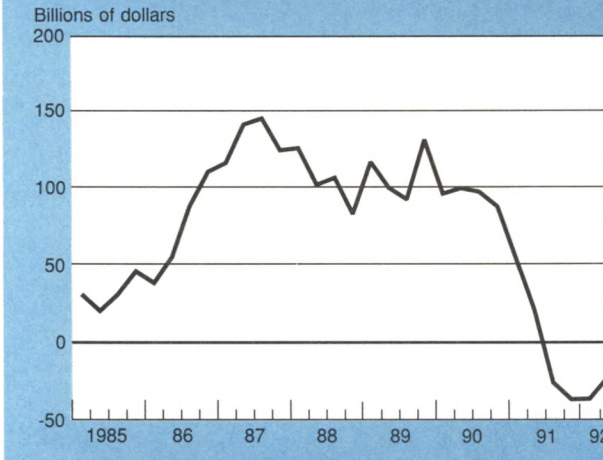
Sources: International Swap Dealers Association; Board of Governors of the Federal Reserve System; Organization for Economic Cooperation and Development.

Notes: Chart shows bond issuance by financial and nonfinancial companies. Swap issuance excludes interdealer transactions.

Chart 15

Total International Interbank Lending

Four-Quarter Moving Averages of Exchange-Rate-adjusted Changes in International Bank Assets



Source: Bank for International Settlements (BIS), *International Banking and Financial Market Developments.*

Notes: Chart shows both cross-border lending and local foreign currency lending. International lending refers only to lending among banks in countries reporting to the BIS.

During the 1980s, pension funds, insurance companies, mutual funds, and employer thrift plans joined the contest for household savings and forced banks to attract deposits by paying more competitive and variable interest rates.[29] At the same time, a loss of borrowers to the securities markets led banks to make the best of the situation by offering credit guarantees such as standby letters of credit and loan commitments. Funds management assured the availability of funds in case of need, but it also required the payment of interest rates sensitive to the money market. With the cost of funds so sensitive to the market, banks learned to separate funding risk from price risk by hedging their interest rate exposures, particularly by using interest rate swaps. In Europe, the need for funds management and hedging may have been more acute than in the United States. The deregulation of deposit rates in France and Switzerland and the efforts of the various monetary authorities to defend exchange rates under the European Monetary System added to the volatility of short-term interest rates and drew banks to swaps and forward rate agreements.

New regulatory capital standards also encouraged financial institutions to use derivatives rather than cash markets for the management of interest rate risks. The Basle accord of 1989 required banks to assign a 20 percent weight to interbank credit for calculating risk-based capital requirements but to apply the same weight only to "credit-equivalent" amounts of OTC derivatives.[30] Hence an interbank swap would require only a small fraction of the capital required by an equivalent interbank cash position on the balance sheet. In the early 1980s, the most important cash market used by banks for hedging was the international interbank credit market. In recent years, the interbank market has plunged, in part because banks now use the market narrowly for funding and use OTC derivatives for hedging (Chart 15).[31]

Swaps by nonfinancial corporations

The use of interest rate swaps by nonfinancial corporations expanded as credit market arbitrage ceased to be the primary motivation and as the corporations began to appreciate the derivative's general usefulness for hedging and speculating. An important factor in the growth of swaps was the rise in U.S. corporate leverage (Chart 16).[32] While the most leveraged corporations probably did not use swaps—for lack of the credit quality required by the market—more moderately leveraged firms evidently found swaps useful. A recent study by Anuradha Dayal of 356 publicly traded firms, for example, shows that the swap end-users were on average more leveraged than the nonusers (Table 4).[33] Most of the swap end-users in the sample were apparently hedging against interest rate risk by swapping into fixed rates.

The uncoupling of swaps issuance from bond and note issuance suggests that many end-users were borrowers from banks rather than from securities mar-

[29]See Federal Reserve Bank of New York, *Funding and Liquidity: Recent Changes in Liquidity Management Practices at Commercial Banks and Securities Firms*, July 1990.

[30]The credit-equivalent amount for an interest rate derivative with remaining maturity of more than a year, for example, would be half a percent of notional principal plus the mark-to-market value (if positive), which would be on the order of perhaps another 1 percent of notional principal.

[31]Svein Andresen provides a good discussion of the development of the interbank market for OTC derivatives; see "The Growth of Interbank Markets for OTC Derivative Instruments," Bank for International Settlements, November 1992

[32]Another measure of leverage, the ratio of net interest payments to cash flows, declined sharply in the last two years. Most of this decline, however, resulted from the fall in short-term interest rates during the period; see Eli Remolona, Robert McCauley, Judy Ruud, and Frank Iacono, "Corporate Refinancing in the 1990s," in this issue of the *Quarterly Review*. Debt-asset ratios have remained high, and many firms still fear the risk of a rise in interest rates.

[33]Anuradha Dayal, "Firm Participation in the Interest Rate Swap Market: An Empirical Investigation," unpublished paper, Brown University, November 1992.

Chart 16

Ratio of U.S. Nonfinancial Corporate Debt to GNP

Source: Board of Governors of the Federal Reserve System, Flow of Funds data.

Table 4

Characteristics of U.S. Nonfinancial End-Users and Nonusers of Swaps

	Fixed Rate Payers	Floating Rate Payers	Nonusers
Number of firms	140	30	186
Leverage			
Ratio of debt to assets	0.42	0.34	0.28
Ratio of interest to cash flow	0.31	0.24	0.14
Type of debt hedged (percent)			
Bank loan	49		
Floating rate or commercial paper	22		
Fixed rate	—	47	
No information	29	53	

Source of basic data: Anuradha Dayal, "Firm Participation in the Interest Rate Swap Market," unpublished paper, Brown University, November 1992.

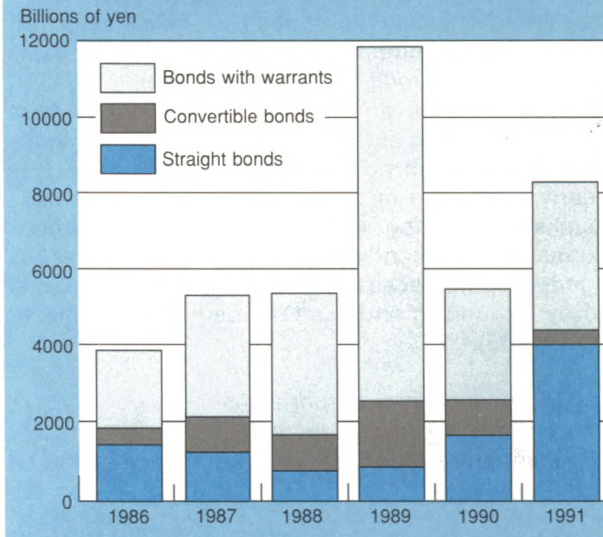
kets.[34] The Dayal study does find that most fixed rate swap payers reported hedging bank loans rather than floating rate notes (Table 4). Indeed, recent theory suggests that instead of issuing floating rate notes, a nonfinancial firm will roll over short-term loans to swap into fixed rates if the management expects the firm's credit rating to improve over time or if a bank creditor believes it can reduce credit risk by monitoring the firm.[35] At the same time, the recent disappearance of the once-ubiquitous call feature of U.S. corporate bonds may be explained in part by the availability of swap floors, collars, and interest rate options as alternative means of protecting fixed rate issuers from a fall in interest rates.

The global diversification of equity portfolios

In the 1980s, moves by institutional investors to diversify their equity portfolios contributed to the growth of the OTC equity index option market. Modern portfolio theory had persuaded these investors that diversification could reduce risk without sacrificing return.[36] They saw that in the absence of transfer risks, settlement risks, and substantial transaction costs, a global diversification of equity portfolios could provide considerable gains over purely domestic diversification, especially when correlations between stock markets remained

Chart 17

Bonds and Warrants Issued Overseas by Japanese Corporations



Source: Tokyo Stock Exchange.

[34] If bank borrowers tend to be poorer credit risks than bond and note issuers, the swaps market may now be subject to greater risks of default than before.

[35] See Robert H. Litzenberger, "Swaps: Plain and Fanciful," *Journal of Finance*, July 1992, pp. 831-50; Larry Wall, "Interest Rate Swaps in an Agency Theoretic Model with Uncertain Interest Rates," *Journal of Banking and Finance*, May 1989; and Marcelle Arak, Arturo Estrella, Laurie Goodman, and Andrew Silver, "Interest Rate Swaps: An Alternative Explanation," *Financial Management*, Summer 1988.

[36] Indeed, the capital asset pricing model (CAPM) suggests that in an efficient market, investors would hold the market portfolio consisting of all securities offered in the market; see William Sharpe, *Portfolio Theory and Capital Markets* (New York: McGraw Hill, 1970).

low.[37] In the 1980s, the Japanese stock market had become one of the world's major stock markets, and exposure to it was an important component of diversification.

During the period, burdensome rules for issuing equity directly in the Tokyo stock market drove capital-seeking Japanese firms to Europe, where they issued equity implicitly by attaching equity warrants to their Eurobonds. Issuance of these equity-linked bonds peaked in 1989 when Japanese firms issued over 9 trillion yen in face value (Chart 17). Investors found it convenient to detach the warrants from the bonds and to trade them separately as a way of trading the underlying Japanese equities. Japanese investors bought up most of the warrants, but enough found their way into the trading accounts of investment houses and the globally diversifying portfolios of institutional investors to form a viable market in Japanese equities outside Japan.

The development of the Japanese equity warrant market gave investment houses a convenient underlying market for OTC index derivatives, especially Nikkei Index options. Demand for these options surged when volatility began to beset the Tokyo stock market in 1990. Experience with trading the Nikkei contracts has apparently whet the appetite of investors and writers for OTC index options on the world's other major stock markets, notably the New York and Frankfurt markets.

[37]Bruno Solnik and B. Noetzlin estimate these gains in "Optimal International Asset Allocation," *Journal of Portfolio Management*, Fall 1982.

Conclusions

The growth and geographical diffusion of financial derivatives seem broadly consistent with the spread of other innovations. Nevertheless, powerful forces of demand played a decisive role in shaping the spread of derivatives in recent years. The growth in exchange-traded derivatives reflected primarily a demand for liquidity-enhancing innovations and the growth in OTC derivatives a demand for risk-transferring innovations.

Four broad developments contributed to the demand for these innovations in recent years. The volatility created by shifts in policy regimes led first to the growth of currency contracts, then to the growth of interest rate contracts, while recent temporary surges in volatility intensified activity in exchange-traded interest rate and equity index contracts in the last two years. The emergence of major new government bond markets and the growth of OTC derivatives created a demand for liquidity that exchange-traded interest rate futures were designed to provide. New inducements to financial institutions and nonfinancial corporations to deal with interest rate risks led to the growth of OTC interest rate contracts, most notably interest rate swaps and forward rate agreements. Finally, the global diversification of equity portfolios and the trading of Japanese equity warrants led to a demand for OTC Nikkei Index options and for OTC index options on other stock markets.

Assessing the Exchange Rate's Impact on U.S. Manufacturing Profits

by Juann Hung

The large and persistent swings of the dollar over the past two decades have generated much discussion about the causes of these movements and their consequences for the U.S. trade balance and U.S. competitiveness. Relatively little effort has been made, however, to assess the effect of exchange rate movements on U.S. manufacturing profits.[1] This article will examine the exchange rate-profits relationship since the introduction of floating rates in 1973, evaluating not only the overall impact of exchange rate changes on aggregate manufacturing profits but also the effects on the profits of exporting and import-competing firms.[2]

Undertaking such a study is important for many reasons. Most obviously, the effects of large and prolonged exchange rate swings on profits will, over time, have significant ramifications for the employment and welfare of manufacturing workers. In addition, fluctuations in manufacturing profits will affect investment and savings, and consequently long-term U.S. economic growth. An increase in profits tends to boost investment by enhancing firms' confidence in potential returns on new investment and by relaxing firms' budget constraints. A rise in corporate profits may increase gross savings through corporate retained earnings, personal savings of dividend income, and government tax revenues.

Of course, exchange rate swings are only one determinant of manufacturing profits at any point in time. Other macroeconomic conditions at home and abroad and factors such as management skills and production efficiency may also affect manufacturing profits, and hence employment and investment. Nevertheless, because exchange rate swings have been so sizable and persistent in the past two decades, their contribution to the evolution of profits in the same period is likely to have been important. Thus, studying the impact of exchange rate swings on profits seems critical to understanding how exchange rates have helped to shape the economy's course.

This article begins by explaining why U.S. manufacturing profits are likely to have a negative correlation with exchange rate movements—that is, why a rise in the dollar is likely to lower profits. The article's second section shows that U.S. manufacturing profits over the past fifteen years do appear to have been negatively correlated with the exchange value of the dollar. The third section introduces an econometric model of manufacturing profits that makes it possible to assess more precisely the quantitative impact of the dollar exchange rate on manufacturing profits. The model focuses on the direct transmission of exchange rate changes to profits through shifts in export and import prices.

Our econometric results show that a sustained appreciation of the dollar does have a significantly negative direct effect on U.S. manufacturing profits in the long

[1] One recent exception is Richard Clarida, "The Real Exchange Rate and U.S. Manufacturing Profits: A Theoretical Framework with Some Empirical Support," Federal Reserve Bank of New York, Research Paper no. 9214, 1992.

[2] Manufacturing profits here refer to profits of domestic U.S. manufacturing firms only. Exchange rate movements also affect profits of overseas subsidiaries of U.S. manufacturing firms. Consequently, the total impact of exchange rate change on U.S. manufacturing profits ought to include the impact on both domestic profits and overseas profits. Data problems, however, make it necessary to limit this study to the exchange rate's effect on profits of domestic manufacturing firms.

run, affecting exporters' profits more than those of import-competitors. Simulations based on the model further suggest that the rise in the dollar in the first half of the 1980s cut manufacturing profits substantially. Although the return of the dollar in the second half of the decade to its 1980 level reversed the decline in the profit rate due to the earlier rise of the dollar, the cumulative effect of the 1981-86 high dollar still resulted in a substantial manufacturing profit loss of about $230 billion (in 1987 constant dollar terms) for the 1981-90 period as a whole. Even if one assumes away the multiplier effect on the economy, this loss is large; indeed, it is equivalent in size to about 10 percent of total gross manufacturing profits during the 1980s.

To be sure, these quantitative findings capture only the direct impact of exchange rate changes on profits. Because exchange rates may influence other determinants of profits, our estimates are suggestive rather than precise.[3] Nevertheless, the dollar's impact on manufacturing profits in the 1980s is shown to be of such a magnitude that the conclusion appears inevitable: a huge and sustained swing in the dollar exchange rate will have a substantial impact on U.S. manufacturing profits.

The linkage between exchange rates and manufacturing profits

Because manufactured goods dominate both U.S. exports and imports, the profits of U.S. manufacturing firms are more susceptible to exchange rate movements than are other components of U.S. corporate profits.[4] This section briefly describes the mechanism through which changes in the exchange rate are transmitted to profits in the exporting and import-competing sectors. A formal derivation of the linkage between manufacturing profits and the exchange rate—how and to what extent a change in the dollar's value affects exporters' and import competitors' profits—is given in the appendix.

From the perspective of a U.S. exporting firm, an appreciation in the dollar is always bad news, whether or not the dollar appreciation results in an increase in (foreign currency) export prices. To be sure, an exporting firm that has market power abroad can try to minimize its profit loss by choosing the extent to which the (foreign currency) export price of its goods adjusts to a dollar appreciation.[5] Nevertheless, a firm's "pricing to market" strategies can only mitigate, but not eliminate, the negative impact of a dollar appreciation.

The firm may choose a strategy of "complete pass-through" and raise the foreign currency price of its exports to the full extent of the dollar's appreciation. In this case, the firm leaves the unit dollar profit of its exports unchanged by holding its dollar export price fixed.[6] The firm's profits are still likely to fall with this strategy, however, because its goods become less price competitive relative to foreign goods and hence its export volume drops.

Alternatively, the firm may choose a strategy of "zero pass-through" and keep the foreign currency price of its exports unchanged, allowing the dollar price of its exports to fall to the same extent that the dollar has appreciated. With this strategy, the firm seeks to prevent its export volume from declining, thereby preserving its market share. In this case, both the firm's export volumes and its profits measured in foreign currency terms are unchanged; however, these foreign currency profits will translate into fewer dollars. In other words, the firm's profits measured in dollar terms will fall because of a dollar translation effect.

In general, the exchange rate pass-through is likely to be incomplete but more than zero, so that an appreciation of the dollar hurts export profits both by lowering the volume of exports and by translating (foreign currency) profits into fewer dollars. There is, in fact, a trade-off between the price/volume effect and the translation effect: as the exchange rate pass-through to U.S. export prices (that is, the increase in the foreign currency price of U.S. exports in response to a dollar appreciation) becomes larger, a given appreciation of the dollar hurts export profits more through a loss in the volume of sales but less through a dollar translation effect.

An appreciation of the dollar also tends to be bad news for U.S. import-competing firms, but good news for foreign exporters. Let's first discuss the effects on foreign firms by supposing that the yen depreciates against the dollar but the production costs (in yen terms) of Japanese goods are not affected.[7] A Japa-

[3] A change in the exchange rate may indirectly affect profits through its impact on GNP and other variables.

[4] For example, manufactured goods constituted 76 percent of total U.S. exports and 79 percent of total U.S. imports in 1990.

[5] See Richard Marston, "Pricing to Market in Japanese Manufacturing," *Journal of International Economics*, vol. 29 (1990); *Footnote 5 continued* Alberto Giovannini, "Exchange Rates and Traded Goods Prices," *Journal of International Economics*, vol. 24 (1985); Paul Krugman, "Pricing to Market When the Exchange Rate Changes," in S. W. Arndt and J. D. Richardson, *Real-Financial Linkages Among Open Economies* (Cambridge, Mass.: MIT Press, 1987).

[6] The production costs of U.S. exports tend not to be affected by changes in the dollar exchange rate because petroleum and other major imported commodity inputs are priced in dollars.

[7] Because commodities tend to be priced in dollars, exchange rate pass-through to U.S. import prices may stem not only from foreign firms' pricing-to-market strategies, but also from changes in their

nese exporting firm is going to benefit no matter what it does, although the extent of its benefit will depend on its pricing strategy. The Japanese firm may choose to keep its price competitiveness by leaving the dollar price of its goods unchanged. In this case, its yen profits would rise as yen sales revenue increases relative to yen production costs, even though its sales volume would not change. That is, with a "zero pass-through" strategy, the Japanese firm would benefit from the dollar's appreciation purely as a result of a yen translation effect. Alternatively, the firm might allow the appreciation of the dollar to pass through fully to the dollar price of its goods (that is, it might maintain the yen price of its goods by allowing the dollar price to fall), thereby increasing the price competitiveness of its goods and expanding its market share in the United States. In this case, the firm benefits through increased sales volume owing to its enhanced price competitiveness.

Of course, Japanese firms' production costs are likely to rise as the yen's depreciation (against the dollar) pushes up the cost of their imported raw material. In this case, Japanese firms are not likely to pass through fully the yen's depreciation to the dollar price of their goods (that is, they are not likely to lower the dollar price of their goods to the full extent of the yen depreciation), since such a strategy would entail a decline in the yen profit margin of their goods sold in the United States. Therefore, the exchange rate pass-through to the U.S. import price is likely to be incomplete in general.

The extent of the loss incurred by U.S. import-competing firms because of the dollar's appreciation depends on the extent to which foreign suppliers pass through their currency's depreciation (against the dollar) to U.S. import prices, as well as the sensitivity of demand for U.S. manufactured goods with respect to the ratio of U.S. prices to import prices. If foreign exporters do not lower the dollar price of their products as the dollar appreciates—the case of zero pass-through—U.S. import-competing firms' profit will not be lowered by the dollar's appreciation, since U.S. goods will not become less price competitive relative to foreign goods. Short of zero pass-through, however, U.S. import-competing firms will tend to suffer from a stronger dollar through the erosion in the price competitiveness of U.S. goods. Indeed, as the appendix shows, the greater the extent to which foreign suppliers pass through their currency's depreciation, the greater the loss incurred by U.S. import-competitors for the same degree of appreciation in the dollar.

In sum, the above partial equilibrium analysis suggests that an appreciation of the dollar would hurt U.S. manufacturing profits regardless of the pricing behavior of U.S. and foreign exporters. By the same token, a depreciation of the dollar would increase manufacturing profits. What accounts for these findings is not only that changes in the dollar exchange rate tend to alter the price competitiveness of U.S. manufactured goods at home and abroad, but also that the dollar profit margin of U.S. exports may change through a dollar translation effect.

U.S. manufacturing profits since the mid-1970s

Our discussion suggests that if other macroeconomic variables remain roughly unchanged, we should observe a negative co-movement between U.S. manufacturing profits and the value of the dollar. When examining the relationship between gross manufacturing profits as a share of GDP and the dollar exchange rate over the past fifteen years, however, we find only some weak evidence of this inverse relationship (Chart 1). The dollar appreciated by about 40 percent from 1980 to its peak in early 1985, and then more or less returned to its 1980 level by 1987. Since then, it has remained in a relatively narrow range. Over that period, the ratio of manufacturing profits to GDP declined considerably during the first half of the 1980s from its 1970s level, as the dollar appreciation would have led one to expect, but then hardly recovered by the late 1980s despite the dollar's fall.

When we recall that manufacturing profits are also subject to other influences, however, the weak inverse mapping between profits and the dollar exchange rate displayed in Chart 1 appears less surprising. To obtain a clearer picture of the correspondence between exchange rate changes and manufacturing profits—in aggregate and across industries—over the past fifteen years, let us now turn to a more detailed, although still impressionistic, analysis. Table 1 traces the evolution not only of the gross profit share in GNP, but also of profit margins, export shares of total sales, and import penetration of major manufacturing industries since the mid-1970s.[8] It presents period averages for each of the above indicators during three subperiods marked by huge shifts in the dollar. The value of the dollar against major foreign currencies in the second period (1981-86)

Footnote 7 continued
production costs induced by changes in the dollar exchange rate. As a result, the total exchange rate pass-through elasticity for import prices tends to derive from the impact of exchange rate changes both on foreign production costs and on firms' pricing-to-market considerations.

[8]Gross profits in Table 1, as in Table 2, refer to profits before depreciation and taxes but after net interest payments. The definition of gross profits in these two tables differs from that in Chart 1 and other parts of this article because data for net interest payments are not available at a disaggregate industry level.

was on average about 22 percent higher than in the first period (1975-80), and subsequently fell back about 24 percent, on average, between the second and the third (1987-91) periods.[9]

The table shows that although the correspondence between the ratio of profits to GNP and the value of the dollar was not clear by the late 1980s, profit margins appeared to be significantly and inversely correlated with the dollar over the past fifteen years.[10] The profit margin of the nonpetroleum manufacturing sector as a whole declined by 0.5 percentage point from the first period to the second, and then increased by 1 full percentage point in the third low-dollar period.

To identify the factors underlying the seemingly insufficient revival in the ratio of profits to GNP in the late 1980s, it is useful to examine the manufacturing performance on both the exporting and import-competing fronts. For the exporting sector, Table 1 shows that the average ratio of exports to sales hardly increased from the first to the second period despite growing world trade, but then increased sharply from the second to the third period. Chart 2 gives a clearer picture of this inverse relationship between the value of the dollar and manufacturing export performance: export sales as a share of total sales increased about 0.4 percentage point each year in the first period, declined about 0.5 percentage point annually in the second period, but then increased rapidly—1.1 percentage points each year—in the third period.

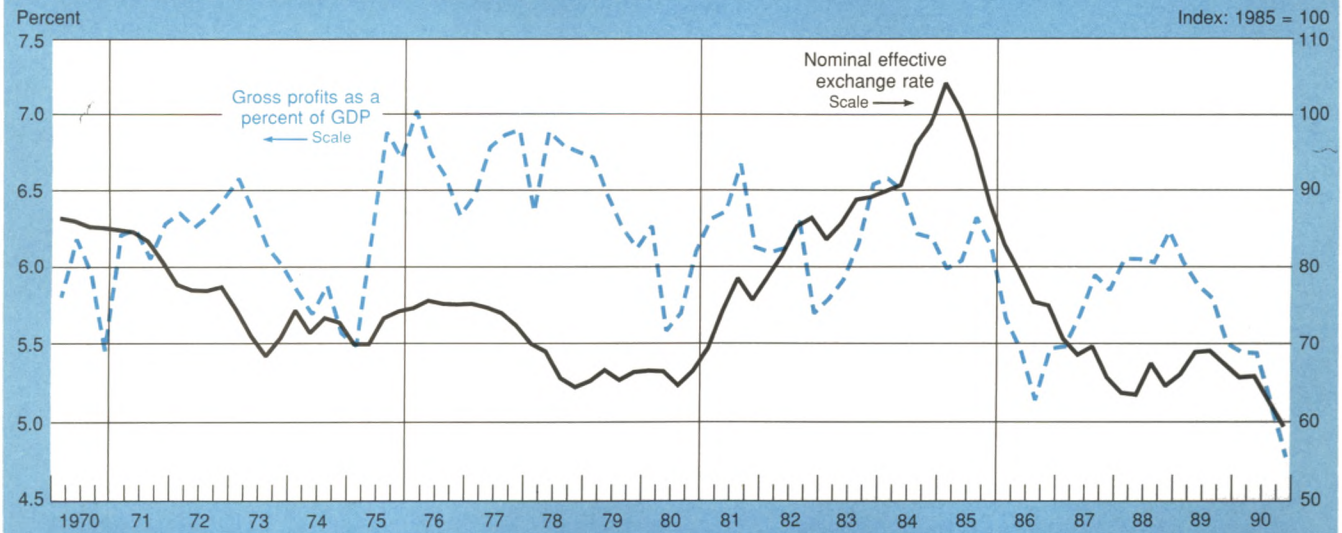
On the domestic market side, the import penetration ratio rose markedly in the period of the sustained dollar appreciation but hardly declined when the dollar depreciated (Table 1). In particular, the import penetration ratio rose from about 9 percent in 1981 to 13 percent in 1986, increasing about 0.8 percentage point annually in the second period. The high ratio of import penetration continued up to 1990, only to decline sharply in 1991 (Chart 2). The persistence of foreigners' inroads into the U.S. market as the dollar receded from its appreciated level may have been caused by lingering effects from earlier dollar appreciation. But it could also have stemmed from other developments, such as growing competition from newly industrialized and developing countries in the 1980s and an increase in world trade effected by other factors.

[9]The occurrence of a recession in each subperiod helps to average out cyclical influences on the ratio of profits to GNP across the three subperiods.

[10]As noted earlier, for a given volume of export sales, a dollar appreciation would lower the profit margin of U.S. exports in dollar terms (that is, the dollar profit per unit of exports) as a result of a dollar translation effect.

Chart 1

U.S. Manufacturing Profits and the Nominal Dollar Exchange Rate



Notes: Gross profits refer to profits before depreciation, interest payments, and taxes. The nominal exchange rate is a trade-weighted average of the dollar relative to the currencies of thirteen industrial countries.

The evidence in Table 1 and Chart 2 suggests that the exporting sector has been adversely influenced by exchange rate movements: both the profit margin and the volume of exports appear to have been inversely related to exchange rate changes. The relationship between the import penetration ratio and the exchange rate is not clear, however. The import-competing sector does not seem to have benefited greatly from the sharp depreciation of the dollar in the late 1980s. Indeed, these import developments may be one major factor underlying the apparently weak response of the manufacturing profits–GNP ratio to the dollar's fall during this period.

Table 2 provides further evidence of the adverse effects of the dollar appreciation on manufacturing profits in the first half of the 1980s. It traces changes in the rate of return for major manufacturing industries from the low-dollar 1978-89 period to the high-dollar 1985-86 period. (The years 1978-79 are chosen as the beginning period for this exercise to control for uneven impacts of the 1980 recession on different industries. The dollar exchange rate in 1978-79 was about the same as the 1980 rate.) The question at issue in Table 2 is whether industries that were more vulnerable to international competition showed a greater decline in the rate of return between these two periods.

The data indicate that the appreciation of the dollar between the 1978-79 and 1985-86 periods was accompanied by a decline in the real rate of return in most manufacturing industries. Moreover, the index of "loss in market share," calculated as the average of the increase in import penetration and the decrease in the ratio of exports to sales, shows that all U.S. manufacturing industries' market shares declined during this period of dollar appreciation. Aside from the primary metals industry, all listed industries experienced a distinct deterioration in their ratios of export sales to total sales while facing greater foreign competition in their respective domestic markets in 1985-86 relative to 1978-79. Overall, the table suggests that the decline in an industry's profit rate was positively, albeit roughly, correlated with the erosion of that industry's international competitiveness as measured by the loss in market share index: industries that incurred higher market share loss tended

Table 1

Performance of Major U.S. Manufacturing Industries since the Mid-1970s

Percent, Subperiod Average

Subperiods	Primary Metals	Fabricated Metals	Machinery & Equipment	Electric Equipment	Motor Vehicles	Food Products	Chemical Products	Other (Nonpetroleum)	Total Nonpetroleum Manufacturing
Ratio of gross profit to GNP†									
75-80	0.3	0.3	0.6	0.4	0.4	0.5	0.6	1.5	4.7
81-86	0.1	0.2	0.4	0.4	0.4	0.5	0.5	1.4	3.9
87-91	0.2	0.2	0.4	0.4	0.4	0.5	0.6	1.4	4.0
Profit margin‡									
75-80	6.3	6.9	9.3	10.2	8.4	5.3	10.1	7.1	7.6
81-86	3.8	6.8	7.2	8.8	8.7	5.6	9.2	7.0	7.1
87-91	5.9	7.6	7.8	11.1	9.0	6.9	11.6	7.3	8.1
Ratio of exports to sales									
75-80	5.0	5.4	18.9	12.8	10.6	4.0	10.3	6.7	8.3
81-86	5.2	5.5	18.7	11.9	9.5	3.7	11.1	6.8	8.4
87-91	8.5	6.0	22.6	17.0	11.9	4.1	12.8	9.0	10.6
Import penetration§									
75-80	10.2	3.5	7.5	12.7	16.4	3.7	4.1	6.6	7.3
81-86	15.3	4.9	12.8	18.4	23.5	3.8	5.6	8.6	10.4
87-91	15.2	6.9	21.9	25.5	28.5	4.1	7.8	10.7	13.5

Memo:

	1975-80	1981-86	1987-91
The nominal dollar effective exchange rate (Index: 1985 = 100)	72.06	88.08	67.42

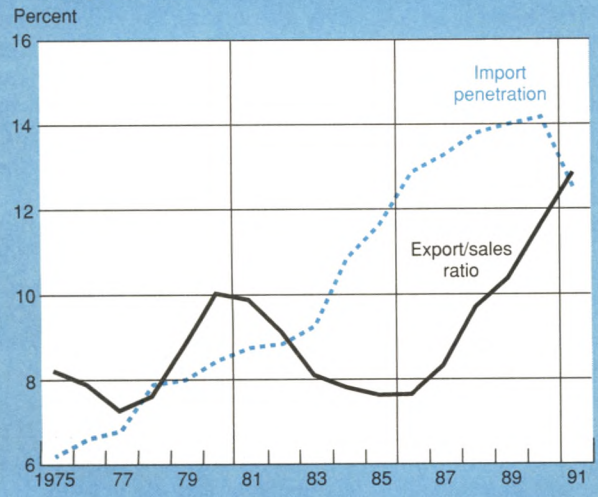
†Gross profits in this table are profits before taxes and depreciation, but after interest payments.
‡The profit margin is calculated as the ratio of gross profits to total sales.
§Import penetration is calculated as imports/[total sales + imports − exports].

to show greater erosion in their rates of return.[11]

[11]The notable anomalies are the auto and food industries. The surprisingly good performance of the auto industry is largely due to the choice of the 1978-79 period as the base period for our comparison. The auto industry's profit in 1979 was substantially lower than its normal profit because of the 1978-89 oil crisis.

Chart 2

U.S. Manufacturing Sector's International Competitiveness



Note: Manufacturing sector excludes the petroleum industry.

The impressionistic evidence presented in Tables 1 and 2 and Charts 1 and 2 appears to support the theoretical claim that U.S. manufacturing profits are inversely correlated with the exchange value of the dollar. Nonetheless, because factors such as business cycles here and abroad may have simultaneous but different influences on exchange rates and profits, the correspondence between manufacturing profits and the exchange rate is not strong. The analysis in the next section will provide a more complete and quantitative understanding of the relationship between manufacturing profits and the exchange rate in a framework that controls for the impact of other factors.

The long-run impact of the exchange rate on U.S. manufacturing profits—an econometric analysis

This section uses an empirical model to assess the long-run impact of the dollar exchange rate on U.S. gross manufacturing profits.[12] The formal derivation of the model and estimation methodologies are described in the appendix. Here an intuitive explanation of the model is given, and the estimation results are analyzed.

A brief description of the model

The behavior of manufacturing profits in an open economy is best understood by regarding total profits as the sum of two components: profits on domestic sales and

[12]Gross profits refer to profits before depreciation, interest payments, and taxes.

Table 2

Profitability Changes of Major U.S. Manufacturing Industries between 1978-79 and 1985-86

Percentage Changes

Industry	Change in Real Rate of Return†	Index of Loss in Market Share‡	Increase in Import Penetration	Decrease in Ratio of Exports to Sales
Nonpetroleum manufacturing	−2.1	2.4	4.3	0.6
Electric	−10.6	5.5	8.0	3.0
Motor vehicles	2.2	5.3	9.9	0.7
Machinery	−17.0	4.3	8.1	0.5
Primary metals	−6.3	3.3	6.1	0.4
Fabricated metals	−2.0	1.1	1.8	0.5
Chemicals	−0.7	1.0	2.1	−0.1
Food	3.1	0.6	0.1	1.1
Other	1.3	1.5	2.8	0.3

†Real rate of return is calculated as the ratio of gross profit to capital stock. Change in rate of return is the difference between the average rate of return in 1978-79 and that in 1985-86. Gross profits in this table are profits before taxes and depreciation, but after interest payments.

‡Index of loss in market share is calculated as 1/2 [increase in import penetration + decrease in exports/sales ratio]. Import penetration is calculated as imports/[total sales + imports − exports].

profits on export sales. Domestic profits are affected by the exchange rate through a price/volume effect on the import-competing sector's profits: the greater the extent to which exchange rate changes are passed through to import prices, the greater the effect of exchange rate changes on the volume of, and profits from, import-competing sales. Export profits are affected by the exchange rate through some combination of a price/volume effect and a dollar translation effect, depending on the degree to which exchange rate changes are passed through to export prices.

Our model is built to capture the two channels through which exchange rate changes affect profits: the price/volume effect (on both the import-competing and the exporting sectors), and the dollar translation effect (on the exporting sector).[13] Correspondingly, the key equation in this model relates changes in manufacturing profits to changes in three exchange-rate-related prices: the ratio of (foreign currency) U.S. export prices to foreign prices (to capture the price/volume effect in the exporting sector), the ratio of import prices to U.S. domestic prices (to capture the price/volume effect in the import-competing sector), and the dollar price of exports (to capture the dollar translation effect in the exporting sector). Other factors affecting profits such as U.S. and foreign activities and unit variable costs are also included in this profit equation.

In addition, the model has two subsidiary equations that estimate the exchange rate pass-through to U.S. export and import prices. The exchange rate pass-through coefficients estimated by these two equations are necessary inputs into our key profit equation, allowing us to trace the long-run effect of a change in the dollar exchange rate through changes in export and import prices and ultimately to changes in manufacturing profits.

Our model of long-run U.S. manufacturing profits thus comprises three long-run equilibrium equations. Details of the three equations and their estimations are reported in Box 1. Here a brief discussion is provided of the estimation results for the main variables and the overall effects of exchange rate changes on manufacturing profits.

Estimation results

Estimation results for the export price equation show that when production costs and foreign prices are held constant, a 1 percent appreciation of the dollar would result in a 0.19 percent decline in dollar export prices.[14] In other words, as the dollar appreciates by 1 percent, unit export price measured in foreign currency terms would increase by about 0.81 percent, thereby resulting in a mere 0.19 percent decrease in dollar export prices.[15]

Estimation results for the import price equation show that when foreign production costs and U.S. goods prices are held constant, a 1 percent appreciation of the dollar would result in a 0.47 percent decrease in U.S. import prices. This finding indicates that foreign suppliers, compared with U.S. exporters, tend to absorb more of the exchange rate shocks by adjusting their profit margins than by passing through exchange rate changes to the dollar price of their goods. Overall, the results on exchange rate pass-through to both export prices and import prices are consistent with other researchers' findings.[16]

Turning to the manufacturing profits equation, let's first note that the coefficients on U.S. and foreign activities are reassuringly reasonable. The coefficient on foreign activity weighted by the share of exports in total sales is estimated to be 3. (This weighting is necessary because foreign activity only affects the export component of total U.S. profits.) This finding means that a 1 percent increase in foreign activity would raise real *total* manufacturing profits by 3 percent times the share of exports in total sales. The share of exports in total sales averaged about 0.09 during the floating rate period (Chart 3). The coefficient on the foreign activity variable thus suggests that a permanent 1 percent increase in growth abroad is estimated to increase U.S. manufacturing profits by about 0.27 percent (that is, 3 percent times 0.09).

By the same token, a sustained 1 percent growth in the U.S. economy is estimated to increase manufacturing profits by 1 percent. That is, it would raise total

[13]Corporate hedging strategies for dealing with exchange rate movements—strategies such as entering into forward contracts or swap arrangements to offset the short-run effect of dollar fluctuations—are not considered in our model, since these strategies have the effect of smoothing cash flows as opposed to shaping long-run corporate performances.

[14]A coefficient estimate in regression analysis using data in log terms can be interpreted as a percent change in a dependent variable in response to a 1 percent change in the independent variable associated with that coefficient.

[15]The data indicate a very slight break in this relationship after the mid-1980s. The export price pass-through coefficient has declined from 0.81 percent to 0.80 percent since the third quarter of 1985.

[16]See Catherine Mann, "Prices, Profit Margins and Exchange Rates," *Federal Reserve Bulletin*, 1986; Peter Hooper and Catherine Mann, "Exchange Rate Pass-Through in the 1980s: The Case of U.S. Imports of Manufactures," *Brookings Papers on Economic Activity*, 1989:1; Ohino Kenichi, "Export Pricing Behavior of Manufacturing: A U.S.-Japan Comparison," *International Monetary Fund Staff Papers*, vol. 36 (September 1989); and Michael Knetter, "Price Discrimination by U.S. and German Exporters," *American Economic Review*, vol. 79 (March 1989).

Box 1: An Open-Economy Model of U.S. Manufacturing Profits in the Long Run

Our model of long-run U.S. manufacturing profits comprises three long-run equilibrium, or so-called cointegrating, regression equations (Exhibit 1).[†] In all three equations, variables are entered in natural log terms. The nominal exchange rate (S) is defined as the dollar price of foreign currency, so that an increase in the exchange rate means a depreciation in the dollar. Because the derivation of the profit equation is more involved than that of the export and import price equations, let's briefly consider the two price equations before we turn to the profit equation.

The export price equation (equation 2) shows that in the long run, U.S. export prices measured in dollar terms (SP^x) are positively related to unit labor costs in the United States (U), the price level abroad (P^*), and the nominal dollar exchange rate (S). This equation is derived from the notion that dollar export prices are determined by a markup over unit variable costs (here measured as unit labor costs). As noted in the text, export markups (or profit margins) are affected by the dollar exchange rate to the extent that changes in the rate are not passed through to export prices. In addition, export markups adjust to prices of competing goods in the foreign market (P^*). One final term in the export price equation, DVS, is a slope dummy variable that tests whether the relationship between export prices and the exchange rate has changed significantly as a result of the sharp appreciation of the dollar in the early 1980s.

By the same token, the import price equation (equation 3) shows that in the long run, U.S. import prices measured in dollar terms (P^m) are positively related to unit variable costs abroad (U^*), prices of U.S. manufactured goods (P^h), and the dollar exchange rate (S). This equation is derived from the notion that dollar import prices are equal to the product of the dollar exchange rate and foreign currency import prices and that foreign currency import prices are in turn determined by a markup over unit variable costs of imports. Import markups are affected by the dollar exchange rate to the extent that changes in the exchange rate are not passed through. In addition, import markups respond to prices of U.S. goods that compete with foreign goods in the U.S. market.[‡]

Equations 2 and 3 together allow us to estimate the response of export prices and import prices to a change in the dollar exchange rate. To complete the assessment of the impact of a change in the dollar exchange rate on profits, we still need to estimate the impact of a change in export prices or import prices on manufacturing profits. To that end, let us now turn to the principal equation—the equilibrium profit equation.

The profit equation (equation 1) is built on the idea that profits are the difference between revenue and costs. Revenue increases either when sales volume increases at a given profit margin or when profit margins increase for a given sales volume. Our regression variables are devised to capture these effects. On the export volume side, an increase in foreign activity (Y^*) or a decrease in the ratio of (foreign currency) export price to foreign price (P^x/P^*) would increase export revenue by increasing the volume of export sales. Exporting revenues are also positively related to the (real) dollar export price (SP^x/P): an increase in the dollar price of exports would increase export profit margins in dollar terms for a given export volume, thereby raising export revenues purely through a dollar translation effect.[§]

On the import-competing side, an increase in U.S. activity (Y) or in the ratio of import prices to U.S. prices (P^m/P^h) would increase domestic revenue by raising the volume of domestic sales. Finally, as to costs, an increase in real unit variable costs (U/P) would reduce the total profits by increasing total variable cost for any given volume of sales. This cost variable is the last term of the regression.

Because the profit equation explains total manufacturing profits rather than export profits and domestic sales profits separately, however, scaling adjustments must be made to the above variables in the regression. Thus, the variables affecting export volume are scaled by the export share in total sales, and the variables affecting domestic sales volumes are scaled by the share of domestic sales in total sales. More specifically, the factors affecting export volume—the foreign activity variable

[†] In a cointegrating regression equation, the nonstationary dependent variable and nonstationary independent variables drift together over time, so that the unexplained "residuals" of the regression equation are stationary over time. The projected value of the equation's dependent variable represents its long-run equilibrium value given the underlying values of independent variables. The residuals of the regression represent the deviation of the actual value from the long-run equilibrium value of the dependent variable.

[‡] A slope dummy term was initially included in the import price equation to test whether the relationship between import prices and the exchange rate changed in the second half of the 1980s. This slope dummy term turned out to be insignificant and was dropped from the equation.

[§] In the zero pass-through case, a 1 percent dollar depreciation (1 percent increase in S) would leave P^x and export volume unchanged while raising the dollar export price (SP^x/P) by 1 percent. Consequently, if other variables are held constant, the percent change in manufacturing profits due to a 1 percent increase in the dollar export price—the coefficient on $\ln(P^x_t S_t/P_t)$ in the regression—would be equal to the pure translation effect.

Box 1: An Open-Economy Model of U.S. Manufacturing Profits in the Long Run *(Continued)*

and the ratio of (foreign currency) export price to foreign price—are scaled by the share of exports in total manufacturing sales (χ). The factors affecting domestic sales volume—U.S. activity and the ratio of import price to U.S. goods price—are scaled by the share of domestic sales in total manufacturing sales ($1-\chi$).

The (real) dollar export price (SP^x/P) is not scaled by export share in total sales, however, since it affects total profits through a translation effect rather than a price/volume effect. The dollar export price is instead scaled by the ratio of export revenue to total manufacturing profits (SP^xX/Π). For a given export volume, a 1 percent increase in the (real) dollar export price would increase real export revenues by exactly 1 percent. Therefore, if the unit variable cost of production is unchanged, this 1 percent rise in the dollar export price would increase total manufacturing profits by 1 percent times the contribution that export revenues make to total profits (that is, by $[SP^xX/\Pi]$ percent). According to this theoretical relationship, a 1 percent increase in the dollar export price (SP^x/P) for a given export volume would increase total profits by (SP^xX/Π) percent exactly. To test whether the data support this theoretical correlation, the coefficient on $(SP^xX/\Pi)\ln(SP^x/P)$ is restricted to be one in the regression.

Overall, our model appears to fit the data quite well. The high R^2's for all three equations suggest that most of the variations in the dependent variables are explained by the independent variables included in each equation. The augmented Dickey-Fuller statistics for the three equations further suggest that each equation is reasonably cointegrated. The coefficient estimates and their implications are discussed in the text.

Exhibit 1: Long-Run Equations for an Open-Economy Model of U.S. Manufacturing Profits
(Sample period: 1973-III to 1990-IV; t-statistics in parentheses)

(1) The long-run manufacturing profits equation

$$\ln(\Pi/P)_t = \underset{(-5.32)}{-8.41} + \underset{(\dagger)}{1\,(SP^xX/\Pi)_t}\ln(SP^x/P)_t + \underset{(3.67)}{3.0\,\chi_t}\ln(Y^*)_t$$

$$\underset{(-2.11)}{-2.22\,\chi_t}\ln(P^x/P^*)_t + \underset{(6.06)}{1.14\,(1-\chi)_t}\ln(Y)_t$$

$$+ \underset{(2.46)}{0.57\,(1-\chi)_t}\ln(P^m/P^h)_t - \underset{(-3.53)}{1.42}\ln(U/P)_t$$

$$+ \mu^1_t$$

Adjusted $R^2 = 0.93$ ADF statistic $= -4.57$

† : the null hypothesis that this coefficient equals one cannot be rejected (t-statistic = 0.2.).

(2) The long-run export price equation

$$\ln(SP^x)_t = \underset{(11.39)}{1.90} + \underset{(4.97)}{0.19}\ln(S) + \underset{(2.27)}{0.01}\,DVS_t + \underset{(2.61)}{0.22}\ln(U)_t$$

$$+ \underset{(6.91)}{0.57}\ln(P^*)_t + \mu^2_t$$

Adjusted $R^2 = 0.99$ ADF statistic $= -3.93$

(3) The long-run import price equation

$$\ln(P^m)_t = \underset{(14.91)}{1.90} + \underset{(14.76)}{0.47}\ln(S)_t + \underset{(9.99)}{0.39}\ln(U^*)_t$$

$$+ \underset{(12.08)}{0.48}\ln(P^h)_t + \mu^3_t$$

Adjusted $R^2 = 0.99$ ADF statistic $= -4.25$

Variables:

- Π = gross nominal profits of domestic U.S. manufacturing firms in dollar terms
- P = U.S. wholesale price level, 1987 = 100
- P^h = U.S. manufactured goods price, excluding food and energy
- P^* = foreign price level
- P^m = U.S. import price in dollar terms
- P^x = U.S. export price in foreign currency terms
- Y = real U.S. domestic demand
- Y^* = real foreign domestic demand
- U = unit labor cost in the U.S. manufacturing sector
- U^* = unit variable cost of foreign goods (in foreign currency): a weighted average of unit labor cost, world commodity price, and oil price
- S = the nominal exchange rate (dollar/foreign currency)
- DVS = slope dummy for $\ln(S_t)$ for 1985-III to 1990-IV
- χ = the share of exports in total sales
- $1-\chi$ = the share of domestic sales in total sales
- μ^i = residual for equation i.

manufacturing profits by the estimated coefficient (1.14) times the share of domestic sales in total sales, which averaged about 0.91 during the floating rate period.[17]

Coefficient estimates on the three price variables of concern also appear plausible. The coefficient on the ratio of (foreign currency) export price to foreign price weighted by the export share in total sales is −2.22. This finding suggests that, on average, a 1 percent increase in the ratio of export prices to foreign prices would lower manufacturing profits about 0.21 percent (−2.22 times 0.09, the average share of exports in total sales during the floating rate period) through the price/volume effect in the exporting sector.

Similarly, the coefficient on the ratio of import price to U.S. price weighted by the share of domestic sales in total sales is 0.57. This estimation suggests that a 1 percent increase in the ratio of import price to U.S. goods price on average would increase manufacturing profits about 0.53 percent (0.57 times 0.91, the average share of domestic sales in total sales during the floating rate period) through the price/volume effect in the import-competing sector.

The coefficient on the (real) dollar export price weighted by the ratio of export revenue to total profit is 1, suggesting that a 1 percent increase in real dollar export prices would raise total real manufacturing profits by 1 percent times the ratio of export revenue to total profits.[18] Because the ratio of export revenue to total profit averaged about 0.84 during the floating rate period (Chart 4), this finding suggests that a 1 percent increase in the real dollar export price would raise manufacturing profits by about 0.84 percent through the dollar translation effect. All these coefficient estimates appear plausible.

We can now combine these three equations to understand the magnitude and distribution of the long-run effect of a dollar appreciation on manufacturing profits. Let's start by gauging the effect of a 10 percent dollar appreciation on total profits through the exporting sector. The export price equation suggests that a 10 percent appreciation of the dollar would result in about an 8 percent increase in foreign currency export prices and hence an 8 percent increase in the ratio of foreign currency export price to foreign price (for a given foreign price level). The profit equation tells us that an 8

[17]It is interesting to note that the influence of foreign economies on manufacturing profits appears to be growing gradually more important: export sales as a share of total sales have been increasing slightly over the past two decades as the U.S. economy has become increasingly open.

[18]For a given export volume, a 1 percent increase in the (real) dollar export price would increase real export revenues by exactly 1 percent. Therefore, a 1 percent increase in the dollar export price (SP^x/P) for a given export volume would increase total profits exactly 1 percent times the ratio of export revenues to total profits. To test whether or not this theoretical relationship is consistent with the data, the coefficient on the dollar export price weighted by the ratio of export revenue to total profits, $(SP^xX/\Pi)\ln(SP^x/P)$, was restricted to be one (see Box 1 for details).

The t-statistic, estimated on the basis of the null hypothesis that the coefficient is one, is extremely low (0.2), suggesting that the null hypothesis cannot be rejected.

Chart 3

Ratio of Export Sales to Total Sales in U.S. Manufacturing Sector

percent increase in the ratio of foreign currency export price to foreign price would lower profits by about 1.7 percent (that is, 0.21 times 8 percent) through its price/volume effect on export sales. Similarly, the export price equation suggests that a 10 percent appreciation of the dollar results in about a 2 percent decline in dollar export prices. From the profit equation, we also know that a 2 percent decline in dollar export prices would lower manufacturing profits by about 1.7 percent (that is, 2 times 0.84 percent) through a dollar translation effect. Overall, a 10 percent dollar appreciation would lower manufacturing profits about 3.4 percent through the exporting sector, half through a price/volume effect and half through a dollar translation effect.

With coefficient estimates for the profit equation and the import price equation, we can also calculate the impact of a dollar appreciation on manufacturing profits through a price/volume effect on the import-competing sector. The import price equation indicates that a 10 percent dollar appreciation would result in a 4.7 percent decline in U.S. import price, and hence a 4.7 percent decrease in the ratio of import price to U.S. price for a given U.S. price level. From the profit equation, we also know that a 4.7 percent decline in the ratio of import price to U.S. price would tend to lower manufacturing profits by about 2.5 percent (that is, 0.53 percent times 4.7) through a price/volume effect on the import-competing sector. An appreciation of the dollar thus appears to have hurt the import-competing sector substantially, although not quite as much as it hurt the exporting sector.[19]

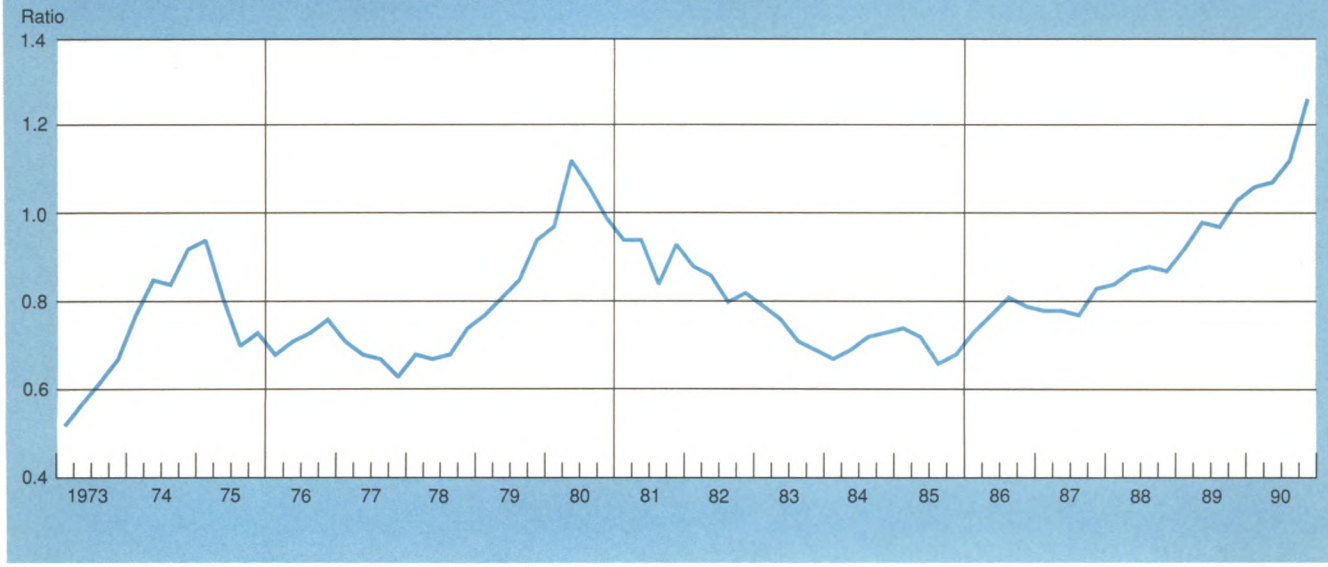
In aggregate, we find that a 10 percent sustained appreciation in the dollar would eventually result in about a 6 percent decline in gross U.S. manufacturing profits. Applying this estimate to the actual amount of real gross manufacturing profits during the 1981-90 period, which averaged about $245 billion (in constant 1987 dollars) per year, we see that a sustained 10 percent dollar appreciation would lower manufacturing profits by roughly $14.5 billion per year. On the basis of this estimate, we can roughly assess the long-run impact of the dollar's swings in the 1980s on manufacturing profits. If we use 1980 as the base year, as many analysts do, then the average real dollar in the 1981-90 period was about 13.2 percent higher than the real dollar's base-year level. Our model suggests that the manufacturing profit loss caused by a 13.2 percent real dollar appreciation sustained over a ten-year period amounts to about $190 billion (that is, $1.45 billion times 13.2 percent times 10) in the long run.

Two qualifications should be added to this summary of our findings. First, the estimated long-run impact of a

[19]Exchange rate changes have a substantial impact on domestic manufacturing profits mainly because the U.S. manufacturing sector relies more heavily on the domestic market than on the foreign market. Domestic sales constitute about 88 percent, while exports constitute about 12 percent, of total U.S. manufacturing shipments during the floating exchange rate period.

Chart 4

Ratio of Export Revenue to Total Profits in U.S. Manufacturing Sector

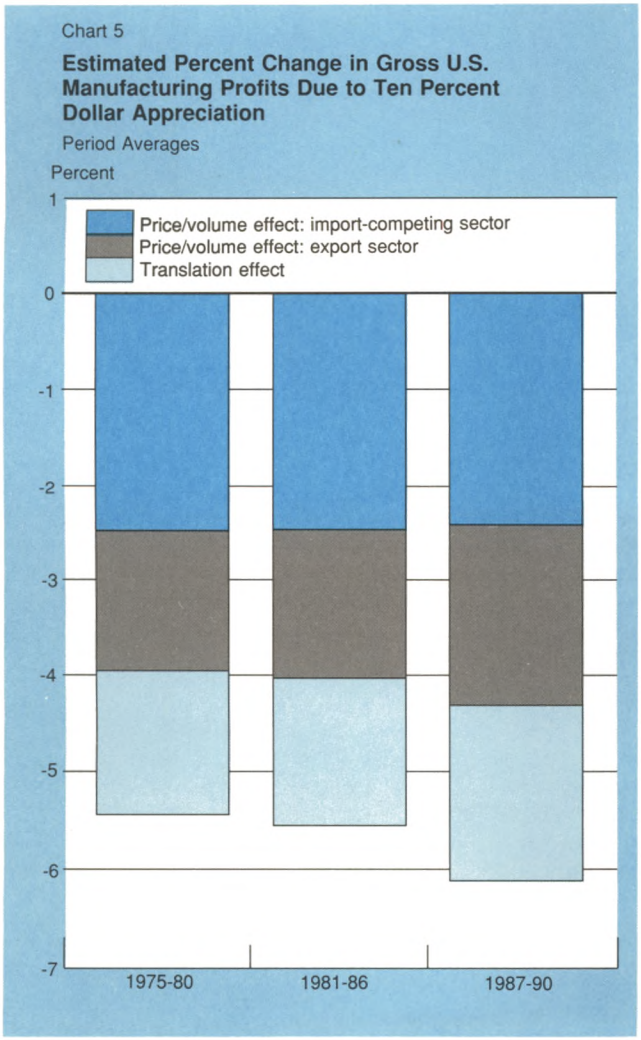


dollar appreciation on profits would depend on the size of the two changing ratios—the ratio of export sales to total sales and the ratio of export revenue to total profits—in any given period. Chart 5 shows that as the export sector became more important in the 1980s, the impact of exchange rate changes on manufacturing profits through the exporting sector gradually increased. Second, the above estimates alone do not tell us the length of time it takes for the long-run effect of exchange rate changes on profits to be fully realized. To obtain a more precise estimate of the evolution of the high dollar's impact on manufacturing profits in the 1980s, we need to extend the above model to include short-run dynamic relations between the exchange rate and profits.

Chart 5

Estimated Percent Change in Gross U.S. Manufacturing Profits Due to Ten Percent Dollar Appreciation

Period Averages



The impact of the dollar's swings in the 1980s on manufacturing profits in the short run and the long run

This section conducts simulations to assess how profit losses of U.S. manufacturing firms have evolved in response to the sharp swings of the dollar in the 1980s. The analysis requires two steps. In the first step, our model is expanded to include both the short-run effect of exchange rate changes on profits and the long-run impact of exchange rate changes on the two adjustment ratios—the ratio of export sales to total sales and the ratio of export revenue to total profits. The estimations and results of these five equations are discussed in Box 2. The second step entails using the expanded model to project the path that manufacturing profits would have taken if the real dollar exchange rate had stayed at its 1980 level throughout the 1980s. These hypothetical "equilibrium" profits are compared with our baseline profits to project the path of manufacturing profit losses attributable to the dollar's movements in the 1980s.

The base year chosen is 1980, in part because many analysts believe that the dollar was roughly at its equilibrium purchasing power parity level that year. Purchasing power parity holds when a dollar can buy roughly the same amount of goods abroad as it can in the United States. That is, the prices of goods at home and abroad, if translated into a common currency, are about the same.

Of course, the dollar moved sharply during the 1980s. From 1980, the real dollar rose about 40 percent to reach its peak in the first half of 1985, then started to fall sharply until it was more or less restored to its 1980 level in 1987. On average, the real dollar was 25 percent above its 1980 level during the 1981-86 period and was slightly below its 1980 level (by about 1 percent) during the 1987-90 period (Chart 6).

Hypothetical nominal exchange rates, computed on the assumption that the real exchange rate had stayed at its 1980 level, are plugged into our expanded model to project the hypothetical profits that would have resulted from a stable real dollar during the 1980s. Baseline profits are obtained by fitting actual exchange rates in the 1980s to our model. Finally, the hypothetical profits are compared with the baseline profits to assess the impact of exchange rate developments on manufacturing profits over the past decade.

Simulation results are summarized in Table 3 and Chart 6. Chart 6 shows that the dollar's rise in the first half of the 1980s did result in a large and lingering profit loss in the manufacturing sector. Because of the complicated dynamics involved, however, the time profile of the profit loss did not exactly mirror the evolution of the dollar's rise and fall. Although the dollar translation effect was felt almost immediately, the price/volume

Box 2: Expanding the Open-Economy Model of U.S. Manufacturing Profits

This box expands our model by estimating the short-run dynamic counterpart of the three long-run equilibrium equations, as well as two auxiliary regressions. The short-run equations are necessary since the three long-run equations alone will not allow us to estimate the time profile of the impact of exchange rate changes on manufacturing profits. The two auxiliary regressions are included to ensure that the simulation results incorporate the effect of exchange rate changes on profits through their effect on the two adjustment factors.

Exhibit 2 presents the estimation results of these five new equations. Equation 4 shows the error correction model of manufacturing profits.† Equations 5 and 6 show the error correction model of U.S. export prices and import prices, respectively. Overall, the three equations fit the data reasonably well: the R^2's are reasonably high for these types of regression. Together, these three equations provide insights into the short-run dynamic effect of the exchange rate on manufacturing profits.

Equation 4 suggests that the rate of change in real manufacturing profits, $\Delta\ln(\Pi/P)_t$, is driven not only by the deviation of actual from long-run equilibrium real profits in the past period ($\mu^1_t - 1$), but also by lagged U.S. economic growth and lagged changes in the ratio of import price to U.S. goods price, the ratio of export price to foreign price, the domestic real interest rate, and manufacturing capital stock.‡ The coefficient estimate on μ^1_{t-1} implies that on average about 22 percent of the deviation of profits from their long-run equilibrium level is eliminated each quarter. Lagged changes in the dollar export price—$\Delta\ln(SP^x)_{t-1}$—do not appear significant in the regression, suggesting that changes in the exchange rate affect manufacturing profits faster through the translation effect than through the price/volume effect. Equation 4 also indicates that the price/volume effect of exchange rate movements on import competitors' profits takes longer to be fully realized than that on exporters' profits: changes in the ratio of import price to U.S. price have a lagged effect on profits that lasts at least five quarters, while most lagged effects of changes in the ratio of export price to foreign price are realized after three quarters.

Equation 5 is based on the idea that the rate of change in dollar export prices—$\Delta\ln(SP^x)_t$—is driven not only by the deviation of the actual from the long-run equilibrium dollar export price in the past period (μ^2_{t-1}), but also by changes in lagged dollar export prices and in lagged domestic and foreign prices. The coefficient estimate on μ^2_{t-1} suggests that on average only about 16 percent of the deviation of the dollar export price from its long-run equilibrium level is eliminated each quarter. Most of the lengthy adjustment time, however, is required for export prices to respond to factors other than the exchange rate. The high coefficient estimate on lagged dollar export prices—$\Delta\ln(SP^x)_{t-1}$—implies that the bulk of exchange rate pass-through is actually achieved rapidly following changes in the exchange rate.

Similarly, equation 6 tells us that the rate of change in import prices—$\Delta\ln(P^m)_t$—is driven not only by the deviation of the actual from the long-run equilibrium import price in the past period (μ^3_t-1), but also by lagged changes in the exchange rate, import prices, U.S. manufacturing goods prices, and unit variable costs abroad. About 44 percent of the dollar import price's deviation from its long-run equilibrium level is eliminated each quarter. Changes in the exchange rate—$\Delta\ln(S)$—have an impact on import price even after four-quarter lags, suggesting that it takes at least five quarters to achieve the bulk of the long-run exchange rate pass-through to import prices.

This discussion points to two conclusions. First, the exchange rate's long-run translation effect on profits is achieved more quickly than its long-run price/volume effect. Second, the long-run price/volume effect on exporters' profits is realized more rapidly than that on import competitors' profits.

Now let's briefly discuss the two auxiliary long-run equations linking the exchange rate and the two adjustment factors in the profit equation. Equation 7 shows that the ratio of export revenue to total profits is positively, but only slightly, affected by a dollar depreciation. Equation 8 indicates that the ratio of export sales to total sales is not significantly affected by changes in the dollar exchange rate in the long run. This finding is plausible because a 1 percent appreciation of the dollar would eventually lower domestic sales almost as much as export sales. The regression results of the two auxiliary equations suggest that exchange rate changes in the long run have only a trivial effect on the two adjustment factors. For the sake of completeness, however, these two equations are included in the model simulation.

†An error correction model of a stochastic variable X characterizes the short-run dynamic adjustment process of X around its long-run equilibrium level. Typically, the first difference of X, ΔX_t, is regressed on the equilibrium error (that is, the deviation between the actual X and the long-run equilibrium X) in the past period, and on lagged changes in ΔX and in independent variables. A parsimonious representation is usually achieved by eliminating most insignificant lag terms. The coefficient estimate on the equilibrium error in an error correction model reflects the average speed of adjusting to the equilibrium level. See the appendix for details.

‡Variables affecting the short-run movements of profits but not included in the long-run profit equation should also be included in the error correction model. The model thus includes capital expenditure, inflation, and changes in the real interest rate.

Box 2: Expanding the Open-Economy Model of U.S. Manufacturing Profits *(Continued)*

Exhibit 2: Short-Run Adjustments and Auxiliary Equations for an Open-Economy Model of U.S. Manufacturing Profits (Sample period: 1973-III to 1990-IV)

(4) The short-run dynamics of manufacturing profits

$$\Delta\ln(\Pi/P)_t = -0.22\ \mu^1_{t-1} - 0.03\ \Delta R_{t-2} + 0.62\ (1-\chi)\ \Delta\ln(Y)_{t-1} - 1.16\ (1-\chi)\ \Delta\ln(P^m/P^h)_{t-2\ to\ -5} - 1.46\chi\ \Delta\ln(P^x/P^*)_{t-2\ to\ -3} + 2.94\ \Delta\ln(P^h)_{t-3} - 5.40\ \Delta\ln(K)_{t-1} + \mu^4_t$$

Adjusted $R^2 = 0.38$

(5) The short-run dynamics of U.S. export prices

$$\Delta\ln(SP^x)_t = -0.16\ \mu^2_{t-1} + 0.52\ \Delta\ln(SP^x)_{t-1} + 0.34\ \Delta\ln(P^h)_{t-1} - 0.05\ \Delta\ln(P^*)_{t-2\ to\ -6} + \mu^5_t$$

Adjusted $R^2 = 0.70$

(6) The short-run dynamics of U.S. import prices

$$\Delta\ln(P^m)_t = -0.44\ \mu^3_{t-1} + 0.42\ \Delta\ln(P^m)_{t-1} + 0.13\ \Delta\ln(S)_{t-1\ to\ -4} + 0.36\ \Delta\ln(P^h)_{t-4} + 0.25\ \Delta\ln(U^*)_{t-2\ to\ -4} + \mu^6_t$$

Adjusted $R^2 = 0.63$

Two auxiliary long-run equations:

(7) $(SP^xX/\Pi)_t = 7.96 + 0.18\ \ln(S)_t + 2.20\ \ln(Y^*)_t - 2.06\ \ln(Y)_t + 0.18\ \ln(P^h)_t + \mu^7_t$

Adjusted $R^2 = 0.87$ ADF statistic = 4.14

(8) $\chi_t = 0.79 + 0.001^*\ \ln(S)_t + 0.37\ \ln(Y^*)_t - 0.28\ \ln(Y)_t + \mu^8_t$

Adjusted $R^2 = 0.93$ ADF statistic = 4.44

Variables:

- K = U.S. manufacturing capital stock
- Π = gross nominal profits of domestic U.S. manufacturing firms in dollar terms
- P = U.S. wholesale price level, 1987 = 100
- P^h = U.S. manufactured goods price, excluding food and energy
- P^* = foreign price level
- P^m = U.S. import price in dollar terms
- P^x = U.S. export price in foreign currency terms
- R = the real interest rate in the United States
- Y = real U.S. domestic demand
- U^* = unit variable cost of foreign goods (in foreign currency)
- S = the nominal exchange rate (dollar/foreign currency)
- χ = the share of exports in total sales
- $1-\chi$ = the share of domestic sales in total sales
- μ^i = residual for equation i.

Note: All coefficients shown are statistically different from zero, except the one noted by *.

effects on both exporters' and import competitors' profits, which accounted for about three-quarters of the total long-run impact of dollar appreciation on profits, took about three years to be fully realized. Consequently, the real manufacturing profit loss due to the dollar appreciation in the early 1980s was not significant until the beginning of 1983. It then climbed steadily as the dollar continued to rise, reaching $55 billion (measured in 1987 dollars) in 1984. The profit loss then lingered at about $50 billion during 1985-86 because of continuing price/volume effects, even though the dollar started to plunge in the second half of 1985. In 1987, two years after the plunge of the dollar, the profit loss began to fall sharply.

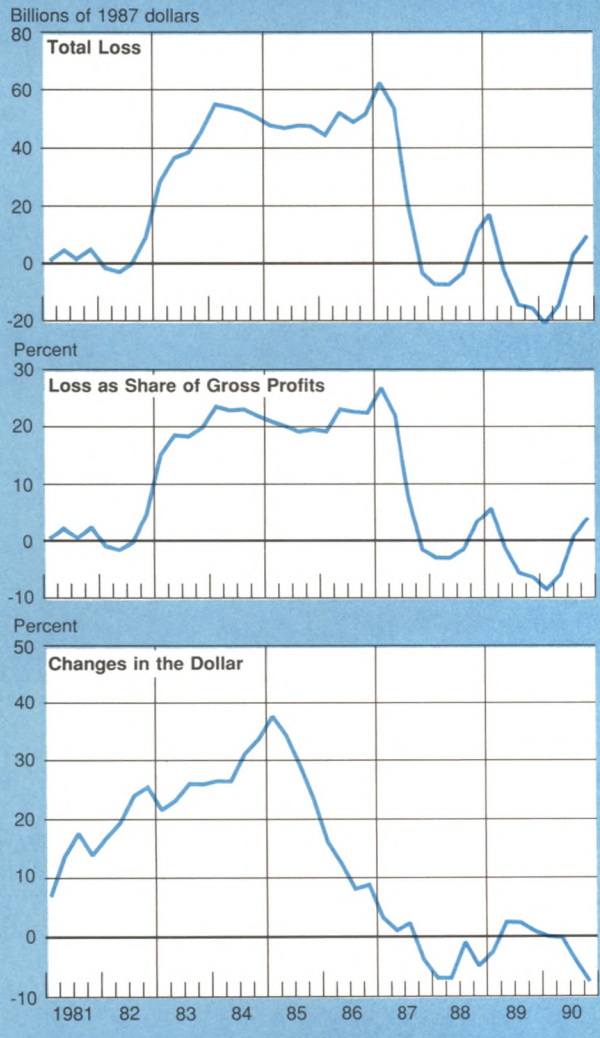
The latter half of the 1980s highlights the complex timing dynamics more dramatically. The rapid positive translation effect on profits of the dollar's 1985-87 fall resulted in a slight profit gain for the manufacturing sector by 1988. The persistent negative lagged price/volume effect of the earlier high dollar, together with the negative translation effect of the rise in the dollar from its low 1987 level, then caused the profit loss to resurface in late 1988 and early 1989. During the second half of 1989 and the first half of the 1990, however, the lagged price/volume effects of the dollar's mid-1980s fall again led to a profit gain.

Table 3 shows that the average annual profit loss reached $51 billion (in 1987 constant dollars) in the highest dollar period (1984-86), remained around $17 billion in 1987-88 when the dollar was already back to

its base year level, and was reversed by 1989-90 as the dollar remained low and lagged price/volume effects of the earlier high dollar tapered off. On average, manufacturing profit losses amounted to about $23 billion per year over the past decade. Our calculations suggest that this profit loss was distributed somewhat more heavily on exporters than on import competitors. The exporting sector's profit loss, stemming more or less equally from the price/volume effect and the translation effect of the dollar's appreciation, was about $13 billion per year. Import competitors' profit loss, deriving entirely from the price/volume effect of the dollar's rise on profits, was about $10 billion per year. Overall, the cumulative dollar profit loss for the entire 1981-90 period was about $230 billion, or 10 percent of total manufacturing profits.

Chart 6

Estimated Manufacturing Loss Due to Changes in the Dollar in the 1980s



Note: Changes in the dollar are measured relative to a benchmark dollar level that would hold the real exchange rate at its 1980 level.

These estimates appear reasonable, given that the price/volume effects of the dollar's appreciation take time to be fully realized and that the average value of the real dollar over the 1981-90 period was still about 13.2 percent higher than the value of the real dollar in 1980. The long-run effect of the high dollar in the 1980s on manufacturing profits drops noticeably, however, once the lagged price/volume effects of the 1987-90 dollar's return to its 1980 level are completed. Our previous estimate, based on the three long-run equilibrium equations alone, indicates that the cumulative manufacturing profit loss amounts to about $190 billion when all the lagged effects are realized (roughly by 1993).[20]

In sum, the simulation results imply that the manufacturing profit loss caused by the high dollar during the 1981-85 period has been sizable, enduring, and widespread. In view of the substantial degree of the dollar's rise during the first half of the 1980s relative to 1980, these results are not surprising. If the degree of the dollar's appreciation during the 1980s had been trivial, its cumulative impact on manufacturing profits would have been negligible in the long run.[21]

Our results also indicate that the complex and prolonged adjustment of profits to exchange rate movements may have contributed significantly to the evolution of profits over the last ten years. Admittedly, developments in the dollar exchange rate do not fully explain the low level of manufacturing profits in the late 1980s. Nevertheless, the prolonged adjustment of profits to the 1981-85 dollar appreciation, together with the still incomplete adjustment of profits to the subsequent dollar depreciation, appears to have been a major factor underlying the weakness in U.S. manufacturing profits

[20]Of course, if the average value of the dollar during the entire 1980s had not differed from the value of the dollar in 1980—that is, if the dollar had depreciated substantially from its 1980 level in the late 1980s to compensate for its earlier appreciation from its 1980 level—the dollar's swings in the 1980s would not have resulted in a cumulative profit loss over the long run.

[21]For example, if we choose 1981 rather than 1980 as the base year for comparison, then the average value of the 1982-90 real dollar was about 1 percent higher than the base-year real dollar. Consequently, if we use 1981 as the base period, the real manufacturing profit loss eventually amounts to a mere $70 billion for the 1982-90 period as a whole, and only about $15 billion in the long run when all lagged adjustments are completed.

Table 3

The Estimated Impact of Exchange Rate Development on U.S. Manufacturing Profits

Yearly Average

	1981-83	1984-86	1987-88	1989-90	1981-90
Total loss due to dollar's swings in the 1980s (billions of 1987 dollars)	15.1	51.2	17.2	−3.4	22.6
Loss as share of total manufacturing profits (percent)	7.4	22.2	7.2	−1.3	10.1
Degree of real dollar appreciation relative to 1980 real dollar (percent)	20.3	24.8	−1.3	−0.2	13.2

throughout much of the 1980s.

Conclusion

This article investigates the effect of exchange rate changes on U.S. manufacturing profits since the advent of the floating exchange rate system. It first demonstrates that an appreciation of the dollar is likely to lower U.S. manufacturing profits, regardless of the ways in which U.S. or foreign exporters adjust their pricing strategies to changes in the dollar exchange rate. Changes in the exchange rate are transmitted to manufacturing profits through a combination of two channels: a price/volume effect (on both import-competing and exporting profits) and a dollar translation effect (on exporting profits).

Next, an econometric model is built and estimated to assess the direct impact of exchange rate changes on manufacturing profits. Estimation results from this model show that over the long run, a 10 percent nominal appreciation of the dollar directly reduces U.S. manufacturing profits by about 6 percent: about 3.4 percent through losses in the exporting sector and about 2.5 percent through losses in the import-competing sector. Expressed in constant (1987) dollar terms and based on profit levels in the 1980s, these estimates imply that a sustained 10 percent dollar appreciation would lower manufacturing profits on average by more than $14 billion per year.

The results indicate that even though the bulk of the decline in the profit rate caused by the high dollar in the first half of the 1980s was restored by the late 1980s, the cumulative profit loss caused by the dollar's swings in the 1980s remained substantial for the 1980s as a whole. If we use 1980 as the base year, the average profit loss due to the high dollar in the 1980s was about $23 billion per year in that decade, or 10 percent of total manufacturing profits. At its peak during 1984-86, the manufacturing sector's loss reached about $50 billion per year, or about 22 percent of actual profits. In sum, the cumulative profit loss from the dollar's swings in the 1980s totaled about $230 billion for the entire 1981-90 period. The cumulative loss is expected to decline to about $190 billion over the long term (roughly 1981-93), when all the lagged price/volume effects of the dollar's depreciation in the second half of the 1980s will have been completed.

Appendix: The Relationship of the Exchange Rate to Pricing Behavior and Manufacturing Profits

The exchange rate and exporters' profits

The relationship between exporters' profits, the export price pass-through elasticity, and the exchange rate can be represented by the following profit identity:

$$\text{(A1)}\quad \Pi^X = S\,P^x\,X - U\,X$$
$$X = X(P^x/P^*)$$
$$P^x = P^x(S),$$

where

Π^X = exporting firms' gross nominal profits from sales to the foreign market, in dollar terms
X = export volume
U = the unit variable cost of U.S. manufactured output
S = the exchange rate (dollar/foreign currency)
P^x = the (foreign currency) unit price of U.S. exports
P^* = the foreign price level.

We can obtain the following equation by taking the derivative of Π^x with respect to the exchange rate (S):

$$\text{(A2)}\quad \partial\Pi^x/\partial S = P^x\,X + S\,X\,(\partial P^x/\partial S) + S\,P^x\,(\partial X/\partial(P^x/P^*))(\partial(P^x/P^*)/\partial S) - U\,(\partial X/\partial(P^x/P^*))(\partial(P^x/\partial P^*)/S).$$

Let θ^x be the elasticity of the U.S. export price (in foreign currency terms) with respect to the exchange rate, and λ^x be the elasticity of demand for U.S. exports with respect to the ratio of (foreign currency) U.S. export price to foreign price. If we assume that $\partial P^*/\partial S = 0$, then after some algebraic manipulation, equation A2 becomes

$$\text{(A3)}\quad (\Delta\Pi^x/\Pi^x)/(\Delta S/S) = SP^xX/\Pi^x\,(1 + \theta^x) + \theta^x\,\lambda^x,$$

where

$\theta^x \equiv (\Delta P^x/\Delta S)/(P^x/S)$, $-1 \leq \theta^x \leq 0$,
$\lambda^x \equiv (\Delta X/\Delta(P^x/P^*))/((P^x/P^*)/X)$, $\lambda^x < 0$.

Equation A3 indicates that a 1 percent depreciation in the dollar will always increase U.S. exporters' profits by $SP^xX/\Pi^x\,(1 + \theta^x)$ percent through the translation effect and by $\theta^x\,\lambda^x$ percent through a price/volume effect.

In the case of zero exchange rate pass-through ($\theta^x = 0$), when U.S. firms fully prevent the depreciation of the dollar from passing through to P^x, export volume will remain unchanged as the dollar depreciates. As a result, a depreciation of the dollar will boost exporters' dollar profit purely through a translation effect: a 1 percent dollar depreciation will raise the dollar export price (SP^x) by 1 percent, and a translation effect of 1 percent dollar depreciation will be equal to the ratio of export revenue to total profits.

In the case of complete pass-through ($\theta^x \equiv -1$), when U.S. firms allow P^x to fall to the full extent of the dollar's depreciation (or to rise by the full extent of the dollar's appreciation), the dollar translation effect will be zero. In other words, dollar receipts for each unit exported will not be affected by the change in the dollar exchange rate. However, in this case, export profits will increase by λ^x percent through a price/volume effect. That is, the elasticity of export profits with respect to the exchange rate will be equal to the price elasticity of foreign demand for U.S. exports (λ^x).

The exchange rate and import competitors' profits

The relationship between import competitors' profits, the import price pass-through elasticity, and the exchange rate can be expressed by the following profit identity:

$$\text{(A4)}\quad \Pi^H = P^h{}_{\Pi}H - U\,H$$
$$H = H(P^m/P^h)$$
$$P^m = P^m(S),$$

where

Π^H = the gross nominal profits of U.S. manufacturing firms in the import-competing sector
H = import-competing firms' output sold domestically
P^h = the (dollar) unit price of U.S. output sold domestically
P^m = the (dollar) unit price of U.S. imports.

If we assume that P^h remains unchanged when the dollar exchange rate changes (that is, $\partial P^h/\partial S = 0$), then we can obtain equation A5 by taking the derivative of Π^H with respect to the exchange rate (S):

$$\text{(A5)}\quad \partial\Pi^H/\partial S = P^h\,(\partial H/\partial(P^m/P^h))(\partial(P^m/P^h)/\partial S) + U\,(\partial H/\partial(P^m/P^h))(\partial(P^m/P^h)/\partial S).$$

Let θ^m be the pass-through elasticity of U.S. import prices (in dollar terms) with respect to the exchange rate, and λ^h the elasticity of U.S. domestic demand for manufactured goods with respect to the (P^m/P^h) relative price. Then it is easy to understand how the gain in Π^H relates to the pass-through elasticity of P^m by deriving the following equation from equation A5:

$$\text{(A6)}\quad (\Delta\Pi^H/\Pi^H)/(\Delta S/S) = \theta^m\,\lambda^h,$$

where

$\theta^m = (\Delta P^m/\Delta S)/(S/(P^m))$; $0 \leq \theta^m \leq 1$

Appendix: The Relationship of the Exchange Rate to Pricing Behavior and Manufacturing Profits *(Continued)*

$\lambda^h = (\Delta H/\Delta(P^m/P^h))/((P^m/P^h)/H)$; $\lambda^h > 0$.

From equation A6, it is clear that a dollar depreciation would raise the profits of U.S. import-competing firms purely through a price/volume effect. Indeed, a 1 percent dollar depreciation would increase U.S. import competitors' profits by $\theta^m \lambda^h$ percent. If foreign exporters passed through the full extent of the dollar's depreciation to the price of their goods in the United States, so that $\theta^m = 1$, the elasticity of import competitors' profits with respect to the exchange rate would simply equal the price elasticity of domestic demand for manufacturing goods (λ^h). If foreign exporters kept P^m unchanged when the dollar depreciated against their currencies (that is, $\theta^m = 0$), the profits of U.S. import-competing firms would not rise, because the depreciation of the dollar would not make their goods more price competitive. Indeed, it is clear from equation A6 that $(\Delta \Pi^H/\Pi^H)/(\Delta S/S)$ is equal to zero in this case.

An Open-Economy Model of U.S. Manufacturing Profits

To examine the effect of the exchange rate on gross U.S. manufacturing profits, let's divide gross manufacturing profits into two components: profits accrued from export sales and profits accrued from domestic sales. Domestic sales includes sales in the import-competing sector as well as sales not in competition with imports. We can then analyze the impact of the exchange rate by making the following assumptions:

(A7) $\Pi_t = \Pi^X_t + \Pi^D_t$

(A8) $\Pi^X_t = S_t P^x_t X_t - U_t X_t$

(A9) $\Pi^D_t = P^h_t Q_t - U_t Q_t$

(A10) $Q_t = Q(Y_t, P^m_t/P^h_t)$

(A11) $X_t = X(Y^*_t, P^x_t/P^*_t)$

(A12) $P^m_t = S_t \phi^m U^*_t$

(A13) $P^x_t = (1/S_t) \phi^x U_t$,

where all profits are in dollar terms, and

Π = gross nominal profits of the manufacturing industry
Π^X = gross nominal profits accrued from export sales
Π^D = gross nominal profits accrued from domestic sales, including sales in both the import-competing sector and the nontrading sector
X = export volume
Q = total volume of U.S. manufactured goods sold domestically
U = the unit variable cost (in dollar terms) of U.S. manufactured output
U^* = the unit variable cost (in foreign currency terms) of U.S. imports
S = the exchange rate (dollar/foreign currency)
P^h = the (dollar) unit price of U.S. output sold domestically
P^m = the (dollar) unit price of U.S. imports
P^* = the (foreign currency) unit price of foreign output sold in the foreign market
P^x = the (foreign currency) unit price of U.S. exports
P = the general U.S. price level
Y = real U.S. national income
Y^* = real foreign income
ϕ^m = the markup that foreign suppliers impose on goods sold in the U.S. market
ϕ^x = the markup that U.S. exporters impose on U.S. exports.

Equations A7 through A9 are identities. Equation A10 assumes that domestic demand for U.S. manufactured goods (Q_t) is a function of U.S. activity (Y_t) and the price competitiveness of U.S. manufactured goods relative to imported goods (P^m/P^h). Similarly, equation A11 assumes that demand for U.S. exports (X_t) is a function of foreign activity (Y^*) and the price competitiveness of U.S. goods abroad (P^x/P^*). Equation A12, the U.S. import price equation, specifies that foreign firms set the price of their goods in their own currency (P^m/S) at a markup (ϕ^m) over their marginal cost of production (U^*), so that $(P^m/S) = \phi^m U^*$, or $P^m = S \phi^m U^*$. Finally, equation A13, the U.S. export price equation, maintains that U.S. firms set the price of their goods in dollar terms (SP^x) at a markup (ϕ^x) over their marginal cost of production (U), so that $(SP^x) = \phi^x U$, or $P^x = (1/S) \phi^x U$.

If we substitute equations A8 through A11 into equation A7, take total differentiation, and assume that the unit profit margin of export sales equals the unit profit margin of domestic sales (that is, $SP^x - U = P^h - U$), then after some algebraic manipulation we can obtain the following real long-run profit equation expressed in log terms:

$$\begin{aligned}(A14)\ \ln(\Pi/P)_t = {} & \text{constant} + \beta_1 (SXP^x/\Pi)_t \ln(P^x S/P)_t \\ & + \beta_2 \chi_t \ln(P^x/P^*)_t + \beta_3 \chi_t \ln(Y^*)_t \\ & + \beta_4 (1-\chi)_t \ln(Y)_t + \beta_5 (1-\chi)_t \\ & \ln(P^m/P^h)_t + \beta_6 \ln(U/P)_t + \mu_t,\end{aligned}$$

where $\chi = X/(X+Q)$, or the share of exports in total sales; and μ is the residual. And if we define $\lambda(Z_1,Z_2)$ as the elasticity of Z_1 with respect to Z_2—that is, let $\lambda(Z_1,Z_2) = (\partial Z_1/\partial Z_2)/(Z_1/Z_2)$—then the coefficients in equation A15 can be expressed as follows:

Appendix: The Relationship of the Exchange Rate to Pricing Behavior and Manufacturing Profits *(Continued)*

$\beta_1 = 1$
$\beta_2 = \lambda(X, P^x/P^*)$
$\beta_3 = \lambda(X, Y^*)$
$\beta_4 = \lambda(Q, Y)$
$\beta_5 = \lambda(Q, P^m/P^h)$
$\beta_6 = -(X + Q)U/\Pi.$

Equation A14, the profit equation, shows the long-run relationship between real gross U.S. manufacturing profits and a host of variables: the ratio of (foreign currency) export price to foreign price (P^x/P^*), the (real) dollar export price (SP^x/P), U.S. activity (Y), foreign activity (Y^*), the ratio of import price to U.S. goods price (P^m/P^h), and the real unit variable cost (U/P).

Because foreign activity (Y^*) and the ratio of (foreign currency) export price to foreign price (P^x/P^*) affect manufacturing profits through their impact on export sales volume, the effect of a change in either of these two factors on aggregate profits is greater when export sales constitute a larger share of total manufacturing sales.† Consequently, in the regression, $\ln(Y^*)$ and $\ln(P^x/P^*)$ are scaled by the share of export sales to total manufactured goods sales (χ). By the same token, $\ln(P^h/P^m)$ and $\ln(Y)$ are scaled by the share of domestic sales to total sales $(1-\chi)$, since the impact of a given change in these factors on profits is bigger when domestic sales constitute a greater share of total sales.

The (real) dollar export price, $\ln(SP^x/P)$, is scaled differently in equation A14 because it affects total manufacturing profits through a translation effect but not a price/volume effect. For a given export volume, a 1 percent increase in the (real) dollar export price (SP^x/P) would increase real export revenues by 1 percent without raising total costs, so that the amount of increase in total real manufacturing profits would be exactly equal to the amount of increase in real export revenue. In other words, the percent increase in total real manufacturing profits (Π/P) due to a 1 percent increase in (SP^x/P) would be equal to (SP^xX/Π) percent. Consequently, in the regression, $\ln(SP^x/P)$ is scaled by (SP^xX/Π), and the coefficient on (SP^xX/Π) $\ln(SP^x/P)$ is restricted to be one.

The last factor included is real unit variable costs (U/P), which is assumed to be the same whether the output is for exports or for domestic sales. If we assume that dollar profit margins on exports and domestic sales are roughly the same, the impact of a 1 percent change in unit variable costs on total profits would depend only on the size of the profit margin, not on the relative size of export sales to domestic sales.‡ Consequently, we do not scale this variable in the regression.

To estimate the impact of the exchange rate on total manufacturing profits, we still need to estimate the relationship between export prices and the exchange rate, and that between import prices and the exchange rate. In the case of the export price equation, if we assume that the markup (ϕ^x) is a function of competitive pressures in the foreign market and use foreign prices (P^*) as a proxy for the competitive pressure faced by U.S. exporters, then U.S. export prices become a function of the nominal exchange rate, the foreign price level, and the U.S. cost of production (U). We can then derive the following long-run export price equation:

$$\text{(A15)}\quad \ln(SP^x) = \text{constant} + \gamma_1 \ln(S)_t + \gamma_2 \ln(U)_t + \gamma_3 \ln(P^*)_t + \mu^x{}_t,$$

where we expect $1 > \gamma_1 > 0$, and $(\gamma_1 - 1)$ is the (pass-through) elasticity of P^x with respect to the exchange rate (S).

Similarly, in the case of the import price equation, if we assume that the markup (ϕ^m) is a function of competitive pressures in the U.S. market and use the price level of U.S. manufactured goods (P^h) as a proxy for competitive pressure faced by foreign suppliers, then U.S. import prices become a function of the nominal exchange rate, the price of U.S. goods, and the foreign unit cost of production (U^*). We then can derive the following long-run import price equation:

$$\text{(A16)}\quad \ln(P^m)_t = \text{constant} + \alpha_1 \ln(S)_t + \alpha_2 \ln(U^*)_t + \alpha_3 \ln(P^h)_t + \mu^m{}_t,$$

where we expect $1 > \alpha_1 > 0$, and α_1 is the (pass-through) elasticity of P^m with respect to the exchange rate.

Together, equations A14, A15, and A16 constitute an empirical model that enables us to determine the long-

†Both Y^* and P^x/P^* affect export profits through the volume effect. For a given dollar export price (SP^x) and unit variable cost (U), a 1 percent increase in export volume (X) would increase both export revenue (SP^xX) and total export cost (UX) by 1 percent, thereby increasing total manufacturing profits by $((SP^x - U)X/\Pi)$ percent, or the percent share of export profits in total manufacturing profits. Under the assumption that profit margins are the same for exports as for domestic sales, the $((SP^x - U)X/\Pi)$ ratio equals the ratio of export sales to total sales.

‡A 1 percent increase in the unit variable cost would increase total variable cost by $(X+Q)U$ percent, and lower total manufacturing profits by $((X+Q)U/\Pi)$ percent. If we assume that the profit margins for export sales and domestic sales are the same, then $(X+Q)U/\Pi$ would be equal to $1/((P/U) - 1)$, where P is the price of the good.

Appendix: The Relationship of the Exchange Rate to Pricing Behavior and Manufacturing Profits *(Continued)*

run impact of a sustained change in the nominal exchange rate on real gross U.S. manufacturing profits. All three equations, with coefficients assumed to be time-invariant, are estimated in two stages using data over the floating exchange rate period from 1973-III to 1990-IV.

In the first stage, the parametric correction suggested by Saikkonen (1990) and Stock and Watson (1989) is used to obtain consistent estimates of the three long-run equations.[§] Then GLS is used to correct for serial correlation among residuals that may still be present. With these corrections, we can use standard t-statistics as a basis for hypothesis testing. The estimation results are reported in Exhibit 1 (Box 1).

The second stage involves estimating the short-run dynamic counterparts of the three equations. For example, we can estimate the short-run adjustment processes of real U.S. manufacturing profits around the long-run equilibrium profit path by estimating the error correction model (ECM) of real U.S. manufacturing profits. More specifically, the first difference of real profits, $\Delta 1n(\Pi/P)_t$, is regressed on the equilibrium error (that is, the deviation of actual profits from long-run equilibrium profits, or the residual from the cointegrating long-run profit equation) in the past period, along with lagged changes in the dependent variable and all independent variables in equation A14. Variables not included in the long-run equation should be included in the error correction model if they affect the short-run movements of manufacturing profits; thus, capital expenditure, inflation, and changes in the real interest rate are also included in the model. A parsimonious representation is achieved by eliminating most insignificant lag terms. The same method is used to estimate the error correction model of export prices and that of import prices. The estimation results of these three error correction models are reported in Exhibit 2 (Box 2).

Equation A14 shows that a proper assessment of the dollar exchange rate's effect on manufacturing profits should take into account the impact of the dollar on both the ratio of export sales to total sales and the ratio of export revenue to total profits. Consequently, we include the following two supplemental equations in the model:

$$(A17)\ (SP^{x}X/\Pi)_t = \text{constant} + a1\ \ln(S)_t + a2\ \ln(Y)_t + a3\ \ln(y^{*})_t + a4\ \ln(P^{h})_t,$$

$$(A18)\ \chi_t = \text{constant} + b1\ \ln(S)_t + b2\ \ln(Y)_t + b3\ \ln(y^{*})_t.$$

The estimation results of A17 and A18 are reported in Exhibit 2 (Box 2).

[§]That is, leads and lags of the first differences of the regressors are added to the right-hand side of each of the three equations to correct for the simultaneity bias that may be caused by the endogeneity of the regressors. See Pentti Saikkonen, "Asymptotically Efficient Estimation of Cointegration Regression," *Econometric Theory*, vol. 7 (March 1991); and James H. Stock and Mark W. Watson, "A Simple MLE of Cointegrating Vectors in Higher Order Integrated Systems," National Bureau of Economic Research, Technical Working Paper no. 83 (1989).

Recent U.S. Export Performance in the Developing World

by Bruce Kasman

Exports have been a major source of strength for the U.S. economy in recent years. The nation's sales abroad have more than doubled since 1986, prompting a large reduction in the U.S. merchandise trade deficit and substantially boosting output and employment growth. Many analysts had expected a surge in exports because of the acceleration of growth in Europe and Japan and the dollar's sharp decline against these countries' currencies during the second half of the 1980s. What had not been anticipated, however, was our remarkable export performance in developing country markets. U.S. sales increases to developing countries have far outpaced export growth to the industrial world since 1986, and over the past three years, the developing world has been the primary source of U.S. export growth.

This article investigates the reasons for the recent strong performance of U.S. exports to the developing world. The analysis suggests that macroeconomic developments in the industrial world have greatly contributed to this strength. Specifically, during the second half of the 1980s, the combination of declining world interest rates, faster industrial world growth, and the fall in the dollar boosted foreign exchange earnings in a developing world beset by high debt burdens and only limited access to external financing. This increase in earnings greatly expanded the spending capability of developing countries and largely explains their growing appetite for U.S. and other industrial country goods.

The close linkages between developing countries' foreign earnings and their import demand also helps explain why, until recently, these countries suffered no deterioration in their balance of trade with the industrial world. Indeed, from 1986 through 1990 the developing world's trade balance with the United States actually improved.

Renewed access to international capital flows has sustained the developing world's demand for U.S. goods in the face of an industrial world downturn during the past two years. The resiliency of developing world demand is limited, however, and the continued strength of our export performance to developing countries remains tied to the ability of developing countries to sell their products to the industrial world.

U.S. export performance since the mid-1980s

Although our export sector accounts for a relatively small share of the U.S. economy, exports have been a key source of output and employment growth in recent years. From 1986 onward, exports of goods and services grew at an average 8 percent annual rate in volume terms (Chart 1). Foreign sales contributed, on average, more than a percentage point to GDP growth per year during 1987-92, in sharp contrast to the first half of the 1980s, when exports placed a drag on activity.[1] Estimates made in a recent Commerce Department study suggest that our sales in foreign markets accounted for nearly all of the job creation in the U.S. manufacturing sector during this period.[2]

[1]Net exports, which measure foreign sales less purchases of goods and services from abroad, contributed slightly less than 1/2 percentage point per year, on average, to GDP growth from 1986 through 1992.

[2]Lester Davis, "U.S. Jobs Supported by Merchandise Exports," U.S. Commerce Department, April 1992. Davis estimates that export growth accounted for all manufacturing employment growth and one-quarter of all civilian employment growth from 1986 to 1990.

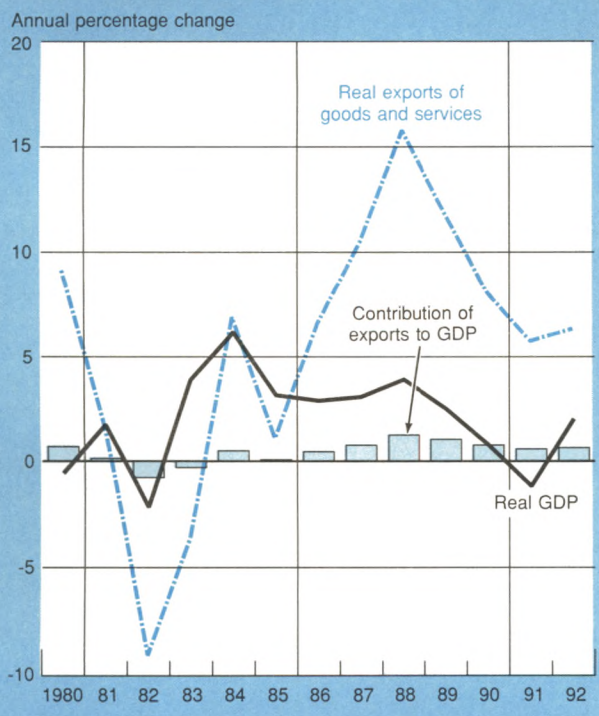
U.S. exports grew most rapidly over the three-year period from 1987 through 1989, when volume increases exceeded 10 percent each year. Since that time, export growth has slowed steadily, falling to about 6 percent in 1992. Despite this slowdown, our foreign sales played a particularly important role in U.S. activity during the more recent period. At a time when other major components of activity stalled or declined, exports contributed 2.1 percentage points to growth over 1990-92, an amount exceeding the increase in GDP during these years.

The acceleration in U.S. export sales since the mid-1980s extended to all regions of the world. Shipments of merchandise goods to countries in Europe, Asia, the Middle East, and the Western Hemisphere all grew rapidly during the second half of the 1980s, in most cases at double-digit annual rates (Table 1). Underlying this broad-based acceleration, however, we observe a pattern of surprising strength in U.S. export growth to developing countries. This record of growth has made developing country markets an increasingly important destination for U.S. goods.

Chart 1

Export and GDP Growth

Constant Dollars, National Income and Product Accounts Basis



Note: Contribution of exports to GDP is measured by the change in exports as a share of GDP.

Following the 1982-86 period, in which our merchandise exports to developing countries declined, exports to the developing world expanded at an average annual rate exceeding 16 percent in current dollar terms from 1986 to 1992. Exports to developing countries in Asia (hereafter called Asia) and in Latin America and the Western Hemisphere more generally (hereafter termed Latin America)—countries that are the destination for almost one-third of our total foreign sales and over 80 percent of our trade with the developing world—increased at about this rate.[3] Within these broad regions, sales to the four Asian NICS, or newly industrialized countries (Hong Kong, Taiwan, South Korea, and Singapore), and Mexico were particularly strong, increasing annually by 17.4 and 22.7 percent, respectively, during 1987-92.

An examination of U.S. export growth by product category indicates that our export boom to the developing world has extended across a wide range of products (Chart 2). In each of the four major export end-use categories—capital goods, industrial supplies, consumer goods, and autos—exports to Latin America and Asia grew, on average, at double-digit annual rates over 1987-92. The success of U.S. auto sales to these regions is particularly notable, although auto sales make up a relatively small share of our trade with these regions.[4]

Our sales to industrial countries also grew rapidly following a period of prolonged weakness during the first half of the 1980s. The pace of U.S. export growth to industrial countries (9.7 percent per year since 1986) was, however, only three-fifths as fast as sales increases to the developing world. In none of our major industrial markets (Western Europe, Canada, and Japan) did U.S. exports grow as fast as they did to Latin America or Asia during this period. As a result, the share of U.S. foreign sales directed to developing countries rose steadily, from 32 percent in 1986 to 40 percent in 1992.

The disparity in our export performance in industrial and developing country markets became more marked after 1989. U.S. sales to the industrial world slowed over 1990-92, increasing only 3.5 percent annually. In contrast, sales to developing countries remained

[3]Throughout this article, Latin America refers to all countries in the Western Hemisphere excluding the United States and Canada. Asia refers to all non-middle-eastern Asian countries excluding Japan, Australia, and New Zealand. In general, the regional groupings used here conform to the country classifications described in the International Monetary Fund's *International Financial Statistics*.

[4]In 1990, U.S. exports of automotive products accounted for 2 percent of our total exports to Asia and 10 percent of our total exports to Latin America.

Table 1

U.S. Merchandise Export Growth by Region

Annual Average Percentage Changes, Current Dollars, Balance of Payments Basis

	Percentage Share of Total in 1990	1982-86	1987-92	1987-89	1990-92
Total	100	−1.2	11.9	17.4	6.6
Developing countries	34	−5.1	16.2	19.8	12.7
Asia	16	1.8	15.5	25.0	6.7
Newly industrialized countries†	10	3.4	17.4	29.6	6.3
Other Asia	6	0.0	12.8	18.4	7.4
Latin America	14	−6.4	16.6	16.7	16.5
Mexico	7	−7.5	22.7	26.1	19.5
Other Latin America	7	−5.6	11.4	9.4	13.4
OPEC	3	−13.2	12.9	8.6	17.4
Industrial countries	66	1.1	9.7	16.3	3.5
Western Europe	29	−1.5	11.4	17.7	5.4
Japan	12	3.9	10.2	18.5	2.5
Canada	21	4.2	8.3	12.6	4.1

Note: Figures for 1992 are based on data through the third quarter.
†South Korea, Hong Kong, Taiwan, and Singapore.

robust, particularly to Latin America, where our exports continued to increase more than 16 percent per year. Overall, two-thirds of total U.S. export growth since 1989 can be attributed to sales to developing countries. This figure represents a dramatic increase from the sales' nearly 40 percent contribution to overall export growth during the previous three years and their less than 20 percent contribution from 1980 to 1986.

Sources of U.S. export growth to developing countries

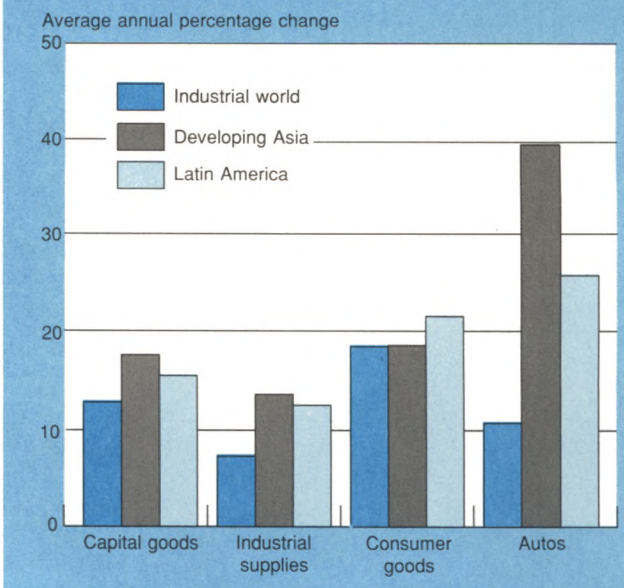
Most recent studies of U.S. export performance have emphasized traditional macroeconomic fundamentals—in particular, relative prices as determined by exchange rates and inflation trends, and foreign income—in explaining the surge in U.S. exports following 1986. Such analyses appear to explain U.S. exports to industrial countries relatively well. However, efforts to apply these determinants to developing countries suggest that this standard macroeconomic approach is not adequate to account for the strength of U.S. export growth to the developing world.

Chart 3 indicates that movements in U.S. relative prices and foreign GDP correspond closely to the observed pattern of U.S. export growth to industrial countries. The acceleration in our sales to the industrial world during 1987-89 was accompanied by a pickup in the pace of economic activity abroad. Foreign industrial

Chart 2

U.S. Export Growth by Major End-Use Category: 1987-92

Current Dollars, Census Basis



Note: Figures for 1992 are based on data through the third quarter.

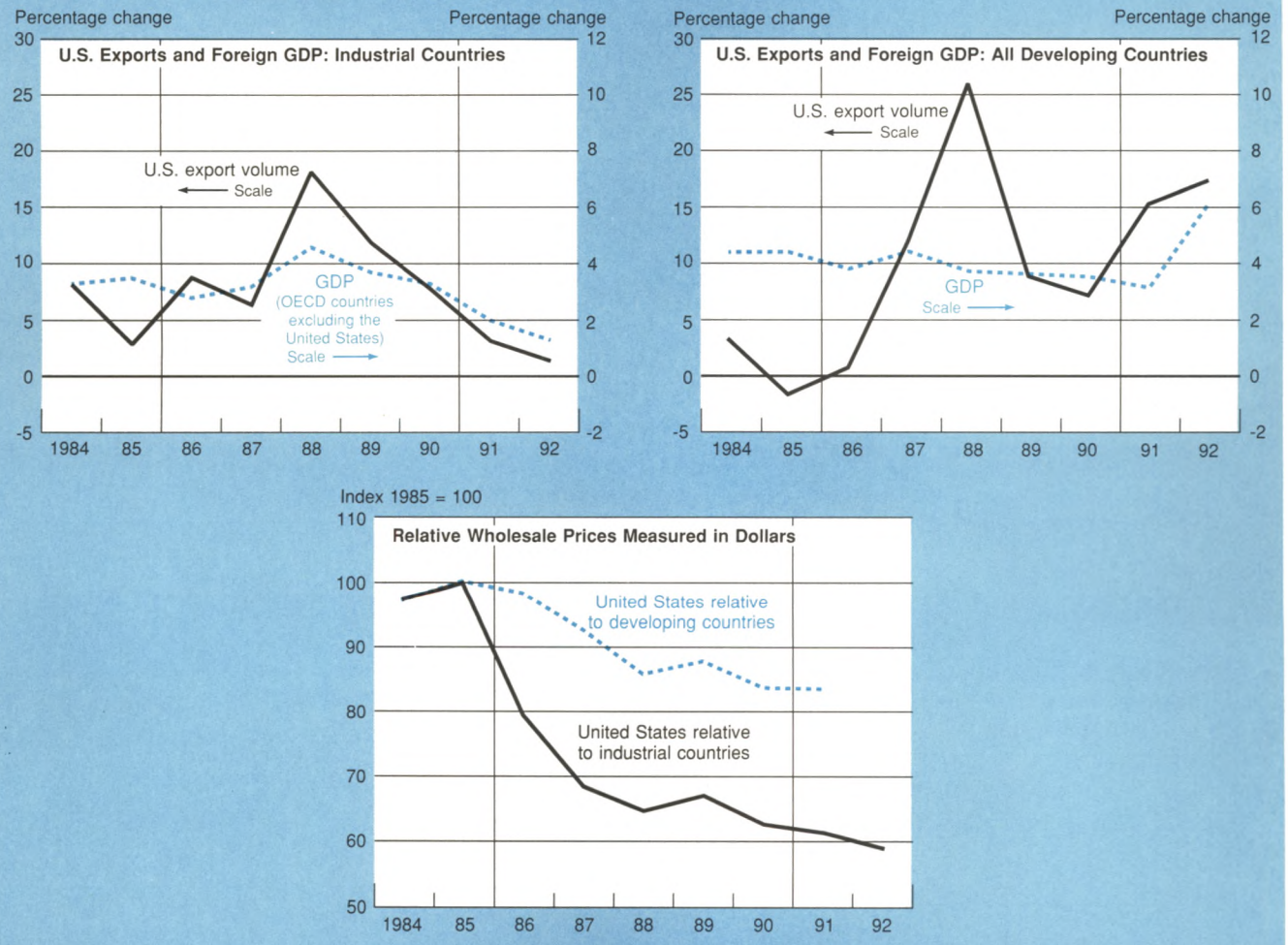
world GDP increased, on average, by close to 4 percent per year over 1987-89, its fastest three-year rate of expansion during the post-1973 period. Similarly, export growth slowed from 1990 onward in an environment of weakening activity abroad.

Our exports to industrial countries have also been boosted by U.S. relative price gains. Following the dollar's decline in 1985, foreign industrial country wholesale prices rose substantially faster than comparable U.S. prices. Through 1988 our relative gains amounted, cumulatively, to more than 30 percent. Since that time, the United States has continued to make modest gains in its competitive position in the industrial world.

Activity growth and relative price movements in the developing world do not seem to be as strongly linked to U.S. export performance. Developing countries' economic growth did not accelerate at the same time as U.S. exports to this region. In fact, developing world

Chart 3

Macroeconomic Determinants of U.S. Exports



Sources: U.S. Commerce Department; Organization for Economic Cooperation and Development, *Economic Outlook*; International Monetary Fund, *International Financial Statistics*.

Notes: In both upper panels, U.S. exports are adjusted by the U.S. aggregate export price deflator to compute export volumes. The lower panel presents trade-weighted indexes comparing U.S. wholesale prices with those of twenty-two developing countries (dashed line) and seventeen industrial countries (solid line). A decline in the index indicates that U.S. prices are rising more slowly than those of our trading partners. Values for 1992 are either through the third quarter or full-year estimates.

growth slowed during 1987-89 from its pace during the previous three years. Moreover, the relative price gains made by the United States against developing countries during this period were comparatively modest, amounting to slightly more than 15 percent cumulatively since 1985.

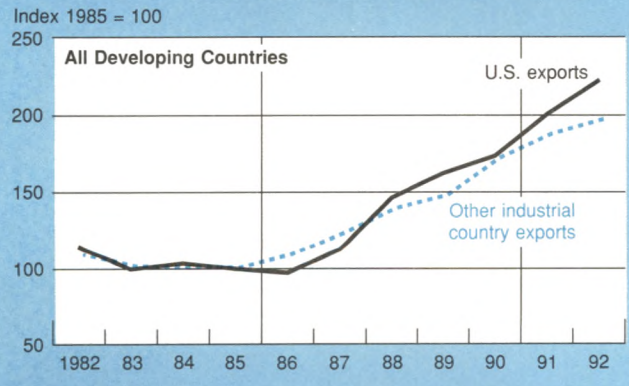
Examining the 1987-92 period in its entirety, we find that the relative strength of U.S. export growth outside industrial countries reflects a sharp rise in the demand for U.S. goods *relative to income* in the developing world. Following five years in which U.S. exports to the developing world grew considerably more slowly than developing country income, our exports increased more than four times as rapidly as developing country income after 1986; in the industrial world our sales increased roughly 2½ times as fast as income since 1986.

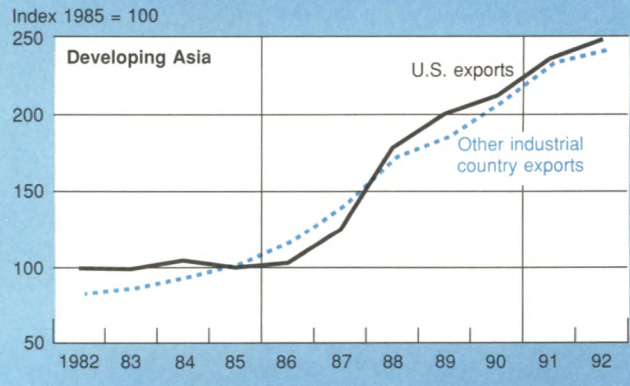
These differences seem particularly surprising given the more modest relative price gains made by the United States in developing world markets. However, any consideration of the competitive gains made by U.S. exporters in the developing world cannot be limited to comparing our prices with those of developing country producers. U.S. exports to developing countries compete more with exports from other industrialized countries than with goods produced in the developing countries themselves. As a result, the greater than 40 percent improvement in our price position against other industrial countries since 1985 may be a better predictor of competitive gains made by U.S. exporters in the developing world.[5]

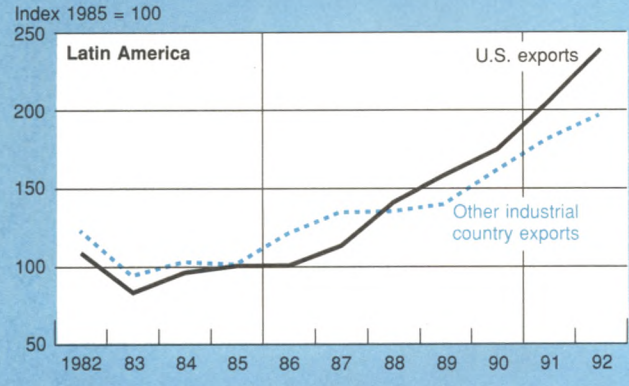
[5]For a detailed analysis of measures assessing the competitiveness of the United States relative to other industrial countries, see Susan Hickok, Linda Bell, and Janet Ceglowski, "The Competitiveness of U.S. Manufactured Goods: Recent Changes and Prospects," this *Quarterly Review*, Spring 1988; and Martine Durand, Jacques Simon, and Colin Webb, "OECD's Indicators of International Trade and Competitiveness," Organization for Economic Cooperation and Development, Working Paper no. 120, 1992.

Chart 4

Industrial Country Exports to Developing Countries







U.S. Share of Industrial World Exports to Developing Countries
(Percentage points)

	1986	1989	1992
All developing countries	24	28	28
Developing Asia	22	26	25
Latin America	50	58	59

Source: International Monetary Fund, *Direction of Trade Statistics*.

Note: Figures for 1992 represent data through the first half of the year, annualized.

If an improvement in our competitive position relative to that of other industrial world exporters explains the surge in U.S. exports to developing countries, then we should observe a shifting in developing country import demand away from other sources. As Chart 4 shows, the United States did make inroads in developing economy markets following the dollar's decline. From 1987 through 1989 our exports to developing countries grew faster than those of other industrial countries. As a result, the U.S. share of industrial country sales to the developing world rose about 4 percentage points from its 1986 level. U.S. exports grew more rapidly than other industrial countries' exports in both Latin American and Asian markets; our market share gains were greatest in Latin America, where in 1989 U.S. exporters' market share was 58 percent of industrial world sales, a full eight percentage points above 1986 levels.[6]

Since 1989, however, U.S. exporters have been unable to make further market share gains. Our exports to the developing world have grown rapidly, but these sales increases have generally been matched by those of other industrial countries. Although small market share gains were recorded by U.S. exporters in Latin American markets, these gains were offset by a deterioration in our share of industrial world exports to Asia.

Overall, increases in the U.S. share of industrial world exports to developing economies do not account for a large part of the strength in U.S. export growth to the developing world. As Chart 4 clearly shows, developing countries have sharply increased their demand for industrial world products generally since 1986, following a prolonged period of weak demand. Other industrial countries, whose currencies swung sharply against the dollar during the 1980s, recorded export growth similar to that of the United States both before and after 1985. Indeed, if U.S. exports had increased only as rapidly as the rate of growth of developing world demand for all industrial country goods, our exports to developing countries would have grown at an annual rate only 3 percentage points slower than they actually did since 1986; over the past three years, U.S. exports would have increased at about their actual pace.[7]

[6]U.S. exporters' large share of the Latin American market is overstated because it includes inputs to the Mexican Macquilidora sector, whose output in large part must be shipped back to the United States. Currently, Macquilidora inputs represent more than 10 percent of total Latin American purchases of industrial world goods.

[7]Although the improvement in relative prices achieved through dollar depreciation did not lead to large market share gains in the developing world, it did enable U.S. exporters to reverse the pattern of market share losses that took place in the first half of the 1980s.

Further evidence of the developing world's increased demand for industrial world products is presented in Table 2. Following five years in which purchases of industrial country goods fell, the developing world's appetite for imported goods increased rapidly after 1986 in both absolute terms and relative to income growth. This acceleration in import demand is observed across regions in the developing world, but the change is sharpest for Latin American countries. Although GDP in Latin America grew at almost the same rate over 1987-92 as during the previous five-year period, the region's imports from the industrial world increased by over 7 percent annually in volume terms during 1987-92, compared with a decline of more than 4 percent per year in the earlier period.

Developing economy imports and industrial world economic conditions

We have seen that the rapid increase in developing country demand for U.S. goods is not fully explained by such standard macroeconomic forces as income growth and competitiveness gains. We now consider other developments since the mid-1980s that may have

Table 2

Developing Country Imports from Industrial Countries

Annual Average Percentage Change

	1982-86	1987-92
All developing countries		
Imports from industrial countries†		
Value	−2.6	11.4
Volume	−1.4	6.4
Real GNP growth	3.3	4.2
Asia		
Imports from industrial countries†		
Value	5.4	13.6
Volume	6.8	8.7
Real GNP growth	7.1	6.7
Latin America		
Imports from industrial countries†		
Value	−5.0	12.3
Volume	−4.1	7.4
Real GNP growth	1.4	1.5

†Measures of developing country imports are based on industrial world export data from International Monetary Fund, *Direction of Trade Statistics*. Import value growth is deflated by the average of the change in industrial country export unit values and regional import unit values to compute import volume growth.

played a role in boosting developing country demand.

One significant change in the developing world has been a shift away from restrictive, inward-looking policies. Since the mid-1980s, several developing countries have undertaken comprehensive adjustment programs combining measures to deregulate domestic markets, reduce the size of the public sector, and foster greater integration of domestic with world markets.

A significant liberalization of trade policies has been a central part of this shift in orientation. A recent study by the International Monetary Fund identified seventeen regionally important countries that since the mid-1980s have moved from tightly controlled trading systems to systems characterized as open or relatively open.[8] That ten countries in this group are in the Western Hemisphere highlights the dramatic changes taking place in this region. Nearly all major countries in Latin America are now committed to open trading systems, and most have bound their tariff schedules in the General Agreement on Tariffs and Trade (GATT).

These internal reforms have opened developing economy markets to industrial world exporters. Nonetheless, the surge in purchases of industrial world goods could not have occurred without a significant improvement in the external economic conditions confronting developing countries. From the early 1980s onward, many developing countries, particularly those in Latin America, faced severe debt repayment problems and had only limited access to international credit markets. As a result, their capacity to import was largely tied to their foreign exchange earnings. During the early 1980s, earnings were depressed in an environment of weak industrial world growth and high dollar interest rates (Chart 5).[9]

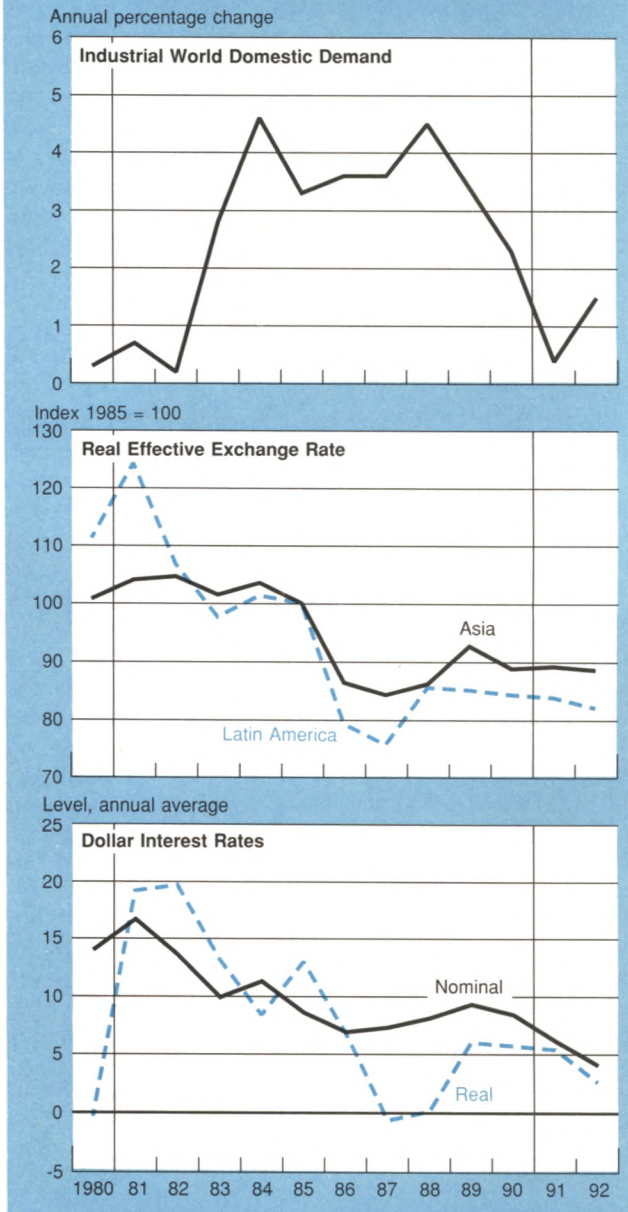
From the mid-1980s onward, however, changing macroeconomic conditions in the industrial world provided a significantly more favorable environment for developing country import demand. As Chart 5 demonstrates, industrial country demand remained above its long-term trend growth rate of about 3 percent for each year from 1984 through 1989. In addition, developing countries were able to improve their price competitiveness after 1985, despite the appreciation of their currencies against the dollar noted earlier. By limiting the degree to which their currencies rose relative to the dollar, devel-

[8]See Margaret Kelley and Anne Kenny McGuirk, "Issues and Developments in International Trade Policy," *World Economic and Financial Survey*, International Monetary Fund, 1992.

[9]For a detailed analysis of the impact of industrial world economic conditions on developing country performance during the early 1980s, see Rudiger Dornbusch, "Policy and Performance Links between LDC Debtors and Industrial Nations, *Brookings Papers on Economic Activity*, 2:1985, pp. 303-68; and Carlos F. Diaz-Alejandro, "Latin American Debt: I Don't Think We Are in Kansas Anymore," *Brookings Papers on Economic Activity*, 2:1984, pp. 335-403.

Chart 5

External Conditions Facing Developing Economies



Sources: Organization for Economic Cooperation and Development (OECD), *Economic Outlook*; Morgan Guaranty Trust Company, *World Financial Markets*; International Monetary Fund, *International Financial Statistics*.

Notes: The top panel measures demand for all OECD countries. The middle panel shows the U.S. trade-weighted average of real effective exchange rates for five Latin American and eight Asian economies. In the bottom panel, nominal interest rates are six-month dollar LIBOR rates. Real rates are obtained by deflating nominal rates by the average annual change in export unit values for non-fuel-exporting developing countries.

oping countries made significant relative price gains against Europe and Japan. Finally, dollar interest rates, both in nominal terms and when deflated by developing country export prices, fell substantially after the mid-1980s.

The rise in export earnings and reduction in debt service resulting from these developments directly eased foreign exchange constraints limiting the developing countries' spending on industrial world goods, thus increasing demand independent of income growth.[10] Indeed, as Table 3 shows, increases in these sources of foreign exchange closely correspond to the rise in imports in the developing world since 1986. In the developing world overall as well as in Asia and Latin America individually, foreign currency income gains—defined as the increase in exports and the decline in debt service payments as a share of GDP—roughly matched the rise in imports from the industrial world between 1987 and 1991. In Asia, the increase of more than 4 percentage points in industrial world imports as a share of output was financed entirely through export earnings. In Latin America and elsewhere in the developing world, export earnings and declining debt service payments contributed about equally to the rise in import shares.

Increased foreign earnings may also have stimulated demand for foreign goods through other channels. In a number of developing countries, the improved profitability in the traded goods sector that accompanied rising export earnings revived investment demand, much of which was met by capital goods exports from the industrial world.[11] In addition, because the external creditworthiness of a country is generally assessed by the ratio of debt service to exports, the expansion in export earnings, independent of income levels, probably reduced borrowing constraints in debt-burdened countries.

Several developing countries that had experienced debt-servicing difficulties have recently, in fact, been able to reenter the international market for capital.[12] During 1991 and 1992, inflows of foreign private capital have been substantial in Latin America and Asia, reflecting renewed investment opportunities and increased solvency in these regions. The ability of the developing world to attract large inflows of foreign capital during 1991 and 1992 helps to explain why import demand and economic activity more generally in the developing world have remained resilient in the face of weakening demand in the industrial world.[13]

[10]Increased earnings and reduced debt service payments also boosted import demand through their direct effect of raising income.

[11]According to estimates presented in the International Monetary Fund's *World Economic Outlook*, October 1992, investment spending as a share of GDP rose roughly 3 percentage points in both Asia and the Western Hemisphere from 1986 to 1992.

[12]For a detailed discussion of recent developments in developing countries' access to international capital markets, see Charles Collyns et al., *Private Market Financing For Developing Countries*, International Monetary Fund, December 1992.

[13]There is some evidence that external forces, specifically the industrial world recession and falling U.S. interest rates, have encouraged a portfolio shift towards developing world assets and influenced the recent pattern of world capital flows. See Guilermo A. Calvo, Leonardo Leiderman, and Carmen Reinhart, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," International Monetary Fund, Working Paper no. 92-62, August 1992.

Table 3

Developing Country Imports and Foreign Income Gains

Shares of GDP

	1986	1991	Change from 1986 to 1991 (Percentage Points)
All developing countries			
Imports from industrial countries	12.1	13.9	+1.8
Exports to industrial countries	13.5	15.0	+1.5
Debt service interest payments	2.9	2.1	−0.8
Asia			
Imports from industrial countries	12.7	16.8	+4.1
Exports to industrial countries	14.7	18.7	+4.0
Debt service interest payments	1.7	1.5	−0.2
Latin America			
Imports from industrial countries	8.4	10.9	+2.5
Exports to industrial countries	10.5	11.7	+1.2
Debt service interest payments	4.9	3.5	−1.4

Source: International Monetary Fund, *World Economic Outlook*, October 1992.

The evidence presented here suggests that developing countries' ability to export to the industrial world independent of income growth has been an important determinant of their purchases of U.S. goods. To assess this linkage more directly, we present in Table 4 the results of regressions relating U.S. export growth to developing countries (USX_i) from 1987 to 1991 to developing countries' sales to the industrial world (DVX_i) and their GDP growth ($DGDP_i$) over this period. In addition, we have included a variable (TRD_i) identifying countries that have undertaken major trade liberalization programs since the mid-1980s to determine whether U.S. exports have grown more rapidly to those countries.

Examining a broad cross section of thirty-eight large developing economies, we find a significant and strong positive relationship between individual country sales to the industrial world and their purchases of U.S. goods. On average, an added 1 percentage point in a developing country's exports to the industrial world over 1987-91 was associated with 0.64 percentage point higher U.S. sales to the country. Estimates of the impact of trade liberalization indicate an additional boost to our export growth from the opening of markets, but the coefficient estimate fails to pass significance tests at standard statistical levels.

Important distinctions can be observed when the relationship between developing countries' sales to the industrial world and their purchases of U.S. goods is estimated across regions. A very strong and significant relationship is found for Latin American countries. During 1987-91, increased Latin exports to the industrial world were associated with a 0.89 percentage point increase in their purchases from the United States. In contrast, estimates for Asian countries are smaller and not significant statistically.

These findings are consistent with the view that developing country export performance has been a particularly important determinant of demand in countries facing high debt burdens. Indeed, when we isolate the countries with the highest ratios of debt service to exports during the mid-1980s, we find a significant relationship between their export earnings and purchases from the United States.

It is also useful to compare these results with estimates of a similar relationship between industrial countries' export performance (here measured as total exports of a country) and their purchases of U.S. goods. In contrast to the developing country results, a negative relationship is found between an industrial country's exports and its purchases of U.S. goods. The divergence in results between industrial and developing economies most likely arises because industrial economies are not credit constrained and employ their resources relatively efficiently. The effect of increased export earnings on demand should therefore be largely captured in the income growth variable. The negative coefficient estimates in the regression probably capture the impact of macroeconomic developments not incor-

Table 4

U.S. Export Performance and Developing Country Sales to the Industrial World

$USX_i = C + B_1(DVX_i) + B_2(DVGDP_i) + B_3(TRD_i) + \mu_i$

	Number of Observations	C	B_1	B_2	B_3	$\bar{R}_2$
All developing countries	38	16.3	0.64**	0.32**	20.24	.44
		(1.14)	(4.24)	(3.29)	(1.64)	
Asia	11	17.7	0.59	0.36*	—	.27
		(0.38)	(1.59)	(2.13)		
Latin America	14	23.4*	0.89**	0.14	—	.41
		(1.76)	(3.97)	(0.44)		
High-debt-service countries†	13	38.9**	0.51**	0.53*	—	.69
		(8.40)	(4.09)	(1.89)		
Industrial economies‡	21	113.5**	−1.19*	0.73	—	.16
		(3.21)	(−2.60)	(1.36)		

Notes: The variables are defined as follows: USX_i = cumulative U.S. export growth to country i, 1987-91; DVX_i = cumulative export growth of country i, to the industrial world, 1987-91; $DVGDP_i$ = cumulative GDP growth of country i, 1987-91; TRD_i = dummy variable identifying countries that undertook major trade liberalizations since the mid-1980s. Data for growth in exports and GDP are based on dollar values of variables. Standard errors are adjusted to be consistent in the presence of heteroskedasticity.

†Defined as those countries whose ratio of debt service to exports exceeded one-third for the 1985-86 period.
‡For industrial economies, export growth (DVX_i) represents total export sales growth over 1987-91.

*Significant at 10 percent level
**Significant at 1 percent level

porated in the estimated relationship—most notably the decline in the dollar's real value relative to other industrial currencies—which weakened foreign exports and stimulated U.S. exports during this period.

Export performance and the U.S. trade balance

The analysis presented here highlights the close linkages between economic conditions in the industrial world and U.S. export performance in developing country markets. These linkages can help to explain the evolution of our merchandise trade balance with developing countries and can shed light on the prospects for the continuation of our strong export performance.

Although U.S. exports grew rapidly to all regions of the world in the second half of the 1980s, our overall trade balance with developing countries followed a different course than our trade balances with industrial countries (Chart 6). Trade with the industrial world accounted for all of the roughly $40 billion improvement in our merchandise trade balance from 1986 through 1990. While U.S. import growth from industrial countries slowed sharply from its pace during the first half of the decade, purchases from developing countries accelerated, increasing nearly as rapidly as our exports. As a result, our trade position with the developing world as a whole, as well as with Asia and Latin America separately, deteriorated somewhat during this period.

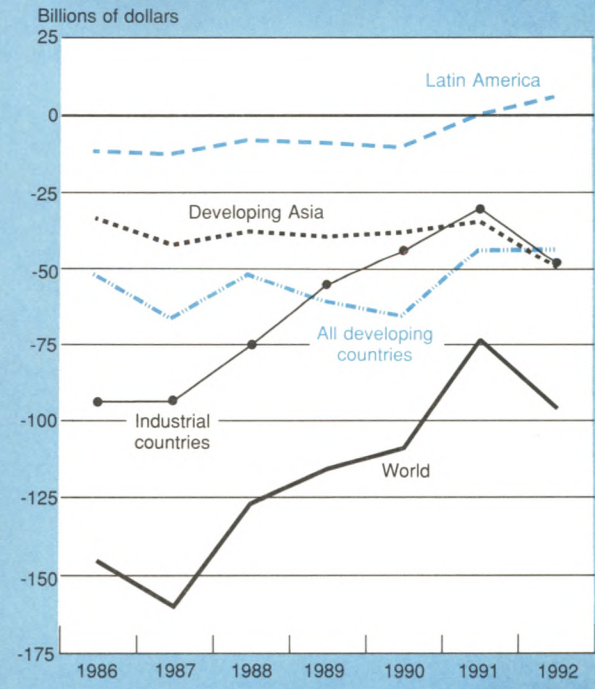
The rapid rise in U.S. imports from the developing world is readily explained by the changes in price competitiveness discussed earlier. By limiting the appreciation of their currencies against the dollar after 1985, developing countries realized large improvements in their competitive position against Europe and Japan. These gains enabled developing country exporters to make significant inroads in U.S. markets, leading to a rise of more than 6 percentage points in the developing world's share of total U.S. imports from 1986 to 1990. Through these market share gains, developing countries improved their trade position with the United States during this period, despite the relatively moderate growth in U.S. domestic demand.[14]

Our earlier analysis linking the imports of developing countries to their foreign exchange earnings would suggest that the developing world's strong appetite for industrial world goods was not accompanied by a deterioration in its balance of trade. In fact, developing countries recorded an improvement of roughly $30 billion in their trade balance with industrial countries from 1986 through 1990. This relationship between imports and foreign exchange earnings did not, however, constrain movements in the trade position of the developing world with any individual industrial country. Nonetheless, the United States is a particularly important destination for developing country exports, accounting for more than 40 percent of Asian sales and more than 50 percent of Latin American sales to the industrial world during this period. As a result, our willingness to expand purchases of developing country goods was probably vital in fueling both developing country demand and the strong performance of our exports to these countries.

The onset of recession in the United States in 1990, followed soon after by a downturn in activity in Europe and Japan, slowed import demand across the industrial world. This falloff in activity has had little impact on our balance of trade with other industrial countries, which

Chart 6

U.S. Merchandise Trade Balances by Region



Note: Figures for 1992 are based on seasonally adjusted annualized data through the third quarter.

[14]The performance of developing country exports was even more impressive elsewhere in the industrial world during this period. Spurred by competitiveness gains and the acceleration in foreign industrial world growth, developing country exports grew more rapidly to Europe and Japan than to the United States after 1986.

remains roughly unchanged from its 1990 level. Weaker industrial country demand did, however, boost the trade position of the United States and other industrial countries relative to developing countries during 1991 and 1992.

Although weaker export earnings slowed spending in many developing countries, developing world import demand did not collapse as it had during the last cyclical slowdown in the industrial world in 1982. A sharp rise in private capital inflows during the past two years enabled the developing world to dampen the effects of this downturn. In particular, capital inflows to Latin America exceeding $40 billion in both 1991 and 1992 (about four times their average during the second half of the 1980s) spurred a boom in regional demand. All of the roughly $13 billion improvement in the U.S. trade balance from 1990 through 1992 can be traced to our trade with Latin America.

The recent rise in capital inflows to the developing world may, however, have negative consequences for U.S. export performance. The history of developing country financing is marked by episodes in which large inflows of capital to the developing world are followed by market corrections and debt-servicing problems. The persistence of high debt levels and the recent deterioration in the current account positions of several large developing countries have raised concerns that a shift in external financing availability could occur, prompting a significant weakening in developing world demand as it did in 1982-83.

It is also true, however, that a country's vulnerability to shifts in external financing depends critically on the resiliency of its economic system and the soundness of policies pursued.[15] Evidence suggests that the recent inflows of capital to the developing world may be, at least in part, the fruits of the fundamental economic and political reforms taking place. These developments, together with other important differences between recent experience and the events of the early 1980s, point to greater sustainability of current financial flows.[16]

Certainly, important risks remain for U.S. export performance in the developing world, particularly if recovery in industrial world activity is delayed or if protectionist pressures lead industrial countries to raise barriers against developing country exports. Nevertheless, the ability of many developing countries to limit their vulnerability to the current economic downturn in the industrial world must be viewed with cautious optimism.

Conclusion

In our highly integrated world economy, major developments in one part of the world have repercussions for nations everywhere. Developing countries have been particularly sensitive to changes in world economic conditions because of their limited access to international credit markets throughout most of the past decade.

Our analysis highlights how the major macroeconomic developments in the industrial world during the second half of the 1980s—specifically, the rapid pace of demand growth and the declines in the dollar's value and U.S. interest rates—improved conditions for a developing world beset by foreign debt problems. One important consequence of this improvement has been a sharp increase in developing country import demand. This increase in turn largely explains the surge in U.S. exports to these countries since 1986.

Our export performance in the developing world has remained strong despite a deterioration in industrial world growth during 1991 and 1992. The revival of capital inflows, particularly to Latin America, has enabled developing countries to weather declines in industrial world demand for their goods and to continue their imports of industrial country goods. Although these developments are supported in part by the ongoing reforms in the developing world, both the linkages described in this article and past experience suggest that the resiliency of developing world demand is limited. As a result, strong U.S. export growth to this region can probably only be sustained if developing countries can also increase the sales of their goods to the industrial world.

[15]In comparing the response of Latin America and developing Asia to the external shocks of the early 1980s, Jeffrey Sachs emphasizes the importance of sound macroeconomic policies ("External Debt and Macroeconomic Performance in Latin America and East Asia," *Brookings Papers on Economic Activity*, 2:1985, pp. 523-64).

[16]For a detailed assessment of the sustainability of the recent inflow of capital to developing countries, see Collyns et al., *Private Market Financing*.

Treasury and Federal Reserve Foreign Exchange Operations

November 1992-January 1993

During the November-January period, the dollar continued to appreciate against the German mark and Japanese yen from the low levels established in the prior period. The U.S. authorities did not intervene in the foreign exchange markets.

Developments in dollar exchange markets

Over the period, the dollar gained 1 percent in value against the yen, 4.5 percent against the mark, and 5.5 percent on a trade-weighted basis.[1] The dollar's upward movement was supported, first, by the perception that the incoming Clinton Administration would pursue a policy of fiscal stimulus and, subsequently, by stronger than expected U.S. economic growth and persistent expectations of official rate reductions in Germany and Japan. The dollar's trend was interrupted by changing estimates of the amount of any U.S. fiscal stimulus, by perceived postponements of German rate reductions, and by widespread market reports of European central bank sales of dollars.

The dollar trends higher. Following the U.S. election in November, analysts were predicting that the U.S. economy would begin to outperform those of other industrialized countries and that a narrowing of interest rate differentials would favor the dollar in the coming year. The prospect of a strengthening dollar was given continued support by indications that President-elect Clinton would apply fiscal stimulus early in 1993 should there be any signs of economic weakness. Although hopes for a reduction in official rates by the Bundesbank were disappointed in both November and December, expectations for such a move early in the new year persisted. Anticipating a stronger dollar in the new year, market participants in late December and early January bid up the dollar to its period highs of DM 1.6490 on January 8 and ¥126.21 on January 13.

After mid-January, however, there was an unwinding of long-dollar positions as it became apparent that a reduction in official rates by the Bundesbank was not imminent and that the Clinton Administration's overall fiscal policy might put greater weight on reducing the budget deficit. Many market participants then assumed that if U.S. economic conditions were to worsen, responsibility for ensuring adequate economic growth would fall on the Federal Reserve. Although a reduction in official U.S. rates was still not seen as likely, an easing was perceived to be in the range of possible monetary policies, and that perception contributed to the dollar's brief reversal. But at the end of January, the release of stronger than expected U.S. economic data, particularly the strong fourth-quarter 1992 gross domestic product and December 1992 durable goods orders, seemed to erase the prospects for interest rate reductions by the Federal Reserve and refresh the expectation that the U.S. economy would be outperforming others over the year. Thus, in the closing days

This report, presented by William J. McDonough, Executive Vice President and Manager of the System Open Market Account, describes the foreign exchange operations of the United States Department of Treasury and the Federal Reserve System for the period from November 1992 through January 1993. John W. Dickey was primarily responsible for preparation of the report.

[1]The dollar's movements on a trade-weighted basis in terms of the other Group of Ten currencies are measured using an index developed by the staff of the Board of Governors of the Federal Reserve System.

of the period, the dollar moved up from January lows of DM 1.5660 and ¥122.85 to close the period at DM 1.6102 and ¥124.60.

The market awaits interest rate reductions in Germany and Japan. Throughout the period, on-again off-again expectations for reductions in official interest rates by the Bundesbank and the Bank of Japan punctuated the dollar's movements.

In response to continued pressures within the European Exchange Rate Mechanism (ERM), many market participants expected the Bundesbank to ease interest rates in early November and, when this did not occur, attention focused on the prospects for an easing in December. Although no official rate reduction came in December, the Bundesbank's market operations were designed to avoid end-of-year upward pressure on interest rates. Moreover, in statements that appeared to acknowledge a weakening in the German economy while expressing optimism about the central bank's ability to control inflation, senior Bundesbank officials predicted sharp reductions in German interest rates during the course of 1993. In the final week of December, Bundesbank officials added that an easing could occur earlier in 1993 than was previously expected. It was during this period that the dollar posted most of its gains toward its January 8 high against the mark.

In early January the Bundesbank did engineer a small reduction in market interest rates through its market repurchase operations. However, by mid-January, when the decline in market rates had not been followed by a reduction in the Bundesbank's official Discount and

Chart 1

The Dollar against the German Mark and the Japanese Yen

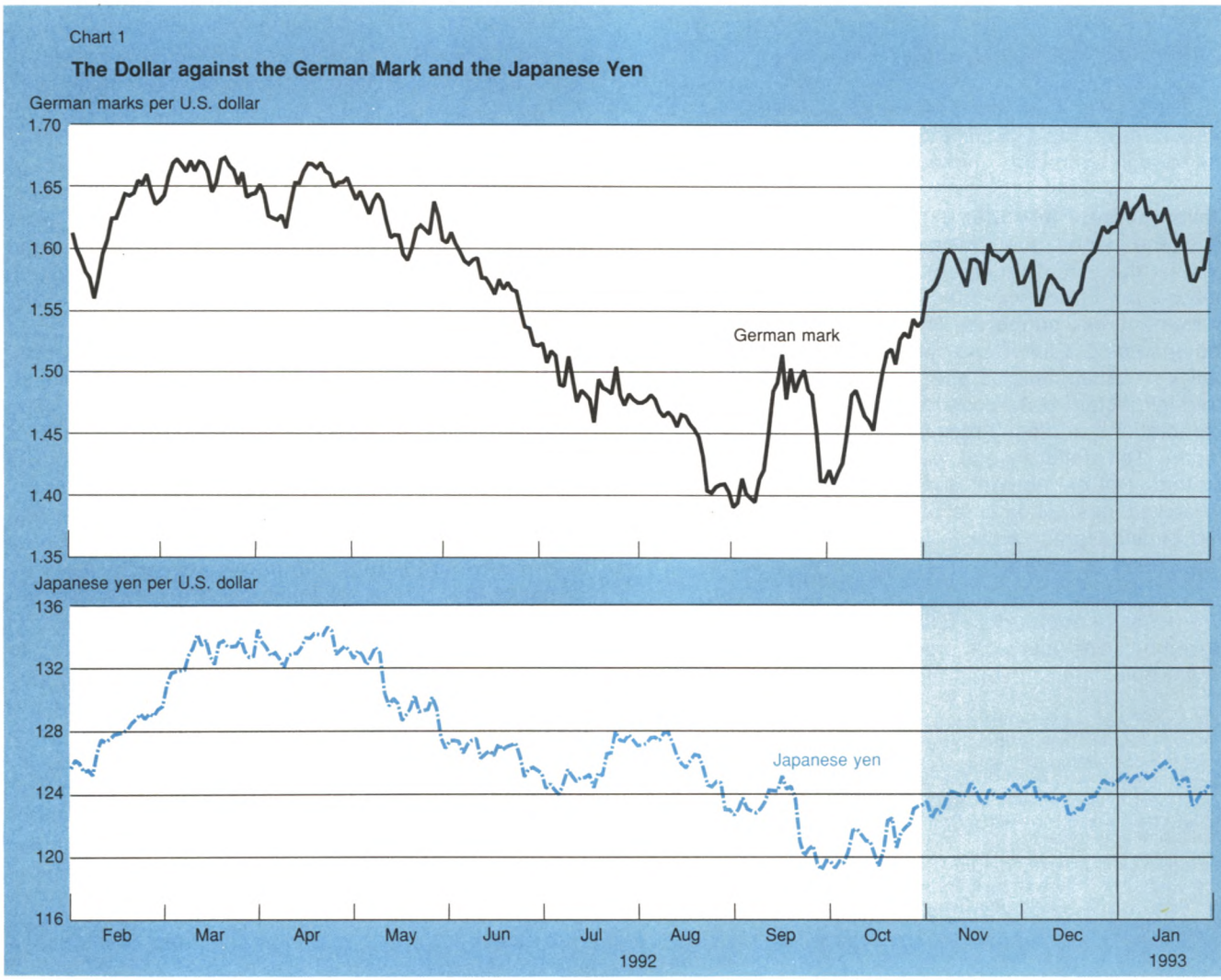


Chart 2

The Dollar against Selected Foreign Currencies

Notes: The chart shows the percentage change in daily rates for the dollar from November 1992 through January 1993. All figures are calculated from New York closing rates.

Table 1

Federal Reserve Reciprocal Currency Arrangements

Millions of Dollars

Institution	January 31, 1993
Austrian National Bank	250
National Bank of Belgium	1,000
Bank of Canada	2,000
National Bank of Denmark	250
Bank of England	3,000
Bank of France	2,000
Deutsche Bundesbank	6,000
Bank of Italy	3,000
Bank of Japan	5,000
Bank of Mexico	700
Netherlands Bank	500
Bank of Norway	250
Bank of Sweden	300
Swiss National Bank	4,000
Bank for International Settlements:	
Dollars against Swiss francs	600
Dollars against other authorized European currencies	1,250
Total	30,100

Lombard rates, expectations for an easing in German monetary policy were postponed to early March and the dollar began its brief reversal against the mark.

Expectations for a reduction in the Official Discount Rate (ODR) by the Bank of Japan persisted during the period, gaining in strength as the period closed, though with less direct effect on exchange rates than in the German case. In December, comments by Japanese officials focused on the need to stimulate demand through fiscal policy and, as a result, prospects for a cut in the ODR receded. But in January, the release of weak Japanese retail sales, production, and employment data and a declining stock market heightened concerns about weakness in the Japanese economy and returned attention to the prospects for an immediate reduction in the ODR. Despite widespread expectations for an ODR cut at the end of January, the dollar was not able to sustain its mid-January high against the yen as exchange market attention focused on the January 22 report of a record Japanese trade surplus for the calendar year 1992 and on the risk that policy makers might respond to the trade imbalance by seeking an appreciation of the yen.

Currency tensions in Europe continue. Pressures on a number of European exchange rates, particularly the German mark/French franc rate, persisted during the November-January period. In response to these pressures, German and French authorities repeatedly stated their commitment to the existing parity between their currencies and confirmed their participation in market intervention in support of the franc. The Spanish peseta and the Portuguese escudo were each devalued within the ERM by 6 percent on November 22, and the Irish punt was devalued by 10 percent on January 30. In addition, the Swedish and Norwegian monetary authorities abandoned their currencies' links to the European Currency Unit on November 19 and December 10, respectively.

While these exchange rate pressures within Europe had little direct impact on dollar exchange rates, particularly in comparison with the previous period, transactions related to the financing of official European intervention were perceived as affecting the dollar. Throughout the period, market participants reported that both in the course of rebuilding official reserves and in transactions related to financing official borrowings, a number of European central banks were heavy sellers of dollars and that, at times, this selling pressure restrained the dollar's upward trend against the mark.

* * * *

Chart 3

The Dollar against the German Mark and the Japanese Yen

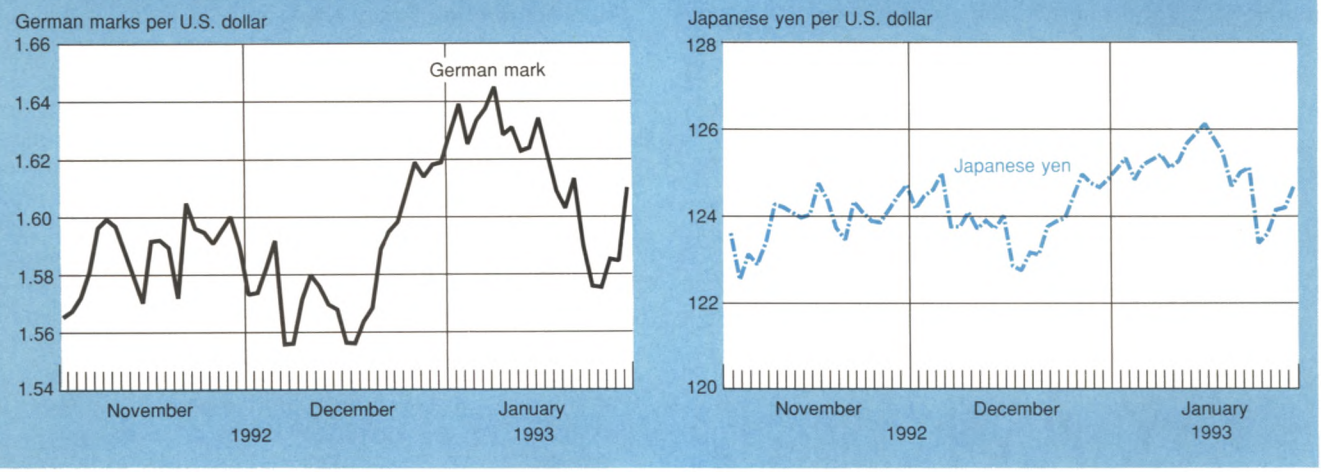


Chart 4

Short-Term Interest Rates for Selected Countries

Table 2

Net Profits (+) or Losses (−) on United States Treasury and Federal Reserve Foreign Exchange Operations

Millions of Dollars

	Federal Reserve	U.S. Treasury Exchange Stabilization Fund
Valuation profits and losses on outstanding assets and liabilities as of October 31, 1992	+3,746.3	+2,293.8
Realized October 31, 1992–January 31, 1993	+109.5	+25.1
Valuation profits and losses on outstanding assets and liabilities as of January 31, 1993	+2,868.4	+1,749.9

Note: Data are on a value-date basis.

While the U.S. authorities did not execute any foreign exchange transactions during the period, settlements were completed on a total of $1,455.8 million in forward sales of German marks. As previously reported, these settlements were executed in May 1992 with the Deutsche Bundesbank in an effort by both the U.S. and German monetary authorities to adjust the level of their respective foreign currency holdings. During the period, $729.4 million and $726.5 million against marks settled on November 23 and December 21, respectively, completing the total of $6,176.6 million of spot and forward dollar purchases from the Bundesbank. For each transaction, 60 percent was executed for the account of the

Federal Reserve and 40 percent for the account of the Treasury's Exchange Stabilization Fund (ESF). The Federal Reserve and the ESF realized profits of $109.5 million and $25.1 million, respectively, from these settlements. As of the end of January, cumulative valuation gains on outstanding foreign currency balances were $2,868.4 million for the Federal Reserve and $1,749.9 million for the ESF.

The Federal Reserve and the ESF invest their foreign currency holdings in a variety of instruments that yield market-related rates of return and have a high degree of liquidity and credit quality. A portion of the balances is invested in securities issued by foreign governments. As of the end of January, the Federal Reserve and the ESF held either directly or under repurchase agreements $7,834.0 million and $8,356.0 million equivalent, respectively, in foreign government securities valued at end-of-period exchange rates.

Treasury and Federal Reserve Foreign Exchange Operations

August–October 1992

The August-October period was marked by serious strains in European exchange rate relationships and shifting market views about the outlook for interest rates in the major countries. Although the dollar briefly reached all-time lows against the mark and yen in September, it closed the period up on balance 4.5 percent against the German mark, down about 3.0 percent against the Japanese yen, and up 6.8 percent on a trade-weighted basis.[1]

The U.S. monetary authorities intervened in the exchange markets in two episodes during August in their only operations during the period. Entering the market on a total of four days that month, they sought to counter persistent downward pressure on the dollar by buying $1.1 billion against the German mark, in amounts shared equally by the U.S. Treasury and the Federal Reserve.

Dollar declines against the mark in response to interest rate pressures

Interest rate considerations were the dominant factor in exchange rate movements during the period. Interest rate differentials provided a strong incentive for capital flows into the higher yielding securities denominated in German marks and in other currencies thought to be closely linked to the mark. They also made it attractive for U.S.-based entities that were building up foreign currency receivables to postpone the repatriation of these funds so as to benefit from higher interest rates overseas and, perhaps, from a continued depreciation of dollar exchange rates.

For many market participants, however, the dollar's position in the exchange market carried a two-sided risk. On the one hand, the fact that the dollar was already trading relatively close to the historical low reached in 1991 against the German currency gave rise to fears that if selling pressures against the dollar became intense enough to break through this level, the dollar's decline might gain significant momentum. On the other hand, market participants were still mindful of the experience the previous month, when the authorities of the United States and other industrialized countries intervened to buy dollars, triggering a sharp short-covering rally.

Under these circumstances, market participants were particularly sensitive to indications either that the interest differentials might widen further—thereby putting renewed selling pressure on dollar rates—or that the authorities might again intervene. The economic data for the United States released early in August gave no clear indication of serious further deterioration, but neither did they offer assurance of a sustained upswing. The Federal Reserve had eased monetary policy in early July, and markets expected further ease in the absence of a stronger recovery. Meanwhile, in the face of rapid monetary growth in Germany, the Bundesbank had tightened monetary policy in mid-July. But above-target money growth continued, and it was thought

This report, presented by William J. McDonough, Executive Vice President of the Federal Reserve Bank of New York and Manager of the System Open Market Account for the Federal Open Market Committee, describes the foreign exchange operations of the United States Department of Treasury and the Federal Reserve System for the period from August to October 1992.

[1]The dollar's movements on a trade-weighted basis are measured using an index developed by the staff of the Board of Governors of the Federal Reserve System.

that the Bundesbank would keep monetary policy firm—perhaps even tighten policy once more—despite data suggesting that the German economy might be beginning to slow.

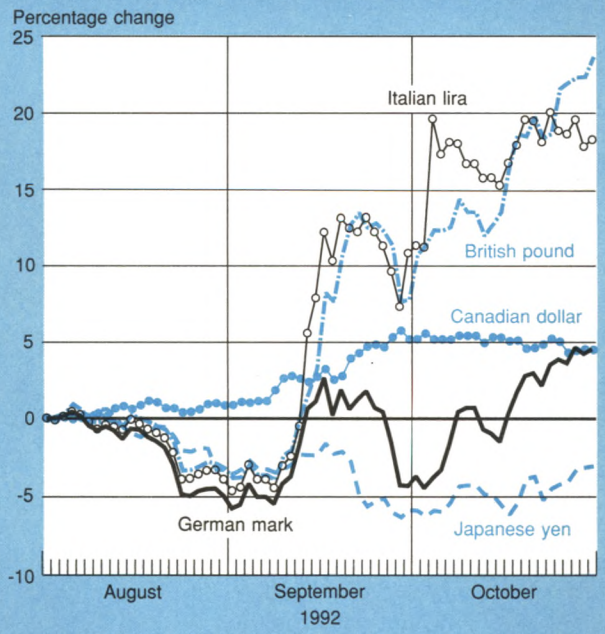
Market participants looked to the release of monthly U.S. labor force data early in August to give direction to dollar rates. They expected that if the data proved to be weaker than expected, the Federal Reserve would soon ease pressures on bank reserves. When the data, released on Friday, August 7, appeared to confirm economic weakness, the dollar showed some initial resistance but then came on offer later that same day, and the U.S. authorities intervened to stabilize the dollar. When pressures reemerged the following Tuesday, the U.S. authorities again intervened in an operation joined by other central banks. Over the two days, the U.S. authorities bought a total of $600 million against the German mark. Selling pressures were somewhat blunted by the interventions, but the operations did not interrupt the tendency of the dollar to decline.

By late August, the German mark was strengthening not only against the dollar but also against other European currencies in response to strains that were to become far more intense later in the period. With the dollar again approaching its 1991 low, the U.S. authorities intervened on August 21 and 24, in cooperation with other monetary authorities, buying a total of $500 million. But when these operations did not appear to discourage the bidding for marks, the U.S. authorities refrained from further intervention.

The dollar continued to ease, establishing a new historical low against the mark of DM 1.3862 on September 2. But trading conditions for the dollar were relatively orderly, even in the face of the disappointing labor market statistics released in early September and the continuing market expectations of declining U.S. interest rates, which appeared to be confirmed by Federal Reserve operations on September 4 that eased conditions in the federal funds market.

Chart 1

The Dollar against Selected Foreign Currencies



Notes: The chart shows the percentage change in daily rates for the dollar from July 31, 1992. All figures are calculated from New York closing rates.

European currencies face severe pressures

By late August and during most of September, market attention focused on pressures within the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) and between the EMS and those currencies linked to it through the European Currency Unit (ECU)—for example, the Finnish markka and Swedish krone. During the lengthy negotiations among European Community countries on European Monetary Union that had led up to the December 1991 Maastricht Treaty, market participants had become impressed by the participating governments' evident commitment to exchange rate stability. Though the treaty did not provide for fixed exchange rates within the system for several more years, market participants came to assume that few of these governments would countenance devaluation in the interim. As a result, investors felt increasingly secure holding securities denominated in ERM currencies other than the mark. Investors purchasing assets that carried even higher yields than DM-denominated assets appeared to give little weight to exchange rate risk in *ex ante* calculations of risk-adjusted returns. During the long interval since the last general ERM realignment in 1987, the total amount of assets allocated on the basis of this view reached substantial sums.

Doubts had begun to develop as to the durability of existing exchange rate relationships and the effectiveness of efforts to achieve greater economic convergence within Europe after Danish voters rejected a referendum on the Maastricht Treaty in June. In mid-August, reports began to spread that voters in France might also vote "no" on a referendum on the Maastricht treaty, and pressures on exchange rates within Europe intensified. In the ensuing weeks an exchange crisis swept through the EMS and related currencies that entailed interventions of unprecedented size, large changes in interest rate differentials within Europe, a

small cut in German official interest rates, two realignments, and the suspension of the pound sterling and the Italian lira from the ERM. The French franc came under selling pressure but stabilized amid intervention purchases of francs and a rise in French interest rates. Outside of the EMS, severe pressures had developed on the Nordic currencies, resulting in sizable interventions and considerable increases in short-term interest rates, particularly in Sweden. The Finnish markka's peg to the ECU was also suspended.

Chart 2

The Dollar against the German Mark and the Japanese Yen

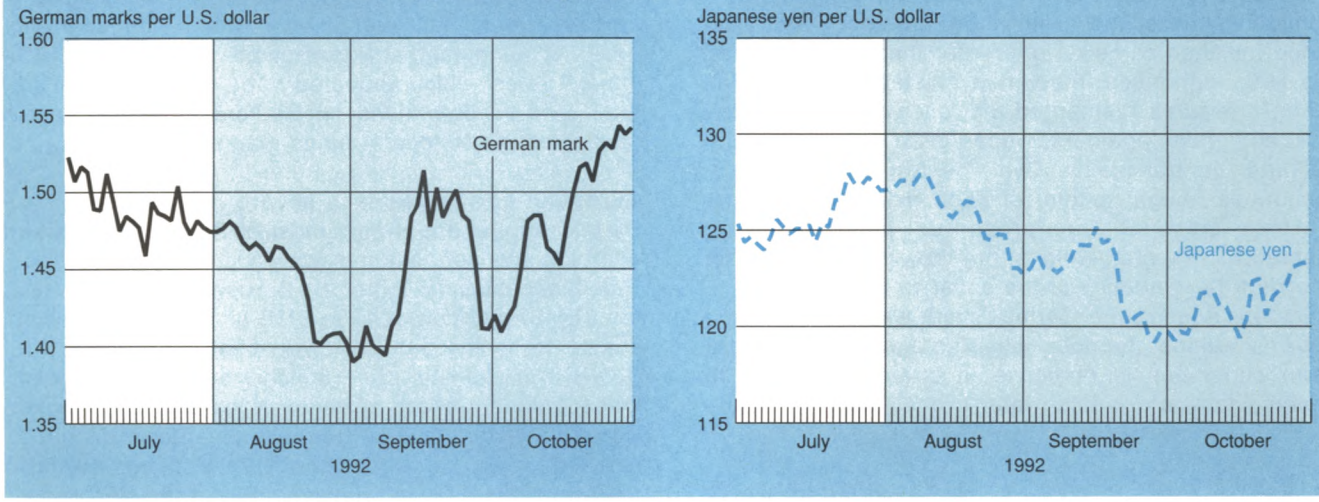
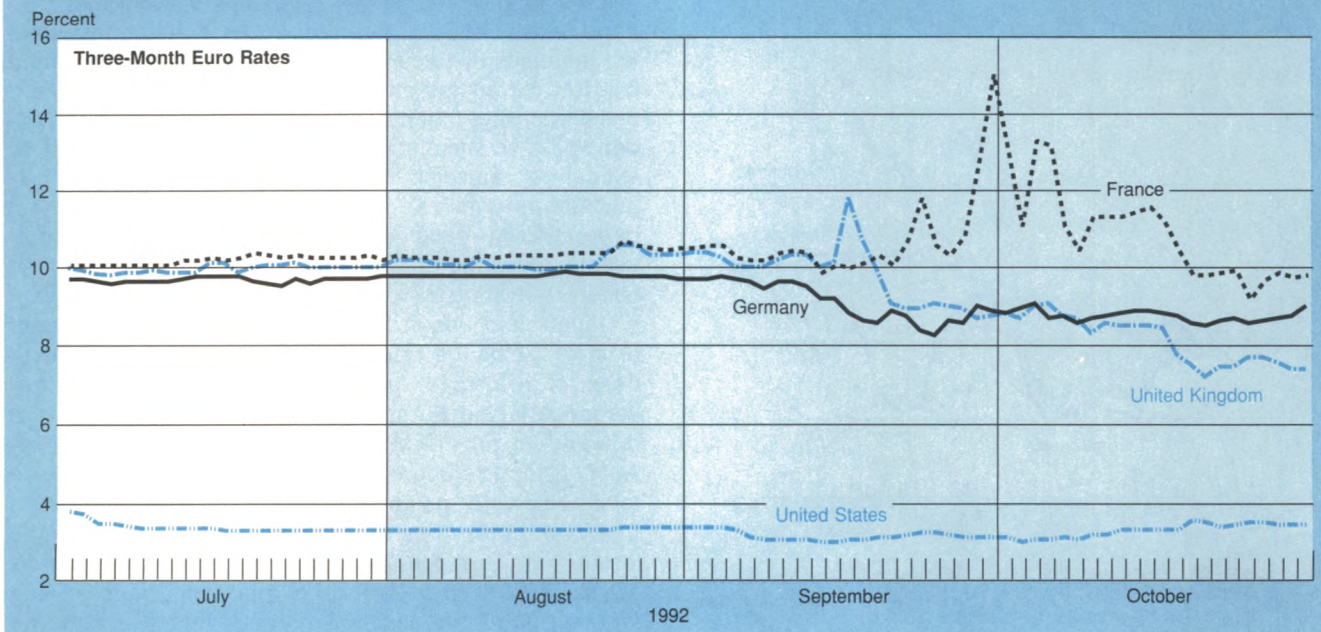


Chart 3

Short-Term Interest Rates for Selected Countries



While dollar exchange rates responded at times to pressures among European currencies in September, the dollar was not the focal point of market attention at that time. It initially encountered selling pressure against the mark as investors sought to cover their intra-European exposures by buying marks. Then, in mid-September, the dollar snapped up rather quickly against the mark when dollar-based investors and U.S. entities sought refuge from the European tensions by converting foreign currency investments or balances into dollars. With the European intervention being conducted in European currencies—mostly in German marks—the financial intermediaries effecting these transactions sold marks in the market to get dollars demanded by their customers. Once the pressures began to subside late in September, the dollar began to drift down toward the levels of late August.

Developments in the dollar/yen exchange rate

The movements of the dollar against the yen during August and September were, in contrast to those against the European currencies, relatively muted. The interest differentials between the United States and Japan were narrower, and market participants believed that the authorities in Japan, like their counterparts in the United States, would be tending to ease monetary conditions. The dollar reached its high for the period of ¥128.19 on August 10 as evidence mounted that the slowdown in the Japanese economy was intensifying and as the Japanese equity market showed persistent weakness. But the yen then appreciated during September. This move reflected some repatriation of capital by Japanese companies with the approach of the fiscal half-year end on September 30, a reaction to a rebound in the Japanese equity market, and some flows into yen-denominated assets in response to the developments taking place in the EMS. The dollar gradually declined against the yen through September, setting a new historical low against that currency of ¥118.60 on September 30.

Market tensions subside during October

Early in October, the pressures in the EMS started to wane. After the British and Italian governments had chosen to suspend their currencies' participation in the ERM, the pound and the lira depreciated to trade well below their previous ERM floors. These and other changes in exchange rates in Europe led to an effective appreciation of the German mark. The Bundesbank lowered both of its official interest rates in mid-September, and money market rates also subsequently eased. Although market participants remained uncertain about the outlook for monetary union and the eventual configuration of the EMS, funds started to flow back to France and short-term interest rates in most of the EMS countries were lowered from the crisis levels reached the previous month. As market participants noted that the slowdown in European economic activity was increasingly evident, they came to believe that the trend of interest rates abroad might turn supportive of the dollar.

Meanwhile, in the United States expectations diminished that monetary policy in the United States would

Table 1
Federal Reserve Reciprocal Currency Arrangements
In Millions of Dollars

Institution	Amount of Facility October 31, 1992
Austrian National Bank	250
National Bank of Belgium	1,000
Bank of Canada	2,000
National Bank of Denmark	250
Bank of England	3,000
Bank of France	2,000
Deutsche Bundesbank	6,000
Bank of Italy	3,000
Bank of Japan	5,000
Bank of Mexico	700
Netherlands Bank	500
Bank of Norway	250
Bank of Sweden	300
Swiss National Bank	4,000
Bank for International Settlements:	
Dollars against Swiss francs	600
Dollars against other authorized European currencies	1,250
Total	30,100

Table 2
Net Profits (+) or Losses (−) on United States Treasury and Federal Reserve Foreign Exchange Operations
In Millions of Dollars

	Federal Reserve	U.S. Treasury Exchange Stabilization Fund
Valuation profits and losses on outstanding assets and liabilities as of July 31, 1992	+4,536.7	+2,503.9
Realized July 31–October 31, 1992	+358.1	+119.9
Valuation profits and losses on outstanding assets and liabilities as of October 31, 1992	+3,746.3	+2,293.8

Note: Data are on a value-date basis.

continue to be eased. The labor market data for September, released in early October, were seen as insufficiently weak to trigger a policy reaction. As the month progressed, talk spread that a fiscal stimulus package would be introduced early in the next year. Under these circumstances, the outlook for interest differentials became more favorable to the dollar. With some of the leads and lags that had built up against the dollar earlier in the year now being reversed, the dollar recovered substantially against the mark and to a lesser extent against the yen in fairly active trading through the rest of October.

Other operations

In other activity, a total of $1,873.1 million in off-market spot and forward foreign currency sales, executed by the U.S. monetary authorities, settled during the period.

- Forward purchases of $740.1 million and $733.0 million against German marks from the Deutsche Bundesbank settled on August 21 and October 21, respectively. These mark sales constituted a portion of the original $6,176.6 million of spot and forward transactions initiated in May. As previously reported, 60 percent of each transaction was executed for the Federal Reserve and 40 percent was for the Exchange Stabilization Fund (ESF) account.
- On September 8, the Federal Reserve agreed to purchase $400 million against German marks in an off-market transaction at the request of a foreign monetary authority.

The Federal Reserve realized profits of $358.1 million, including $230.3 million from off-market transactions that settled during the August-October period. The Treasury realized profits of $119.9 million, which included $33.5 million from off-market transactions that settled during the same three-month period. Cumulative bookkeeping or valuation gains on outstanding foreign currency balances were $3,746.3 million for the Federal Reserve and $2,293.8 million for the Treasury's ESF. These valuation gains represent the increase in dollar value of outstanding currency assets valued at end-of-period exchange rates, compared with rates prevailing at the time the foreign currencies were acquired.

The Federal Reserve and the ESF regularly invest their foreign currency balances in a variety of instruments that yield market-related rates of return and that have a high degree of quality and liquidity. A portion of the balances is invested in securities issued by foreign governments. As of the end of October, holdings of such securities by the Federal Reserve amounted to the equivalent of $8,146.1 million, and holdings by the Treasury amounted to the equivalent of $8,666.9 million valued at end-of-period exchange rates.

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