
FEDERAL RESERVE BANK
OF NEW YORK

March 2007
Volume 13 Number 1

ECONOMIC POLICY REVIEW

- 1 FINANCIAL SECTOR FDI AND HOST COUNTRIES:
NEW AND OLD LESSONS
Linda S. Goldberg
- 19 AN EXAMINATION OF TREASURY TERM INVESTMENT
INTEREST RATES
Warren B. Hrungr
- 33 TRENDS IN FINANCIAL MARKET CONCENTRATION
AND THEIR IMPLICATIONS FOR MARKET STABILITY
Nicola Cetorelli, Beverly Hirtle, Donald Morgan, Stavros Peristiani,
and João Santos
- 53 THE EMERGENCE OF “REGULAR AND PREDICTABLE”
AS A TREASURY DEBT MANAGEMENT STRATEGY
Kenneth D. Garbade
-
-

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CONTENTS

ARTICLES:

1 FINANCIAL SECTOR FDI AND HOST COUNTRIES: NEW AND OLD LESSONS

Linda S. Goldberg

Foreign direct investment (FDI) into the financial sectors of emerging economies soared during the 1990s, leaving many countries with banking sectors owned primarily by foreign institutions. While the implications of FDI into emerging markets are well documented, less clearly understood is how the host countries are affected by financial sector FDI specifically. An understanding of this relationship is crucial for countries formulating policy with respect to foreign banks. This article argues that many lessons learned from work on FDI into manufacturing and primary resource industries apply directly to host-country financial sectors. The author provides evidence on such themes as technology transfers, productivity spillovers, wage effects, macroeconomic growth, and fiscal policy to show that financial sector FDI into emerging markets generally has positive effects on the host countries. In banking and finance specifically, she argues that financial sector FDI can potentially strengthen institutional development through improvements to regulation and supervision.

19 AN EXAMINATION OF TREASURY TERM INVESTMENT INTEREST RATES

Warren B. Hrung

In November 2003, the Term Investment Option (TIO) program became an official cash management tool of the U.S. Treasury Department. Through TIO, the Treasury lends funds to banks for a set number of days at an interest rate determined by a single-rate auction. One reason why the Treasury introduced TIO was to try to earn a market rate of return on its excess cash balances. This article studies 166 TIO auctions from November 2003 to February 2006 to determine how TIO interest rates have compared with market rates. The author investigates the spread between TIO rates and rates on mortgage-backed-security repos, a close benchmark for TIO rates. He finds that aside from offerings with very short term lengths, the Treasury receives an interest rate on TIO auctions comparable to market rates. He also documents a negative relationship between an auction's size and the spread between TIO and repo rates. Furthermore, the Treasury's announcement and auctioning of funds on the same day does not adversely affect rate spreads, a finding that suggests that banks are indifferent to more advance notice of TIO auctions.

33 TRENDS IN FINANCIAL MARKET CONCENTRATION AND THEIR IMPLICATIONS FOR MARKET STABILITY

Nicola Cetorelli, Beverly Hirtle, Donald Morgan, Stavros Peristiani, and João Santos

The link between financial market concentration and stability is a topic of great interest to policymakers and other market participants. Are concentrated markets—those where a relatively small number of firms hold large market shares—inherently more prone to disruption? This article considers that question by drawing on academic studies as well as introducing new analysis. Like other researchers, the authors find an ambiguous relationship between concentration and instability when a large firm in a concentrated market fails. In a complementary review of concentration trends across a number of specific markets, the authors document that most U.S. wholesale credit and capital markets are only moderately concentrated, and that concentration trends are mixed—rising in some markets and falling in others. The article also identifies market characteristics that might lead to greater, or less, concern about the consequences of a large firm's exit. It argues that the ease of substitution by other firms in concentrated markets is a critical factor supporting market resiliency.

53 THE EMERGENCE OF “REGULAR AND PREDICTABLE” AS A TREASURY DEBT MANAGEMENT STRATEGY

Kenneth D. Garbade

During the 1970s, U.S. Treasury officials revised the framework within which they selected the maturities of new notes and bonds. Previously, they chose maturities on an offering-by-offering basis. By 1982, the Treasury had ceased these “tactical” sales and was selling notes and bonds on a “regular and predictable” schedule. This article describes that key change in the Treasury’s debt management strategy. The author shows that in 1975, Treasury officials financed an unusually rapid expansion of the federal deficit with a flurry of tactical offerings. Because the timing and maturities of the offerings followed no predictable pattern, the sales sometimes took investors by surprise, disrupting the market. These events led Treasury officials to embrace a more regularized program of regular and predictable issuance—a program they had been using for decades to auction bills. The Treasury’s switch to regular and predictable issuance of notes and bonds was widely praised for reducing the element of surprise in Treasury offering announcements, facilitating investor planning, and decreasing Treasury borrowing costs.

FINANCIAL SECTOR FDI AND HOST COUNTRIES: NEW AND OLD LESSONS

- The financial sectors of many developing countries are being reshaped dramatically by the rise in foreign direct investment, or FDI.
- The growth in financial sector FDI, in which banks in industrialized countries establish branches and facilities in emerging markets, has drawn attention to the consequences of foreign ownership of banking resources.
- An analysis of research on “real-side” FDI—investment into manufacturing and primary resource industries—suggests that lessons in these industries also apply to the financial sectors of host countries.
- Real-side and financial sector FDI can heighten the host country’s integration into world business cycles through improved allocative efficiency, higher technology transfer rates, and greater wages. In banking and finance, financial sector FDI can potentially strengthen institutional development in the host country through improved regulation and supervision.

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1. INTRODUCTION

In the 1990s, foreign direct investment (FDI) became the largest single source of external finance for many developing countries.¹ Most discussions on the causes and effects of FDI have focused on flows into manufacturing and real production sectors, where this type of investment has traditionally been concentrated. More recently, however, FDI into the financial sector has soared, and the sector is being reshaped dramatically.

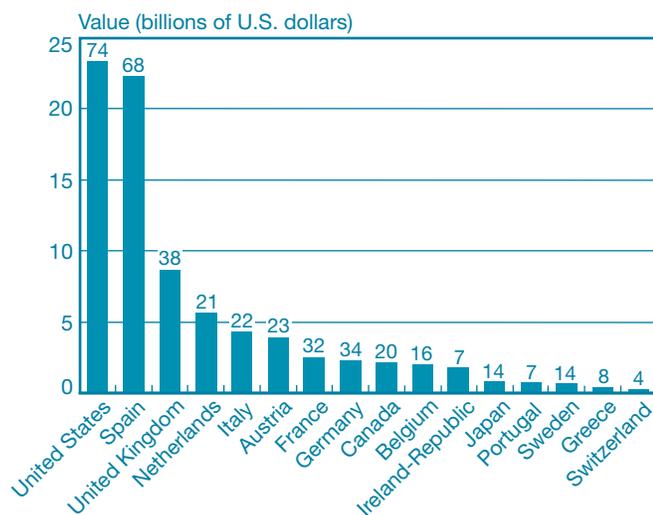
Financial sector FDI, a relatively new phenomenon, typically takes the form of banks in industrialized countries establishing branches and facilities in developing countries. Following the dissolution of the Soviet Union, bank entry into Central and Eastern Europe in the early 1990s led to foreign ownership in local banking systems; today, such ownership often exceeds 80 percent of local banking assets. In addition, the liberalization of financial sectors in Latin America was likely spurred in part by foreign direct investment, especially in countries facing potential competitive losses to Asian economies. Within Latin America, the financial crises of the mid-to-late 1990s provided additional opportunities for foreign entry, as countries sought to recapitalize their banks and improve the efficiency of their financial systems.

¹Other sources of external finance include bank flows, revenues from bond sales, and foreign portfolio inflows. For more information, see International Monetary Fund (2006).

The author thanks Don Morgan, two anonymous referees, participants in the Bank for International Settlements Committee on Global Financial Stability in Basle, in the 2004 Allied Social Science Associations meetings in San Diego, and in the Trinity College of Dublin Conference on Micro and Macro Perspectives on FDI. The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

CHART 1

Value and Number of Acquisitions of Banks in Developing Countries by Source Country, 1990-2003



Sources: Bank of England; Thompson Financial.

Note: The figures above the bars are the number of acquisitions.

Banks in the United States, Spain, the United Kingdom, and other countries with highly developed financial systems are the main sources of financial sector FDI (Chart 1). Parent banks based in industrialized countries have assumed substantial, if not majority, control of assets in host-country financial systems. This growing trend is illustrated in Chart 2, which shows the evolution of foreign control of emerging market financial assets between 1994 and 2004. Whereas foreign control was typically below 10 percent of assets in 1990, it more often surpassed 40 percent by the late 1990s. Acquisitions of local banks continued through the early 2000s, significantly expanding foreign bank presence into majority ownership in many countries. From 1999 to 2004, the largest change in structure occurred in Central Europe, where the foreign ownership share rose to 77 percent.²

As one might expect, these dramatic shifts in investment into foreign financial sectors have raised concerns about the consequences of ownership of banking resources. In this article, we emphasize that some of the consequences are already well established in studies of foreign investment, although that work does not focus specifically on the financial sector. In the broad literature on FDI, the authors draw their results primarily from “real-side” investment—that is, activity in manufacturing and primary resource industries. And although a new line of inquiry is concentrating on financial sector FDI,

²The history of and context for these developments are discussed in Bank for International Settlements (2006).

it typically ignores the lessons documented in the research on real-side investment that also apply to the financial sector.

The stylized facts derived from the literature on the causes and consequences of real-side FDI are usually based on theoretical arguments supplemented by case studies.³ Within the economic research on this theme, the data studied are often from individual countries or from manufacturing industries within countries. Yet one limitation of real-side research is that conclusions seldom distinguish between FDI in the form of mergers and acquisitions and FDI in the form of greenfield (referred to as *de novo* in the financial services industry) investments. This limitation is relevant for understanding and interpreting the employment, growth, and efficiency consequences of FDI.

The emerging body of literature on financial sector FDI addresses some issues that have not received much attention in real-side studies. This research directly explores the cross-border flows of products and the consequences of ownership in the financial services industry. It generally focuses on the implications of foreign entry into local banking systems, either

This article attempts to bridge some of the gap between research on real-side FDI and work on financial sector FDI by presenting a selective survey of the literature.

from the perspective of the investing firms and parents making risk management decisions or from the vantage point of the host markets that are sometimes skeptical of foreign entry.⁴

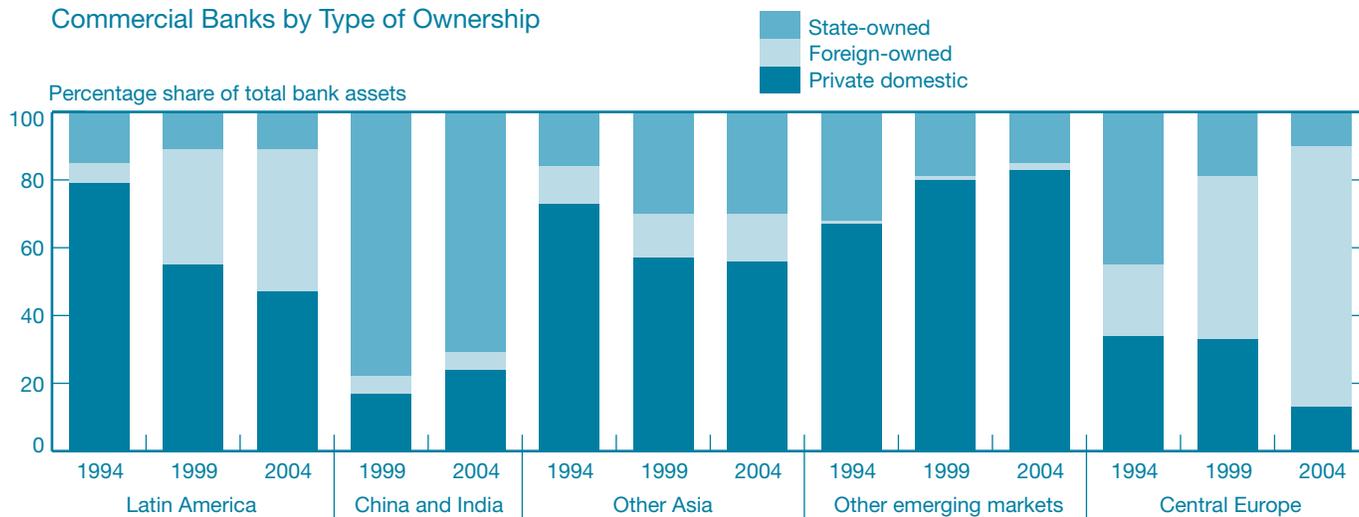
This article attempts to bridge some of the gap between research on real-side FDI and work on financial sector FDI by presenting a selective survey of the literature. We argue that real-side and financial sector FDI share many features. Accordingly, there are many lessons in the research that can benefit both fields of study. Moreover, because research on financial sector FDI is growing, attention could be focused on areas where real-side lessons are lacking or inapplicable, in which case real-side lessons need not be reinvented. In addition, we point to specific areas where financial sector FDI

³The case studies employ distinct “definitions” of FDI, sometimes using a flow definition such as one covering the foreign investment that took place within a particular time period, or a stock definition meant to represent the total cumulative value of all foreign investment up to some point in time. Data availability often drives the type of analysis conducted.

⁴The insurance industry has also received significant foreign investment flows, but less research attention. For example, see Skipper (2001).

CHART 2

Commercial Banks by Type of Ownership



Source: Mihaljek (2006).

has broader consequences—some that are quite policy-relevant—and argue that these consequences need to be understood more fully.

Our review takes as its primary focus the host-country implications of FDI, especially for emerging markets. The implications span evidence on technology transfers, productivity spillovers, wage effects, macroeconomic growth, institutional development, and fiscal and tax concerns. One intention of the review is to emphasize the findings that have been presented independently in real-side FDI research and more recently in studies of financial sector FDI. While the language of these two distinct areas of analysis is subtly different (see box), we show that many conclusions drawn from them are strikingly similar. We also examine research in which no overlap exists between the two lines of inquiry and present conclusions from real-side FDI likely to apply to financial sector FDI. In addition, we comment on how both types of FDI may have different implications for host countries.

Our main conclusions are that real-side and financial sector FDI can induce limited technology transfers and productivity gains as well as have wage implications in the host country. Both types of investment can heighten the host country's integration into world business cycles. Moreover, in banking and finance, financial sector FDI has the potential to strengthen institutional development through improvements to regulation and supervision. Banks provide key financial intermediation services, and their activities have externalities for bank regulation and supervision that cannot be overlooked

(and certainly have come to the attention of host countries). These differences between real-side and financial sector FDI, more so than the similarities, warrant further attention from the research and policy communities. If the balance of evidence weighs in favor of making host-country financial systems healthier and improving intermediation—which seems to be true when robust and well-regulated foreign banks enter emerging markets—the governments of the host countries may wish to consider looking more closely at options for encouraging the benefits of financial sector FDI.

2. DOES FDI LEAD TO TECHNOLOGY TRANSFER AND PRODUCTIVITY SPILLOVERS?

Economists argue that multinationals, through FDI, can help to fill an “idea gap” between developed and developing, or host, countries and provide greater opportunities for growth in the host markets (Romer 1993). According to this view, producers in the developed country have access to productive knowledge that is not otherwise readily available to producers in the host country. However potent, such productive knowledge may be intangible, taking the form of technological expertise, marketing and managing skills, export contacts, coordinated relationships with suppliers and customers, and reputation (Markusen 1995). Technology transfers from FDI, economists contend, can stimulate growth in developing countries.

The “Language” of FDI

To understand why “real-side” and financial sector foreign direct investment (FDI) are so similar, first consider an FDI decision process. In each case, a foreign producer of goods or services makes a two-step decision. The producer begins by determining whether to serve a particular market and then determining whether the market should be served through exports or through the establishment of a local production facility requiring FDI.

While manufacturers/real-side producers use the language of exports or production by multinationals as a means to satisfy customer needs, financial services firms use a different language for a similar decision process. In the financial services industry (in particular, banking), the bank first decides whether to provide lending, deposit-taking, and other services to a market. It then determines whether to serve the market through cross-border activities (arm’s-length transactions) or through foreign direct investment in the form of setting up branches or subsidiaries to engage in local lending. Banks produce services, not goods, so “export” transactions are sometimes not practical, especially when the information intensity of the transaction requires proximity to the client. Some banks specialize in screening and monitoring more opaque borrowers, making cross-border transactions—that is, exports—more costly than operating through a branch or subsidiary in the host country. Financial sector FDI thus entails either a de novo operation of introducing a new, licensed bank in the host country or the acquisition of an existing bank.

Although the language used to describe transactions is different for real-side and financial sector FDI, the decision process is similar. In both contexts, FDI is an activity that occurs as part of a multinational’s broader strategic plan. Flows can respond both to microeconomic stimuli, such as tax incentives,^a and to macroeconomic stimuli, such as fluctuations in exchange rates and business cycles. The sometimes lumpy reallocation of capital across borders can occur when governments reduce their protection of inefficient or corrupt local industries.^b Opportunities to gain local market share and exploit sales or production networks also trigger entry. These features are common to manufacturing industries and extractive resource industries as well as to financial services providers.

^aSee Feldstein, Hines, and Hubbard (1995) for analyses of tax and FDI issues.

^bDixit and Kyle (1985) provide an elegant conceptual exposition.

This concept of technology transfer between countries has a long and rich research history.⁵ Nonetheless, studies of technology transfer reach mixed conclusions on the extent to which the transfers and productivity spillovers have occurred as a result of foreign direct investment in manufacturing and extractive resource industries. Some conclude that domestic firms in sectors with greater foreign ownership are more productive than firms in sectors with less foreign participation.⁶ Others dispute the spillover benefits of FDI into local markets.⁷ Part of the disagreement among researchers stems from methodological disputes, particularly the extent to which the studies properly control for the conditions in a country or sector that existed prior to the entry of the foreign investors. Sometimes foreign investment enters sectors where firms are *ex ante* more productive. Observations of *ex post* high levels of productivity in these sectors therefore offer no proof that foreign entry contributed to enhanced productivity via technology transfer or some other channel.

On balance, research on real-side FDI supports the finding of positive productivity and technology spillovers into host markets. However, the level of these benefits depends on

Economists argue that multinationals, through FDI, can help to fill an “idea gap” between developed and developing, or host, countries and provide greater opportunities for growth in the host markets.

preexisting conditions among the host-country producers.⁸ Small plants may have the largest productivity gains from foreign entry. Some local plants may lose workers and experience productivity declines. In some cases, the gains from foreign investment appear to be captured entirely by the joint ventures.⁹

Technology transfers also flow into local industries that are not themselves direct recipients of foreign capital. Indeed, the view that a new plant will stimulate the local development of

⁵See Horstmann and Markusen (1989) for an early discussion and formalization of this concept.

⁶See, for example, Blomstrom (1989) on Mexico.

⁷See Germidis (1977) for an early discussion of spillovers in the Organization for Economic Co-operation and Development countries.

⁸Gorg and Greenaway (2004) provide a rich and more exhaustive review of the evidence on this point. They are more skeptical that the balance of evidence is positive, but also emphasize that methodological issues need to be addressed better.

⁹Aitken and Harrison (1999) and Harrison and Aitken (1994) provide evidence for Venezuela and preliminary results for Indonesia.

services and attract related producers is occasionally offered as a justification for (possibly excessive) incentive packages offered to foreign investors.¹⁰ Such positive “externalities” have been observed. For example, Javorcik (2004) shows that

Financial sector FDI typically is found to enhance the efficiency of banks that remain in business in the host markets.

among Lithuanian firms, productivity spillovers from FDI took place through contact between the foreign affiliates and their local suppliers in upstream sectors, that is, through vertical linkages. This careful study finds no support for the claim of spillovers taking place within the same industry, sometimes referred to as horizontal linkages.

This same logic should apply to the financial services industries. Instead of using the language of *productivity*, recent research on financial sector FDI considers whether foreign bank entry alters the *efficiency* of foreign-owned and domestically owned banks. Financial sector FDI typically is found to enhance the efficiency of banks that remain in business in the host markets. Efficiency calculations are performed by using data on overhead costs (the ratio of bank overhead costs to bank total assets) and bank net interest margin (bank interest income minus interest expense divided by bank total assets). Foreign banks operating in developing countries appear to be more efficient than their domestic counterparts, whether those counterparts are privately or government-owned. Domestic banks are forced to become more efficient after foreign entry, especially in the business lines in which foreign banks choose to compete. Among the relevant studies is Claessens, Demirguc-Kunt, and Huizinga (2001), who use data from a sample of eighty countries to show that foreign entry reduces the profitability of domestic banks but enhances their efficiency. Country-specific studies that mainly use bank balance-sheet data reach similar conclusions, such as work on Latin America by Crystal, Dages, and Goldberg (2001), on the Philippines by Unite and Sullivan (2001), on Colombia by Barajas, Steiner, and Salazar (2000), and on Argentina by Clarke et al. (1999). Turner (2006) argues that the larger role of foreign-owned banks in Europe and Mexico in the past decade has made the banking industry more efficient and improved credit allocation.

These financial sector FDI studies do not identify whether the productivity enhancements that occur in banking are

¹⁰Such themes are developed in the elegant theoretical analysis of Markusen and Venables (1999) and in Rodriguez-Clare (1996).

attributable to increased competition among banks or to technology transfers between foreign and domestic banks. This distinction is important for assessing whether financial sector FDI is helping to close a knowledge gap between countries. The distinction may also help reconcile two potentially contradictory themes in discussions on financial sector FDI. One such theme is that financial sector FDI induces efficiency gains by changing an industry’s competitive structure: foreign entry reduces the monopolistic excesses of domestic banks. Bank exit or mergers and acquisitions change local competitive structures in ways largely unparalleled in other sectors that have received FDI. Another theme is that the significant amount of bank consolidation during the past decade has been fostered by technological change and foreign entry into emerging markets. Interestingly, Gelos and Roldos (2002) show that while such consolidation has been associated with efficiency improvements, it has not reduced competition in local financial markets. Foreign entry may be enhancing the productivity of other banks in the host market through the channel most often explored in real-side FDI research—technology transfers—instead of exclusively through competitiveness changes. This issue is interesting from a policy perspective: If the main channel is technology transfers, productivity transfers and gains can continue as long as the parent banks innovate, even if a stable ownership structure exists in the host-country banking industry.

3. IMPLICATIONS OF FDI FOR HOST-COUNTRY WORKERS

The productivity and technology transfer arguments lead directly to the question of whether foreign entry benefits local workers in terms of wages. When the foreign firm has some

The productivity and technology transfer arguments lead directly to the question of whether foreign entry benefits local workers in terms of wages.

intangible productive knowledge, technology transfer and other training after entry should expand the human capital of the employees of the foreign firm within the host country. This expansion of human capital should manifest itself in greater worker productivity and be rewarded by higher wages.

Studies of manufacturing industries link higher levels of foreign direct investment to higher wages. In Mexico and

Venezuela, wage growth was experienced by workers in foreign-owned firms, but it did not spill over more broadly through the host-country labor markets. In the United States, the wage effects from foreign investment were smaller and spilled over more into local labor markets (Aitken, Harrison, and Lipsey 1996). In Indonesia, wages paid in domestically owned manufacturing plants taken over by foreign firms increased sharply relative to wages paid in those plants that remained in domestic hands (Lipsey and Sjöholm 2003).¹¹ On balance, these studies conclude that some workers in manufacturing industries benefit directly from FDI through higher wages. Whether because of the accumulated capital being firm-specific or because of efforts by foreign firms to limit outmobility of productive workers, analogous growth in wages and productivity is generally not observed outside the sector receiving FDI.

While the same issues are relevant for workers in financial services industries, the topic has not been studied extensively. Bank balance-sheet data indicate that foreign bank operating costs are lower and that domestic bank costs are pushed down by foreign entry (Crystal, Dages, and Goldberg 2001). In some

Studies of manufacturing industries link higher levels of foreign direct investment to higher wages.

cases, wage expenditures also decline. The analysis has not determined whether these cost reductions are due to decreases in the number of workers (often a result of acquisitions and consolidations of banks) without wage declines or to reductions in employment with higher wages paid to the remaining workers.

Research on real-side FDI has examined the employment effects of foreign direct investment. The overall implications for the host economy are the combination of FDI effects on employment by the specific firms receiving capital and on employment changes that FDI induces in the rest of the economy. Some implications are contingent on whether FDI takes the form of greenfield (de novo) investments or occurs via mergers and acquisitions of existing plants (or banking networks). Greenfield investments, where new plants or facilities are built, may generate increased host-country employment. This job growth might be strongest if the new plant does not compete directly with other local production facilities that serve thin host-country markets. Net employ-

¹¹These results persisted even after the authors controlled for the initial characteristics of the plants taken over by foreign investors.

ment gains could also be strong if agglomeration externalities exist, so that the infrastructural improvements associated with FDI spill over to other local firms and all local producers gain.¹²

The net employment effects of merger-and-acquisition FDI are less transparent. Mergers and acquisitions may trigger consolidation of an inherited bloated infrastructure, leading to job loss. Fewer individuals may be employed at higher wages

The special role of banks in financial intermediation means that the employment consequences of financial sector FDI may be broader, and more positive, than the consequences of FDI to the real economy.

in a plant or banking system that ultimately operates more efficiently. In the case of financial sector FDI, evidence reported by the Bank for International Settlements (2006) shows that this type of investment is often made through acquisitions of host-country banks. If financial sector FDI is followed by branch closures and reductions in wage bills after acquisition, it accords with this scenario. Yet such declines in employment by a bank do not necessarily imply reductions in total employment in host countries. The special role of banks in financial intermediation means that the employment consequences of financial sector FDI may be broader, and more positive, than the consequences of FDI to the real economy. This could arise if intermediation is improved and financial capital is allocated more effectively in the host country.

4. DO FDI INFLOWS ACCELERATE MACROECONOMIC GROWTH?

The relationship between FDI and macroeconomic growth, and the stability of this growth, is a central consideration as host countries evaluate the trade-offs associated with foreign entry. One way this topic has been discussed is in the context of longer term performance, stemming from the argument by

¹²Job creation by a single plant is generally not an appropriate welfare metric for employment calculations. The foreign plant employs workers and pays higher wages, drawing some workers from other local plants. In a situation where the foreign investor takes over a local plant, restructuring could lead to job loss, with only the remaining employees getting higher wages. The producer potentially generates larger income and tax revenues for local governments.

Romer (1993) that an idea gap has held back growth in emerging markets. If an idea gap has impeded growth, the argument continues, FDI can induce a catch-up process.

Indeed, the most robust evidence on FDI and aggregate growth is found in studies of developing countries. For example, analyses of inward investments to Greece, Taiwan, Indonesia, and Mexico show a significant positive contribution

Studies of financial sector FDI effects conclude that growth may expand both through the technology transfer channel and through improved intermediation of capital flows between savers and investment opportunities.

to these countries' growth.¹³ Research using detailed industry-level data finds that growth spillovers across industries depend on the industries into which FDI flows. The spillovers and growth ramifications are expected to be strongest when foreign affiliates and local firms compete most directly with each other, as may be the case in previously protected industries.¹⁴ Borensztein, DeGregorio, and Lee (1998) find positive threshold effects between FDI and growth, with human capital accumulation in the host country needing to be sufficiently large before countries can reap the beneficial growth effects of the foreign inflows.

Studies of financial sector FDI effects conclude that growth may expand both through the technology transfer channel and through improved intermediation of capital flows between savers and investment opportunities.¹⁵ Cross-country growth regressions reach the broader finding that financial development improves economic growth.¹⁶ Demircug-Kunt

¹³The caveat to these results is that it is difficult to control adequately for reverse causality problems. More specifically, investors may put their resources into countries where growth is expected to be higher. See Lipsey (2000) for an informative overview of the literature.

¹⁴Markusen (1995) was an early advocate of the view that the competitive structure of an industry is a key driver behind FDI implications.

¹⁵A related area of research looks beyond financial sector FDI and considers the growth implications of overall financial liberalization. The issue of financial FDI, as opposed to portfolio investments or other forms of capital inflows, is not explicitly addressed. In this literature, financial liberalization events are usually defined in terms of regulatory changes, such as the relaxation of capital controls or the lifting of interest rate ceilings. Despite the considerable research undertaken, the extent of the long-term growth benefits of capital account liberalizations is hotly debated, and a consensus view has not emerged. Researchers have found sharply contrasting results owing to differences in country coverage, sample periods, inclusion of crisis controls, and indicators of financial liberalization. For recent examples and surveys, see Edison et al. (2002) and Eichengreen and Leblang (2003).

and Maksimovic (2002), however, find no evidence that country differences in economic growth can be explained by distinguishing countries by financial structure (that is, bank-based versus market-based structures).

Positive growth effects from financial sector FDI can occur because of more efficient credit allocation in host markets, with funds made more available for private sector use. Prior to financial sector liberalization and reform, some governments used the local banking system as a tool for providing directed credit to politically favored constituents or favored but loss-incurring sectors of the economy. The banks implicitly play a role in patronage and “development finance” and subsidize levels of activities that might not be viable on market terms. Suggestive evidence of the costliness of such strategies is found in La Porta, Lopez-de-Silanes, and Shleifer (2002). Using global data, the authors argue that a higher level of government ownership of banks is associated with lower growth of per capita income and productivity. Sapienza (2002), in a fascinating study of state-owned banks in Italy, shows that public bank lending has a pattern of rewarding political supporters.

While serving as a means of fiscal stimulus, this type of directed lending crowds out intermediation to worthy private borrowers—a point also made by Mishkin (2005), who expounds on the principal-agent problems associated with

Research on lending comparisons across banks differentiated by owner types supports the conclusion that financial sector FDI fosters economic growth.

directed lending. If foreign banks operating in host markets are better regulated and subject to parent bank oversight, these banks may be able to resist local suasion more effectively. As such, they may discipline host-country fiscal or monetary “irresponsibility” better and be less amenable to forced purchases of government bonds or forced lending to favored political constituents. Such outcomes are auspicious for sustainable economic growth.

A related finding by Galindo and Schiantarelli (2003) is that financial liberalization tends to relax financing constraints on producers in developing countries and make them less adversely influenced by financial crises. Foreign banks sometimes enter as a component of larger scale financial liberalization or bank privatization efforts and sometimes as local governments seek to recapitalize their financial systems

¹⁶For example, see Levine, Loayza, and Beck (2000) and Rajan and Zingales (1998).

in the wake of crises. Outside of crisis periods, foreign banks might be expected to contribute to growth by providing capital to worthy but previously credit-constrained borrowers and by not crowding out credit provision to worthy borrowers that are outside the scope of their business model. During crises, foreign-owned banks may be destinations for local flight capital, preventing this capital from leaving the country and creating greater opportunities for these funds to continue to be intermediated locally.

Research on lending comparisons across banks differentiated by owner types supports the conclusion that financial sector FDI fosters economic growth. Credit provision by U.S. banks to Latin American countries grew faster during the 1990s and was less sensitive to local cycles than credit provision by domestically owned banks (Crystal, Dages, and Goldberg 2001). The composition of credit provision is also important for long-term growth, raising the concern that small businesses relying on bank credit might have constrained access with foreign bank entry. In Latin America, foreign-owned banks have been providing credit to local constituents in patterns similar to those of healthy domestically owned banks (Dages, Goldberg, and Kinney 2000). Detailed evidence for Latin American countries shows that other than possible biases in borrower orientation often linked to bank size

Overall, these observations support the conclusion that financial sector FDI should foster more rapid growth within economies. The conclusion is also supported by arguments based on better information processing, technology, and risk management practices.

(large banks lend relatively less to small and medium-size enterprises), there has been no systematic bias in orientation specifically associated with foreignness (Clarke, Cull, and Peria 2001). In Eastern Europe (specifically Hungary), in aggregate foreign entry may even have been associated with expanded credits to small and medium-size enterprises when the domestic banks had to search more aggressively for a broader clientele for lending (Bonin and Abel 2000). Berger, Klapper, and Udell (2001) find that foreign banks in Argentina behaved significantly differently from local banks only when decision-making remained in foreign headquarters.

Overall, these observations support the conclusion that financial sector FDI should foster more rapid growth within

economies. The conclusion is also supported by arguments based on better information processing, technology, and risk management practices.

5. FDI AND BUSINESS CYCLES

Foreign direct investment can also influence the pattern of business cycles in host countries, the transmission of cycles from foreign markets, and crisis contagion across markets. Analyses of business cycle comovements across countries look for explanations for changes in synchronization that have occurred across recent decades. Yet when developing countries

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are divided into two broad groups—more financially integrated and less financially integrated economies—both groups have low correlations with world macroeconomic aggregates, with these correlations not statistically higher in recent decades compared, for example, with the 1960s and the 1970s (Kose, Prasad, and Terrones 2003).¹⁷

The independent role of FDI, and specifically of multinational firms, in business cycle integration has not been explored as thoroughly. While Hanson and Slaughter (2004) posit a role for multinationals that relies on profit sharing between parent and affiliate firms, especially through wages, the strength of this channel has not been widely tested empirically or assessed relative to other channels.¹⁸ As a general point, the specific contribution of real-side FDI to business cycle linkages across countries, as opposed to financial integration more broadly defined, largely remains an open

¹⁷Prasad et al. (2003) provide an extensive review of this evidence, noting the broad group of papers that look at financial integration and growth. The role of FDI within financial integration is less well documented. Imbs (2004) finds that financial integration raises correlations among a sample of industrialized countries. Kose and Yi (2001) argue that the increased vertical integration of production in world trade poses a powerful channel for business cycle transmission. Such vertical production linkages are frequently supported by patterns of general FDI and suggest that FDI in manufacturing and extractive resource industries stimulates business cycle comovements.

¹⁸The arguments draw from Budd and Slaughter (2000) on international rent sharing.

question. Likewise, the relative importance of real-side FDI compared with financial sector FDI in changing the nature of local business cycles has not been determined.

In contrast, studies conclude that financial sector FDI clearly has consequences for local business cycles. This line of research typically uses bank-level data to relate lending activities to shock transmission within and across national borders. In principle, bank lending activity can either be procyclical or countercyclical with respect to local business cycles and other shocks. The availability of loanable funds via the deposit base contributes to procyclicality. However, if foreign bank entrants are less reliant on host-country funding sources and more reliant on foreign sources, the procyclicality of their supply of loanable funds may be reduced. Loan demand, too, can either be procyclical, as individuals or businesses borrow more to expand their holdings in prosperous times, or countercyclical, as individuals try to smooth consumption intertemporally.

Researchers generally find strong evidence of procyclicality in bank lending. In addition to the aforementioned points, other arguments for procyclicality rely on information asymmetries between borrowers and lenders, as within a

The cyclical lending responses of banks could differ between foreign- and domestically owned institutions.

financial accelerator view of credit cycles.¹⁹ Or, as Borio, Furfine, and Lowe (2001) contend, procyclicality may result from inappropriate responses by financial market participants to changes in risk over time. These inappropriate responses can be attributable to market participants underestimating risk in good times and overestimating it in bad times. Inappropriate credit cycles can also derive from market participants having incentives to react to risk, even if correctly measured, in ways that are socially suboptimal. Related arguments for procyclicality stem from bank provisioning practices and their links to rules on regulatory capital (Cavallo and Majnoni 2001).

The cyclical lending responses of banks could differ between foreign- and domestically owned institutions. Dages, Goldberg, and Kinney (2000) find that although foreign banks are procyclical lenders, they do not appear to magnify the

¹⁹The financial accelerator argument maintains that information asymmetries between lenders and borrowers contribute to the procyclicality of lending. When economic conditions are subject to an adverse shock, and collateral values decline, even those borrowers with profitable projects have difficulty obtaining funding.

boom-bust cycles in emerging markets. Analysis of individual bank data from Chile, Colombia, and Argentina supports broad similarities between the lending patterns of private, domestically owned domestic banks and longer established

A related issue is whether financial sector FDI can reduce the magnitude of host-country cycles if foreign bank involvement reduces the actual incidence of crises.

foreign banks. The similarities with newer, established foreign banks are less systematic. While foreign banks had higher average loan growth, they did not add significant volatility to local financial systems or act as relatively destabilizing lenders.²⁰ In a study of the Malaysian experience, Detragiache and Gupta (2004) find that foreign banks with sufficient international diversification played a stabilizing role in host credit markets during the Asian crisis. By contrast, foreign banks that had a narrower focus on Asia behaved similarly to domestic banks. Arena, Reinhart, and Vazquez (2006) study bank behavior across twenty Asian and Latin American countries from 1989 through 2001 to compare foreign- and domestically owned bank activities. They find weak evidence that foreign bank entry into emerging markets contributes to credit market stability.

A related issue is whether financial sector FDI can reduce the magnitude of host-country cycles if foreign bank involvement reduces the actual *incidence* of crises. The boom-bust cycles in international capital flows are often derided as wreaking havoc on economies, with lending booms contributing to financial crises. Financial liberalization, by giving banks and other intermediaries more freedom of action and allowing them to take greater risks, is sometimes argued to increase the financial fragility of an emerging market. Studies by Demirguc-Kunt and Detragiache (1998, 2001), as well as work by Rojas-Suarez (2001), find that financial liberalization (defined as interest rate liberalization) has costs in terms of increased financial fragility, especially in developing countries where the institutions needed to support a well-functioning financial system are generally not well established.

The transmission of shocks across borders is another issue that bears on financial crises. Foreign banks may contribute to contagion through common-lender effects, as documented in Van Rijckeghem and Weder (2003). These banks could also be subject to foreign cyclical flows. However, any private bank

²⁰See also Goldberg (2002), Dages, Goldberg, and Kinney (2000), and Horvath (2002).

with access to foreign loanable funds can be affected similarly: foreign cycles have been shown to affect the lending and deposit bases of domestically and foreign-owned private banks in emerging markets (Crystal, Dages, and Goldberg 2001). More evidence is needed on the question of whether foreign banks can, and do, receive additional capital from their head offices in times of stress. Accordingly, this topic warrants more rigorous study.

On the issue of crises, it is worth noting that foreign banks may contribute to domestic financial stability by operating within a country's borders, rather than from abroad. If flight to

Foreign banks may contribute to domestic financial stability by operating within a country's borders, rather than from abroad.

quality occurs in stress periods, it may be better for domestic depositors to keep their money within the domestic financial system, to be reintermediated locally, rather than leave the country through capital flight. Peria and Schmukler (1999) document that depositors recognize differences in the health and efficiency of banks and move their assets to better functioning ones or demand higher deposit rates. Locally generated claims from foreign-owned banks substitute in part for cross-border flows, with the latter occasionally being more volatile.²¹

6. FDI AND HOST-COUNTRY INSTITUTIONAL DEVELOPMENT

In theory, real-side and financial sector foreign direct investment can play a causal role in host-country institutional development. The direct role of real-side FDI in host-country institutional reform has not been well documented. Financial

²¹More evidence is needed on the extent to which substitutability exists between cross-border flows and locally generated claims by foreign branches and subsidiaries. There are direct parallels between these questions in financial FDI and questions long raised in the area of real-side FDI. In manufacturing industries, there is no clear pattern of substitutability compared with complementarity in bilateral flows between Latin American countries and the United States. However, manufacturers in different countries may engage in distinct FDI strategies. Research shows that FDI from Japan enhanced Japanese exports to Southeast Asian countries, consistent with intermediate input trade, while FDI from the United States substituted for exports from the United States to Southeast Asia. FDI from these two sources did not systematically influence exports from the United States or Japan to Latin American countries (Goldberg and Klein 1998, 2001).

sector FDI has been more closely linked to institutional reforms, but systematic analysis of this response is warranted. The recent availability of rich institutional databases, such as the World Bank database on Bank Regulation and Supervision, may facilitate such testing.²²

Nevertheless, institutions in developing countries can respond positively to financial sector FDI. Crystal, Dages, and Goldberg (2001) show that foreign-owned banks appear to contribute to the overall soundness of local banking systems by screening and treating problem loans more aggressively. If foreign entry spurs additional regulatory improvements, the risk of financial crisis declines. Demirguc-Kunt, Levine, and Min (1998) relate foreign bank entry per se to the probability of a banking crisis. The foreign bank presence was found to have a negative and statistically significant coefficient, leading the authors to conclude that, after they controlled for other factors likely to produce banking crises, greater foreign bank participation had a stabilizing effect.

Mishkin (2005) argues that financial globalization should be an important supporting force behind institutional reform.

The entry into emerging markets of foreign banks that are healthier than domestic banks implicitly allows a country to import stronger prudential regulation and increase the soundness of the local banking sector.

He contends that domestic institutions, facing competition from abroad, will seek new customers to stay in business. For lending to be profitable, domestic banks will require information to screen and monitor their customers. Better accounting standards and disclosure requirements, as well as a more efficiently managed legal system, will be consistent with continued domestic bank profitability. Foreign-owned banks will also be a constituency supporting these positive reforms because, as outsiders, they would not have access to the same information as their domestic competitors.

Numerous studies assert that financial sector FDI spurs improvements in bank supervision, with regulatory spillovers. The entry into emerging markets of foreign banks that are healthier than domestic banks implicitly allows a country to import stronger prudential regulation and increase the soundness of the local banking sector. In Argentina, Chile, and

²²See Barth, Caprio, and Levine (2002).

Colombia, for example, foreign banks have contributed to enhanced domestic financial stability by engaging in more aggressive risk management techniques (Crystal, Dages, and Goldberg 2001). Calomiris and Powell (2001) argue that

Foreign bank entry also raises issues of competition policy within host-country banking systems.

Argentina's bank regulatory system in the late 1990s was one of the most successful among emerging market economies. Reliance on market discipline was viewed as playing an important role in prudential regulation by strengthening risk management among banks.

The transition to improved local supervision, however, might be bumpy. Major international banks may try to build market share by offering a variety of new financial products, including over-the-counter derivatives, structured notes, and equity swaps. These new derivative products can provide greater opportunities for hedging risks. Yet some new products may also be used to evade prudential regulations and take on excess risks, especially in countries with weak financial systems and underprepared supervisors (Garber 2000). One clear implication is that local supervisors in emerging markets may have to invest in upgrading their skills in order to evaluate more efficiently the use and effects of new products. Other challenges for supervisors arise in the context of relationships with parent banks, and may depend on whether the foreign entry is accomplished through branches or subsidiaries.²³

Foreign bank entry also raises issues of competition policy within host-country banking systems. While the actual experiences of host countries have been researched extensively (see Bank for International Settlements [2001] and the volume's overview by Hawkins and Mihaljek), on average consolidation has occurred without deterioration of the competitiveness of a country's financial services industry (Gelos and Roldos 2002).

Another challenge can arise if a country's financial services industry becomes highly concentrated, in which case banks may exert monopolistic pricing tendencies more extensively. If foreign banks are among the few surviving banks, local regulators may be tempted to conclude that these banks bear specific responsibility for adverse outcomes. Yet in many cases,

²³One recent study considers the stability of cross-border compared with FDI flows in banking in Central and Eastern Europe (Buch, Kleinert, and Zajc 2003). In preliminary work, the authors argue that FDI should have an additional stabilizing feature because it should allow banks in these countries to draw on the liquidity buffer of their headquarters abroad. Branches and subsidiaries are not distinguished in the conceptual presentation.

foreign bank entry is part of a larger scale restructuring and recapitalization of the emerging market financial system. More concentrated market power may have occurred regardless of whether owners were foreign or domestic. Even with monopolistic pricing, there may be other benefits through scale economies and improved services that are by-products of consolidation. These issues challenge regulators to engage in careful cost-benefit analyses and policy reactions.

7. FISCAL AND TAX QUESTIONS RAISED BY FDI

Public finance decisions concerning multinationals²⁴ and host-country governments have received considerable analytical attention, particularly in terms of real-side FDI. One pertinent and very important issue is incentives offered to foreign investors to attract them to a country or a locality within a country. Such efforts have been extensive. As reported by the United Nations Conference on Trade and Development (2001, pp. 6-7), nearly 95 percent of the almost 1,200 changes in national FDI legislation from 1991 through 2000 were favorable to foreign investors, sometimes taking the form of special incentives such as lower income taxes, income tax holidays, and import duty exemptions for foreign enterprises as well as subsidies for infrastructure.

Researchers and policymakers correctly ask whether, quantitatively, the benefits of real-side FDI justify the costs. When governments compete actively against each other for FDI, profits from the investments are shifted from the host country to multinational enterprises (Oman 2000).²⁵ While debate over this point is ongoing, Blomstrom and Kokko (2003) provide a compelling argument that the types of long-term benefits generated by FDI may not justify the short-term costs. These benefits include the positive spillovers between firms and across sectors that researchers continue to identify. To compete effectively, governments may make long-term financial commitments that are excessive when compared with the employment and political gains received in the short term.

Strong promotion efforts show that the government is actively doing something to strengthen employment, productivity, growth, or some other policy objective Another reason is that some of the perceived benefits (in particular, the jobs created by FDI) are easily observable while some of the costs (particularly related to tax breaks and fiscal incentives) are distributed over long periods of time and hard to measure (Blomstrom and Kokko 2003).

²⁴See Feldstein, Hines, Jr., and Hubbard (1995).

²⁵Similar arguments apply to states within countries that compete against each other to attract new production facilities.

The same questions, to date applied almost exclusively to real-side FDI, are also pertinent to the financial sector. We have suggested a number of important dimensions along which financial sector FDI is expected to have implications distinct from other forms of FDI. These include reduced incidence of crisis, moderated business cycle magnitudes, and institutional development. Given the welfare consequences of business cycles and crises, the calculus of the costs and benefits of actively promoting and subsidizing such foreign entry is a topic worthy of further study. Analysis of the extent to which host markets encourage or tax foreign entrants, given their

To compete effectively, governments may make long-term financial commitments that are excessive when compared with the employment and political gains received in the short term.

implications for local markets, could be explored for entrants during unstable as well as normal periods. If such analysis weighs strongly in favor of encouraging financial sector FDI from healthy parent banks, the arguments could satisfy some of the critics concerned about “fire-sale” terms on local market assets. The quantities that have been implicitly or explicitly put on the table for attracting financial sector FDI should be systematically studied for the lessons they can offer.

8. CONCLUSION

Our selective survey of the literature on foreign direct investment supports our argument that multinationals and FDI in emerging markets generally have important effects on the host countries, with some effects being particularly notable in financial services industries. These effects take the form of changes in allocative efficiency, technology transfer and diffusion, wage spillovers, institution building, altered macroeconomic cycles, and overall economic stability.

We find that FDI is typically associated with improved allocative efficiency. This improvement can occur when foreign investors enter industries with high entry barriers and then reduce local monopolistic distortions. The presence of foreign producers may also increase technical efficiency: heightened competitive pressure or some demonstration effect may spur local firms to use existing resources more effectively.

FDI is also shown to be associated with higher rates of technology transfer and diffusion as well as with greater wages. While there is evidence of technological improvements from FDI and a presumption that such investment will consequently stimulate economic growth, the strength of these effects is disputed. FDI into host countries also induces higher wages, although these wage effects are sometimes limited to the foreign-owned production facilities and do not spill over more broadly.

Institutional change is another potential implication of FDI. At least in the context of financial services, the outcome is expected to be in the direction of improved regulation and supervision, with such improvements potentially sought by the remaining domestically owned banks as well as by the foreign-owned banks. These improvements occasionally occur with a lag, as supervisors in the host countries at first may not be prepared to evaluate the new products and processes introduced by foreign entrants.

FDI can also affect crisis and noncrisis macroeconomic conditions. Foreign banks are procyclical lenders in emerging markets. Domestic, privately owned banks also are procyclical lenders, so the presence of foreign banks does not negatively affect the boom-bust cycle in lending and international capital flows. Foreign entrants may introduce a more diversified supply of funds, in principle making loan supply less procyclical but also more sensitive to foreign fluctuations. Foreign bank entry into emerging markets reduces the incidence of crises, but enhances the potential for greater contagion through common-lender effects. The contagion problem is reduced when foreign banks have a stronger subsidiary presence, as opposed to supporting local markets through cross-border flows.

The employment and growth effects of financial sector FDI are more subtle than other effects,²⁶ depending in part on whether the investment is greenfield or merger and acquisition. In the latter case, the effects also depend on whether the acquired institution was financially sound or in need of restructuring, regardless of the nationality of the new owners. However, if financial intermediation improves, financial sector FDI should support greater employment and growth prospects.

The institutional effects of financial sector FDI are potentially clearer and quite positive. Financial sector FDI from well-regulated and well-supervised source countries can support emerging market institutional development and governance, improve a host country’s mix of financial services and risk management tools, and potentially reduce the incidence of sharp crises associated with financial

²⁶If FDI evidence in manufacturing is a guide, Kokko (1994) shows that the incidence of spillovers is associated with a host country’s ability to absorb them.

underdevelopment in emerging markets. Yet this type of investment can initially pose formidable challenges to local supervisors, who may need to develop expertise in the practices and products introduced into their economies.

Finally, whether governments should actively pursue FDI through subsidies and other incentive programs is a subject of strong debate. There is some skepticism in the literature on real-side FDI about whether the benefits of investment to the host country justify the sometimes large incentives offered to attract foreign investors. The special features of financial sector FDI add other dimensions to this debate, and accordingly warrant further exploration.

These findings will hopefully contribute to discussions about whether developing countries should open their financial sectors to foreign entrants. The evidence suggests that many emerging markets have responded with strong affirmative statements in the past decade. It also suggests that the benefits of financial sector FDI can be substantial enough for a country to encourage and support entry from well-regulated and healthy banks. Careful discussion and further rigorous analysis will no doubt continue to inform these important issues.

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AN EXAMINATION OF TREASURY TERM INVESTMENT INTEREST RATES

- The U.S. Treasury, through its Term Investment Option (TIO) program, lends excess cash balances to banks at interest rates determined by single-rate auctions.
- An important issue in TIO auctions is whether the Treasury receives a market rate of return on TIO funds.
- An analysis of the spread between rates on TIO auctions and rates on mortgage-backed-security (MBS) repos suggests that for small auction sizes, TIO rates are comparable to market rates, except on offerings with term lengths of fewer than five days.
- The study also finds that a more compressed auction schedule, in which the Treasury announces and auctions TIO funds on the same day, does not adversely affect TIO rates; thus, banks appear to be indifferent to more advance notice of auctions.

1. INTRODUCTION

The Term Investment Option (TIO) program is a cash management tool of the U.S. Treasury Department. Through TIO, which is part of the broader Treasury Tax and Loan (TT&L) program, the Treasury lends funds to depository institutions for a set number of days. The rate that the Treasury receives is determined via a single-rate auction format.

An important issue in TIO auctions is whether the interest rates received by the Treasury are comparable to market rates. In this article, we compare TIO rates with rates on mortgage-backed-security (MBS) repurchase (repo) agreements. MBS repo rates are the closest benchmark for TIO rates in several respects: depository institutions can obtain funds using both types of transactions, the transactions are collateralized, and the eligible collateral is similar. We study the 166 auctions held from November 2003, when TIO first became an official Treasury cash management facility, to February 2006.¹

¹TIO began as a pilot in April 2002. We do not examine the first twenty-seven auctions from April 2002 to October 2003. The structure of the 166 auctions we study is similar to the structure of future TIO auctions. During the TIO pilot, auctions tended to be held in the latter part of the year, so there were extended periods with no auctions.

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The author thanks two anonymous referees, Chris Burke, Seth Carpenter, Chris Kubeluis, John McGowan, Glen Owens, John Partlan, Ryan Rials, Paul Santoro, Charles Sims, Barbara Wiss, the Treasury Relations and System Support staff of the Federal Reserve Bank of St. Louis, the staff of the Office of the Fiscal Assistant Secretary of the U.S. Treasury Department, and seminar participants at the Federal Reserve Bank of New York for helpful comments. Geddes Golay, Peter Hennessy, and Hang Pham provided valuable research assistance. The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

TIO auctions can shed light on bidding behavior in general, because they vary along more dimensions than traditional Treasury debt auctions. For example, TIO auctions are not held on a regular basis and their size and term length vary. Typical Treasury debt auctions, by comparison, are held on a regular schedule,² and the amount auctioned is usually the only variable.

A key finding of our work is that for small auction sizes, TIO interest rates are fairly comparable to MBS repo rates for term lengths of five days or more. However, shorter term lengths result in the Treasury receiving lower TIO rates relative to market rates. We also observe a negative relationship between the size of an auction and the spread between the TIO rate and the MBS repo rate. Finally, a more compressed auction schedule, in which the Treasury announces and auctions TIO funds on the same day, does not adversely affect TIO rates. This finding suggests that banks are indifferent to more advance notice of TIO auctions.

Our study proceeds as follows. In Section 2, we provide background information on the TT&L program, term investments, and repo transactions. Our data and our regression framework are presented in Section 3, while regression results can be found in Section 4. In Section 5, we draw conclusions.

2. BACKGROUND

2.1 The Treasury Tax and Loan Program

Treasury funds are held either at Federal Reserve Banks (the Fed balance) or private depository institutions in what is known as the Treasury Tax and Loan program (see Garbade, Partlan, and Santoro [2004] for a discussion of recent innovations in Treasury cash management). The Fed balance does not earn explicit interest,³ while balances held at private depository institutions, which can be withdrawn on demand, earn the TT&L rate, which is the weekly average overnight federal funds rate less 25 basis points.⁴ Depository institutions specify the maximum TT&L balances they are willing to hold, and the balances must be collateralized. If balances exceed the lesser of the specified limit or the collateral value of assets

²For example, four-, thirteen-, and twenty-six-week Treasury bills are auctioned every week.

³As funds in the Fed balance reduce the supply of bank reserves, open market operations to purchase Treasury securities are required to offset this drain. The interest earned on these securities is included in Federal Reserve earnings, which are remitted weekly to the Treasury. Thus, implicit interest is earned by the Treasury on the Fed balance.

pledged by the institution, the excess is transferred to a Treasury account at the Federal Reserve Bank of St. Louis.

There are three types of depository institutions in the TT&L program: collector institutions, which collect tax payments and transfer them to Treasury accounts at District Federal Reserve Banks; retainer institutions, which collect and hold funds until balances exceed their limit or collateral or until the Treasury

The management of Treasury funds directly affects the conduct of monetary policy, as the net movement of funds into and out of the banking sector generally has to be offset by open market operations.

withdraws the funds; and investor institutions, which are similar to retainer institutions but also accept direct placements of funds *from the Treasury*.

The management of Treasury funds directly affects the conduct of monetary policy, as the net movement of funds into and out of the banking sector generally has to be offset by open market operations. Payments by the U.S. government are made from the Fed balance, while some tax receipts flow directly into the Fed balance. Depository institutions in the TT&L program collect the bulk of tax receipts. The Fed balance fluctuates daily as tax payments are received and outlays are paid. An increase in the Fed balance drains reserves available in the banking system, while a decrease adds them. The Treasury typically seeks to maintain a relatively stable Fed balance of \$5 billion, with the remainder of its funds held at private depository institutions. The target balance is achieved through withdrawals from and deposits to the depository institutions. The maintenance of a stable Fed balance prevents changes in the balance from affecting the supply of bank reserves and minimizes the need for offsetting open market operations.

Assets acceptable as collateral in the TT&L program range from Treasury securities to insured student loans (Table 1). A lower collateral value is assigned to less liquid and less creditworthy assets.⁵ Collateral must be held either at a Federal Reserve Bank or at a Treasury-approved third-party

⁴The weekly average rate is computed for a seven-day interval, beginning on a Thursday and ending the following Wednesday, with the rate for a Saturday, Sunday, or holiday taken as the rate for the preceding business day. The weekly average rate less 25 basis points is used to calculate a daily interest factor that is applied to the daily average amount of TT&L balances for each Thursday-Wednesday cycle, and interest is payable on the following Thursday.

TABLE 1

Acceptable and Unacceptable Collateral in the Treasury Tax and Loan Program

Panel A: Acceptable Collateral

Category 1	Obligations issued and fully insured or guaranteed by the U.S. government or a U.S. government agency. (See Category 4 for insured or guaranteed educational loans.)
Category 2	Obligations of government-sponsored enterprises and government-sponsored corporations of the United States that under specific statute may be accepted as security for public funds.
Category 3	Obligations issued or fully guaranteed by international development banks (acceptable only if denominated in U.S. dollars).
Category 4	Insured student loans or notes representing educational loans insured or guaranteed under a program authorized under Title IV of the Higher Education Act of 1965, as amended, or Title VII of the Public Health Service Act, as amended. (Securities issued by the Student Loan Marketing Association are included in Category 2.)
Category 5	General obligations issued by the states of the United States and by Puerto Rico.
Category 6	Obligations of counties, cities, or other U.S. government authorities or instrumentalities that are not in default on payments on principal or interest and that may be purchased by banks as investment securities under the limitations established by appropriate federal bank regulatory agencies.
Category 7	Obligations of domestic corporations that may be purchased by banks as investment securities under the limitations established by appropriate federal bank regulatory agencies.
Category 8	Qualifying commercial paper, commercial and agricultural loans, and bankers' acceptances approved by the Federal Reserve System at the direction of the Treasury.
Category 9	Qualifying publicly issued asset-backed securities that are Aaa/AAA rated by at least one nationally recognized statistical rating agency and approved by the Federal Reserve System at the direction of the Treasury.

Panel B: Unacceptable Collateral

Common and preferred stock.

Consumer paper or consumer notes.

Foreign-currency-denominated securities.

Mutual funds.

Construction loans.

Obligations issued by the pledging bank or by affiliates of the pledging bank.

Obligations of foreign countries (that is, sovereign debt).

Collateralized bond obligations, collateralized loan obligations, and collateralized mortgage-backed securities except as otherwise noted.

Real estate mortgage-backed securities (one-to-four-family mortgages are acceptable only if held in a borrower-in-custody arrangement to secure special direct investments).

Panel C: Stripped and Zero-Coupon Securities

Securities offered in stripped, zero, or residual forms are acceptable only when market prices are available.

U.S. government agency securities may be stripped into their separate components and are acceptable only when market prices are available.

Source: U.S. Treasury Department (<<http://www.publicdebt.treas.gov/gsr/gsrctlaccxx0205.pdf>>).

custodian.⁶ During months with heavy tax inflows, balances at depository institutions can exceed available collateral, resulting

⁵Refer to <http://www.easysaver.gov/instit/statreg/collateral/collateral_taxandloanable.pdf> for the margins applied to the various types of collateral.

in a transfer of these excess funds to the Fed balance and potentially causing the balance to exceed the \$5 billion target.

⁶Depository institutions can serve as third-party custodians; currently, the Depository Trust Company is the only non-depository institution approved by the Treasury.

2.2 The Term Investment Option Program

The TIO program is another option within the TT&L program for placing Treasury funds with depository institutions. It began on a pilot basis in April 2002 and was expanded in November 2003.⁷ TIO offers greater certainty than the regular TT&L program about the amount of funds invested and the length of time funds will be invested.⁸ Participation is limited to TT&L depositories that have executed a TIO agreement.⁹ The only publicly available information on the number of institutions in the TIO program is as of September 2004; at that time, forty-three institutions were participating.¹⁰ Depository institutions in the TIO program are not required to bid in TIO auctions, and the Treasury reserves the right not to place funds.

Depository institutions bid on TIO funds in auctions that follow a single-rate format. The identity of bidding institutions is known to the Treasury, but funds are allocated on the basis of auction bids. Participating institutions submit bids indicating the maximum rate they would pay on a specified quantity of funds. Institutions may submit multiple bids for differing amounts and rates.¹¹ The interest rate that fills the

One of the Treasury's motivations for initiating TIO [the Term Investment Option program] was to try to earn a market rate of return on its excess cash balances.

auction, known as the stop-out rate, is determined, and this rate applies to all successful bids (those at or above the stop-out rate). Bids at higher rates are filled in full and bids at the stop-out rate may be prorated. A single institution is limited to 50 percent of the *announced* amount.

One of the Treasury's motivations for initiating TIO was to try to earn a market rate of return on its excess cash balances. On average, for the first 193 auctions TIO rates have been about 16 basis points higher than TT&L rates and 6.5 basis

⁷TIO no. 28 was the first TIO auction after the program became an official cash management tool of the Treasury.

⁸The Treasury reserves the right to call back funds placed in the TIO program before maturity, but it would be assessed a penalty in the form of interest. Moreover, such a call would likely result in reduced future participation in the program, and an early call has never occurred.

⁹All types of TT&L depositories (collector, retainer, and investor institutions) are eligible to participate in the TIO program.

¹⁰See <<http://www.fms.treas.gov/tip/TIO-Presentation.ppt>>. There are approximately 8,000 TT&L depositories.

¹¹There is a \$10 million minimum for bids. There is no limit on the number of bids that may be submitted by a single institution.

points lower than comparable MBS repo rates (the calculation is described below).

Another motivation was to increase TT&L capacity following the federal budget surpluses of the late 1990s and 2000-01. The surpluses occasionally resulted in Treasury balances available for investment with depository institutions exceeding TT&L collateral. As a result, Fed balances exceeded the \$5 billion target and drained reserves from the banking system. Open market operations by the Federal Reserve were

After the TIO program became an official cash management tool, the Treasury began placing more term investments for greater cumulative and average amounts.

required to offset this drain. While federal budget surpluses are currently not an issue, TT&L capacity constraints are still important during months with large tax inflows, such as April.

TIO collateral requirements are less restrictive than those for the regular TT&L program in the sense that collateral such as commercial loans can be held on the premises of the depository institution (or an affiliate) in a borrower-in-custody arrangement instead of at a Federal Reserve Bank. While collateral held in such an arrangement is acceptable only on an auction-by-auction basis, these loans typically have been accepted since June 2002.¹²

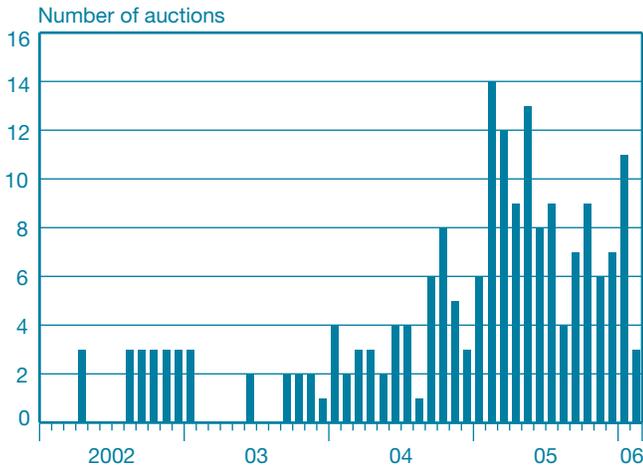
In the regular TT&L program, because commercial loans must generally be held at a Federal Reserve Bank, depositories are less likely to pledge these loans as collateral. As a result, even though depository institutions do not have to bring in new collateral to back term investments, allowing commercial loans to be held on depository premises leads institutions to bring in additional collateral that was previously unpledged. Capacity for the TT&L system as a whole is therefore increased. Requirements for all other collateral for TIO funds are similar to those for TT&L collateral: the collateral must be held either at a Federal Reserve Bank or at a Treasury-approved third-party custodian.

According to data from the Federal Reserve Bank of St. Louis, commercial loans comprise around 50 percent of collateral pledged in the TIO program; Treasury, federal agency, and corporate securities account for around 25 percent; mortgage-backed securities represent about 10 percent; and all other collateral make up the remaining 15 percent. The corresponding percentages for the regular TT&L program

¹²See <<http://www.publicdebt.treas.gov/gsr/gsrcltio.htm>> for information on acceptable collateral for the TIO program.

CHART 1

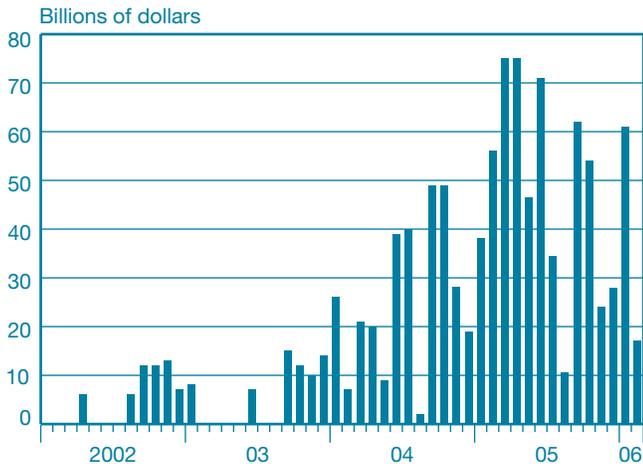
Term Investment Option Auctions, Monthly Totals



Source: Author's calculations, based on data from the U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>).

CHART 2

Term Investment Option Auctions, Monthly Total Amounts Placed



Source: Author's calculations, based on data from the U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>).

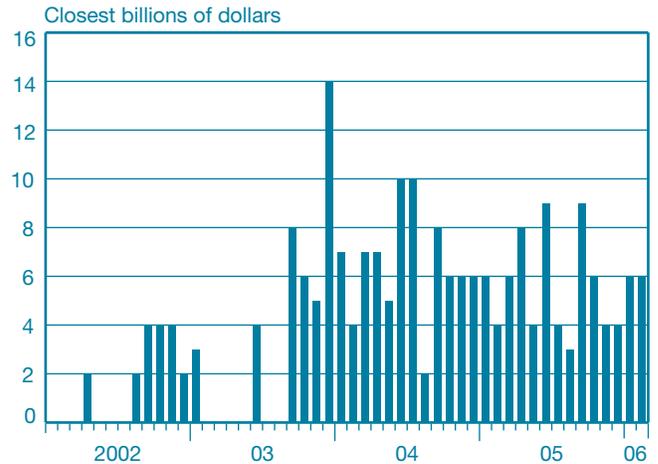
are approximately 3 percent, 10 percent, 60 percent, and 27 percent.

The Treasury sponsored 193 term investments through February 2006.¹³ At that point, it faced a debt-limit crisis that

¹³The last TIO auctioned in February 2006 was no. 194, but auction no. 173 was canceled "due to adjustments to cash balance projections" (<<http://www.fms.treas.gov/tip/auctions/HistoricalFinal05.pdf>>).

CHART 3

Term Investment Option Auctions, Monthly Average Amounts Placed



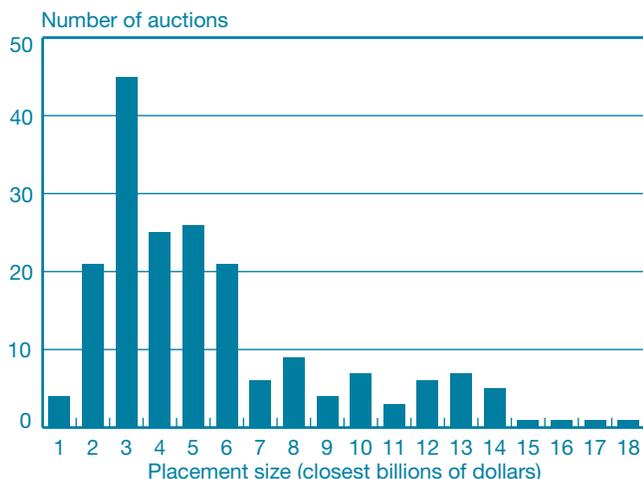
Source: Author's calculations, based on data from the U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>).

was not resolved until March 20, 2006. No TIO auctions were held during this period, disrupting the typical schedule for these auctions.¹⁴ Chart 1 displays the number of investments each month since the program's inception through February 2006. Term investments generally were relegated to the latter half of the year for 2002 and 2003. After the TIO program became an official cash management tool, the Treasury began placing more term investments for greater cumulative (Chart 2) and average (Chart 3) amounts. Chart 4 shows that of the first 193 auctions, the largest single offering was \$18 billion, with most offerings being less than \$7 billion. Term lengths have varied from one day to as many as nineteen, but very few have been greater than fifteen days (Chart 5).

While the main parameters of a TIO auction are under the Treasury's control, in deciding the size and term length of a TIO auction the Treasury primarily relies on forecasts of future cash balances, which are dependent on forecasts of tax receipts and outlays. The Treasury also examines the expected forecast errors, which are based on historical data. Naturally, forecast errors for days further out are typically larger than errors over one or two days. Term investment parameters are chosen so that the Treasury's remaining cash balances will likely be sufficient to maintain the \$5 billion Fed balance target during the length of the term investment. As a result, TIO offering announcements provide insight into the Treasury's anticipated

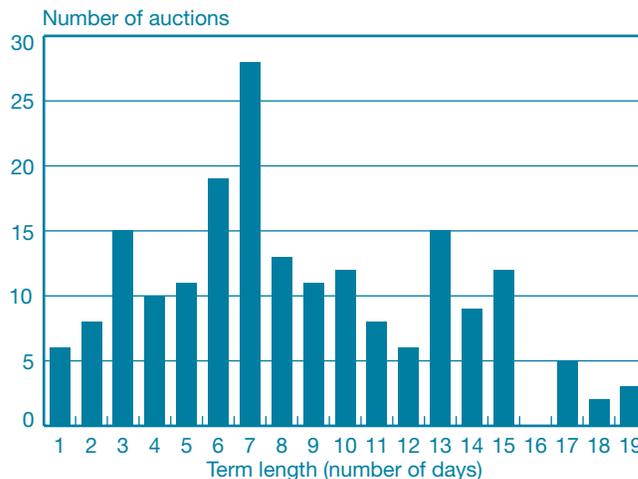
¹⁴Term investments are typically made during the second half of a month (when receipts are greater) and in the first few days of the following month.

CHART 4
Term Investment Option Auctions,
Distribution of Placement Sizes,
January 2002–February 2006



Source: Author's calculations, based on data from the U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>).

CHART 5
Term Investment Option Auctions,
Distribution of Term Lengths,
January 2002–February 2006



Source: Author's calculations, based on data from the U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>).

cash balances and, by implication, the Treasury's borrowing requirements.

If receipts are weaker than anticipated or outlays stronger than anticipated, the Treasury can reduce the amount of funds that it auctions from the amount that was announced.¹⁵ In the extreme, the Treasury could auction no funds (that is, cancel an auction). The Treasury does not reduce auction sizes after

The Treasury occasionally compressed the [auction] schedule into two days, announcing and auctioning on the same day and placing the funds the following day.

announcement in response to expectations of interest rates. If receipts are stronger than forecasted or outlays weaker than forecasted, the Treasury cannot increase the size of a given auction after announcement. In the analysis below, auction size amounts are based on the announced auction size, not the actual amount that the Treasury auctions. The Treasury has never altered the announced term length of a given auction.

¹⁵Other reasons why amounts placed can be less than amounts announced include collateral deficiencies and insufficient bids. Of the first 193 auctions, there were 9 occasions on which the amount placed was less than the amount announced.

Our analysis would be more complex if the Treasury set the size and term length of TIO offerings based on rate-of-return considerations. If the Treasury did exercise this discretion, it may prefer to hold more (less) funds in regular TT&L balances when the federal funds rate is trading significantly higher (lower) than the target set by the Federal Open Market Committee. This is because a higher effective federal funds rate increases the TT&L rate. Table 2 presents simple regression results for 2004-05 relating the percentage of total Treasury funds held in the regular TT&L program with dummy variables for cases when, on the previous day, the effective federal funds rate traded 10 or more basis points higher or lower than the target.¹⁶ The results show that the dummy variable coefficients are not statistically significant; the Treasury does not hold more funds in regular TT&L balances (and less in TIO balances) when the federal funds rate is trading significantly higher than the target and vice versa. Therefore, even though the parameters of TIO auctions are under the Treasury's control, these results suggest that they are not set based on rate-of-return considerations.

Beginning in 2004, movements in term investment balances began to parallel closely movements in total TT&L balances, as the Treasury became more active in placing term investments. Chart 6 shows monthly average total TT&L balances divided into

¹⁶The effective federal funds rate can be found at <<http://www.newyorkfed.org>>. Information on TT&L balances can be found in the Daily Treasury Statement (<<http://www.fms.treas.gov/dts>>).

TABLE 2

Ordinary Least Squares Regression Results

	Dependent Variable: Regular TT&L Balance/Total Balances
Intercept	0.36 (23.151)
1 (effective fed funds rate minus target $t_{-1} > 9$ bp)	-0.02 (-0.559)
1 (effective fed funds rate minus target $t_{-1} < -9$ bp)	-0.05 (-0.858)
R^2	0.002

Source: Author's calculations.

Notes: t -statistics, in parentheses, are based on Newey-West (1987) standard errors. The number of observations is 503. The period examined is January 5, 2004, to December 30, 2005. TT&L is Treasury Tax and Loan program; bp is basis points.

regular TT&L balances and TIO balances. During 2002 and 2003, there is very little correlation between total TT&L balances and term investment balances. The correlation coefficient between the balances for 2002-03 is -.03, while the coefficient for 2004 is .79. The coefficient for 2005 is even higher, at .93.

For the time period studied here, the term investment auction process typically took place over three *business* days. This process is coordinated by the Federal Reserve Bank of St. Louis as the fiscal agent for the Treasury:

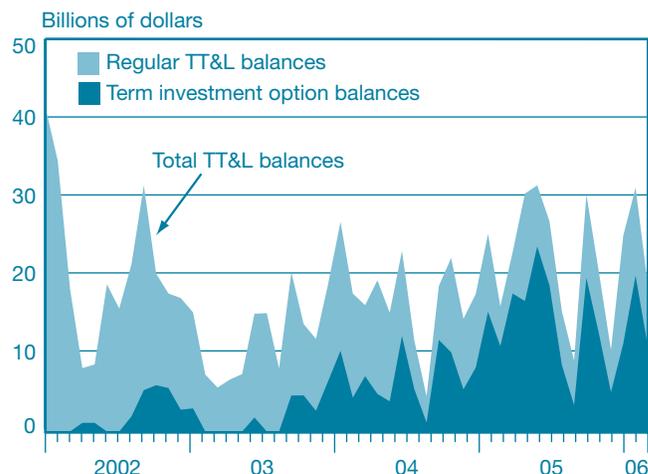
- Day t : The Treasury announces that it will auction \$X billion for Y days.
- Day $t+1$: Participating institutions bid on the funds and the Treasury announces the results.
- Day $t+2$: Funds are placed and the Fed balance falls by \$X billion.
- Day $t+2+Y$: \$X billion plus interest is returned to the Fed balance.

The Treasury occasionally compressed the schedule into two days, announcing and auctioning on the same day and placing the funds the following day.¹⁷ A compressed schedule allows the Treasury to take into account more information on cash flows before deciding on the auction size. The Treasury has also occasionally auctioned two term investments of different amounts and lengths on the same day.

¹⁷Since May 2006, the Treasury has moved to a standard process of announcing and auctioning TIO funds on the same day.

CHART 6

Monthly Average Treasury Tax and Loan (TT&L) Program Balances



Source: Author's calculations, based on U.S. Treasury Department, Daily Treasury Statement (<<http://www.fms.treas.gov/dts>>).

2.3 Repurchase Transactions

A repo is essentially a purchase and subsequent sale of an asset with the price differential reflecting the interest on the transaction. The transaction resembles a collateralized loan, as the lender of funds receives an asset as collateral to protect against default. A general collateral (GC) repo transaction does not involve a specific security within a class of securities, such as Treasury, federal agency, and mortgage-backed securities. For example, all Treasury bills, notes, and bonds (including inflation-indexed securities) are eligible for a GC Treasury repo transaction. GC repo rates are quoted for various lengths, such as overnight, one week, two weeks, and three weeks.

TT&L depositories that participate in the TIO program and bid on TIO funds can also obtain funds via repos; therefore, repo rates can be considered a benchmark for TIO rates.¹⁸ Acceptable collateral for mortgage-backed-security repos is also most similar to collateral pledged in the TIO program. Acceptable collateral for GC MBS repos consists of Treasury securities, non-mortgage-backed securities from agencies such as the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation, and mortgage-backed securities.

¹⁸From the Treasury's standpoint, the TT&L rate is the proper rate against which to compare the TIO rate because the TT&L rate represents what TIO funds would have earned had they not been placed in the TIO program. However, TT&L rates are not known at the time of TIO auctions.

Repos can settle either as a delivery-versus-payment (DVP) transaction or via a tri-party clearing arrangement. In the former, collateral and funds are exchanged directly between counterparties. In the latter, the transaction is conducted through a third-party clearing bank (see Garbade [2006, p. 38]). There are several benefits to a tri-party repo compared with a DVP repo. For example, in a tri-party repo, the clearing bank, instead of the counterparties, is responsible for the settlement of funds and collateral. In addition, specific collateral does not

TT&L [Treasury Tax and Loan] depositories that participate in the TIO program and bid on TIO funds can also obtain funds via repos; therefore, repo rates can be considered a benchmark for TIO rates.

have to be allocated when the counterparties agree on the transaction amount. Also, many different pieces of collateral can be cleared together. Most MBS repos are tri-party transactions, as the transfer of MBS collateral, which typically consists of various heterogeneous securities, is potentially very burdensome.¹⁹

3. DATA AND REGRESSION FRAMEWORK

Our regression framework is as follows:²⁰

$$\text{TIO - MBS repo rate}_i \text{ spread} = \alpha + \beta_1 X_{1,i} + \dots + \beta_N X_{N,i} + \varepsilon_i$$

$$\varepsilon_i \sim N(0, \sigma_\varepsilon^2),$$

where the subscript i represents the TIO auction number. We analyze auctions after TIO became an official Treasury cash management tool (those after no. 27) through February 2006, for a total of 166 auctions. Auctions held in this sample period are more similar to the way in which TIO auctions are likely to be structured and conducted in the future than auctions held

¹⁹Special thanks to John McGowan for his insights into DVP and tri-party repos. For more on repo markets, see Meulendyke (1998, pp. 101-4).

²⁰The data on term investment auctions studied here are publicly available. See <<http://www.wrightson.com/treasury/data/tio>> (registration required) or <<http://www.fms.treas.gov/tip>>. These websites contain information on dates of announcement, auction, placement, and maturity; the amount auctioned; and the TIO auction award rate (the TIO rate). Comparable MBS repo rates are calculated from the opening MBS repo rate, which can be obtained via Bloomberg.

during the pilot program. For example, TIO auctions now occur more frequently than they did during the pilot program. X_1, \dots, X_N represent the independent variables that influence the TIO-MBS repo rate spread (the spread). These include the size of the term investment auction and the term length. The coefficients to be estimated are represented by α and the β s, and ε represents a random error term.

One complication when calculating comparable market rates is that MBS repo rates are not observed for term intervals other than overnight, one week, two weeks, etc., so exact comparisons of rates are not possible for TIO term lengths of two to six days, eight to thirteen days, etc. In addition, implied forward rates are the appropriate benchmark because TIO funds are placed on the next business day after the day of auction. In contrast, a repo transaction typically starts on the trade date.

We calculate comparable MBS repo rates in two steps. First, we compute repo rates for a length of time equal to $t+k$ days, where t is the number of days from auction to placement and k is the term length.²¹ We calculate these rates by linearly interpolating comparable rates using the MBS repo term structure.

For example, TIO no. 54 was auctioned on September 14, 2004, was issued on September 15, 2004, and matured on September 27, 2004, for a term length of twelve days, so that

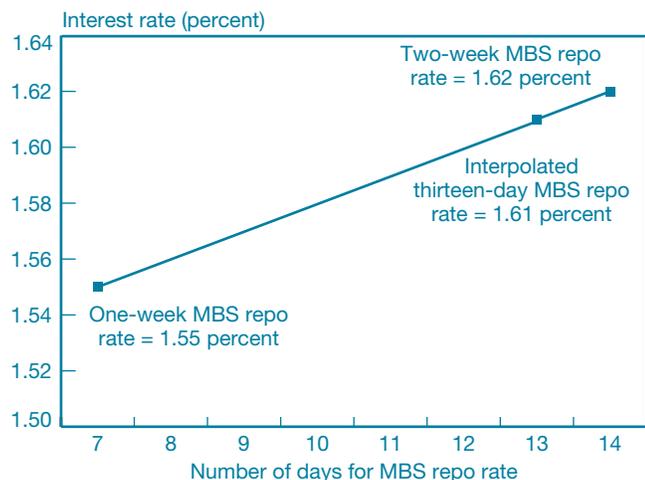
One complication when calculating comparable market rates is that MBS [mortgage-backed-security] repo rates are not observed for term intervals other than overnight, one week, two weeks, etc., so exact comparisons of rates are not possible for TIO term lengths of two to six days, eight to thirteen days, etc.

$t = 1$ and $k = 12$. The one-week MBS repo rate on the day of auction, September 14, 2004, was 1.55 percent and the two-week MBS repo rate was 1.62 percent. The difference between these two rates (.07 percent) is multiplied by the number of days within the seven-day interval between two weeks and one week that is covered by $t+k$, $(13-7)/7$.²² This product is added to the one-week MBS repo rate to arrive at the thirteen-day MBS repo rate for TIO no. 54 (see Chart 7):

²¹The parameter t can take on values greater than 1 because of weekends and holidays.

CHART 7

Interpolation of Thirteen-Day Mortgage-Backed-Security (MBS) Repo Rate for Term Investment Option No. 54



Sources: Author's calculations; Bloomberg.

$$R_{t+k} = R_{13} = 1.55 \text{ percent} + .07 \text{ percent} * (6/7) = 1.61 \text{ percent.}$$

Second, implied forward rates must be calculated. The forward rate is the proper comparison rate because TIO investments are placed on the next business day after auction. To calculate the comparable MBS repo rate for a given TIO auction, f_k , we use:

$$(1) \quad \left[1 + \frac{k}{360} f_k \right] = \frac{\left[1 + \frac{t+k}{360} R_{t+k} \right]}{\left[1 + \frac{t}{360} R_{o/n} \right]},$$

where $R_{o/n}$ represents the overnight MBS repo rate, and overnight is defined as the next business day. Thus, for TIO no. 54, $R_{o/n}$ on September 14, 2004, was 1.5 percent, and given the calculation of R_{13} to be 1.61 percent, we substitute values into equation 1:

$$\left[1 + \frac{12}{360} f_{12} \right] = \frac{\left[1 + \frac{13}{360} .0161 \right]}{\left[1 + \frac{1}{360} .015 \right]}.$$

²²Note that for $t+k < 7$, the interval will typically be six days (seven days for a one-week transaction minus one day for an overnight transaction). The proper interval will also be affected by weekends and holidays. For example, an overnight transaction conducted on a Friday will be for three days, assuming no holiday on the following Monday.

TABLE 3

Summary Statistics

	Mean	Standard Deviation
TIO-TT&L rate spread (basis points)	16.34	7.12
TIO-MBS repo rate spread (basis points)	-6.14	6.99
Size (billions of dollars)	5.98	3.74
Term (days)	8.01	4.36
Term investments outstanding on day of placement (billions of dollars)	14.99	13.02
Days since last TIO auction	5.04	7.12
1 (announcement day = auction day)	0.283	0.452
1 (first auction if two auctions on same day)	0.054	0.227
1 (second auction if two auctions on same day)	0.054	0.227

Source: Author's calculations.

Notes: The number of observations is 166. TIO is term investment option; TT&L is Treasury Tax and Loan program; MBS is mortgage-backed security.

Therefore, the comparable MBS repo rate for TIO no. 54 is:

$$\text{MBS repo rate}_{54} = f_{12} = .01619, \text{ or } 1.619 \text{ percent.}$$

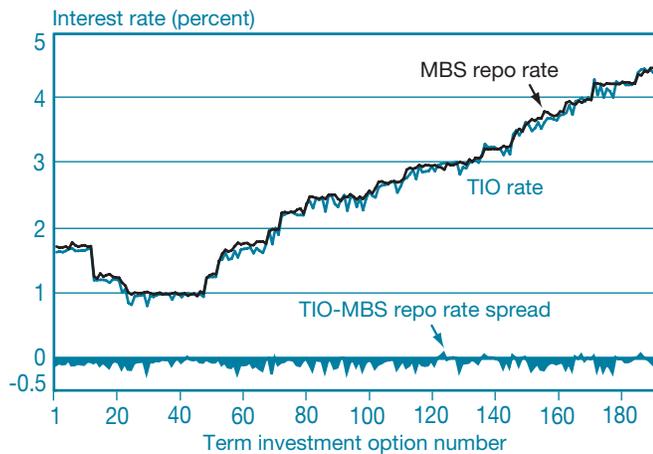
We present summary statistics for the variables in Table 3. For the sample period, the average spread is negative, at -6.14 basis points. The average TIO investment is for \$5.98 billion for a term of eight days. While the Treasury only began announcing and auctioning term investments on the same day in 2005, 28.3 percent of term investments in the sample were announced and auctioned on the same day.

Chart 8 depicts TIO and MBS repo rates. Consistent with the negative average spread, the MBS repo rate typically trades slightly above the TIO rate. The spread between the two rates is also plotted in the chart. The largest spread was 8.8 basis points for TIO no. 125 and the smallest spread was -24.5 basis points for TIO no. 70. While the spread is typically negative, there are a number of cases where it is positive. There does not appear to be any obvious trend in the spread over time despite the growth of the TIO program.

In terms of expected signs for the regression coefficients, as more TIO funds are auctioned (the supply of term investments increases), assuming a downward-sloping demand curve, the TIO rate is expected to fall. Therefore, the spread is expected to narrow or become more negative, so the size of the auction is expected to be negatively related to the spread.²³ The amount of term investments outstanding is also expected to have a

CHART 8

Term Investment Option (TIO) Rate Compared with Mortgage-Backed-Security (MBS) Repo Rate



Sources: Author's calculations; U.S. Treasury Department (<<http://www.fms.treas.gov/tip>>); Bloomberg.

negative relationship with the spread, as banks are expected to bid less aggressively as more of their allocated collateral is exchanged for TIO funds.²⁴ The need for funding assets will also generally be reduced by prior TIO awards. As the auctioned amount can differ from the amount actually placed (on rare occasions), the auctioned amount is used in the regressions because this is the amount on which banks are bidding.²⁵ Because the benchmark rate is for the same term length, it is not clear that longer term lengths should have any relationship with the spread. We also analyze the number of days since the last auction. More frequent auctions are generally associated with more TIO funds outstanding, so more time between auctions is expected to be positively related to the spread. However, this coefficient should be interpreted carefully.

In addition, in the sample period the Treasury occasionally compressed the TIO auction schedule by announcing and auctioning term investments on the same day. We investigate the relationship between a compressed schedule and the spread using a dummy variable for auctions announced and auctioned on the same day. This coefficient is expected to be negative if

²³For Treasury debt auctions, Seligman (2006), Fleming (2002), Simon (1991, 1994), and Duffee (1996) find that increases in the size of issuance lead to higher yields (lower prices for Treasury debt).

²⁴When two auctions occur on the same day, we set the amount outstanding for the second (higher numbered) auction to include the amount in the first auction. The higher numbered auction will have a later closing time.

²⁵This scenario can occur for a variety of reasons. For example, the announced amount for TIO no. 137 was \$3 billion, but because of a collateral deficiency only \$2.96 billion was placed (<<http://www.fms.treas.gov/tip/auctions/HistoricalFinal05.pdf>>).

banks bid less aggressively when they have less time to prepare for an auction. The Treasury has also occasionally held two auctions for different amounts and term lengths on the same day. A casual observation of the data suggests that the rate for the second auction of a multiple-auction day is low compared with the rate for the first auction. Dummy variables for days of the week of an auction are also investigated.

4. REGRESSION RESULTS

Column 1 of Table 4 presents a basic specification with only an intercept, the size of the TIO auction, and the term length. The size of the TIO auction is negatively related to the spread, so an increase in supply leads to lower bids. The term length is positively related to the spread. All coefficients are statistically significant.

Column 2 adds other explanatory variables and represents the preferred specification. For the other variables, we add quadratic and cubic terms for the term length as well as a dummy variable for one-day TIOs. A casual observation of the data shows that the six TIO offerings with one-day term lengths in the sample resulted in relatively low spreads. The dummy variable for one-day terms explicitly controls for these

Overall, for small auction sizes . . . for term lengths of five to nineteen days, the Treasury appears to receive an interest rate comparable to market rates.

auctions. As expected, one-day term lengths result in very poor outcomes for the Treasury.²⁶ The linear term coefficient is now larger in magnitude and still statistically significant. The squared term coefficient is negative, while the cubic term coefficient is positive.

Holding all other variables at zero, we plot in Chart 9 the effect of term length on the spread. The effect of increasing term length is greatest for lengths of one to four days. For term lengths of five to sixteen days, predicted spreads are close to zero, and the effect of increasing term length is not large in magnitude. Beyond sixteen-day terms, the cubic term starts to dominate and the effect of increasing term length starts to climb again. Overall, for small auction sizes, the chart shows that for term lengths of five to nineteen days, the Treasury appears to receive an interest rate

²⁶When a dummy variable for two-day term investments was added, its coefficient was negative but not significant.

TABLE 4

Ordinary Least Squares Regression Results

	Dependent Variable: TIO-MBS Repo Rate Spread				
	(1)	(2)	(3)	(4)	(5)
Intercept	-0.068 (-4.424)	-0.123 (-3.745)	-0.105 (-3.194)	-0.132 (-4.326)	-0.136 (-3.524)
Size	-0.005 (-2.538)	-0.007 (-3.936)	-0.007 (-3.784)	-0.007 (-3.728)	-0.007 (-3.858)
Term	0.004 (3.328)	0.035 (3.331)	0.036 (3.171)	0.033 (3.067)	0.038 (3.269)
Term ²		-0.003 (-2.934)	-0.003 (-2.762)	-0.003 (-2.871)	-0.004 (-3.028)
Term ³		0.0001 (2.705)	0.0001 (2.576)	0.0001 (2.788)	0.0001 (2.881)
1 (term = 1)		-0.059 (-2.530)	-0.065 (-2.601)	-0.058 (-2.534)	-0.040 (-1.452)
Term investments outstanding on day of placement		-0.001 (-1.029)	-0.001 (-2.687)		-0.001 (-1.653)
Days since last TIO auction		0.006 (1.988)		0.008 (3.334)	0.005 (1.802)
Days since last TIO auction ²		-0.0001 (-1.705)		-0.0002 (-2.562)	-0.0001 (-1.309)
Tuesday					-0.017 (-1.138)
Wednesday					-0.022 (-1.074)
Thursday					-0.012 (-0.706)
Friday					-0.0004 (-0.022)
1 (announcement day = auction day)					0.008 (0.513)
1 (first auction if two auctions on same day)					-0.0002 (-0.009)
1 (second auction if two auctions on same day)					-0.038 (-1.129)
Time trend					0.018 (1.325)
Adjusted R ²	0.104	0.272	0.249	0.266	0.287
Durbin-Watson	1.59	1.39	1.41	1.42	1.41

Source: Author's calculations.

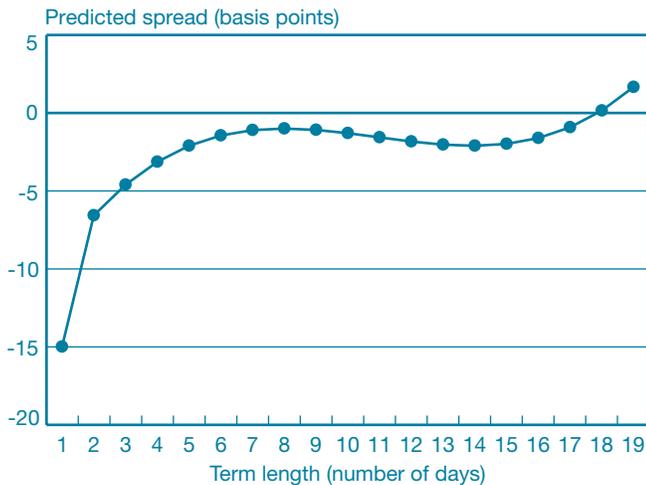
Notes: *t*-statistics, in parentheses, are based on Newey-West (1987) standard errors. The number of observations is 166. TIO is term investment option; MBS is mortgage-backed security.

comparable to market rates. We note that the effect on the spread for term lengths greater than sixteen days should be interpreted with caution, because—as Chart 5 shows—only ten offerings were for term lengths of more than sixteen days.

For term lengths of one to four days, the impact on the spread may be associated with the more cumbersome process of transferring TIO collateral compared with MBS repo collateral. As we discussed, the settlement of TIO transactions with

CHART 9

Intercept and Term Length Coefficients;
Other Variables Set to Zero



Source: Author's calculations.

noncommercial loans pledged as collateral is essentially via delivery-versus-payment.²⁷ However, MBS repos are predominantly settled via tri-party, the more operationally efficient method of settlement. Accordingly, depository institutions may consider the transfer of TIO collateral back and forth for term lengths of less than five days to be particularly burdensome, leading to low relative TIO rates for short term lengths.²⁸

As expected, the coefficient on the amount of term investments outstanding on the day of placement is negative, but the coefficient is not statistically significant.²⁹ The magnitude of this coefficient is also smaller than the coefficient for size of auction. The number of days since the last TIO auction is positive and significant; the coefficient on the quadratic term is negative and significant at the 90 percent level.

Columns 3 and 4 of Table 4 present results in which the number of days since the last TIO auction and the amount of term investments outstanding, respectively, are deleted from the specification. The interaction of these variables may be confounding their coefficients in column 2. As we discussed, more frequent auctions generally are associated with more TIO funds outstanding. In column 3, the variables for the number of days since the last auction are deleted and the amount of term

²⁷At this time, it is not clear whether the Treasury has the legal authority to engage in tri-party transactions.

²⁸For a given cost of transferring collateral, the average cost (per day) is larger for shorter term lengths.

²⁹This amount does not include the amount being placed.

investments outstanding is retained. Whereas in column 2 the coefficient for the amount of term investments outstanding is insignificant, the coefficient in column 3 is now statistically significant at the 95 percent confidence level.

In column 4, the variables for the number of days since the last auction are retained and the amount of term investments outstanding is deleted. Compared with their values in column 2, the coefficients for both the linear and quadratic terms for the number of days since the last auction are larger in magnitude and statistically significant at the 95 percent confidence level.

Furthermore, an F-test of the null hypothesis that these three coefficients are jointly equal to zero can be rejected at the 99 percent confidence level.³⁰ As a result, we retain these three variables in the preferred specification in column 2.

4.1 Additional Issues

Table 4, column 5, presents a fuller specification with additional variables for the day of the week of auction, cases when TIO funds are announced and auctioned on the same day, dummy variables for days with multiple auctions, and a time trend (in decimal years).³¹ None of the additional coefficients is statistically significant. Therefore, column 2 represents the preferred specification.

The insignificant time trend suggests that spreads did not narrow over the sample period. Higher order terms for the time trend (not presented) also were insignificant. The coefficient on the dummy variable for auctions announced and auctioned on the same day is positive, but insignificant. This result suggests that compressing the auction schedule does not negatively affect the Treasury in terms of the spread; banks appear to be indifferent to more advance notice of a TIO auction.

In addition, coefficients on the dummy variables for days with multiple auctions are not significant.³² Note that the amount of term investments outstanding is always greater for the second auction on a day with multiple auctions. Also, the number of days since the last auction is always zero for the second auction. While the magnitude of the coefficient for the second auction on a multiple-auction day suggests that the Treasury may need to be somewhat cautious in conducting multiple auctions on the same day, the statistical insignificance of the coefficient implies that this variable does

³⁰The test statistic has a value of 6.82, which exceeds the 1 percent $F_{3,157}$ critical value of 3.78.

³¹Thus, the time trend takes on a value of 1 on November 21, 2004, one year after the sample period began.

³²In the sample, there are nine occasions on which two auctions occurred on the same day.

not add much explanatory value beyond the effects of the amount of term investments outstanding and the time since the last auction.

5. CONCLUSION

This article considers whether the interest rates received by the Treasury through TIO auctions are comparable to market rates. Central to our study is an analysis of the spread between rates on TIO auctions and rates on mortgage-backed-security repos. We study the 166 TIO auctions held from November 2003, when TIO became an official Treasury cash management tool, through February 2006.

We find that for small auction sizes, TIO interest rates and MBS repo rates are comparable for auctions with term lengths of five days or more. However, the Treasury tends to receive

lower TIO rates relative to market rates when term lengths are of shorter durations. We also find that the spread between the TIO rate and the MBS repo rate is negatively related to auction size. Finally, banks appear to be indifferent to more advance notice of TIO auctions. We base this conclusion on our finding that TIO interest rates are not adversely affected by a more compressed auction schedule, whereby the Treasury announces and auctions TIO funds on the same day.

These findings may be of interest to a variety of market participants. For instance, the Treasury would be interested in whether its term investments are receiving a rate of return comparable to market rates. In addition, those who study Treasury auctions may find our results informative, because TIO auctions vary along more dimensions than do typical Treasury debt auctions and hence can offer new insight. Finally, our work may be of interest to other central banks, as the management of treasury funds affects the level of bank reserves and thus the conduct of monetary policy.³³

³³Different countries have different frameworks for managing government funds. For example, in Japan all government funds are held at the central bank and no funds are held at banking institutions. See Bank of Japan (2004).

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TRENDS IN FINANCIAL MARKET CONCENTRATION AND THEIR IMPLICATIONS FOR MARKET STABILITY

- The issue of whether concentrated financial markets—those with a few large suppliers—are more stable or less stable than less concentrated markets is important to policymakers and others concerned about potential market disruptions.
- An analysis of how U.S. financial market structure has changed over the last decade finds no pervasive pattern of high and increasing concentration.
- A complementary line of inquiry into the link between concentration and the risk or severity of market instability focuses on substitution by firms; substitution can stabilize markets by dampening the upward pressure on prices attributable to a large exiting supplier.
- The departure of a major supplier will cause less market disruption the more promptly other firms can substitute for it.

1. INTRODUCTION

Imagine two very different financial market structures. The first has many suppliers, each with only a small share of the market. The second has a few very large firms that supply most of the market, plus many smaller players that make up the rest. Which structure is more stable: the one with many small firms or the concentrated market where a few firms dominate? Which structure best describes financial markets in the United States? Those are questions we address in this article.¹

A *stable* market is one that can endure shocks to supply or demand without collapsing—that is, without experiencing surging (or wildly oscillating) prices or sharply shrinking volumes. Stability requires certain self-correcting tendencies that ensure that a market can right itself. If supply falls because a major producer fails, for example, the resulting excess demand must push prices upward. Rising prices, in turn, must induce prompt substitution toward other suppliers or products. Substitution tends to dampen upward pressure on prices, thus stabilizing the market.

¹Our study analyzes market concentration. That is, we focus on the risks to financial stability in markets with a few large suppliers. We do not discuss other forms of concentration that might be of concern to financial supervisors, such as concentration in a firm's asset portfolio, concentration among users of a specific product or service, or concentration of many firms with the same risk exposures. These are all very important but distinct concepts requiring separate analysis.

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The authors thank two anonymous referees for helpful comments. The views expressed are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

Markets can experience shocks to supply or demand from many sources, such as changes in regulation, technological innovation, shifts in demographics, and knock-on effects from shocks to other markets or economic sectors. We focus here primarily on one particular type of supply shock: the failure and exit of one or more large suppliers. This is a natural channel to focus on given our interest in the relationship between market concentration and market stability, since the presence of a few large suppliers is the defining feature of a concentrated market.

The link between concentration and stability is hard to pin down, so we mostly try to identify the link by breaking it down into parts. For example, we distinguish between the *probability* of distress by a given firm and the *severity* of the market consequences in that event. After reviewing literature that investigates the link between financial market concentration and financial stability, we conclude that the link is ambiguous—some of the side effects of changing market structure may have a stabilizing influence, while other influences may be destabilizing. Our own findings are consistent with that ambiguity. We find a mixed relationship between market concentration and volatility in the investment-grade-bond and syndicated loan markets, consistent with an ambiguous relationship as suggested in the theoretical literature. We conclude that there are no simple answers to the question of whether concentrated financial markets are more stable or less stable than less concentrated markets.

Our analysis of how U.S. financial market structure has changed over the last decade produces more definitive conclusions. Using firm-level data from a variety of sources,

Markets can experience shocks to supply or demand from many sources

We focus here primarily on one particular type of supply shock: the failure and exit of one or more large suppliers.

including data collected by central banks, we document that in aggregate, most U.S. wholesale credit and capital markets are only moderately concentrated. Concentration in most global over-the-counter (OTC) derivatives markets is low, though rising. Overall, concentration trends are mixed, rising in some markets and falling in others. Given the rise in bank concentration at the national level, we view the moderate and mostly stable levels of concentration at the individual market level as surprising. We also find that linkages *across* markets

have increased since the late 1990s as more second-tier firms have ventured into other markets. The stability implications of increased cross-market linkages are mixed; the probability of disruption is lower if firms in multiple markets are more diversified, but contagion across markets may make disruption more severe.

After documenting those facts, we return to the question of stability and concentration, but with a twist: we argue that the exit of a single large firm will cause less market disruption the more promptly other firms can substitute for the exiting firm,

Our findings should offer some reassurance to policymakers concerned about whether high or rising financial market concentration portends greater financial market instability.

and we discuss market characteristics that will speed or impede such substitution. We then rank markets by potential substitutability among firms in that market (as proxied by turnover in market share rankings) on the one hand, versus concentration on the other. We find few markets with high concentration *and* low turnover.

In sum, our findings should offer some reassurance to policymakers concerned about whether high or rising financial market concentration portends greater financial market instability. Most financial markets, at least those in the United States, are not particularly concentrated, nor are they becoming more so. Moreover, even if the opposite were true, the implications for financial stability are ambiguous; it depends on what else is changing along with market structure, and on how fluidly other firms can substitute for the incapacitated firm. Looking at concentration alone, without considering these other factors, will not always provide a reliable view of the likelihood or likely damage from a market disruption. More detailed analysis of individual markets is needed to obtain a full understanding.

Our policy recommendations are simple. Besides the obvious—monitoring trends in concentration and turnover—we advocate public policies that enhance substitution among firms within a given market by, for example, promoting standardization of products, ensuring rapid clearing of payments, and monitoring competition to ensure that key players do not become entrenched (and hence irreplaceable) because of privileged access to trading platforms or technologies.

2. THE AMBIGUOUS LINK BETWEEN CONCENTRATION AND STABILITY

Why should a change in concentration affect either the probability of a firm's distress or the severity of the consequent market disruption? In this section, we review theory and empirical evidence that address this question.

History certainly suggests a link between market concentration and the severity of market disruption given the distress of a major market supplier. A good example is the market for original-issue, below-investment-grade (junk) bonds and the role played in it by Drexel Burnham Lambert. At the peak of the firm's market dominance in the mid-1980s, Drexel's market share oscillated around 50 percent, with a dollar value of issues up to ten times that of the second largest competitor (Altman and Nammacher 1987). As a result of well-known events, Drexel filed for Chapter 11 bankruptcy protection in February 1990.

Drexel's exit significantly disrupted the junk-bond market. Return spreads over Treasury securities increased from an average of 400 basis points during the 1980s to 1,000 basis points after Drexel's exit. Issuance also shrank substantially.

Why should a change in concentration affect either the probability of a firm's distress or the severity of the consequent market disruption?

The annual value of new issues declined from about \$30 billion before Drexel's exit to about \$4 billion in 1990, and it took three years to return to pre-exit volumes (Edwards and Mishkin 1995). Moreover, negative repercussions were also felt in other industries, as large junk-bond holders attempted to find suitable substitutes for the services Drexel had provided.²

Theory, however, has focused almost exclusively on the link between market concentration and the probability of a firm's distress, offering mixed conclusions about the link's direction. Some of the literature suggests a negative link between market concentration and the probability of firm distress. This literature focuses on how market concentration affects firms' incentives to take risk, a concept with direct correspondence to the probability of a firm's distress. Keeley (1990) as well as Hellmann, Murdock, and Stiglitz (2000) argue that banks in

²For example, this was the case in the life insurance sector, where foreclosures occurred as a result of sizable losses from junk-bond investments (Brewer and Jackson 2000).

concentrated markets have incentives to reduce risk. If higher concentration reflects decreased competition and increased profitability, then banks' franchise values will be higher. Higher franchise values reduce the incentives of equity holders to engage in excessive risk-taking behavior that might jeopardize their franchise. Focusing more on how firms interact with each

History certainly suggests a link between market concentration and the severity of market disruption given the distress of a major market supplier.

other, Carlin, Lobo, and Viswanathan (2004) argue that a market with a few large players will be stable *most of the time*, as firms choose optimally to act as cooperating oligopolists. However, one player will find it optimal, occasionally, to deviate from this strategy, and its action could lead to significant market instability.

There are also links between concentration and risk through a *size channel*. The dominant banks in concentrated markets are frequently very large, and large banks have opportunities to diversify and reduce risk. Concentrated markets thus should be more stable overall (for example, Allen and Gale [2000]). However, large firms may reoptimize by changing investment strategies (entering riskier market segments or adopting lower capital ratios) so that eventually overall risk might remain unaltered. Empirical evidence based on U.S. data supports this conjecture (Demsetz and Strahan 1997; Stiroh 2006).

While these factors suggest a negative or neutral link between market concentration and firms' incentives to take on risk, other factors suggest the opposite effect. In particular, an increase in firm size may be associated with lower transparency. Size allows financial firms to expand across multiple geographic markets and lines of business. It also allows the use of increasingly sophisticated financial instruments and the evolution toward complex forms of corporate organization. This may result in reduced managerial efficiency, less effective internal corporate control, and the potential for increased operational risk. The increasing complexity of the organizations could also render both market discipline and regulatory action less effective in preventing excessive risk exposure. Large size also raises moral hazard concerns if the owners of large banks operate under the presumption that they are *too big to be allowed to fail*.

Given the ambiguous theoretical relationship between financial market concentration and financial market stability, it should come as no surprise that the scant empirical literature

on that question also reaches conflicting conclusions.³ Using data across seventy countries from 1980 to 1997, Beck, Demirguc-Kunt, and Levine (2003) estimate the relationship between banking market concentration and the likelihood of a banking crisis.⁴ They find a negative relationship; as concentration increases, the probability of crises decreases. However, De Nicoló et al. (2003) investigate empirically the role of concentration on an indicator proxying for the probability of the largest financial firms failing. Using cross-country data, they find that higher concentration is associated with higher probability of failure.

We find a similarly ambiguous relationship in our estimates of the link between concentration and volatility in two particular U.S. financial markets: investment-grade-bond underwriting and syndicated loans. Our two-step regression methodology constructs a measure of volatility from the excess variation in bond or loan spreads—variation above and beyond what one would predict given the risk of the issuer or borrower,

Given the ambiguous theoretical relationship between financial market concentration and financial market stability, it should come as no surprise that the scant empirical literature on that question also reaches conflicting conclusions.

contract terms (for example, maturity), and macroeconomic conditions at the time of issuance. (Our statistical methodology is described in greater detail in the appendix.) Put differently, volatility is measured by deviations in spreads that are not attributable to firm or macroeconomic fundamentals. Those nonfundamentals are presumably the types of disturbances to supply and demand that can destabilize a market.⁵

In the second stage of our regression methodology, we estimate how volatility in each market changes over time in relation to changes in the level of concentration, as measured by the Herfindahl-Hirschman Index (HHI) of concentration.⁶ The estimates of the volatility-concentration relationships are not robust; they depend instead on the market in question and the period under observation (Chart 1). For syndicated loans,

³Boyd and De Nicoló (2005) also conclude that theory and evidence relating concentration and financial stability are ambiguous.

⁴Banking crises are defined as events where 1) emergency measures were taken to assist a nation's banks (bank holidays, deposit freezes, blanket guarantees to depositors or creditors, or large-scale nationalization), 2) nonperforming assets reached at least 10 percent of total assets at the height of the crisis, or 3) the cost of rescue operations was at least 2 percent of GDP (see <<http://www.nber.org/digest/feb04/w9921.html>>).

the relationship is nonlinear but generally negative, suggesting somewhat lower volatility as market concentration rises. For investment-grade bonds, the relationship is negative in a narrow range of low concentrations but turns positive for

We find a similarly ambiguous relationship in our estimates of the link between concentration and volatility in two particular U.S. financial markets: investment-grade-bond underwriting and syndicated loans.

higher HHI levels, suggesting the opposite relationship to the syndicated loan market, at least for higher market concentration levels. However, the volatility-concentration relationship for bonds is unstable. When we exclude observations before 1990 (a period in which most banks were not allowed to compete for underwriting business), the relationship estimated over the observations in the 1990-2004 period is negative.⁷

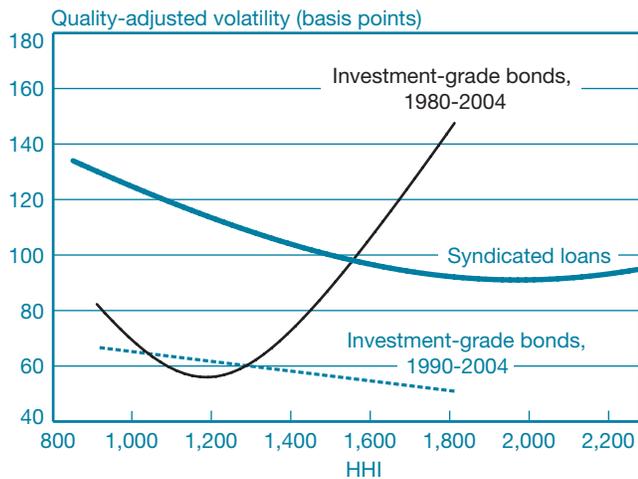
These findings showing variation across markets and across time do not support any particular conclusions about the relationship between concentration and volatility. Perhaps the safest view is to take these estimates as consistent with the ambiguous relationship in the literature we just reviewed. Put differently, our findings can be seen as a counter-example to hypothetical claims that concentrated markets are always more stable or less stable.

⁵While this volatility measure does not directly reflect the impact of a large supplier's failure, we believe it provides a reasonable proxy for market resiliency to a range of supply and demand shocks. In fact, the measure tracks other, broader gauges of financial market instability fairly closely. For instance, the correlation between our annual measure of bond price volatility and the Chicago Board Options Exchange Volatility Index (VIX) is close to 70 percent. The VIX is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. Essentially, many consider this index one of the most important forward-looking indicators of investor sentiment and market volatility. We take this close correlation as evidence that the first-stage volatility estimates are doing a good job capturing changes in market stability over time.

⁶Volatile markets have more frequent and larger price disruptions (by definition), so the self-correcting tendencies required for stability are more demanding. We also looked at extreme events—that is, episodes in which our measure of excess volatility was in the tail of the distribution. The results were qualitatively similar to those reported in this article. To account for the possibility that price volatility might also depend on the business cycle, we also estimated a second-stage regression specification that, in addition to concentration, included several macroeconomic controls such as GDP growth, the unemployment rate, and inflation. Overall, the relationships depicted in Chart 1 remained fairly unchanged.

CHART 1

Relationship between Price Volatility and Market Concentration



Sources: Securities Data Corporation; Loan Pricing Corporation.

Note: HHI is the Herfindahl-Hirschman Index.

3. CONCENTRATION TRENDS

We now examine trends in concentration across a selection of major U.S. financial markets over the past fifteen years. The basic question is whether the regulatory changes of the 1990s have led to a broad pattern of high and increasing concentration in U.S. financial markets. It is already well known that bank concentration at the *aggregate* level (measured by the market share of the four largest U.S. banks) has climbed steadily since the early 1990s (Chart 2), rising from less than 10 percent of banking industry assets in 1990 to 25 percent at the end of 2004. Our review shows that high and rising concentration is not universal across individual financial markets. We find generally moderate levels of concentration in wholesale credit and capital market activities and in most OTC derivatives markets, plus a mixed pattern in terms of trend, with concentration rising in some markets and falling in others. The most noticeable exception is the prime brokerage market, where concentration is high (but declining).

Our review covers major U.S. wholesale credit and capital markets. Admittedly, these markets are not exhaustive;

⁷Implicit in the relationship that we derived between price volatility and concentration is, among other things, our assumption that the pool of bond issuers does not change with competition among bond underwriters (our results assume similar conditions in the case of syndicated loans). If these assumptions do not hold, other explanations for our findings are also plausible. For instance, if more new issuers come to the market as concentration decreases, these issuers are likely to contribute to a negative relationship between price stability and concentration because, in general, there is less information available about them than about issuers with an established track record.

CHART 2

Share of Total Bank Assets Held by Top Four U.S. Commercial Banks



Source: Federal Financial Institutions Examination Council Reports of Condition and Income.

however, they do represent some of the most important markets for core wholesale financial and banking services.⁸

We measure market concentration by the standard n -firm concentration ratio, calculated as the sum of the market shares of the top n (two, three, or five) firms in the market, or by the Herfindahl-Hirschman Index, the sum of squared market shares of all firms in the market.⁹ The HHI ranges from zero for a market with an infinite number of equally sized (very small) competitors to 10,000 for a market with a single competitor with a 100 percent market share. Guidelines published by the U.S. Department of Justice used in antitrust analysis specify that markets with HHIs of between 1,000 and 1,800 are considered “moderately concentrated,” while markets with HHIs greater than 1,800 are considered “highly concentrated.” Although the application is not direct, these figures are useful for interpreting the HHI figures we discuss.

3.1 Underwriting and Financial Services

The U.S. underwriting markets are dominated by a handful of large financial firms. Increased competition from bank entry, however, has changed the character and diversity of these

⁸We do not look at the markets for deposit-taking or other consumer services, since studies have shown that these activities are conducted mostly in local markets and that concentration in local markets has not been increasing (Dick 2006). Nor do we analyze payment-related markets, since concentration in these markets, especially government securities clearing, is well documented and has been actively studied from a policy perspective.

⁹In general, n -firm concentration ratios and HHIs display very high positive correlations.

TABLE 1

Concentration Trends in Underwriting and Selected Financial Services, 1990-2004

Market	Average HHI	Growth in HHI (Percent)	Top Five (Percent)
Securities underwriting			
Initial public offerings	1,149	4.32	60.7
Seasoned offerings	854	4.85	49.2
Investment-grade bonds	1,122	-3.41	56.4
High-yield bonds	1,144	-1.54	56.1
Merger and acquisition			
advisory services	1,160	9.44	56.8
Syndicated loan	1,391	-1.97	50.2

Source: Securities Data Corporation.

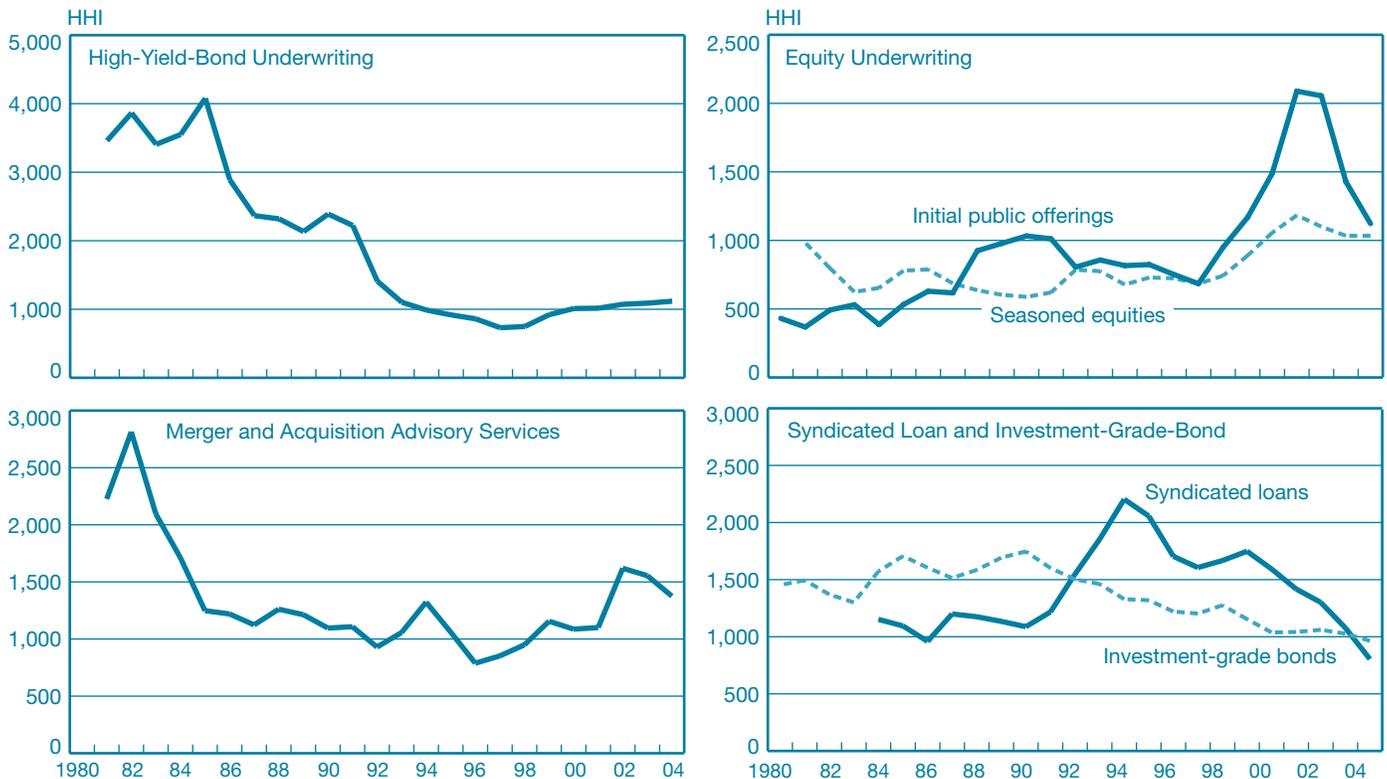
Notes: Herfindahl-Hirschman Index (HHI) calculations are based on the lead underwriter.

markets. Table 1 summarizes the levels and changes in concentration in the major underwriting and financial services markets: securities underwriting, syndicated loan, and merger and acquisition (M&A) advisory services. Chart 3 shows the change in HHI in these markets from year to year since the early 1980s.¹⁰ Overall, these measures reveal low to moderate levels of concentration across the markets. Average HHIs range from about 850 to 1,400, within or slightly below the Department of Justice’s “moderately concentrated” range.

Several markets have seen significant declines in concentration since 1980, most notably the high-yield-debt underwriting and M&A advisory services markets (Chart 3). Since 1990, the pattern across markets has been mixed, with some experiencing increases in measured concentration (equity initial public offerings [IPOs], seasoned equity, and M&A advisory services) and others experiencing declines (bond underwriting and syndicated loans). Even over the relatively short period since 1998, no consistent pattern emerges, with concentration in some markets trending up and concentration in other markets trending down.

CHART 3

Concentration in Investment Banking Markets



Sources: Securities Data Corporation; Loan Pricing Corporation.

Note: HHI is the Herfindahl-Hirschman Index.

3.2 OTC Derivatives Markets

OTC derivatives markets have grown tremendously in recent years along with rising demand for corporate risk management. Commercial banks are the largest dealers in these rapidly growing markets.¹¹

Tables 2 and 3 summarize patterns in market concentration for a variety of OTC derivatives products. Table 2 reports information on concentration in global markets for interest rate and foreign exchange (FX) derivatives from the 2004 Bank for International Settlements (BIS) Triennial and Semiannual

Concentration in credit derivatives products has declined substantially over the last few years as financial institutions have rushed to take part in this exploding market.

Surveys on Positions in Global Over-the-Counter Derivatives Markets.¹² Chart 4 shows how concentration in these markets has varied from year to year since 1998. Overall, global concentrations for the major categories of interest rate and FX products are low or moderate, though rising.

The BIS survey does not publish concentration measures for the credit derivatives market. The last row of Table 2 presents an estimate of concentration for the OTC credit derivatives market based on U.S. dealers reporting to the BIS survey and information gathered from the annual reports of major non-U.S. dealers. Our estimates reveal moderate levels of concentration in the credit derivatives market during the 2000-04 period. Moreover, concentration in credit derivatives products has declined substantially over the last few years as financial institutions have rushed to take part in this exploding market.

Table 3 reports concentration figures for equity-linked derivatives markets. Concentration in global markets is low to moderate for U.S. and European equity-linked derivatives, though concentration in the more specialized regional markets, such as in Asia and Latin America, is quite high. In addition to presenting BIS estimates of global market concentration, Panel B of Table 3 gives information on concentration for U.S.

¹⁰The HHI for the syndicated loan market starts in 1986 because our data source for this market is not comprehensive before that year.

¹¹For a thorough discussion of the link between derivatives markets and the risk of systemic events, see Hentschel and Smith (1994).

¹²The BIS database on major OTC dealers is made up of data collected by central banks in major industrialized countries. The BIS reports aggregate information on nominal positions and HHI concentration, but it does not collect or make available bank-specific information on the roughly 240 reporters.

TABLE 2

Concentration Trends in Interest Rate and Foreign Exchange Over-the-Counter Derivatives Markets

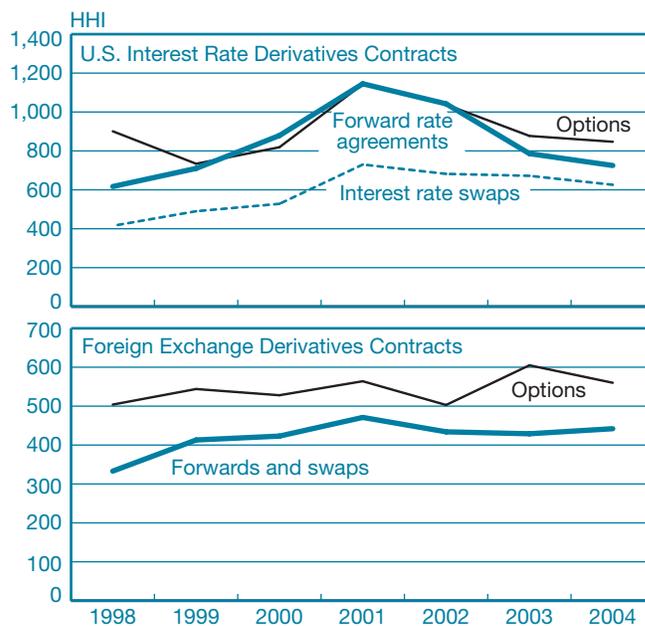
Market	Average HHI	Growth in HHI (Percent)
Panel A: Global concentration: BIS surveys, 1998-2004		
U.S. interest rate derivatives		
Forward rate agreements	843	4.64
Interest rate swaps	591	8.20
Options	908	0.75
Foreign exchange derivatives		
Forwards and swaps	420	5.30
Options	544	2.31
Panel B: Federal Reserve Bank of New York Estimates of Concentration: 2000-04		
Credit derivatives	825	-14.04

Sources: Bank for International Settlements, Triennial and Semiannual Surveys on Positions in Global Over-the-Counter Derivatives Markets (2004); Federal Reserve Bank of New York; company annual reports.

Notes: HHI is the Herfindahl-Hirschman Index; BIS is Bank for International Settlements. Estimates for the credit derivatives market are calculated from the U.S. Reporter Survey, company annual reports, and call reports.

CHART 4

BIS Estimates of Concentration in Over-the-Counter Markets



Source: Bank for International Settlements (BIS), Triennial and Semiannual Surveys on Positions in Global Over-the-Counter Derivatives Markets (2004).

Note: HHI is the Herfindahl-Hirschman Index.

TABLE 3

Concentration Trends in Equity-Linked Over-the-Counter Markets

Market	Average HHI	Growth in HHI (Percent)	Top Two (Percent)
Panel A: Global concentration: BIS surveys, 1998-2004			
Forward, swap, and option			
United States	924	7.44	—
Europe	827	4.30	—
Asia (ex Japan)	2,707	35.88	—
Latin America	5,771	12.81	—
Panel B: U.S. reporters only, 2000-04			
Forward, swap, and option			
United States	2,162	-0.001	53.3
Europe	3,239	-9.65	70.5
Asia (ex Japan)	4,257	25.15	77.6
Latin America	6,976	4.38	96.2

Sources: Bank for International Settlements, *Triennial and Semiannual Surveys on Positions in Global Over-the-Counter Derivatives Markets* (2004); Federal Reserve Bank of New York; company annual reports.

Note: HHI is the Herfindahl-Hirschman Index; BIS is Bank for International Settlements.

reporters.¹³ Concentration in the U.S. OTC derivatives markets is higher, especially for the broader U.S. and European equity-linked markets. For smaller equity-linked markets, such as those in Asia and Latin America, however, concentration measures are comparable because they are essentially dominated by U.S. reporting firms.¹⁴

3.3 Secondary-Market Trading by Primary Dealers

An important element of liquid securities markets is the extent of secondary-market trading.¹⁵ Table 4 presents concentration measures for the secondary-market trading volumes of

¹³We use a database on large U.S. reporters available from the Statistics Function of the Federal Reserve Bank of New York as well as call report information.

¹⁴We report the U.S. dealer information here to establish that it is reasonably comprehensive for the global market. In the analysis to follow, we will need firm-level data not provided in the BIS survey. For the interest rate and foreign exchange derivatives markets, we can construct reasonable proxies for firm-level data from data on U.S. reporters and from annual reports of non-U.S. reporters. However, for the equity-linked markets, we are unable to collect sufficiently comprehensive data from these sources; thus, we use the U.S. reporter data.

¹⁵The primary dealer information (Weekly Report of Dealer Transactions, FR 2004B) is compiled by the Statistics Function of the Federal Reserve Bank of New York.

TABLE 4

Concentration Trends for Primary Dealers, 1995-2004

Market	Average HHI	Growth in HHI (Percent)	Top Five (Percent)
Treasury securities			
Bills	515	4.88	37.6
Coupons	596	3.44	42.5
TIPS	1,826	11.43	71.9
Other securities			
Mortgage-backed	954	0.39	58.2
Corporate	1,336	-5.76	73.6
Federal agency	694	1.20	45.8

Source: Board of Governors of the Federal Reserve System, *Weekly Report of Dealer Transactions* (FR 2004B).

Note: HHI is the Herfindahl-Hirschman Index; TIPS is Treasury Inflation-Protected Securities.

primary dealers in several types of securities.¹⁶ Concentration in secondary-market trading of Treasury securities is generally low, with the exception of the Treasury Inflation-Protected Securities (TIPS) market (row 4 of Table 4). However, the relatively high measured concentration in TIPS trading can be attributed to the early dominance of one dealer. With the TIPS market maturing, HHIs declined from 3,500 in 2002 to just below 1,500 by the end of 2004. Mortgage-backed, corporate, and federal agency securities trading also appears to be unconcentrated, with HHIs beneath or just above the

Concentration in secondary-market trading of Treasury securities is generally low, with the exception of the Treasury Inflation-Protected Securities market.

Department of Justice's "moderately concentrated" range. Actual concentration levels in these securities may be even lower than indicated by the HHIs in the table, since the primary dealer data may not cover the full range of market participants in the trading of these securities.

3.4 Prime Brokerage

An increasingly important business for investment banks and large commercial banks is prime brokerage. Prime brokerage firms essentially service the hedge fund community. Typically,

¹⁶Primary dealers are banks and securities brokerages that trade in U.S. government securities with the Federal Reserve System.

TABLE 5

Concentration in Prime Brokerage

Year	Concentration	
	HHI	Top Three (Percent)
2001	2,006.7	65.17
2002	2,093.8	65.61
2003	1,931.2	60.53
Average HHI	2,010.5	
Growth in HHI (percent)	-1.71	

Source: HedgeWorld.com.

Note: HHI is the Herfindahl-Hirschman Index.

they provide hedge fund clients with a variety of services: financing (securities lending, margin lending, or other structured derivatives products), trading and clearing, customer support, and research. The proliferation of hedge funds over the last few years has made prime brokerage a significant source of revenues for banks and other providers.¹⁷

Concentration measures for the prime brokerage industry in 2001-03 show that the prime brokerage market is more concentrated than the securities underwriting market (Table 5).¹⁸ HHIs are in the “highly concentrated” range, but concentration has remained fairly stable over the three-year period.

3.5 Global Custody

The global custody business involves processing trades across countries and safeguarding and servicing financial assets for a variety of large customers (institutional investors, brokers/dealers, and money managers). Typically, the portfolio of assets held by global custodians for their customers includes bonds, equities such as mutual fund holdings, and derivatives products. With the rapid expansion of financial markets, assets in custody surged from \$7.6 trillion in 1994 to \$36.3 trillion in 2000 and to more than \$52.0 trillion in 2004.¹⁹

Global custody is a fairly specialized business requiring an international network of subcustodians and expertise in

¹⁷According to Boston Consulting Group, hedge fund industry revenues in 2003 amounted to \$60 billion. The servicing of hedge funds has generated roughly \$15 billion in revenue opportunities for prime brokers.

¹⁸We use the HedgeWorld Service Provider Directory League Tables to derive HHI measures of concentration. The HedgeWorld rankings are based on a large pool of hedge funds tracked by TASS Research.

¹⁹Our source is *The Global Custody Yearbook*, 2005 Eleventh Annual Survey, Buttonwood International.

managing a large portfolio of securities denominated in several currencies. Consequently, global custody is dominated by a small number of major banks and specialist providers. The top-five market for global custody during the 1994-2004 period averaged around 76.9 percent. Overall, during this period the market was moderately concentrated, with an average HHI of 1,397.

4. MARKET INTERDEPENDENCIES

Thus far, our discussion has centered on the analysis of single markets. However, the probability of distress for a firm and the severity of market disruption may also be affected by interdependencies *across* markets. The emergence of large financial superstores in the late 1990s suggests that financial markets may now be more interrelated. In this section, we

As financial markets become increasingly dominated by the same set of financial firms, these firms may also become more and more alike, thus actually increasing the risk of exposure to common aggregate shocks.

examine a variety of evidence on cross-market linkages, finding that these linkages have increased, especially since the late 1990s. This increase has been driven mainly by a growing common set of second-tier firms, rather than by increases in the number of firms with top-five market shares in multiple markets.

Is an increase in cross-market linkages a concern for overall stability? On the one hand, the ability of financial firms to operate simultaneously in several product markets should open up better diversification opportunities, reducing risk and thus the probability of firm distress. On the other hand, the diversification benefits may be spent by undertaking riskier investment strategies, making the overall effect on risk unclear.

Moreover, as financial markets become increasingly dominated by the same set of financial firms, these firms may also become more and more alike, thus actually increasing the risk of exposure to common aggregate shocks. Risk may also be enhanced when the same firms are big providers in multiple markets because alternate suppliers are needed in many places at once. This multi-market presence might potentially strain

alternate suppliers, especially if they themselves are operating in the same multiple markets. On net, firms that are active in multiple markets may be more diversified, but the financial system on the whole may be more vulnerable to firm-specific shocks.²⁰

We look at cross-market linkages through two lenses. First, we examine trends in market share correlations—that is, are banks' shares in one market now more or less correlated with their shares in other markets? Second, we examine the extent to which individual firms have high shares across multiple markets and how those shares have changed.

4.1 Correlations of Market Shares

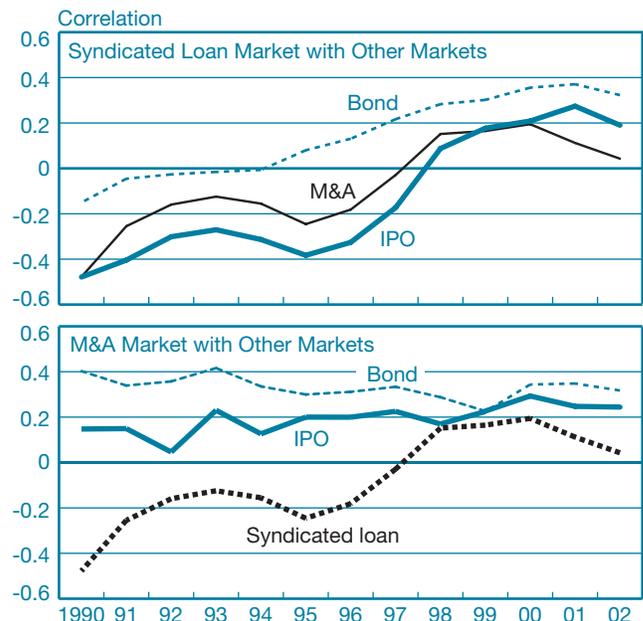
One direct measure of linkages between two markets is the correlation of market shares of individual firms in any two markets. A high positive correlation would signal that firms are likely to have similar market shares in both markets. In fact, market share correlations have increased since the late 1990s, largely reflecting the increased role of commercial banks in underwriting activities.

Charts 5 and 6 plot the market share correlation in selected securities underwriting markets and M&A advisory services from 1990 to 2004. The syndicated loan market has become increasingly more integrated with securities underwriting and M&A advisory services. The key reason for the higher correlation is bank entry; in the early 1990s, most large commercial banks at the top of the syndicated loan market hierarchy were not very active in securities underwriting, but by the end of the 1990s several leading syndicated loan underwriters were heavily involved in investment banking.

The M&A and securities underwriting markets usually have low positive correlations. Generally, correlations among these markets have trended higher, especially after the mid-1990s, indicating that many underwriters have sought to achieve some synergies by operating in both markets. Stronger commercial bank presence is again a catalyst for the rising correlations. However, during this period a number of top-tier investment banks have also made an effort to increase their market shares in financial services.

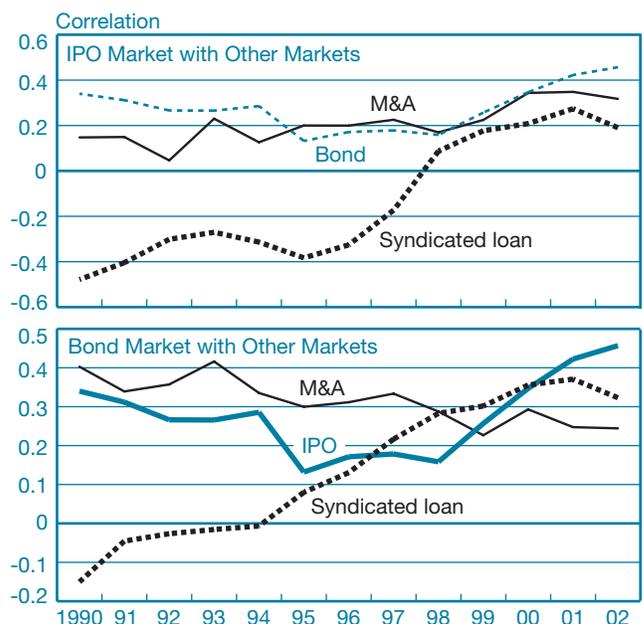
²⁰The failures of Drexel and Long-Term Capital Management (LTCM) illustrate the perils of cross-market interdependencies. While Drexel's failure roiled the high-yield-debt market, the broader impact was muted because Drexel was a very small player in other financial markets. In contrast, the collapse of LTCM created widespread concerns among market participants worried about liquidity across several closely integrated financial markets.

CHART 5
Correlation in Market Shares



Sources: Securities Data Corporation; Loan Pricing Corporation.
Note: M&A is merger and acquisition; IPO is initial public offering.

CHART 6
Correlation in Market Shares



Sources: Securities Data Corporation; Loan Pricing Corporation.
Note: M&A is merger and acquisition; IPO is initial public offering.

4.2 The Presence of Large Banks in Multiple Markets

We now consider a second and even more direct measure of market interdependency: the extent to which individual firms have high market shares in multiple markets. We find that the number of firms ranking in the top five (by market share) in multiple markets has not increased since the early 1990s, though the number of firms with multiple top-ten and top-twenty market shares has increased. Taken together, those findings reveal increased linkages across markets through the emergence of more “second-tier” providers, rather than through an increased commonality among “top-tier” providers.

Table 6 presents these findings for four markets: syndicated loan, investment-grade-bond underwriting, equity IPO, and M&A advisory services. Table 7 lists the top twenty firms by market share in each of these four markets in 2004.

The first measure in Table 6 is the number of distinct firms ranking in the top five (by market share) in just one market (top panel, column 1). The maximum possible for this number is twenty—in other words, twenty different firms occupying the top five rankings in the four separate markets. The mini-

TABLE 6
Banks Operating in Single and Multiple Markets

Year	In a Single Market	In All Four Markets	In Three or Four Markets	In Two, Three, or Four Markets
Among the Top Five Banks				
1990	9	0	3	4
1995	7	0	3	5
2000	7	0	3	5
2004	6	0	4	5
Among the Top Ten Banks				
1990	17	0	5	9
1995	19	1	4	8
2000	9	3	8	10
2004	8	2	8	11
Among the Top Twenty Banks				
1990	29	1	12	19
1995	36	1	11	16
2000	16	7	13	22
2004	22	8	12	19

Sources: Securities Data Corporation; Loan Pricing Corporation.

Note: The markets are syndicated loan, investment-grade-bond underwriting, equity initial public offering, and merger and acquisition advisory services.

mum possible, zero, indicates that the twenty available slots were occupied by firms all with at least two top-five ranking positions, indicating a high degree of (at least pair-wise) dependence across markets. We compute similar statistics for the top ten and top twenty firms (middle and bottom panels of Table 6).

This indicator, however, is silent about the *extent* of the linkages between these markets. Changes in the “single market” count could reflect more firms having high market shares in just two markets, in three markets, or across all four markets. This difference is important because the lower the number of firms that dominate these markets, the higher the degree of interdependency. To this end, we compute additional measures of multi-market interdependency. These indicators count how many firms occupy top-five rankings in at least *two*,

TABLE 7
Ranking of Top-Ten Firms in Bond Underwriting, Equity IPO, M&A, and Syndicated Loan Markets in 2004

Firm	Bond Underwriting	Equity IPO	M&A	Syndicated Loan
Citigroup	5 (20)	5	10	5 (5)
Lehman	5 (10)	10 (20)	10 (10)	20
J.P. Morgan	5 (20)	10	5 (10)	5 (5)
Morgan Stanley	5 (5)	5 (5)	5 (5)	20
Goldman Sachs	5 (5)	5 (5)	5 (5)	20
Bank of America	10	10	20 (20)	5 (5)
Merrill	10 (5)	5 (10)	5 (10)	20
HSBC	10			20 (10)
Barclays	10			5 (5)
Credit Suisse				
First Boston	10 (5)	10 (5)	5 (5)	20 (20)
Wachovia	20	20		10
Deutsche Bank	20	20	10	5 (10)
ABN AMRO Inc.	20			10
Union Bank of Switzerland	20	5	10	(5)
Paribas Corporation	20			10 (20)
Royal Bank of Scotland				10 (10)
Mizuho Financial Group				10 (20)
Friedman Billings Ramsey		10		
Lazard			10 (20)	

Sources: Securities Data Corporation; Loan Pricing Corporation.

Notes: The values 5, 10, and 20 indicate that a firm was ranked in the top five, top ten, and top twenty, respectively. Figures in parentheses are rankings in 1990; if there is no figure, the firm did not have a ranking in the top twenty that year. IPO is initial public offering; M&A is merger and acquisition.

at least *three*, or even *all four* markets (columns 2-4 of the table). We compute similar statistics for the top ten and top twenty banks, respectively. In contrast with our first measure of multi-market interdependency, an increase in these indicators suggests more interdependency.

As Table 6 shows, the number of independent firms ranked in the top five in the four markets remained constant during the 1990-2004 period. In contrast, there is a reduction in the number of “single market” firms among the top-ten (from seventeen in 1990 to eight in 2004) and, to a lesser extent, among the top-twenty rankings. The other measures offer similar interpretation. Among the top-five rankings, there were

[Our] results suggest that the markets for syndicated loans, bond underwritings, equity IPOs, and M&As became more interlinked between 1990 and 2004.

no significant changes in the number of firms with large market shares in more than one market over time. In contrast, among the top-ten and top-twenty rankings, there was a clear increase in the number of firms that have large market shares in more than one market. Significantly, the largest changes occurred in the number of firms with large market shares in all four markets (among the top twenty) and in the number of firms with large shares in three markets (among the top ten).

These results suggest that the markets for syndicated loans, bond underwritings, equity IPOs, and M&As became more interlinked between 1990 and 2004. This finding is important, because a problem experienced by one of the key players in these markets is now more likely to spread to a larger number of markets. However, given that the new interdependencies emerge among second-tier firms, the disruption arising from a problem in one of these firms is likely to be smaller than what would emerge had the new market linkages arisen among first-tier firms.²¹

5. PROMPT SUBSTITUTION MINIMIZES DISRUPTIONS

Our review of trends in financial market structure yields two main findings. First, while high and rising concentration is not universal, some markets are indeed highly concentrated or

²¹Moreover, the presence of more firms operating simultaneously in these markets may make it easier for one of them to step in and replace the one in trouble, thereby reducing the disruptions due to its exit.

increasingly so. Second, financial markets are becoming more interdependent, and the same set of large institutions is increasingly likely to occupy top rankings in several markets.

The stability implications of higher concentration in some markets and increasing interdependence are two-sided. If the firms that dominate a concentrated market or that are spreading across markets are more diversified, then the probability of a given firm’s failure should be lower accordingly. In such an event, however, disruptions may be more severe, because the exit of a dominant firm in a concentrated market leaves a bigger hole in that market *and* in any others where that firm was top-ranked.

Whether the failure of a leading financial provider will disrupt the entire market for a given product depends crucially on how quickly users can switch to other providers or products. If clients of the departed leader can readily switch to secondary providers at little extra cost, or if they can substitute a related service, the resulting disruption will be accordingly small. If switching is slow or costly, then disruptions will be more severe.

This section discusses financial product characteristics that tend to speed or slow substitution. We also compare financial markets by two simple indicators of potential substitution: the number of active providers and the turnover in providers’ relative rankings. Lastly, we array markets by those indicators and by the level of concentration. Markets with low turnover, indicating less potential for substitution among providers, *and* high concentration may be more susceptible to severe market upheaval in the event of failure by a leading firm than would those markets characterized by high concentration alone. Considering both characteristics together thus may provide more insight than examining concentration in isolation.

5.1 Ready (or Not) Substitution

What determines how readily and cheaply financial market users can switch between producers or products? For the *goods* market, the answer would be tastes. Does the consumer like this product or producer better than another? For financial markets, the speed and cost of substitution depend on a variety of factors.

Substitution will be slower, all else equal, the closer the relationship between the provider and user. Bank loans, especially to small firms, are relationship-intensive compared with the more arm’s-length dealing in syndicated loans (to large firms), bonds (especially investment-grade), and stocks. Banks have to learn about a small firm before they lend, and that information gets embodied in the relationship.²² The same is true with junk bonds; underwriters require detailed knowledge of issuers before they can sell their bonds—

knowledge that could not be instantaneously or credibly transferred to another underwriter (Benveniste, Singh, and Wilhelm 1993). The price of bonds underwritten by Drexel dropped sharply *before* the firm failed, indicating that Drexel's services could not have been replaced easily by other firms operating in the market or by alternative financial instruments

In a fast market, with many transactions occurring over a short period . . . it would be more difficult for other market players to substitute promptly than in a slow market.

(Brewer and Jackson 2000). Relationship-intensive products also tend to be highly tailored to clients, and customization slows substitution. Bank loans to small firms are bespoke products, with pricing, covenants, maturity, and other terms negotiated case by case. Syndicated loans to larger firms are more standardized, and bonds (especially high-grade) and stocks are even more so.

A second determinant of the speed or cost of substitution is the knowledge or technology required to produce or price a particular product. OTC derivatives can require considerable sophistication to value and substantial platforms to manage and market. For instance, a recent Federal Reserve study argues that the complexity of interest rate *options* may hinder substitutability in that market more than in the market for more commoditized OTC interest rate *swaps*, where the risks are linear and noncomplex in nature and the technology to manage them is widely dispersed.²³ Some products also require more intermediation between users and “raw material” suppliers. The knowledge, technology, and relationships needed to make loans, for example, or to underwrite stocks or bonds may be more widely held than those needed to generate a supply of interest rate volatility for an options dealer.

Lastly, the speed and cost of substitution may depend on the duration of the product in question and the “speed” of the particular market. All else being equal, substitution will be slower or costlier the longer the exposure implied by a transaction. For instance, a long-term credit or counterparty relationship implies a longer exposure than a one-off service such as underwriting. The speed of the market—the frequency

of transactions and the time required between initiating and consummating a transaction—also affects the speed of substitution. In a fast market, with many transactions occurring over a short period—payments, for example—it would be more difficult for other market players to substitute promptly than in a slow market.

5.2 Comparing Substitutability across Markets

How do the markets we examined rank in terms of potential for prompt substitution? It would be difficult to rank them directly by the various characteristics just discussed, as some products may not be very relationship-intensive yet still very technology-intensive. Instead of applying those characteristics directly, we rank the markets by two simple proxies that should reflect the overall potential for substitution: breadth and turnover. *Breadth* is just the number of firms actively competing in the market. A thicker, deeper market suggests easy entry and plenty of substitutes. A thin or shallow market hints at informational or technological barriers that limit entry and, by extension,

There are significant differences in breadth and turnover across markets.

substitution. *Turnover* is the average change over time in the market share ranking of firms in a given market.²⁴ High turnover means the leading firms are not entrenched and that users are in fact switching between providers. Low turnover suggests some friction—relationships or technological barriers—that limits substitution among providers.

There are significant differences in breadth and turnover across markets (Table 8). At one end, securities underwriting markets are very deep and have relatively high turnover. The numbers for market breadth may not fully capture the extent of likely substitution, however, since small or midsize underwriters may not be able to substitute for top-tier firms. That said, the fairly high level of the top-five ratios in underwriting and financial services markets (Table 1) suggests the presence of several interchangeable top-tier underwriters. The turnover figures also suggest considerable movement in the hierarchy

²²A study by Polonchek, Sushka, and Slovin (1993) finds that when a bank is on the verge of failure, the values of its borrowers rise and fall with the prospects of the bank, precisely because investors know that firms may not readily switch banks.

²³Board of Governors of the Federal Reserve System (2005).

²⁴Algebraically, turnover can be defined by $\sum_i \omega_i |\Delta r_i|$, where Δr_i represents the change in the ranking of the firm (i) in two consecutive years. The change is measured in absolute value, so any moves up and down will not cancel out. Also, turnover is weighted by ω_i (based on a firm's asset size), so a move from rank one to rank two counts substantially more than a move from rank fifty to rank fifty-one.

TABLE 8

Estimates of Substitutability for Financial Markets

Market	Breadth: Number of Participants	Turnover: Average Change in Rank
Securities underwriting (1990-2004)		
Initial public offerings	100	4.03
Seasoned offerings	60	3.64
Investment-grade bonds	40	1.95
High-yield bonds	30	2.54
Merger and acquisition advisory services (1990-2004)	100	5.89
Syndicated loan (1990-2004)	40	3.10
Derivatives (2000-04)		
Interest rate	40	2.21
Foreign exchange	40	1.57
Credit	40	1.63
Prime brokerage (2001-03)	35	0.69
Global custody (1994-2004)	20	0.87
Primary dealer (1995-2005)		
Treasury bills	21	3.67
Coupons	21	2.15
TIPS (1999-2005)	21	2.79
Corporate securities (2002-05)	21	1.35
Mortgage-backed	21	2.43
Federal agency	21	2.44
Mean turnover, all markets		2.50

Sources: Securities Data Corporation; Loan Pricing Corporation; Board of Governors of the Federal Reserve System, *Weekly Report of Dealer Transactions* (FR 2004B); Buttonwood International, *The Global Custody Yearbook*; Bank for International Settlements, *Triennial and Semiannual Surveys on Positions in Global Over-the-Counter Derivatives Markets* (2004); HedgeWorld.com; company annual reports.

Notes: Estimates of market breadth represent the approximate number of firms that are actively participating, and collectively account for most of the business in each market. The turnover measure is weighted by market share. Periods in parentheses indicate the sample over which estimates are derived. Estimates for derivatives markets are calculated from the U.S. Reporter Survey, company annual reports, and call reports. TIPS is Treasury Inflation-Protected Securities.

of underwriters over time, some of which can be attributed to bank entry, as noted above. The high turnover ratios in the M&A advisory services and syndicated loan markets also signify major changes in the hierarchy of top-tier underwriters. Overall, high breadth and turnover in these underwriting markets suggest the potential for reasonably fluid substitution.

Turnover in secondary-market securities trading by primary dealers is also relatively high. The exception is trading

in corporate securities, where the turnover figure is about half that for many of the other security types, perhaps reflecting less-than-full coverage of all market participants in these data. The breadth measures are perhaps somewhat less relevant for these markets, as primary dealer status is regulated by the Federal Reserve. As noted above, the primary dealer data may not cover the full range of participants in these activities for non-Treasury securities.

In contrast with underwriting, M&A advisory services, and trading, turnover in the derivatives markets is considerably lower. To calculate the breadth and turnover numbers for these markets, we combine detailed data on U.S. participants with data derived from annual reports for major non-U.S. dealers.²⁵

In contrast with underwriting, M&A advisory services, and trading, turnover in the derivatives markets is considerably lower.

The resulting figures combine activity across several derivatives products (swaps, options, and forwards) by the nature of the underlying instrument (FX, interest rate, and credit derivative). Although the markets are arguably distinct across some of these product types, we view the aggregate turnover figures as reasonably representative of the submarkets.

As intermediaries between sellers and buyers of options or swaps, top-tier derivatives dealers require ready and steady access to financial instruments (for example, callable debt or structured notes) or investors and clients (hedge funds) to facilitate these complex transactions. Top-tier derivatives dealers are required to commit significant investments and resources to building the infrastructure and maintaining these important trading relationships. Consequently, the exit of a large derivatives dealer would probably require a concerted effort by other top-tier dealers to fill the gap.²⁶

The turnover ratio in prime brokerage during the 2001-03 period is also significantly lower than it is for underwriting markets. This low estimate reflects the continued dominance of just a few firms. However, the recent boom in hedge funds has encouraged more aggressive entry in the industry, as evidenced

²⁵The global data from the BIS survey are available only in aggregate form, not on the firm-by-firm basis needed to calculate our turnover measure. While the BIS survey focuses on OTC products, it is not always possible to separate out OTC and exchange-traded derivatives from the annual reports. Thus, the reported turnover and concentration measures for interest rate and FX may include both OTC and exchange-traded products.

²⁶For a full discussion of tiering in the OTC U.S. dollar interest rate options market and a discussion of the structure of that market more generally, see Board of Governors of the Federal Reserve System (2005).

by the 5 percent decline in the market share of the two largest firms, mostly captured by commercial bank competitors.

The low turnover scores in derivatives and prime brokerage markets are not surprising, because they do not meet the prompt-substitutability criteria outlined earlier. These markets rely heavily on client relationships that are often built over a number of years. OTC derivatives products and prime brokerage services are continually evolving to meet the changing needs of the financial community and clients. Both markets require an extensive infrastructure to satisfy their sophisticated customers. As we discussed, OTC dealers have to commit significant resources to building and maintaining a trading infrastructure. Similarly, in prime brokerage hedge fund clients require integrated products and services that encompass trading in complex financial assets, financing (margin and securities lending), and customer support services.

5.3 The Concentration-Substitution Dimension

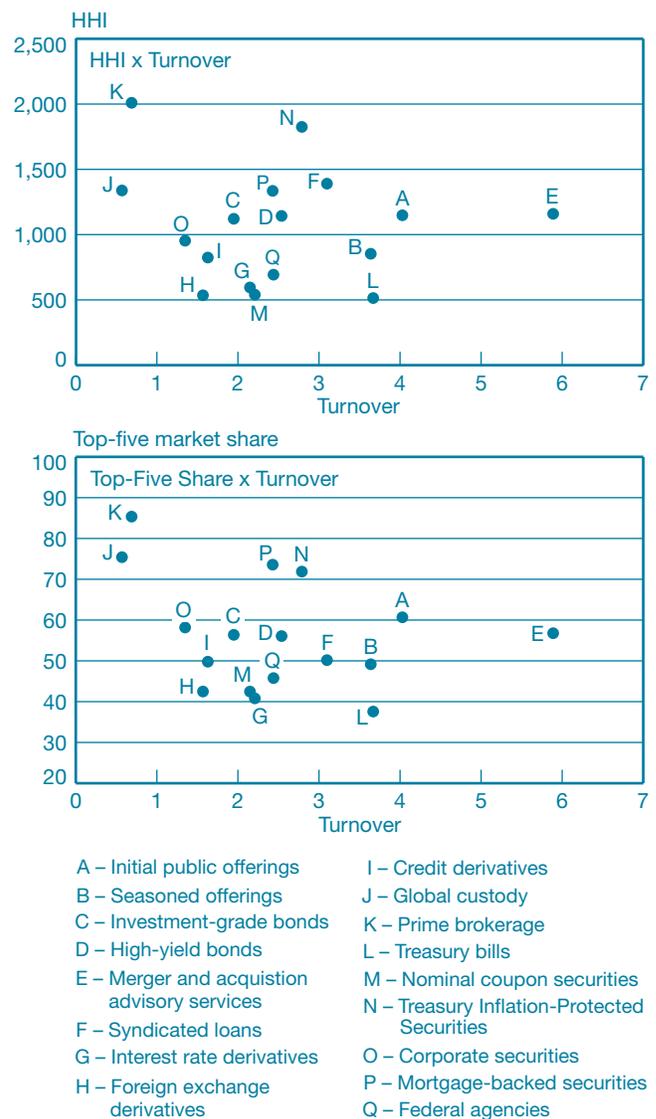
The potential for market instability depends not just on concentration, we have argued, but also on the potential for prompt substitution. To summarize these potential determinants of instability, we use a graphical approach to classify markets based on concentration and turnover. Although this approach lacks the specificity that detailed case studies of individual markets might offer, it has the advantage of being easy to calculate using available market share information for a wide number of markets. Thus, we argue, it is a useful first-cut indicator of the likely severity of market disruption that can be used to rank markets and prioritize resources for further investigation.

The resulting concentration-substitution comparison is given in Chart 7. The chart arrays the seventeen markets we have examined by our measure of market turnover (along the x-axis) and by two different measures of market concentration (along the y-axis). The first measure of concentration is the HHI, which summarizes the overall degree of concentration in each market. The second measure is the market share of the five largest firms in the market. Empirically, the two measures are correlated. However, the top-five market share measure may help us identify markets where the largest participants have very large market shares, even if the overall market appears not to be highly concentrated based on the HHI.²⁷

As it turns out, the results from the two different concentration measures are quite similar. The figures show no systematic relationship between concentration and turnover.²⁸

²⁷This could happen if one or two firms had large market shares but there were many other small competitors.

CHART 7
Market Concentration and Turnover



Sources: Securities Data Corporation; Loan Pricing Corporation; Board of Governors of the Federal Reserve System, Weekly Report of Dealer Transactions (FR 2004B); Buttonwood International, *The Global Custody Yearbook*; Bank for International Settlements, Triennial and Semiannual Surveys on Positions in Global Over-the-Counter Derivatives Markets (2004); HedgeWorld.com; company annual reports.

Notes: The chart plots the measure of market turnover by two different measures of market concentration for the seventeen markets examined in this article. HHI is the Herfindahl-Hirschman Index.

A possible objection to our analysis might be that a market with a naturally high level of turnover is also a market where the dynamics of entry and exit are such that one would never

²⁸The correlations between turnover and the top-five market share and HHI variables are negative but not statistically significant.

observe a high level of concentration (the substitutability indicates low barriers to entry and hence low incumbent advantage). That we do not observe any relationship indicates instead that the two market characteristics convey independent information on market stability.

Focusing on market-specific patterns, Chart 7 also indicates that relatively few markets appear to be in the potentially unstable neighborhood of high concentration and low

By focusing solely on market concentration, one misses important factors influencing market stability.

turnover (the upper-left-hand regions). Among the markets we examine, prime brokerage and global custody tend most strongly to fall into this region. While some other markets have relatively low turnover (for example, the FX, interest rate, and credit derivatives markets), they have low concentration, even when the markets are split into the more disaggregate sub-categories by product type. Two other markets with somewhat high concentration—the mortgage-backed-security (MBS) and TIPS primary dealer markets—also have relatively high turnover. It is not unusual initially to observe higher concentration in newly created markets such as the TIPS and MBS markets. As the markets have matured, concentration has come down with the entry of additional primary dealers.

As this simple example suggests, more detailed analysis is necessary to understand the true stability characteristics of particular markets. Such analysis could include examining trends in concentration, considering additional measures of concentration and market substitutability, and conducting descriptive case studies of individual markets.²⁹ In our view, the basic analysis in Chart 7 is not sufficient to draw strong conclusions about individual markets in the absence of more detailed study. Instead, our point in presenting the chart is that by focusing solely on market concentration, one misses important factors influencing market stability. In particular, understanding the extent to which prompt substitution can take place is a crucial second factor in assessing financial market stability.

²⁹See Board of Governors of the Federal Reserve System (2005) for an example of a detailed market study—in this case, that of the OTC markets for U.S. dollar interest rate options.

6. CONCLUSION

Our review of the literature shows that, theoretically, higher concentration may either increase or decrease the probability of a firm leaving the market as a result of distress. However, anecdotal evidence, and common sense, indicates that the market disruption generated by such an event would be more *severe* in concentrated markets. Hence, even if concentration were to reduce firms' incentives to take risk and thus the potential for distress, public oversight would still be justified.

We find that market concentration has *not* followed a universal upward trend: concentration has increased in some markets and fallen in others. Markets have become more interdependent, it seems, as the same small set of financial firms has become more dominant across multiple markets. We argue that the risk or severity of financial instability depends not just on concentration, but also on whether other firms can *promptly substitute* for an exiting firm. By examining the concentration-substitution dimension, we are able to identify potentially problematic areas where the exit of a large player might exacerbate financial instability.

What does our analysis say about the role of policymakers? If the severity of disruptions is limited by the availability of ready substitutes, what can or should policymakers do to enhance substitution? The answer depends on those factors that limit substitution in the first place. If close relationships are the limiting factor, *laissez-faire* may be optimal. Financial relationships are delicate, dynamic, and sometimes implicit contracts that are probably hard to improve from the top down. However, if the drag on substitution is customized products, policymakers might help in efforts to standardize. Standardization is a public good or externality, so public officials are right to lead efforts in that direction.³⁰ The recent initiative to remove the backlog of uncleared derivatives transactions and to hasten future clearing appears to be a good step. Policymakers may also have a say when the friction that limits substitution is some technological barrier; if privileged access to a key trading or pricing platform entrenches dominant providers and limits the choices of users, policymakers clearly have a legitimate interest to ensure both stability *and* competition.

³⁰All producers might gain from standardization, but no individual producer may have an incentive to lead and coordinate standardization initiatives.

We describe our investigation of the link between price stability and market concentration. The analysis focuses on investment-grade bonds and syndicated loans because pricing information is more transparent in these two markets. Information on corporate bond issuance was obtained from the Thomson Financial Securities Data Corporation database. The final sample of bond issues excludes convertible issues and offerings by financial companies. The Loan Pricing Corporation DealScan database provides extensive information on syndicated loans granted to large and midsize corporations.

The price of an investment-grade bond at issue is defined by its credit spread (yield to maturity minus a comparable-maturity Treasury yield). Similarly, for syndicated loans the price is measured by the credit spread over LIBOR. The relationship between price stability and concentration is derived from a two-step estimation procedure. Let y_{it} represent the bond (or loan) spread for firm (i) at time (t). In the first stage, the credit spread is regressed on a set of explanatory variables defined by the vector x_{it} . In particular,

$$(A1) \quad y_{it} = \alpha_i + \beta x_{it} + u_{it}.$$

The initial price of corporate bonds or syndicated loans is primarily determined by borrower and deal characteristics represented by x_{it} and macroeconomic conditions measured by the time-varying parameter α_i . In the case of bonds, x_{it} includes the Standard and Poor's (S&P) rating and firm size to capture the creditworthiness of the issuer. The bond price regression also controls for issue characteristics that are normally expected to affect the price of the security. In particular, we control for bond maturity, coupon rate, callability, sinking fund provisions, subordinate debt, and 144a issues.

In the case of loans, x_{it} includes both a set of firm-specific variables and loan-specific variables. Included in the former set are proxies for the overall risk of the firm, such as its age and sales; proxies for the risk of the firm's debt, such as the firm's profit margin, its interest coverage, leverage, and earnings volatility; and proxies for the losses the firm's debt holders can incur in the event of default, such as the firm's tangible assets and the firm's net working capital (current assets less current liabilities) divided by total debt. The regression controls for the firm's growth opportunities and its

sector of activity. We also control for loan-specific variables, including controls for the purpose of the loan and for the type of loan contract; controls to distinguish, among other things, loans that are senior, those that are secured, and those that have a guarantor; and information on the maturity of the loan, its size, and variables to control for the size of the loan syndicate.

The first-stage regression residual measure \hat{u}_{it} represents the portion of the credit spread not explained by fundamentals. This component includes all the idiosyncratic shocks that may affect the issue markets. In the second stage of the estimation, we use the squared residuals \hat{u}_{it}^2 to construct a measure of price instability. This quality-adjusted volatility measure is next regressed on the annual Herfindahl-Hirschman Index (HHI) of market concentration,

$$(A2) \quad \hat{u}_{it}^2 = \gamma_0 + \gamma_1 HHI_t + \gamma_2 HHI_t^2 + \varepsilon_{it}.$$

Essentially, equation A2 asserts an additive form of heteroskedasticity on the error structure of the price equation A1. To obtain asymptotically efficient estimators, we use an iterative procedure described in Kmenta (1986).

The results of the first-stage estimation are not reported in this article. As expected, in the case of bonds the S&P rating is the most significant variable impacting bond spreads. A one-notch increase in the S&P rating (for example, from BBB to BBB+) lowers the spread on investment-grade bonds by roughly 12 basis points. Callability and bond maturity are also important factors increasing the costs to bond issuers.

The coefficients for the control variables in our model on loan spreads are generally consistent with what we would expect. Older and larger firms, as well as firms with more tangible assets, pay significantly lower spreads. The market-to-book ratio comes in strongly negative. Our proxies for default risk have their expected signs, and all but profit margin is strongly significant. The statistical insignificance of profit margin is likely due to the inclusion of interest coverage in our model. Our loan-specific controls are also generally consistent with our expectations. In contrast to the purpose of the loan, which appears to play only a limited role in the loan interest rate, the type of loan contract is important in this regard. Credit lines, for example, carry lower interest rates than do term loans and bridge loans. The other loan controls show that

larger loans and loans extended by larger syndicates have lower spreads. Loan features that increase loan safety (dividend restrictions, secured interests, guarantors, and sponsors) generally have positive effects on spreads. This finding is consistent with the well-established result that banks tend to require these features for riskier credits. Finally, longer term loans have lower spreads, but the effect is not statistically significant.

Regarding the second stage of our method, we find that the estimates for the parameter vector $(\gamma_0, \gamma_1, \gamma_2)$ of the additive specification are significant for both investment-grade bonds and syndicated loans. Chart 1 illustrates more clearly the nonlinear volatility-concentration relationships for investment-grade bonds and syndicated loans estimated from the second-stage equation A2.

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THE EMERGENCE OF “REGULAR AND PREDICTABLE” AS A TREASURY DEBT MANAGEMENT STRATEGY

- In 1975, the U.S. Treasury had to finance a rapidly growing federal deficit with sales of new notes and bonds on an offering-by-offering basis.
- Because the timing and maturities of these “tactical” offerings did not follow a predictable pattern, the issuances sometimes caught investors off guard and disrupted the market.
- Treasury officials, recognizing the need for more regularized offerings, revised the framework within which they selected the maturities of new notes and bonds.
- By 1982, the Treasury had abandoned tactical issuance and was following a “regular and predictable” schedule of new note and bond offerings.
- The move to regular and predictable issuance was widely credited with reducing market uncertainty, facilitating investor planning, and lowering the Treasury’s borrowing costs.

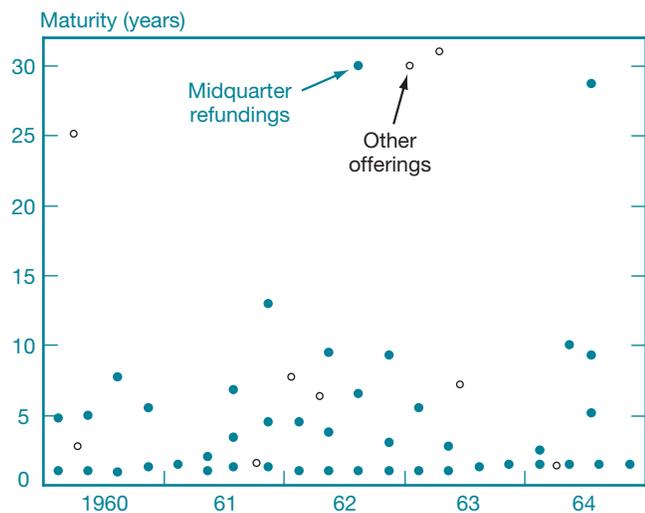
1. INTRODUCTION

Treasury debt management is the set of actions taken by U.S. Treasury officials in the course of financing the federal deficit and refinancing maturing debt. An important dimension of debt management is the decision of which maturity debt to sell. On the one hand, short-term financing can complicate budget planning because it raises the variability of near-term interest expenses; on the other, longer term borrowings have a higher expected cost because of term premia on intermediate- and long-term interest rates.

During the 1970s, Treasury officials revised the framework within which they selected the maturities of new notes and bonds. Previously, they chose maturities on an offering-by-offering basis, typically after surveying market participants to identify investor demand for different maturities. By 1982, the Treasury had abandoned this type of “tactical” debt management and was selling notes and bonds on a “regular and predictable” schedule, with monthly offerings of two-year notes and quarterly sales of longer term securities.

The switch from tactical to regular and predictable debt management is illustrated in Charts 1 and 2. Between 1960 and 1964, the Treasury made regular quarterly offerings, for cash or in exchange for maturing debt, of coupon-bearing securities in February, May, August, and November of each year (Chart 1).

CHART 1
Maturities of Offerings of Coupon-Bearing Securities,
January 1960-December 1964



Source: Federal Reserve Bank of New York circulars (1960-64).

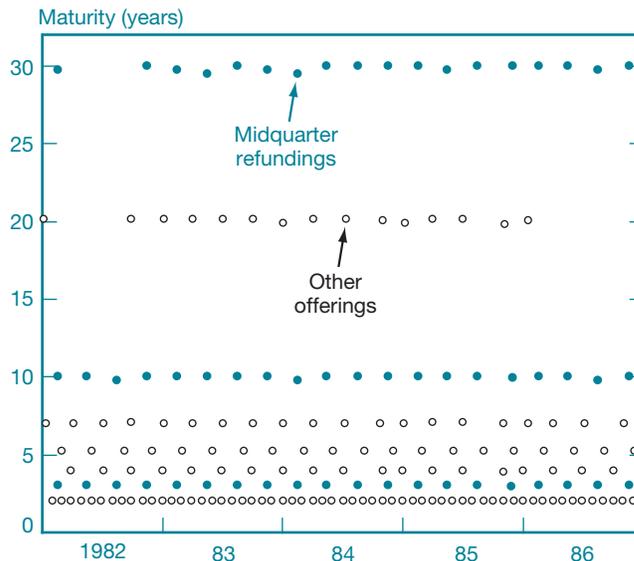
The number and maturities of these tactical “midquarter refundings,” though, varied from quarter to quarter. The only persistent feature was the appearance of an “anchor” issue maturing in one to one and a half years. As Chart 1 shows, the Treasury also sold coupon-bearing securities outside of midquarter refundings on nine occasions between 1960 and 1964. However, neither the timing of the nine issues nor their maturities followed any readily apparent pattern.

By comparison, the regularity of the Treasury’s offerings between 1982 and 1986 is striking (Chart 2). The Treasury continued to sell coupon-bearing securities in the middle of each quarter, but offered the same maturities in every refunding: a three-year note, a ten-year note, and, with two exceptions, a thirty-year bond.¹ Additionally, it sold two-year notes monthly; four-, five-, and seven-year notes quarterly; and, with two exceptions, twenty-year bonds quarterly until terminating the twenty-year series in the spring of 1986. The Treasury sold two-, three-, and ten-year notes and thirty-year bonds in amounts that did not vary substantially from offering to offering (Charts 3 and 4). Other series exhibited a similar pattern of substantially comparable amounts sold from offering to offering.

This article examines why, during the 1970s, Treasury officials changed the framework within which they made their

¹Following the February 1982 midquarter refunding, the Treasury exhausted its authority to issue bonds with coupon rates in excess of a statutory ceiling of 4¼ percent. It was limited to issuing bills and notes until Congress increased the exemption following the August 1982 refunding.

CHART 2
Maturities of Offerings of Coupon-Bearing Securities,
January 1982-December 1986



Source: U.S. Department of the Treasury, Bureau of the Public Debt.

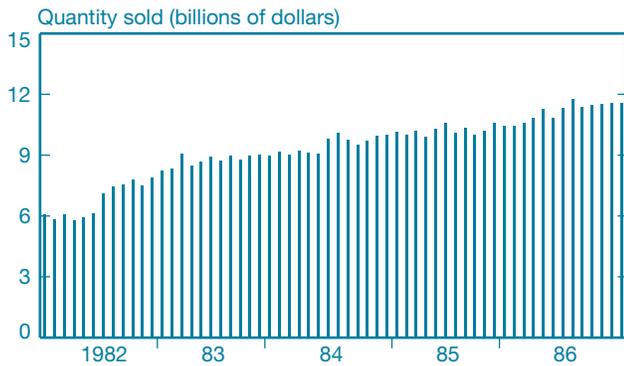
debt management decisions. We show that the Treasury financed an unusually rapid expansion of the deficit in 1975 with a flurry of tactical offerings. The offerings disrupted the market and provided the impetus to adopt a program of regular and predictable issuance that allowed investors to plan future commitments of funds with greater confidence.

The emergence of regular and predictable as a Treasury debt management strategy is important for three reasons. First, this type of issuance is one of the pillars of the modern Treasury securities market. In 1982, Mark Stalneck, Treasury Deputy Assistant Secretary for Federal Finance, expressed the view that “regularity of debt management removes a major source of market uncertainty, and assures that Treasury debt can be sold at the lowest possible interest rate consistent with market conditions at the time of sale.”² More recently, Gary Gensler, Treasury Assistant Secretary for Financial Markets, observed that “consistency and predictability in [the Treasury’s] financing program ... reduces uncertainty in the market and helps minimize our overall cost of borrowing.”³ Second, the circumstances that led to regular and predictable issuance illustrate the costs of tactical issuance, and the benefits of

²Committee on Banking, Finance, and Urban Affairs (1982, p. 5).

³Testimony before the House Committee on Ways and Means, June 24, 1998 (available at <<http://www.treas.gov/press/releases/rr2555.htm>>). Gensler went on to note that “in keeping with this principle, Treasury does not seek to time markets; that is, we do not act opportunistically to issue debt when market conditions appear favorable.”

CHART 3
Monthly Sales of Two-Year Notes,
January 1982-December 1986



Source: U.S. Department of the Treasury, Bureau of the Public Debt.

predictability, in an environment of large deficits. Finally, the emergence of regular and predictable issuance shows how a change in the economic environment can induce policymakers to alter the practices of the institutions they manage.

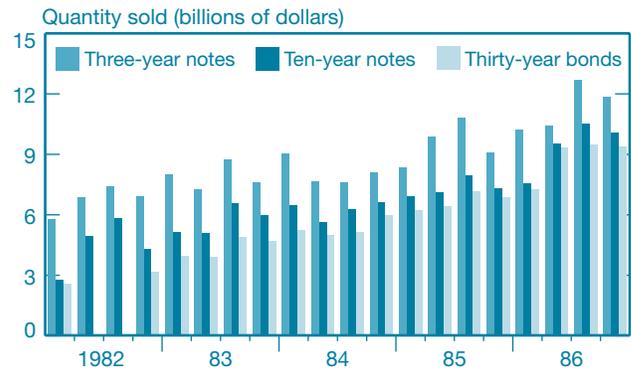
The first half of the 1970s also witnessed the successful introduction of auction sales of notes and bonds. There is an important connection between this development and the emergence of regular and predictable issuance: Treasury bills

The Treasury did try to institutionalize auction sales of Treasury bonds in 1935 and again in 1963, but failed in both attempts.

provided a template for both actions. This raises the question of why, since the Treasury had been auctioning bills on a regular and predictable basis for decades, it did not introduce regular auction sales of notes and bonds at an earlier date.⁴ In fact, the Treasury did try to institutionalize auction sales of Treasury bonds in 1935 and again in 1963, but failed in both attempts.⁵ The earlier attempts suggest that officials appreciated the advantages of auction sales of notes and bonds long before they were able to institutionalize such sales. Conversely, the absence of any attempt to introduce regular and predictable

⁴The Treasury first issued bills in 1929; it began auctioning bills on a regular and predictable basis in the early 1930s. Some of the same observers who advocated auction sales of notes and bonds in the late 1950s and early 1960s also advocated regular and predictable sales of those securities. See Joint Economic Committee (1959, p. 3024, testimony of Milton Friedman), Friedman (1960, pp. 60-5), and Gaines (1962, ch. 8).

CHART 4
Sales of Three-Year Notes, Ten-Year Notes,
and Thirty-Year Bonds in Midquarter Refundings,
January 1982-December 1986



Source: U.S. Department of the Treasury, Bureau of the Public Debt.

sales of notes and bonds before 1972 suggests that, prior to that time, tactical flexibility may have been perceived as more beneficial.

Our study proceeds as follows. Section 2 presents an overview of the goals and instruments of Treasury debt management and the choice between tactical and regular and predictable issuance. In Section 3, we explain how the Treasury conducted financing operations in the 1960s. The Treasury's initial steps toward "regularizing" short-term notes in 1972 are examined in Section 4. We explain in Section 5 how rapid growth of the deficit in 1975 led the Treasury to begin embracing regular and predictable issuance more completely. Section 6 presents empirical evidence consistent with the hypothesis that regular and predictable issuance mitigated a cost of tactical issuance. Finally, we briefly describe in Section 7 the subsequent development of debt management policy within the framework of regular and predictable issuance.

2. GOALS AND INSTRUMENTS OF DEBT MANAGEMENT

Debt management has goals, or objectives, and it has decision variables that managers have to choose to advance toward their stated goals.

⁵Garbade (2004) suggests that the Treasury failed in its earlier attempts primarily because it began by auctioning long-term bonds. The Treasury was more successful when, in the early 1970s, it began by auctioning short-term notes and then gradually extended the maturities of its offerings. The gradual extension gave dealers an opportunity to build up their risk management and sales programs in an orderly fashion.

Financing at least cost over time is the most frequently and consistently cited goal of Treasury debt management. Andrew Mellon, Secretary of the Treasury from March 1921 to February 1932, was said to manage the public debt “by providing various types of securities suited to the needs of various classes of lenders, thereby obtaining funds for needed periods at minimum cost.”⁶ Robert Roosa, Treasury Under Secretary for Monetary Affairs from January 1961 to December

Financing at least cost over time is the most frequently and consistently cited goal of Treasury debt management.

1964, observed that Treasury debt “must be placed at an interest cost that will stand up to the critical test of both the Congress and the public who do not want to have any more money devoted to the debt service . . . than is necessary.”⁷

The Treasury has sometimes announced debt management goals in addition to least-cost financing. During the 1960s, Treasury officials sometimes made debt management decisions to maintain upward pressure on short-term interest rates (to support the value of the dollar in foreign exchange markets) and/or to limit upward pressure on long-term interest rates (to promote economic growth).⁸ In the 1990s, officials focused on three debt management goals, including ensuring the availability of adequate cash balances and promoting efficient capital markets as well as financing at least cost.⁹

More recently, however, Peter Fisher, Under Secretary of the Treasury from August 2001 to October 2003, observed that ensuring the availability of adequate cash balances is a constraint on, rather than a goal of, debt management and that the single objective of financing at least cost best describes the basis for Treasury debt management decisions.¹⁰

⁶Simmons (1947, p. 334).

⁷Roosa (1963).

⁸The resulting decisions to sell short-term debt in lieu of long-term debt were typically made in the context of some version of the “segmented markets” theory of the term structure of interest rates, which implies that debt securities of different maturities are imperfect substitutes and that exogenous variation in the maturity composition of the debt can affect the shape of the yield curve. See Culbertson (1957). See also the “preferred habitat” theory proposed by Modigliani and Sutch (1966, 1967) and the analysis in Modigliani and Sutch (1966) of the attempt by Treasury and Federal Reserve officials to alter the shape of the yield curve by raising short-term rates and reducing, or at least maintaining, long-term rates in what became known as “Operation Twist.”

⁹Testimony of Gary Gensler, Treasury Assistant Secretary for Financial Markets, before the House Committee on Ways and Means, June 24, 1998 (available at <<http://www.treas.gov/press/releases/tr2555.htm>>), and testimony of Lewis Sachs, Treasury Assistant Secretary for Financial Markets, before the House Committee on Ways and Means, September 28, 1999 (available at <<http://www.treas.gov/press/releases/ls128.htm>>).

The primary decision variables of Treasury debt management are the quantities of debt to be sold at different maturities. Other important decision variables include the type of offering, that is, a fixed-price subscription offering or an auction offering in either a single-price or multiple-price format, and whether the Treasury is obligated to repay fixed nominal amounts or amounts indexed to current prices (as has been the case with inflation-protected securities issued since 1997).

This article examines the emergence of a self-imposed constraint on the Treasury’s method of choosing the timing and maturities of new issues. As illustrated in Section 7, the constraint limits the frequency with which the timing and maturities of new offerings are changed. Treasury officials adopted the constraint to advance the always important (and, more recently, unique) goal of financing at least cost. As we show in the next section, prior to 1970, tactical issuance preserved a high level of managerial discretion that allowed debt managers to shift the focus of their decision-making

The primary decision variables of Treasury debt management are the quantities of debt to be sold at different maturities.

literally from offering to offering. It also allowed debt managers substantial flexibility as to when they would raise new money with sales of coupon-bearing debt. However, tactical issuance had a downside: investors could not readily anticipate what maturity debt the Treasury would choose to sell and they could not easily anticipate when the Treasury would sell notes and bonds outside of the midquarter refundings. The downside became excessively costly when Treasury officials had to finance unprecedented peacetime deficits after 1974. In order to facilitate investor planning and thereby reduce Treasury borrowing costs, the officials began to adopt a more regular and predictable issuance schedule.

3. DEBT MANAGEMENT IN THE 1960S

In mid-1960, the marketable public debt of the United States was \$184 billion, including \$33 billion in bills, \$18 billion in certificates of indebtedness, and \$133 billion in notes and

¹⁰Remarks of Under Secretary of the Treasury Peter Fisher to the Futures Industry Association, March 14, 2002 (available at <<http://www.treas.gov/press/releases/po1098.htm>>). See also remarks of Assistant Secretary of the Treasury Brian Roseboro to the UBS Eighth Annual Reserve Management Seminar for Sovereign Institutions, June 3, 2002 (available at <<http://www.treas.gov/press/releases/po1349.htm>>).

bonds. Bills were single-payment instruments maturing in a year or less; the other three instruments made semi-annual coupon payments. A certificate of indebtedness matured in no more than a year from its date of issue; notes matured in no more than five years. A bond could have any term but could not be issued with a coupon rate in excess of 4¼ percent.¹¹

There were four distinct types of Treasury financings at the beginning of the 1960s: bill financings, midquarter refundings, stand-alone offerings, and advance refundings. All but the last were mechanisms for borrowing money to finance the federal deficit and to refinance maturing debt.¹²

3.1 Bill Financings

The Treasury used bills to bridge the gap between cash management and debt management and to finance a portion of the debt at low short-term interest rates. Thirteen-week bills had been auctioned on a regular weekly basis since 1937. In late 1958, the Treasury began a parallel program of regular weekly auctions of twenty-six-week bills “to place on a routine basis, so far as practicable, the roll-over of ... debt maturing within one year.”¹³ The sizes of the thirteen- and twenty-six-week-bill auctions varied from time to time, but investors knew the auctions would be held and they knew the amounts offered would be comparable to what was maturing—perhaps a bit less if the government was flush with cash or a bit more if cash balances were low. In early 1959, the Treasury further expanded its bill offerings by introducing regular quarterly sales of one-year bills, to be issued on or about the fifteenth of the first month of a quarter and to mature a year later.¹⁴

¹¹The 4¼ percent ceiling on Treasury bond rates was established by the Third Liberty Bond Act (April 4, 1918). A brief history of the rate ceiling appears in Committee on Ways and Means (1967, pp. 25-8).

¹²An advance refunding was an offer to exchange a new security for an equal principal amount of an existing, shorter term security that was *not* close to maturity. For example, an advance refunding in October 1960 gave investors an opportunity to exchange a bond maturing in nine years for an equal principal amount of a bond maturing in thirty-eight years. Treasury officials introduced advance refundings in 1960 when they became concerned that a growing concentration of Treasury indebtedness in short-term securities might be contributing to inflation (U.S. Treasury Department 1960, p. 4; Beard 1966, p. 7). See also Committee on Finance (1962) and Bryan (1972). Advance refundings did not play any substantial role in the emergence of regular and predictable issuance.

¹³Federal Reserve Bank of New York Circular no. 4663, November 18, 1958.

¹⁴The Treasury also used irregular offerings of “tax anticipation bills” to smooth seasonal variations in tax receipts. Tax anticipation bills were first introduced in 1951 (Nelson 1977).

3.2 Midquarter Refundings

By 1960, maturing coupon-bearing debt was refinanced exclusively in midquarter refundings. Offerings were sometimes in exchange for maturing debt and sometimes for cash. New issues were always set to mature on the fifteenth of the second month of a quarter so they could be refinanced in subsequent refundings.

An *exchange offer* was an offer to exchange a new issue for an equal principal amount of a maturing issue and was available only to holders of the maturing debt. An investor who was not

Midquarter refundings followed a regular routine. Toward the middle of the first month of each quarter, Treasury officials solicited the advice of market participants on what maturities were currently in demand and then held a press conference to announce what would be offered.

interested in exchanging a maturing issue could either sell the debt to another investor who wanted to acquire the new issue or present the debt for redemption. The fraction of a maturing issue presented for redemption was known as “attrition.”

A *cash offering* was made at a fixed price and was open to all investors. Subscriptions were filled on a pro-rata basis. Cash refundings allowed the Treasury to raise modest amounts of new cash by offering somewhat more than what was needed to redeem maturing debt.

Midquarter refundings followed a regular routine. Toward the middle of the first month of each quarter, Treasury officials solicited the advice of market participants on what maturities were currently in demand and then held a press conference to announce what would be offered.¹⁵ Subscription books opened within a week of the announcement and remained open for several days, after which the Treasury announced the results and began to fill subscriptions. The entire process was completed by the middle of the second month of the quarter. Box 1 describes the origin of midquarter refundings.

¹⁵Although the Treasury kept in regular contact with a variety of market participants (Committee on Government Operations 1956, p. 113), it particularly solicited the views of several advisory committees when it contemplated a major operation. Committee members reflected their “impressions of what the market demand and supply is” (p. 50) and what they thought “could best be sold” (p. 63).

The Origin of Midquarter Refundings

The Treasury introduced midquarter refundings during the 1950s to ease constraints on the conduct of monetary policy. Both cash subscription offerings and exchange offerings were made on fixed terms: an investor could only accept or reject the terms proposed by the Treasury. A decision by Federal Reserve officials to tighten monetary policy during the five to seven days between the announcement of a new offering and the close of the subscription books therefore was liable to jeopardize the success of the offering.

Following the Treasury-Federal Reserve Accord of March 1951 and the restoration of Federal Reserve control of monetary policy, Federal Reserve officials adopted a policy of maintaining a fixed monetary policy during Treasury offerings.^a Concentrating the Treasury's longer term financings in four quarterly windows minimized the amount of time that the Treasury was in the market and thus maximized the amount of time during which monetary policy could be changed. Quarterly refundings also reduced direct competition with other issuers by providing constructive notice about when the Treasury would be in the market. By late 1958, 80 percent of coupon-bearing Treasury debt was scheduled to mature on the fifteenth of February, May, August, or November of some future year.^b

^aThis policy was sometimes known as "even keeling." See Gaines (1962, pp. 241-3, 264), Struble and Axilrod (1973), and Committee on Banking, Finance, and Urban Affairs (1982, pp. 32-3, testimony of Stephen Axilrod, Staff Director for Monetary and Financial Policy, Board of Governors of the Federal Reserve System).

^bFederal Reserve Bank of New York Circular no. 4663, November 18, 1958. ("For some time, the Treasury has been working towards scheduling its maturities on these quarterly dates to reduce the number of times each year its financing will interfere with other borrowers such as corporations, states, municipalities, etc.; to minimize the 'churning' in the money markets on the major quarterly corporate income tax dates; and to facilitate the effective execution by the Federal Reserve of its monetary policy.")

3.3 Stand-Alone Cash Subscription Offerings

A stand-alone offering was an offering of a coupon-bearing security on a cash subscription basis outside of a midquarter refunding. The Treasury made stand-alone offerings when it needed funds to finance a deficit or to rebuild its cash balance following heavy attrition on a midquarter exchange offering. New issues sold in stand-alone offerings, like new issues sold in midquarter refundings, were set to mature on the fifteenth of the second month of a quarter to facilitate refinancing.

3.4 Debt Management Decisions

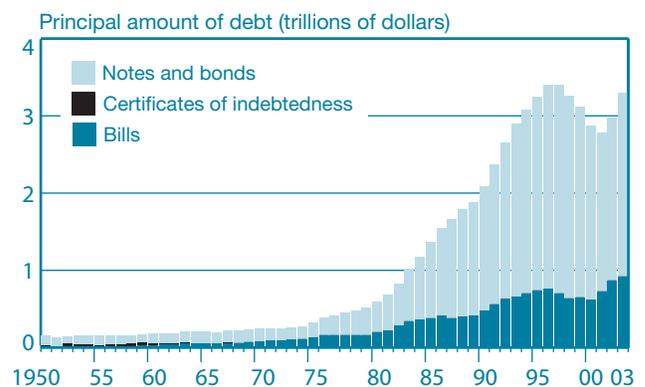
The variation in marketable Treasury debt in the 1960s is illustrated in Chart 5. Indebtedness did not decline, so midquarter refundings remained important. However, indebtedness did not grow rapidly, so stand-alone cash subscription offerings remained relatively unimportant. Marketable debt increased from \$184 billion in 1960 to \$226 billion in 1969, or less than \$5 billion per year. The Treasury financed \$17 billion of the \$42 billion increase with bills and with certificates of indebtedness and \$25 billion with notes and bonds.

As we observed, there was considerable irregularity in terms of the maturities offered in midquarter refundings in the first half of the 1960s. Table 1 summarizes the justifications provided by Treasury officials for their maturity choices. Two features are significant:

- As we discussed in Section 2, officials sometimes chose to issue short-term securities to maintain upward pressure on short-term interest rates (to support the value of the dollar) and to moderate upward pressure on long-term rates (to promote economic growth). At other times, officials emphasized the importance of maintaining or extending the average maturity of the debt. Box 2 discusses the importance that Treasury officials attached to maturity extension.
- Maturity decisions were sometimes based on the character of contemporaneous demand. For example, investor preferences were important in the decision to offer 28¼-year bonds in July 1964, when Under Secretary Roosa stated that the bond market was "strong," "eager," and "indicating an actual need" for long-term bonds.¹⁶

CHART 5

Marketable Treasury Debt, 1950-2003



Source: *Treasury Bulletin* (various issues).

Note: The chart depicts outstanding marketable debt at the end of each fiscal year—on June 30 until and including June 30, 1976, and on September 30 thereafter.

TABLE 1
Midquarter Refundings, 1960-64

Offering	Years to Maturity			Amount Offered (Billions of Dollars) ^a	Comment
	Anchor Issue	Intermediate Issues	Long-Term Bond		
Feb. 1960	1	4¾	—	11.36e	
May 1960	1	5	—	6.41e	
Aug. 1960	1	7¾	—	8.75c	
Nov. 1960	1¼	5½	—	10.84e	The Treasury reduced the term of the intermediate-term issue from seven years to five and a half years to make the offering “a little more attractive.”
Feb. 1961	1½	—	—	6.90c	The refunding offered only a single short-term note to maintain upward pressure on short-term interest rates and to limit upward pressure on long-term rates.
May 1961	1	2	—	7.75c	The refunding offered two short-term issues to maintain upward pressure on short-term rates.
Jul. 1961 ^b	1¼	3, 6¾	—	12.20e	Surveys indicated investor interest in securities out to seven years, but no interest in any longer maturities.
Nov. 1961	1¼	4½, 13	—	6.96e	
Feb. 1962	1	4½	—	11.18e	A four-and-a-half-year issue was offered because surveys indicated bank interest in higher yielding (even if longer term) securities.
May 1962	1	3¾, 9½	—	11.68e	A nine-and-a-half-year issue was offered because of continuing bank demand for higher yielding securities.
Aug. 1962	1	6½	30	8.75c	The thirty-year bond was a surprise. The Treasury cited the need for “balanced financing” (referring to a need to avoid contraction of average maturity).
Nov. 1962	1	3, 9¾	—	10.98e	A “plain vanilla” financing in the midst of the Cuban Missile Crisis.
Feb. 1963	1	5½	—	9.47e	
May 1963	1	2¾	—	9.49e	The refunding offered two short-term issues to maintain upward pressure on short-term rates.
Aug. 1963	1¼	—	—	6.64e	The refunding offered a single short-term note to maintain, and possibly even lift, short-term interest rates.
Nov. 1963	1½	—	—	7.60c	The refunding offered a single short-term note to maintain upward pressure on short-term rates.
Feb. 1964	1½	2½	—	8.38e	The maturities were selected to fill relatively open dates.
May 1964	1½	10	—	10.61e	Market participants expected a five-year note. The Treasury offered a ten-year bond to avoid “over-loading” the front end.
Jul. and Aug. 1964 ^c	1½	5¼, 9¼	28¼	10.13e, c	Treasury surveys indicated a “strong” market, investors “eager” to acquire long-term bonds.
Nov. 1964	1½	—	—	9.25c	The refunding offered a single short-term note to maintain upward pressure on short-term rates.

Sources: Federal Reserve Bank of New York circulars (1960-64); *New York Times* (1960-64); *Wall Street Journal* (1960-64).

^aAmounts are total amount offered in a cash subscription offering (denoted “c”) or total amount of maturing securities eligible for exchange in an exchange offering (denoted “e”).

^bThis refunding was accelerated because the security being refunded was a note that matured on August 1, 1961.

^cThe exchange portion of this refunding was accelerated to July to take advantage of favorable market conditions. See “Treasury Offers Giant Refunding,” *New York Times*, July 9, 1964, p. 43, and “Treasury Offers Advance Refund of \$41.7 Billion,” *Wall Street Journal*, July 9, 1964, p. 3. Attrition was financed with a cash subscription offering in August 1964.

Taken as a whole, midquarter refundings between 1960 and 1964 evidenced a debt management process in which officials made maturity decisions on an offering-by-offering basis.

¹⁶“Treasury Offers Giant Refunding,” *New York Times*, July 9, 1964, p. 43, and “Treasury Offers Advance Refund of \$41.7 Billion,” *Wall Street Journal*, July 9, 1964, p. 3.

Midquarter refundings in the second half of the 1960s exhibited greater regularity than those in the preceding five years (Chart 6). However, the greater regularity was largely a by-product of the statutory prohibition on issuing bonds with coupon rates in excess of 4¼ percent. The rate ceiling kept the Treasury out of the bond market after May 1965. In the

TABLE 2

Stand-Alone Cash Subscription Offerings, January 1960-December 1969

Offering	Years to Maturity	Amount Offered (Billions of Dollars)	Comment
Apr. 1960	2.1	2.00	
Apr. 1960	25.1	1.50	The Treasury was “testing” public demand for long-term bonds.
Oct. 1961	1.6	2.00	
Jan. 1962	7.7	1.00	The maturity of the offering came as a surprise to the market. Dealers had expected an offering with a maturity of two to three years but the Treasury, feeling no immediate need to put upward pressure on short-term rates, took advantage of an opportunity to lengthen the average maturity of the debt.
Apr. 1962	6.3	1.00	The offering came earlier than expected (it had been expected for late May or early June) because individual income tax refunds ran ahead of expectations. The Treasury again felt no immediate need to put upward pressure on short-term rates and again took advantage of the opportunity to lengthen average maturity.
Jun. 1963	7.2	1.25	The Treasury felt the market was “clearly ready” to accept an intermediate-term issue.
Mar. 1964	1.3	1.00	The Treasury chose a short-term issue to do the financing “in an inconspicuous way” because the market was “trying to find itself.”
Jan. 1966	0.8	1.50	The maturity was kept short to make the offering more appealing to banks.
Aug. 1967	3.5	2.50	Dealers had expected a longer (five-to-seven-year) issue. They conjectured that the Treasury was reluctant to issue longer because that would have required a higher coupon rate and provoked more disintermediation from thrift institutions.

Sources: Federal Reserve Bank of New York circulars (1960-67); *New York Times* (1960-67); *Wall Street Journal* (1960-67).

4. DEBT MANAGEMENT BETWEEN 1970 AND 1974

The first half of the 1970s was a time of transition for Treasury debt management. The changes that occurred reflected concern with the continuing decline in the average maturity of Treasury debt and the need to provide some measure of predictability in note offerings outside of midquarter refundings.

4.1 The Renewal of Bond Issuance and a Growing Regularity in Midquarter Refundings

In 1971, Treasury officials became concerned with the continuing decline in the average maturity of Treasury debt (Box 2 chart) and petitioned Congress to eliminate the 4¼ percent ceiling on bond rates. Congress declined to remove the ceiling but did authorize the Treasury to issue up to \$10 billion of bonds at interest rates in excess of 4¼ percent.¹⁸

¹⁸Committee on Ways and Means (1971, pp. 3, 5-7) and U.S. Treasury Department (1971, p. 10). Congress increased the amount of bonds that could be issued at interest rates in excess of 4¼ percent from time to time after 1971 and eliminated the rate ceiling altogether in November 1988.

In the August 1971 midquarter refunding, Treasury officials used their new bond issuance authority to give holders of maturing securities an opportunity to exchange the securities for ten-year bonds. The Treasury offered a bond in virtually every subsequent refunding (Chart 7).¹⁹ It first offered a long-term bond in a refunding in May 1973, and it continued to offer a long-term bond in every subsequent refunding. By mid-1974, the Treasury was offering a short-term anchor note, an intermediate-term note of six or seven years, and a long-term bond on a fairly regular basis in its midquarter refundings.

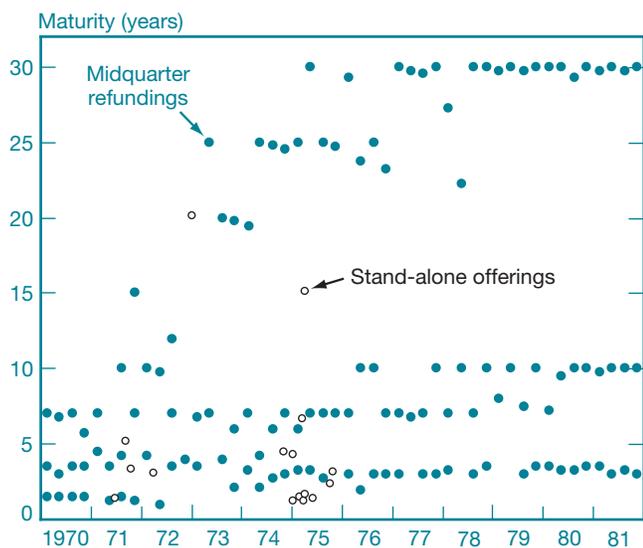
4.2 The Introduction of Two-Year Cycle Notes

Between 1970 and the first half of 1972, midquarter refundings experienced unusually high attrition. In contrast to the 10 percent attrition that was considered normal in the 1960s,²⁰ the average rate of attrition in nine exchange offerings between

¹⁹The only exceptions were November 1972, when only a small amount of securities had to be refinanced, and February 1973. The February 1973 refunding followed the first sale of a long-term Treasury bond—a stand-alone offering of twenty-year bonds in January 1973—in eight years. Officials promised that they would let the twenty-year bonds “get fully digested” before they offered more bonds for sale (“U.S. to Offer 20-Year Bonds By New Method,” *Wall Street Journal*, December 29, 1972, p. 2).

CHART 7

Maturities of Offerings of Coupon-Bearing Securities, January 1970-December 1981



Source: Federal Reserve Bank of New York circulars (1970-81).

Note: Cycle notes are not shown.

February 1970 and February 1972 was 24.3 percent. The high attrition forced the Treasury to rebuild its cash balances by issuing additional securities, including a total of \$7.25 billion of new notes in four stand-alone cash offerings between June 1971 and April 1972.

The spate of stand-alone offerings—there had been only eleven in the 1960s—led Treasury officials to begin to think about “regularizing” their note offerings. In March 1972, Under Secretary of the Treasury Paul Volcker revealed that Treasury officials were considering whether “to routinize or regularize the handling of more of our debt, as we have done for many years in the bill area.”²¹ In particular, officials were considering whether, “in contrast to building up the present concentration of note and bond maturities at quarterly intervals [that is, on the fifteenth of the second month of each quarter], to be handled flexibly at the Treasury’s discretion at maturity,” it might not be better to adopt a scheme of “more frequent but also more routine rolling over of relatively short-

²⁰The average rate of attrition for all exchange offerings in midquarter refundings between February 1960 and November 1969 was 13.4 percent. The average falls to 9.8 percent if the refundings in the third quarter of 1964 and the first quarter of 1965 are excluded. Those two refundings were accelerated several weeks, to mid-July and mid-January, respectively, and were not representative of other refundings. They had respective attrition rates of 67.0 percent and 54.5 percent.

²¹Volcker (1972). See also “Proposals on Reform of Debt Management Offered by Volcker,” *New York Times*, March 8, 1972, p. 57, and “Treasury Seeking to Put More Borrowing on Regular Basis, as With Bill Auctions,” *Wall Street Journal*, March 8, 1972, p. 2.

term notes.” Such a scheme might “reduce market uncertainties . . . caused by large intermittent financing operations.”

Treasury officials took the first step toward putting short-term note sales on a regular schedule when they announced in early October 1972 that they would begin shortly to auction two-year notes at regular quarterly intervals. The first tranche—\$2 billion of notes maturing on September 30, 1974—was auctioned on October 11. One market participant praised the new program as “safe, simple, and not at all damaging to the market.”²²

Although Treasury officials initially intended to sell subsequent issues of two-year notes at the end of every quarter, the new program got off to a somewhat irregular start. A second offering came at the end of December but, because the Treasury’s cash balances grew unexpectedly in the next six months, officials canceled the offerings that had been expected in March and June 1973.²³ The Treasury returned to issuing quarterly two-year notes in September 1973.

The Treasury’s two-year note program broke new ground in two ways. Most important, it was the first program of regular and predictable sales of coupon-bearing securities with a specified term to maturity. Additionally, it broke the pattern of

Treasury officials took the first step toward putting short-term note sales on a regular schedule when they announced in early October 1972 that they would begin shortly to auction two-year notes at regular quarterly intervals.

coupon-bearing securities always maturing on the fifteenth of the second month of a quarter. Debt management officials clearly intended that two-year notes should be on their own self-sustaining cycle, separate and apart from the midquarter refundings that had previously dominated Treasury finance.²⁴

The introduction of two-year cycle notes put short-term note sales on a regular schedule but it did not signal that longer term notes and bonds would soon be sold on a regular and predictable basis. Volcker commented in his March 1972 speech that “regularization and routinization are nice sounding words; straightjacket and rigidity are not. From where I sit, I cannot help but be conscious of the number of

²²“Treasury Treads Lightly At Outset of Big Funding,” *New York Times*, October 6, 1972, p. 59.

²³U.S. Treasury Department (1973, pp. 12, 22) and “Treasury Postpones \$2 Billion Note Offering,” *Wall Street Journal*, April 2, 1973, p. 17.

times in which particular market or economic objectives may influence the Treasury's thinking as to the form of a particular financing."²⁵ His comments suggest that Treasury officials were not prepared to abandon tactical discretion in 1972. The cancellation of the two-year note auctions in March and June 1973 support that conjecture.

5. EMBRACING REGULAR AND PREDICTABLE AS A DEBT MANAGEMENT STRATEGY

The pattern of growth in marketable Treasury debt changed dramatically in fiscal year 1975. Outstanding notes and bonds increased by \$25 billion between June 30, 1974, and June 30, 1975, an increase substantially in excess of the increases in prior years. The rapid expansion of the deficit led Treasury officials to regularize note sales beyond the two-year sector.

5.1 The Increasing Pace of Treasury Financings

Forecasts of the federal budget deficit deteriorated rapidly during the winter of 1974-75. In November 1974, officials estimated that the deficit for the fiscal year ending June 30, 1975, would be about \$9 billion and that the deficit for fiscal year 1976 would be \$10 billion-\$20 billion.²⁶ By mid-March 1975, the deficit projections had grown to \$45 billion and \$80 billion, respectively.²⁷

The five-fold growth in the two-year deficit, from \$25 billion to \$125 billion, meant that the Treasury would

²⁴The introduction of two-year cycle notes had two knock-on effects. First, it led officials to replace monthly sales of one-year bills (issued at the end of a month and maturing at the end of the same month one year later) with quad-weekly sales of fifty-two-week bills. This released end-of-month maturity dates for the new two-year notes. Additionally, beginning in August 1972, the Treasury extended the maturities of anchor issues in midquarter refundings from less than two years to about three years. By the end of 1972, the Treasury was offering fifty-two-week bills once every four weeks, two-year notes at the end of every quarter, and notes with about three years to maturity in the middle of each quarter.

²⁵Volcker (1972). Similarly, Edward Roob, Special Assistant to the Treasury Secretary for Monetary Affairs, remarked in 1973 that despite the benefits of regular and predictable note offerings, "we cannot tie down our debt-management strategy too much" (Roob 1973, p. 184).

²⁶"Fiscal '76 Budget Deficit is Now Likely, In a Range of \$10 Billion to \$20 Billion," *New York Times*, November 11, 1974, p. 3, and "Estimate of Fiscal '75 U.S. Deficit Raised By Ford Aides as Recession Cuts Revenues," *Wall Street Journal*, November 21, 1974, p. 2.

²⁷"\$37-Billion Rise in Deficit Is Seen," *New York Times*, March 18, 1975, p. 15, and Committee on the Budget (1975, pp. 996, 1030, 1033, testimony of Secretary of the Treasury William Simon).

TABLE 3
Stand-Alone Cash Offerings, January 1974-December 1975

Auction Date	Issue Date	Maturity Date	Years to Maturity	Amount Offered (Billions of Dollars)
Oct. 23, 1974	Nov. 6, 1974	May 15, 1979	4.5	1.00
Dec. 30, 1974	Jan. 7, 1975	May 15, 1979	4.4	1.25
Jan. 2, 1975	Jan. 9, 1975	Mar. 31, 1976 ^a	1.2	0.75
Feb. 19, 1975	Mar. 3, 1975	Aug. 31, 1976 ^b	1.5	1.65
Mar. 11, 1975	Mar. 19, 1975	Nov. 15, 1981	6.7	1.75
Mar. 13, 1975	Mar. 25, 1975	May 31, 1976 ^b	1.2	1.60
Mar. 20, 1975	Apr. 7, 1975	May 15, 1990	15.1	1.25
Apr. 1, 1975	Apr. 8, 1975	Nov. 30, 1976 ^b	1.6	1.50
May 22, 1975	Jun. 6, 1975	Oct. 31, 1976 ^b	1.4	1.60
Sep. 24, 1975	Oct. 7, 1975	Feb. 28, 1978	2.4	2.10
Oct. 7, 1975	Oct. 22, 1975	Dec. 31, 1978	3.2	2.50

Source: Federal Reserve Bank of New York circulars (1974-75).

^aOffering reflects the reopening of an outstanding two-year note.

^bDate represents an end-of-month maturity date not already filled by an outstanding two-year note.

have to sell an unprecedented (for a peacetime economy) volume of new securities. As early as December 1974, economists at one large dealer firm were predicting that stand-alone cash offerings would "most likely be [made] in nearly each month of [the next] half year."²⁸ The Treasury made a total of nine such offerings in fiscal year 1975 (Table 3), easily breaking the previous record of four stand-alone offerings in fiscal year 1972.

Treasury officials struggled to cope with the growing financing requirements. In January 1975, they announced an offering of two-year notes outside of the quarterly cycle established in 1972-73. Under Secretary of the Treasury Jack Bennett stated that "in the coming months, we will be studying the possibility of establishing regular month-end, rather than quarter-end, two-year notes."²⁹ Officials confirmed the new monthly frequency in early April.³⁰

The Treasury also began to give market participants more notice of when it would offer securities. In late February 1975, Under Secretary Bennett announced that it would auction four new issues in a three-week interval between mid-March and early April. The *New York Times* commented that the "unusual

²⁸"Treasury Plans Big Borrowings," *New York Times*, December 30, 1974, p. 39 (forecast of Henry Kaufman and Albert Gross of Salomon Brothers).

²⁹Committee on Ways and Means (1975, p. 16, transcript of news conference on Treasury financing plans by Under Secretary Jack Bennett on January 22, 1975).

³⁰"Official of Treasury Discloses Need for \$41-Billion," *New York Times*, April 1, 1975, p. 62.

advance disclosure ... was aimed at giving the ... market some idea of how the Treasury will be coping with the large present and impending budget deficit.” Bennett said he wanted to give investors an opportunity to “get ready and find a place” for the coming issues.³¹

In spite of their efforts, Treasury officials soon reached the limit of what could be accommodated within the existing debt management framework. On March 20, 1975, the Treasury auctioned \$1.25 billion of fifteen-year bonds at the same time that an underwriting syndicate led by Morgan Stanley & Co. brought to market the largest industrial debt offering in history: \$300 million of ten-year notes and \$300 million of thirty-year debentures from AAA-rated General Motors Corporation. The simultaneous offerings left the bond market in “chaos.” One dealer described the market as a “disaster,” another said it was a “shambles,” and the *New York Times* reported that “the head-on competition between the most credit-worthy borrowers from the public and private sectors left the ... market in disarray.”³² The chairman of the Joint Economic Committee, Senator Hubert Humphrey of Minnesota, characterized Treasury debt management as “being conducted in an inexplicable and seemingly highly inappropriate fashion.”³³

5.2 A Change in Strategy

The deficit had to be financed, but Treasury officials and other market participants appreciated that head-on competition and closely spaced tactical offerings could be reduced by replacing stand-alone sales with regular and predictable offerings.³⁴

In June 1975, Treasury officials announced \$1.75 billion of four-year notes that “might be the first of a ‘cycle’ of four-year notes maturing at the end of a quarter.”³⁵ “Might” turned to “would” when officials announced a second tranche of four-year notes in August.³⁶

³¹“\$7-Billion in Borrowing Is Planned by Treasury,” *New York Times*, February 25, 1975, p. 45, and “Treasury to Raise Total of \$7 Billion Via Spring Issues,” *Wall Street Journal*, February 25, 1975, p. 3.

³²“Treasury Bond Auction Creates Chaos; Supply of Money Shows a Record Rise,” *New York Times*, March 21, 1975, p. 53, and “Financier for the U.S. Debt,” *New York Times*, April 20, 1975, p. F7.

³³“Financier for the U.S. Debt,” *New York Times*, April 20, 1975, p. F7. See also Joint Economic Committee (1975).

³⁴As early as February 1975, two Treasury advisory committees had recommended expanding the use of cycle notes to maturities beyond two years (Committee on Ways and Means 1975, pp. 25, 31, transcript of news conference by Under Secretary Jack Bennett, February 24, 1975).

³⁵“2 New Notes, More Bills Set but No Long-Term Issue,” *New York Times*, June 19, 1975, p. 63.

Five months later, in January 1976, shortly after what initially looked like a stand-alone auction of five-year notes, Under Secretary of the Treasury Edwin Yeo announced that officials were “seriously considering” adopting a new series of five-year notes.³⁷ In early April, the Treasury issued a second tranche of five-year notes without additional comment, but when it announced a third tranche for settlement in early July an official stated that investors could henceforth expect the Treasury to issue five-year notes at the beginning of each quarter.³⁸ Thus, by mid-1976, the Treasury was issuing two-year notes monthly and four- and five-year notes quarterly.

Observers pointed out that the Treasury did not have any immediate need for the proceeds of the third five-year note offering in July 1976, but that it had nevertheless proceeded with the offering to maintain a regular and predictable auction

Regularization of coupon offerings proved enormously popular.

schedule.³⁹ That decision—the reverse of the tactical decisions to cancel the two-year note auctions in March and June 1973 because of ample cash balances—was an important step in the adoption of a strategic approach to Treasury debt management. The Treasury never again canceled an auction merely because it had no immediate need for additional funds.

Instead, it sold securities on a regular and predictable basis and managed any undesirably large cash balances through its Treasury Tax and Loan program,⁴⁰ by reducing the amounts offered or, as we discuss in Section 7, by terminating a series.

Box 3 describes the subsequent extension of regular and predictable issuance in the late 1970s and early 1980s. By the beginning of 1982, the Treasury had added a seven-year note series and a twenty-year bond series and it had standardized the midquarter refundings with regular offerings of three- and ten-year notes and thirty-year bonds.

³⁶The *Wall Street Journal* referred to the second tranche of four-year notes as “the second four-year cycle note.” “Treasury Boosts Earlier Estimate of Its Cash Needs,” *Wall Street Journal*, August 7, 1975, p. 3.

³⁷“Treasury Plans Heavy Borrowing,” *New York Times*, January 28, 1976, p. 58, and “Treasury to Sell \$13.8 Billion Bills, Notes and Bonds,” *Wall Street Journal*, January 28, 1976, p. 25.

³⁸“Treasury to Sell Notes To Raise \$2.5 Billion New Cash Next Week,” *Wall Street Journal*, March 17, 1976, p. 27, and “Treasury Refines Its Management of Federal Debt,” *New York Times*, June 28, 1976, p. 50.

³⁹“Treasury to Raise \$2.5 Billion by Selling 61-month Notes Despite Bulging Coffers,” *Wall Street Journal*, June 28, 1976, p. 15.

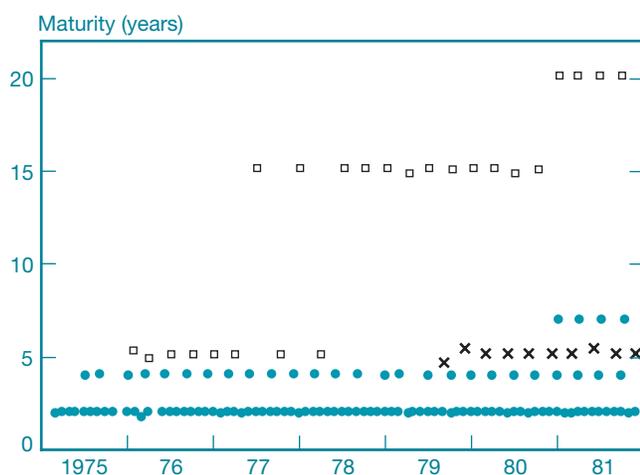
⁴⁰Brockschmidt (1975), McDonough (1976), and Lovett (1978) describe the Treasury Tax and Loan program in the 1970s. Garbade, Partlan, and Santoro (2004) describe the present program.

Debt Management between 1977 and 1982

Marketable Treasury debt continued to grow rapidly in the late 1970s and early 1980s (Chart 5). That growth led Treasury officials to expand further their new program of regular and predictable issuance.

In April 1977, Under Secretary of the Treasury Anthony Solomon announced that in the interest of extending the average maturity of the debt, officials were considering substituting a fifteen-year bond for the five-year note that they would normally auction for settlement in early July.^a They made the change and thereafter alternated fifteen-year bonds and five-year notes for

Maturities of Cycle Notes and Regularized Notes and Bonds, January 1975-December 1981



Source: Federal Reserve Bank of New York circulars (1975-81).

Note: Monthly two-year and quarterly four- and seven-year cycle notes are depicted as circles; regularized beginning-of-quarter offerings (initially five-year notes, then alternating five-year notes and fifteen-year bonds, then fifteen-year bonds, then twenty-year bonds) are depicted as squares; regularized beginning-of-third-month-of-quarter offerings of five-year notes are depicted as crosses.

another four quarters (see chart below). In September 1978, the Treasury eliminated five-year notes and began offering fifteen-year bonds exclusively for settlement at the beginning of every quarter.

The replacement of five-year notes with fifteen-year bonds left the five-year sector open. When the Treasury needed to raise new funds in August 1979 it announced a stand-alone five-year issue. Under Secretary Solomon stated explicitly that officials did not anticipate issuing five-year notes on a regular basis.^b However, the press of financing requirements led the Treasury to continue to auction five-year notes for settlement in the beginning of the third month of every quarter.

In March 1976, Congress extended the maximum maturity of a note to ten years. Thereafter, the Treasury twice offered ten-year notes in lieu of seven-year notes in its midquarter refundings (Chart 7). In November 1977, it began to alternate the two maturities and in August 1980 it made ten-year notes a regular part of the midquarter offerings.

The replacement of seven-year notes with ten-year notes in midquarter refundings left the seven-year sector open. When the Treasury needed to raise still more funds at the beginning of 1981, it introduced a seven-year cycle note. At the same time, it replaced the fifteen-year bond with a twenty-year bond, reportedly because fifteen-year bonds had not been popular with investors.^c

^a“U.S., With Cash Surplus in Quarter, Plans to Pay Off \$2 Billion of Debt,” *New York Times*, April 28, 1977, p. 85, and “Treasury to Sell \$3.75 Billion of Securities,” *Wall Street Journal*, April 28, 1977, p. 33.

^b“Treasury Schedules a \$7.25 Billion Sale,” *New York Times*, July 26, 1979, p. D7, and “Treasury to Raise Additional Cash of \$2.42 Billion,” *Wall Street Journal*, July 26, 1979, p. 32.

^c“Yields of Treasury Bills Tumble,” *New York Times*, December 23, 1980, p. D5. See also Committee on Banking, Finance, and Urban Affairs (1982, p. 78, reporting the opinion of a Treasury advisory committee that “the fifteen-year bond has not had an auspicious history in the market”).

Regularization of coupon offerings proved enormously popular. The *Wall Street Journal* described it as a “widely applauded campaign to finance the nation’s debt in a more orderly manner” and an observer noted that “regularity makes a lot of sense from a debt management view. Making ... new issues available on a regular basis gives market participants a better feel for the securities when they are sold.”⁴¹ A dealer

⁴¹“Treasury to Raise \$2.5 Billion by Selling 61-month Notes Despite Bulging Coffers,” *Wall Street Journal*, June 28, 1976, p. 15.

stated that cycle notes “have enabled the Treasury to raise enormous amounts of money, have minimized any impact on the securities markets, have reduced uncertainty, have extended the average maturity of the national debt, and produced a better defined yield curve.”⁴²

⁴²“New Interest in Treasury Yields,” *New York Times*, October 30, 1977, p. 120. See also “Decoding the Treasury’s Auction Agenda,” *New York Times*, May 20, 1979, p. F2.

6. THE COST OF TACTICAL ISSUANCE

Treasury officials began to switch from tactical issuance to regular and predictable issuance when the fiscal environment changed. Officials had found tactical issuance useful in the 1960s—it allowed them to advance any of a variety of policy objectives, depending on the circumstances of the moment—and there is no reason to believe that this aspect of tactical issuance became less important.⁴³ This suggests that the change to regular and predictable issuance occurred because of an increase in some cost associated with tactical offerings. We now present empirical evidence consistent with that proposition.

Our data are the constant maturity Treasury (CMT) yields reported in Federal Reserve Statistical Release H.15. Daily yields on three-, five-, and ten-year coupon-bearing Treasury securities are available from January 1, 1962. We divided the data into four periods. The first period—January 1, 1962, to December 31, 1970—ends before the Treasury reentered the bond market in 1971 and before it had to rebuild its cash balances with four stand-alone cash offerings between June 1971 and April 1972. The second period—January 1, 1971, to May 31, 1975—includes the stand-alone offerings of 1971-72, the rapid increase in the deficit during the first half of 1975, and the nine stand-alone cash offerings in fiscal year 1975. The third period—June 1, 1975, to December 31, 1981—begins with the introduction of four-year cycle notes in June 1975 and includes the subsequent extensions of regular and predictable issuance to five- and seven-year notes and twenty-year bonds. We are not sure when market participants finally concluded that the Treasury had wholeheartedly adopted a strategy of regular and predictable issuance,⁴⁴ but it seems reasonable to believe that they reached that understanding no later than 1982.⁴⁵ Thus, the third period concludes at the end of 1981. The last period—January 1, 1982, to December 31, 1986—includes offerings made following the unambiguous adoption of a regular and predictable strategy.

⁴³See, for example, Volcker's 1972 comment on the value of discretion quoted in the text at footnote 25.

⁴⁴Prior to 1982, Treasury officials sometimes denied, and sometimes failed to confirm, that an offering was the first in a new series rather than a stand-alone offering. See, for example, the discussion in the preceding section and in Box 3 of the initial introduction of a five-year note series in 1976 and the reintroduction of a five-year series in 1979. In addition, some series were changed too quickly to justify characterizing them as regular and predictable offerings. See the discussion in Box 3 of the partial (and subsequently complete) substitution of fifteen-year bonds for five-year notes in 1977 and 1978, the partial (and subsequently complete) substitution of ten-year notes for seven-year notes in midquarter refundings between 1976 and 1980, and the introduction of seven-year cycle notes and replacement of fifteen-year bonds with twenty-year bonds in 1981.

⁴⁵See Chart 2 and the remarks of Deputy Assistant Secretary Stalneckner quoted in the text at footnote 2.

The Treasury announced offerings of coupon-bearing securities on thirty-eight different days between January 1, 1971, and May 31, 1975 (Table 4, panel B). The root-mean-square (RMS) change in the five-year CMT yield over the interval from the close of business one business day before an announcement to the close of business one business day after an announcement was 10.8 basis points.⁴⁶ Over the same

TABLE 4
Root-Mean-Square (RMS) Changes in Constant Maturity Treasury Yields over Two-Day Intervals that Include Treasury Offering Announcements and over Other Two-Day Intervals

Interval	Sector			Number of Observations
	Three-Year	Five-Year	Ten-Year	
Panel A: January 1, 1962-December 31, 1970				
Announcement intervals	5.7	5.7	4.2	43
Other intervals	6.3	5.4	4.8	416
Panel B: January 1, 1971-May 31, 1975				
Announcement intervals	11.6*	10.8**	6.7	38
Other intervals	9.3	7.9	5.6	192
Panel C: June 1, 1975-December 31, 1981				
Announcement intervals	21.0**	18.9**	16.4**	152
Other intervals	14.7	14.2	12.0	209
Panel D: January 1, 1982-December 31, 1986				
Announcement intervals	12.0	11.1	11.2	120
Other intervals	12.1	11.9	11.7	143
Panel C1: June 1, 1975-October 7, 1979				
Announcement intervals	8.4	7.0	5.9	97
Other intervals	7.4	7.0	5.2	142
Panel C2: October 8, 1979-December 31, 1981				
Announcement intervals	33.2**	30.0*	26.1*	55
Other intervals	23.7	22.9	19.8	67

Source: Author's calculations.

Note: RMS changes are expressed in basis points.

**Statistically significantly greater than the RMS yield change over two-day intervals that did not include a Treasury offering announcement at a 1 percent confidence level.

*Statistically significantly greater than the RMS yield change over two-day intervals that did not include a Treasury offering announcement at a 5 percent confidence level.

period, there were 192 disjoint intervals of two consecutive business days, each of which was disjoint from the two-day intervals associated with the thirty-eight offering announcements. The RMS change in the five-year yield over the 192 nonannouncement intervals was 7.9 basis points. The “excess”

[Our results suggest] that investors were, on average, surprised by—or, equivalently, did not fully anticipate—Treasury offering announcements between January 1971 and May 1975.

yield volatility for the thirty-eight announcement intervals was therefore 2.9 basis points ($2.9 = 10.8 - 7.9$). We can reject the null hypothesis that the volatility of five-year CMT yields was the same for the thirty-eight announcement intervals and the 192 nonannouncement intervals at a confidence level in excess of 1 percent.⁴⁷ Similar comments apply to yield changes in the three-year sector.

This result implies that, on average, more new information became available to market participants on days when the Treasury announced a new offering than on other days, and is consistent with the proposition that offering announcements contained new information relevant to the valuation of Treasury securities. More generally, the result is consistent with the proposition that investors were, on average, surprised by—or, equivalently, did not fully anticipate—Treasury offering announcements between January 1971 and May 1975. It is not unreasonable to conjecture that the inability of investors to anticipate and plan for new issues led to higher financing costs for the Treasury.

In contrast, panel D of Table 4 shows that offering announcements after 1981 were not associated with unusual yield changes. This result implies that, following the unambiguous adoption of a regular and predictable issuance strategy, no more new information became available to market participants on days when the Treasury announced a new offering than on other days, and is consistent with the proposition that announcements of regular and predictable

⁴⁶The Treasury sometimes made offering announcements before the close of trading and sometimes after the close. We used a two-day interval to ensure that each yield change occurred over an interval that included an offering announcement.

⁴⁷On the null hypothesis that yield changes over two-day intervals are normally distributed with a mean of zero and a common variance, the statistic $(10.8/7.9)^2$ is distributed as F with 38 and 192 degrees of freedom. There is no evidence of any statistically significant mean change, or drift, in interest rates during announcement intervals in any of the four periods.

offerings did not contain new information. More generally, the result is consistent with the proposition that regular and predictable issuance reduced the element of surprise in Treasury offering announcements and therefore facilitated investor planning.

Two other features of Table 4 are of interest. First, panel A shows that offering announcements before 1971 were, on average, not associated with unusual yield changes. It is outside the scope of this article to identify the reason for this result,⁴⁸ but the result is consistent with the evident absence of any incentive for Treasury debt managers to shift to regular and predictable issuance in the 1960s.

The second interesting feature of Table 4 is that panel C suggests that offering announcements between June 1975 and December 1981 were associated with unusual yield changes. This result is surprising because the transition to regular and

[Our results suggest that after 1981,] regular and predictable issuance reduced the element of surprise in Treasury offering announcements and therefore facilitated investor planning.

predictable issuance was well under way by the time the initial five-year series was formalized in July 1976. Nevertheless, panel C shows that excess yield volatility during announcement intervals was greater in the second half of the 1970s than in any of the other three periods.

One possible explanation for this result is that the reaction of market participants to Treasury offering announcements changed following the well-known change in monetary policy in October 1979 that placed greater emphasis on control of monetary aggregates.⁴⁹ Panels C1 and C2 of Table 4 divide the period from June 1975 to December 1981 into two subperiods. Panel C1 shows that after June 1975 but before the change in monetary policy, offering announcements were not associated with unusual yield changes. This is consistent with the proposition that the benefits of adopting a regular and predictable strategy accrued rather quickly. Panel C2, however, suggests that these benefits were negated when the Federal Reserve altered its approach to monetary policy. The relationship between debt management policy and monetary policy is

⁴⁸One possibility is that, during the 1960s, Treasury officials did a better job communicating their financing plans prior to making formal offering announcements. Assessing this hypothesis would require careful study of informal contacts between Treasury officials and market participants.

⁴⁹See Melton (1985, ch. 4).

left for future research. For the present, it suffices to observe that the benefits of regular and predictable issuance reemerged when the Federal Reserve began to reemphasize control of interest rates.

7. DEBT MANAGEMENT POLICYMAKING WITHIN THE FRAMEWORK OF REGULAR AND PREDICTABLE ISSUANCE

The regularity of coupon-bearing debt offerings between 1982 and 1986 (Chart 2) demonstrates that the Treasury had adopted a strategy of regular and predictable issuance by the beginning of 1982. The new strategy limited, but did not eliminate, the ability of Treasury debt managers to alter the timing and maturity of new issues.

Chart 8 shows offerings of coupon-bearing securities between 1987 and 2002. Several important debt management actions are evident, including:

- Termination of the four-year note series and initiation of monthly (in lieu of quarterly) five-year notes in January 1991. The Treasury made the change to shift some of its financing activity from bills to intermediate-term notes.⁵⁰
- Termination of the seven-year note series and reduction to semi-annual (in lieu of quarterly) issuance of thirty-year bonds in May 1993. The Treasury made the change to shift some of its financing activity from intermediate-term notes and long-term bonds to bills and shorter term notes in an effort to reduce interest expenses.⁵¹
- Termination of the three-year note series and reduction to quarterly (in lieu of monthly) issuance of five-year notes as part of the regular midquarter refundings in August 1998. Officials made the change in light of large and persistent federal budget surpluses and a material reduction in financing requirements.⁵²

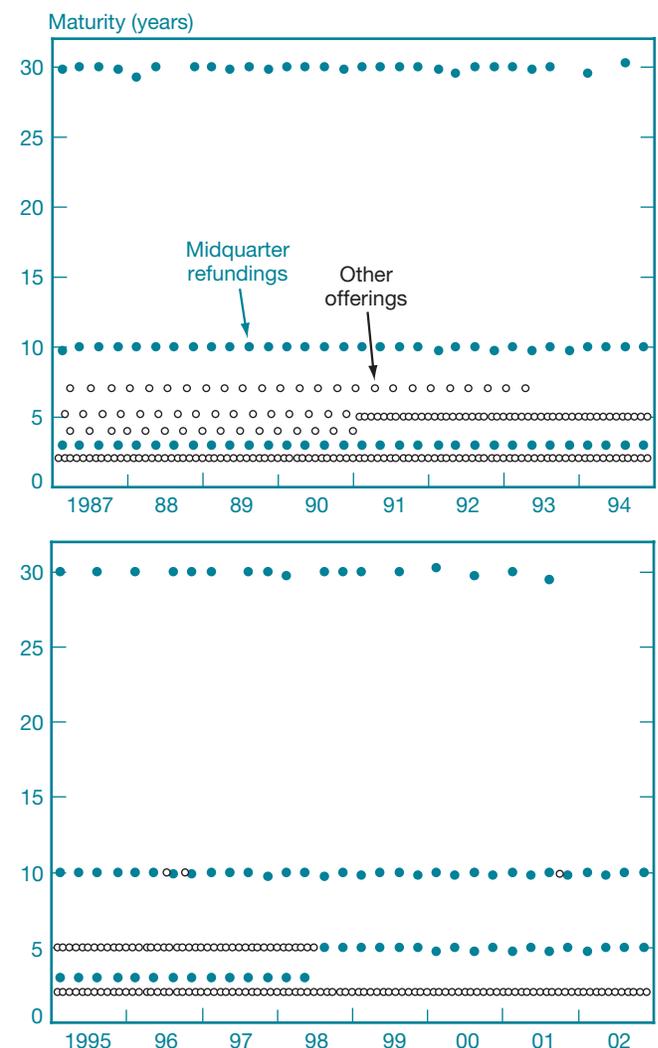
⁵⁰“Treasury Announces Change in Regular Quarterly Auction Cycles Beginning in January 1991,” *Treasury News*, December 11, 1990. The Treasury also wanted to reduce the build-up of issues maturing on midquarter refunding dates. Five-year notes had previously been issued in the beginning of the third month of a quarter and matured in the middle of the following quarter five years and two and a half months later. The new five-year notes were issued at the end of a month and matured at the end of the same month five years later.

⁵¹“Treasury Slashes Sales of Long-Term Bonds,” *Wall Street Journal*, May 6, 1993, p. C1, and “Treasury Maturities Shortened,” *New York Times*, May 6, 1993, p. D1.

⁵²“It’s Two Steps Back for Short-Term Treasury’s,” *Wall Street Journal*, May 7, 1998, p. C1.

These actions show that adherence to a regular and predictable issuance schedule did not foreclose the exercise of managerial discretion with respect to the maturity structure of new issues. Treasury debt managers have continued to alter the timing and maturities of new offerings in light of evolving fiscal conditions and their assessments of the costs and benefits of shorter term versus longer term financing, but they now choose the times and maturities of *series* of debt issues rather than of individual issues.

CHART 8
Maturities of Offerings of Coupon-Bearing Securities, January 1987-December 2002



Source: U.S. Department of the Treasury, Bureau of the Public Debt.

8. CONCLUSION

During the 1970s, Treasury officials changed the framework within which they made debt management decisions, transitioning from tactical issuance of notes and bonds to a regular and predictable schedule. The emergence of regular and predictable sales of Treasury notes and bonds reduced the element of surprise in Treasury offerings and allowed investors to plan future commitments of funds with greater confidence. Treasury officials have asserted repeatedly that regular and predictable issuance allows them to finance deficits and refinance maturing debt at the lowest possible interest rates consistent with contemporaneous market conditions.

Regular and predictable issuance was not a novel concept in the 1970s; the Treasury had been issuing bills on a regular schedule for decades. Nevertheless, debt managers had kept

note and bond offerings on a tactical basis—in part because financing at least cost was not the only objective of Treasury debt management. Debt managers sometimes chose to issue short-term debt to maintain upward pressure on short-term interest rates and limit upward pressure on long-term rates; they sometimes chose to issue longer term debt to limit further contraction in the average maturity of Treasury debt.

Regular and predictable issuance became more attractive after Treasury officials had to bring four stand-alone cash offerings in fiscal year 1972 as a result of unusually high attrition in midquarter exchange offerings. They introduced two-year cycle notes to put short-term note financings on a more routine basis. The much larger and more significant need to finance a rapid expansion of the deficit beginning in 1975 led them to phase in additional cycle notes in 1975 and 1976 and, ultimately, to abandon tactical issuance altogether.

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