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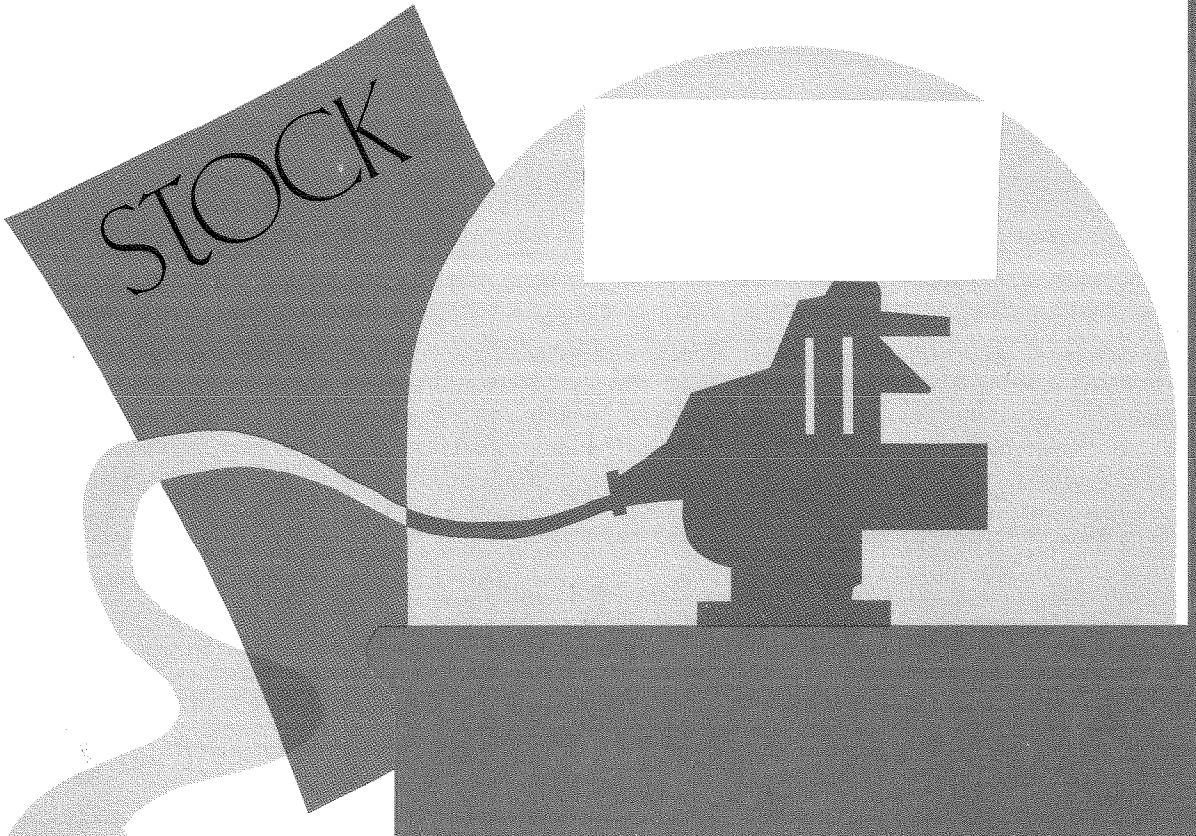

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GNMA Futures: Stabilizing or Destabilizing?

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On any list of the most controversial sectors of the U.S. economy, surely futures markets, financial markets, and the housing market would appear near the top. The housing sector has been the intended beneficiary of a wide variety of public programs. Financial markets have long been subjected to a myriad of government regulations. And futures markets have had to fight repeated attempts to legislate them out of existence.

The Chicago Board of Trade established a unique link among these three sectors in October 1975 when it inaugurated a futures market in the financial instruments of the Government National Mortgage Association (GNMA). This agency had designed its "pass-through" certificates—mortgage-backed bonds guaranteed by GNMA—in order to help the housing industry by attracting more investors to the mortgage market. Most economists would argue that the institution of futures trading in GNMA certificates should further that goal. Economic theory suggests that futures trading arises in markets characterized by large price variability and that it helps to reduce that variability.[1] By contrast, many non-economists believe that futures trading is a *cause* of greater price variability rather than a *response* to that variability. *Business Week* referred recently to ". . . the charge that futures markets themselves increase the volatility of commodity prices and that speculators are the chief culprits behind wild swings, often pushing prices in directions that are unwarranted by underlying economic conditions."[2]

If the establishment of a GNMA futures market increases the variability of GNMA spot prices, a number of investors might find GNMA certificates less attractive. Futures trading in GNMA's would then be at odds with the goal of increasing the liquidity of the mortgage market—a market in which GNMA securities are playing an increasingly important role. At the end of 1977, GNMA-back securities accounted for almost $44 billion of the $650 billion outstanding debt on one-to-four-family homes.[3]

There have already been charges that the "explosive growth" of the GNMA market has led to speculative excesses.[4] Presumably, the growth of a futures market will encourage even more speculative activity in this market. The purpose of this article is to determine whether futures trading in GNMA certificates has stabilized or destabilized GNMA spot prices. This question is important to policymakers charged with aiding the housing market as well as to those responsible for regulating futures trading. Furthermore, the question has implications for the other financial futures markets now in existence: Treasury bills, Treasury bonds, and commercial paper. The *Wall Street Journal* has noted government officials' concern that speculative activity in financial futures could disrupt the bond market.[5] Consequently, should the development of these futures markets be encouraged or discouraged? As in the case of the GNMA's, the answer partly depends on the extent to which futures trading affects spot prices.

A related and equally important policy issue is whether banks and thrift institutions should hold financial futures only for use in hedging activities. However, this article will not attempt to address that question.

Section I discusses the motivations which led to the development of the GNMA futures market. Section II examines the theoretical basis for the belief that speculation will tend to stabilize rather than destabilize prices. Section III presents the results of alternative empirical tests of the effect of GNMA futures on the spot market. Section IV summarizes the principal findings, which support the position that futures trading has had, if anything, a stabilizing influence on the spot prices of GNMA certificates.

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I. Development of the GNMA Futures Market

The GNMA futures market is the result of two separate developments, both dating back to the late 1960's. The first was the mortgage industry's attempt to devise a hedging mechanism to protect itself from unforeseen interest-rate fluctuations. The second was GNMA's introduction of a new security to attract more investors to the housing market.

Mortgage hedging[6]

The possibility of unforeseen price changes makes holding inventories of any good a risky business. Since many people are willing to pay a price to exchange risk for certainty, organized futures markets exist so that holders of inventories can hedge against the risks of price changes.[7] For example, when a warehouse purchases grain, it may simultaneously enter into a futures contract to lock in the price at which it can sell that grain at a later date.

Until the 1960's, futures trading in the United States was concentrated in grains and the soybean complex. But during the next decade, futures contracts were added in a number of other "commodities," ranging from plywood to pork bellies. And just when the exchanges began looking for new markets to enter, real-estate investors began discussing the feasibility of a futures market to hedge against interest-rate risk.

Actually, economists at a much earlier time had used the analogy between the markets for financial instruments of varying maturities and the commodity futures markets to explain the term structure of interest rates.[8] But now people were beginning to discuss the practical problems of setting up an interest-rate futures market. They were motivated to do so by the sharp rise in interest rates in 1969, and by the resulting losses incurred by fixed-income security holders in general and by mortgage lenders in particular.

Mortgage bankers and mortgage-originating savings-and-loan associations stand to lose money if interest rates rise between the time at which they commit their funds and the time at which they sell the mortgages. Their situation is exactly analogous to that of the grain elevator which temporarily holds wheat bought from farmers before selling it to millers. The biggest difference between the two groups is that the latter deals in a homogeneous commodity for which it is easy to set standards, while the former deals in a "commodity" (i.e., mortgages) which varies tremendously in quality and in exact specifications. This lack of homogeneity among mortgages was one of the greatest obstacles to the establishment of a mortgage-futures market.[9]

GNMA certificates

At the same time that the real-estate community was attempting to find a way to hedge mortgage-interest risks, the Government National Mortgage Association—created by the Housing Act of 1968 as part of the Department of Housing and Urban Development—was attempting to help the housing market by making mortgages more attractive to all types of investors.[10] Both groups faced the same key problem: the lack of homogeneity across mortgages. Many investors, lacking the necessary ability to gauge the quality of particular mortgages, tended to avoid the secondary mortgage market. Individual investors were further dissuaded by the large volume of funds which would be needed to purchase a reasonably well-diversified portfolio of mortgages. As a result, the secondary mortgage market lacked the depth of, say, the secondary government-bond market. During periods of high interest rates, whenever thrift institutions tried to sell mortgages out of their portfolios to offset deposit outflows, they were forced to accept unfavorable terms because of the thinness of the secondary market. In view of this problem of raising funds, they found it difficult to continue making new mortgage loans during tight-money periods.

The GNMA modified pass-through certificates represented a means of easing this difficulty.[11] Introduced in early 1970, these certificates enable an individual investor to purchase a share in a pool of FHA/VA insured mortgages, with payment of the interest and principal guaranteed by GNMA. The originator of the mortgages—typically a mortgage banker or savings and loan—packages them into a pool of at least $1 million and turns them over to a custodial bank. All of the mortgages must bear the same face rate of interest and have roughly the same maturity

date. GNMA may then issue securities in amounts as small as $25,000 on the pool.

The coupon rate on the securities is 50 basis points less than that on the underlying mortgages. (Yield quotations on the securities are based on the assumption of prepayment in the 12th year.) The issuer of the securities receives 44 basis points as a management fee—for collecting the monthly mortgage payments, "passing-through" the payments to the security holders, and for dealing with any delinquent loans or foreclosures. Even if the issuer does not receive all of the monthly payments due him, he remains responsible for seeing that the security holders get their full payments on time. (It is this feature that gives rise to the name "modified" pass-through security.) GNMA itself guarantees timely payment to the security owners in the event of a default by the issuer, for which service it receives 6 basis points.

GNMA securities therefore have three levels of guarantees. The underlying mortgages are all FHA- or VA-insured. The issuer of the securities guarantees payment of principal and interest whether or not he receives his payments on time. And GNMA stands behind his guarantee with the full faith and credit of the U.S. Government. Thus, GNMA securities allow an investor with no specialized knowledge of mortgages to participate in the secondary mortgage market with virtually no fear of default risk.

Forwards and futures

The introduction of GNMA certificates not only helped to broaden the secondary mortgage market; it also suggested a solution to the problem faced by those attempting to create a mortgage futures market. Rather than deal directly in mortgages, market participants might trade GNMA securities of some designated denomination. Indeed, several years before the approval of organized *futures* trading, the market developed informal *forward* trading in GNMA securities.[12]

Forward trading and futures trading are not the same thing, despite a number of similarities. Whenever two people agree now to the terms of a transaction which will take place sometime later, forward trading can be said to exist. For example, when a mortgage banker begins the months-long process of assembling a pool of mortgages for conversion into a GNMA certificate, he might negotiate with, say a life insurance company regarding the price at which he will sell that security at some specified future date. Such forward contracts became increasingly common as mortgage lenders attempted to hedge against interest-rate risk—but they did not constitute a futures market.

A forward contract is an agreement between two individuals, tailored to their particular needs. A futures contract is a standardized agreement, traded on an organized exchange, in which the exchange itself is the opposite party in every contract. Telser and Higinbotham express the difference as follows:

> "In a forward contract, the actual identity of the buyer and seller is important. Neither has recourse in case of dispute to a third party other than a court of law. The validity of the forward contract depends on the good faith of the two parties themselves. A futures contract has a third party, the organized exchange or its designated representative, that guarantees the validity of the contract and will enforce the terms."[13]

With contracts standardized and with the entire exchange standing behind each agreement, futures contracts are much more liquid instruments than forward contracts. As a result, the transactions costs involved in divesting oneself of a futures contract are generally less than for a forward contract. The greater expense of finding a buyer for an individually-tailored forward contract tends to limit the sale of such contracts to individuals who actually plan to take physical possession of the underlying commodity. But futures-market participants also include a large number of speculators who are willing to incur the price risks of buying and selling futures contracts but who never want to take or to make delivery. Because of the presence of these speculators, futures markets have a greater breadth than forward markets, with consequent expanded possibilities for hedging.

Nonetheless, futures markets often evolve out of forward markets. In the case of GNMA securities, this evolutionary process was aided by the passage of the Commodity Futures Trading

Commission Act of 1975, which provided the legal basis for the establishment of a formal interest-rate futures market. In October of that year, trading in GNMA futures contracts began on the Chicago Board of Trade.

Each contract confers the right to buy or sell a GNMA certificate with $100,000 in principal balance and an 8-percent coupon at some specified future date. (Actual delivery may be made using certificates with another coupon rate, in which case the principal balance is adjusted accordingly.) It is currently possible to enter into contracts up to almost three years into the future.

Trading in GNMA futures has grown very rapidly. In 1977, over 422,000 contracts changed hands, compared to less than 129,000 during 1976, the first full year of trading. Open interest in GNMA futures (the number of contracts outstanding) rose to almost 21,000 by the end of 1977, over four times the level of a year earlier.[14] But the futures market, not surprisingly, has by no means replaced the forward market. The two markets typically coexist during the early stages of development of a futures market, and they may coexist indefinitely.

A number of recent articles have described how the GNMA futures contract may be used for hedging.[15] The question here, however, is not the usefulness of GNMA futures to *individual* hedgers, but rather the impact—if any—of futures trading on the *spot market*. Has the futures market been "too successful" in attracting speculators, so that they, rather than hedgers, dominate the setting of futures prices? To determine how much truth there is in that popular fear, let us take a look, first, at the economic theory of speculation, and second, at the empirical evidence in the case of GNMA futures.

II. The Economics of Speculation

Basically, although speculation usually occurs in markets characterized by a relatively large amount of price variability, it is the *result* not the *cause* of that variability. This view was succinctly expressed by John Stuart Mill over a century ago:

> "These dealers [speculators] naturally buying things when they are cheapest, and storing them up to be brought again into the market when the price has become unusually high; the tendency of this operation is to equalize price, or at least to moderate its inequalities. . . Speculators, therefore, have a highly useful office in the economy of society; and (contrary to common opinion) the most useful portion of the class are those who speculate in commodities affected by the vissicitudes of the seasons."[16]

Speculation, of course, can occur apart from the existence of futures markets. In the above quote, Mill described the behavior of speculators who deal only in the spot market. But as we noted earlier, organized futures trading tends to encourage speculation. Speculation in futures markets can be carried out without any need to handle the commodities involved. Moreover, transactions costs in futures markets are very low, and capital requirements are small—at least compared with the costs of actually purchasing goods on the spot market and holding them in inventory.

Consequently, if speculation is socially beneficial, and if futures markets lead to more speculation than would otherwise occur, we may conclude that futures markets are useful to society as a whole, over and above their benefits to individual hedgers. Furthermore, their existence may help to reduce price fluctuations in ways other than those described by Mill. They may do so by improving inventory and production decisions—specifically, by providing information on the likely course of prices in months to come.[17] Holbrook Working has gone so far as to say that, "Today, the fact that futures trading provides central market prices established in open competitive bargaining may deserve to be regarded as the chief merit of futures markets from the public standpoint."[18]

But what if speculators forecast badly? Might they not then affect prices perversely, increasing their variability and reducing their usefulness as a source of information to direct the allocation of resources? Milton Friedman, in an often-quoted passage dealing with foreign-exchange specula-

tion but applicable to any commodity, argued that any such tendencies could not persist for long:

> "People who argue that speculation is generally destabilizing seldom realize that this is largely equivalent to saying that speculators lose money, since speculation can be destabilizing in general only if speculators on the average sell when the currency is low and buy when it is high."[19]

Presumably, such speculators would be speedily eliminated from the market, leaving only those with superior foresight.

However, Friedman was careful to add a qualification, which is less often quoted: "A warning is perhaps in order that this is a simplified generalization on a complex problem."[20] Friedman himself conceded the possibility, earlier suggested by Kaldor, that destabilizing speculation might persist if a small body of professional speculators made money while a continually changing group of amateurs regularly lost larger sums. The successful speculators would still be the ones with superior foresight, but they would use their forecasting skills to predict the psychology of other speculators. As Kaldor argued:

> "In such circumstances, even if speculation as a whole is attended by a net loss, rather than a net gain, this will not prove, even in the long run, self-corrective. For the losses of a floating population of unsuccessful speculators will be sufficient to maintain permanently a small body of successful speculators; and the existence of this body of successful speculators will be a sufficient attraction to secure a permanent supply of this floating population."[21]

In Kaldor's scenario, it is profitable for professional speculators to act in a destabilizing manner—buying even when they consider prices to be too high in terms of non-speculative underlying trends—as long as they believe that they will be able to sell at even higher prices to other speculators. When the psychology of the market changes, the hapless amateurs are left with the goods, which they must sell at a loss. These unsuccessful speculators are then eliminated from the market, but a fresh group is always available to support the next speculative boom.

Other economists have also attempted to argue that destabilizing speculation can be profitable.[22] But the possibility described by Kaldor, in which speculators devote their efforts to outwitting each other, probably best accords with the popular suspicions about futures markets. These suspicions are buttressed by what Abba Lerner refers to as ". . . the hostility which people who have to work hard for their living often develop against the mysterious gains that speculators make in offices while dealing in goods which they would not even recognize."[23] Let us consider whether, in the specific case of GNMA futures, there is any factual basis for this anti-speculative attitude.

III. Empirical Evidence

Statistical tests for the effects of GNMA futures trading on GNMA spot prices face a fundamental limitation. We may be able to determine whether the behavior of spot prices has been different (in some suitably-defined way) since the start of futures trading, but we may never be able to ascribe such differences definitely to the existence of a futures market. They may merely reflect any of a number of changes which have occurred in the economy since futures trading began.

This problem is, of course, common to many economic studies, but it is particularly troublesome in the present context. Since October 20, 1975—the beginning of GNMA futures trading—the course of the U.S. economy in general and of financial markets in particular has changed considerably from what went before. But in addition, the GNMA pass-through is itself a relatively new financial instrument, so that the development of the GNMA futures market has coincided with the maturation of the GNMA spot market. As a result, any claims that changes in the spot market were *caused* by the establishment of a futures market would have to be accompanied by even more than the usual qualifications.

Graphic analysis

With those warnings in mind, let us analyze the actual behavior of spot GNMA prices during the periods before and after futures trading began. (Chart 1. Incidentally, the months immediately surrounding the start of futures trading have been omitted to remove any transitory disturbances associated with the opening of the new market.) Clearly, the average level of GNMA prices has been higher, and the variability about that average has been lower, since futures trading began. But it would surely be wrong to attribute those spot-market changes primarily to the futures market.

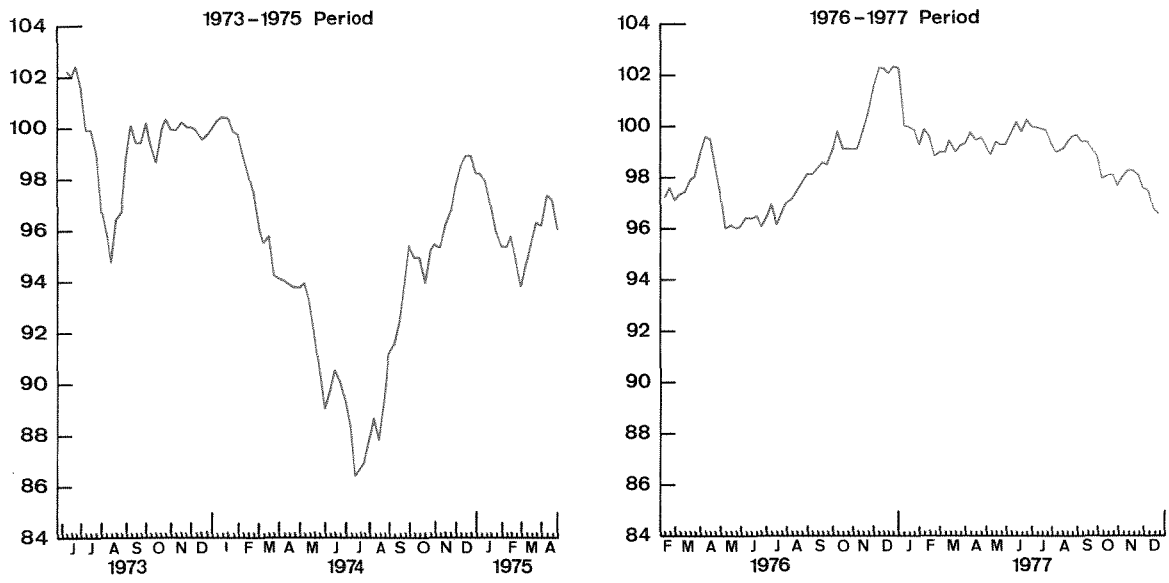
The broad movements in the level of spot prices are more reasonably explained as the normal market response to changes in the prices of long-term debt instruments which substitute for GNMA's in investor portfolios. Indeed, recent prices of GNMA's have roughly paralleled the prices of long-term government bonds. However, while it would be wrong to attribute the reduced variability in the level of GNMA spot prices to futures trading, it would similarly be unfair to blame futures trading for the wider swings in spot prices which would undoubtedly accompany another period of widespread greater variability in bond prices. The effects of futures trading—for good or ill—must be sought elsewhere.

One likely place to look would be the behavior of the *changes* in spot prices. Thus, while the overall trend in spot GNMA prices will be dominated by the overall movements in bond prices, futures trading might reduce the short-run variability in spot prices about that trend. It could do this by providing market participants with more information, in the form of instantly available price quotations on futures contracts, determined through competitive bidding in a centralized market. Armed with this additional information, investors in the spot market should be able to move prices more rapidly to their equilibrium values, thereby reducing the purely random movement in those prices.

An examination of the first differences in the weekly GNMA price series appears to bear out this hypothesis (Chart 2). The variability of the differences has declined markedly since the com-

Chart 1

GNMA SPOT PRICES



mencement of futures trading, especially when the sharp price movements of January 1977 are excluded. The graphical evidence, then, suggests that futures trading in GNMA's may have reduced the random variability in spot prices. But before drawing this conclusion, we should test statistically to determine whether the reduction in the week-to-week movements in GNMA prices again merely parallels a more general market trend.

Table 1
Responsiveness of GNMA Prices to Changes in Bond-Market Prices

Sample Period	Percentage Change in Government Bond Prices	Standard Error	Durbin-Watson
May 30, 1973-	0.646	0.00541	1.78
December 28, 1977	(15.1)		
May 30, 1973-	0.637	0.00709	1.65
October 15, 1975	(8.97)		
October 22, 1975-	0.658	0.00302	2.37
December 28, 1977	(16.7)		

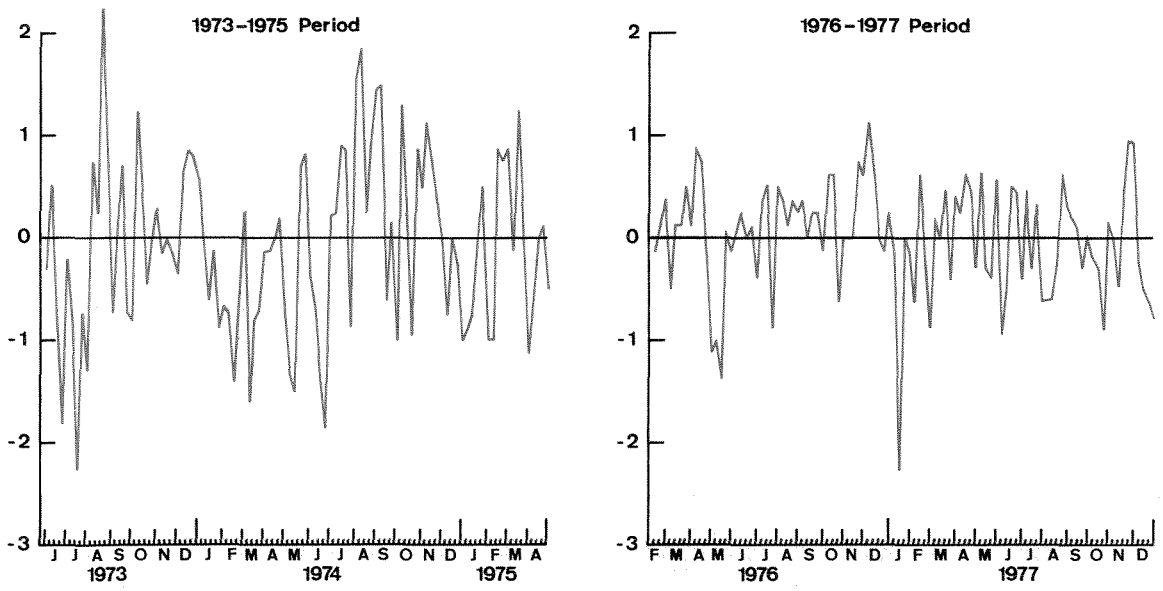
(Numbers in parentheses are t-statistics. None of the constant terms were significant, and were therefore not reported.)

Regression results

Our test involves regressing the weekly percentage changes in spot GNMA prices on the weekly percentage changes in the prices of ten-year U.S. Government bonds, which serve as a proxy for "the bond market." (The ten-year maturity was chosen because it approximates that of GNMA certificates, which are usually assumed to have an average life of 12 years.)[24] The coeffi-

Chart 2

FIRST DIFFERENCES OF GNMA SPOT PRICES



cient of the latter variable provides a measure of the variability of GNMA prices *relative* to the variability of bond prices generally. If the coefficient rises significantly after the beginning of futures trading, one could argue that futures trading tends to destabilize spot prices, increasing their relative variability and hence making GNMA's a riskier asset.[25]

The coefficient on the market index appears roughly constant in both the period before and the period after the beginning of futures trading. The standard F-test for the equality of coeficients confirms this impression (at the five-percent level of significance).[26] Therefore, the evidence in Table 1 suggests that futures trading has not made GNMA's more risky.

The standard error of the regression was much smaller in the second sub-period than in the first. Again, this impression is supported by the appropriate F-test, which indicates that (at the one-percent level) the standard error is significantly less in the later period.[27] Since a greater proportion of the week-to-week variance in GNMA prices can be explained by the movement of other bond-market prices following the start of futures trading, it appears that the GNMA market has become more integrated over time with the rest of the capital market.

Time-series analysis

As a check on these regression results, a Box-Jenkins analysis was utilized to measure the impact of GNMA futures trading.[28] As above, it is assumed that futures trading has a negligible impact on the *level* of GNMA prices—broad market forces cause the systematic movements in the spot price, but futures trading can affect the size of the random movements around the systematic trend. The time-series approach seeks to explain the systematic component of GNMA prices solely in terms of the past history of those prices.

An analysis of the autocorrelation structure of GNMA spot prices suggests that the series could be adequately represented as a second-order autoregressive process, i.e., current prices can be explained by the prices of last week—GNMA (−1)—and the week before—GNMA (−2)—plus a constant term (Table 2).

As in Table 1, F-tests indicate no statistically significant difference (at the five-percent level) between the coefficients in the two sub-periods, but they indicate a sigificantly smaller standard error of the regression in the second period (at the one-percent level).[29] We can thus infer that the systematic movements of GNMA prices have followed the same pattern in the period after as in the period before futures trading—as evidenced by the unchanged coefficients—but that the random fluctuations in spot prices have been reduced significantly.

In a final test, we regress the percentage weekly change in spot prices on the previous week's percentage change (Table 3). In this case, the coefficient on the lagged percentage price change is significant on the first sub-period but not in the second. In other words, a knowledge of how GNMA prices moved last week no longer contains useful information as to how they will move this week. All new information affecting GNMA prices is rapidly incorporated into the current market price rather than absorbed by the market slowly over several weeks. In the language of capital-market theory, the GNMA market has become more "efficient" since futures trading began.[30]

Table 2
Time Series Analysis of Spot GNMA Prices

Sample Period	Constant	GNMA (−1)	GNMA (−2)	Standard Error	Durbin-Watson
May 30, 1973-	3.48	1.20	−0.238	0.707	2.05
December 28, 1977	(2.44)	(18.5)	(−3.70)		
May 30, 1973-	4.06	1.22	−0.261	0.844	2.05
October 15, 1975	(1.98)	(13.1)	(−2.84)		
October 22, 1975-	6.26	1.07	−0.139	0.526	2.06
December 28, 1977	(2.24)	(11.6)	(−1.54)		

(Numbers in parentheses are t-statistics.)

Table 3
Time Series Analysis of
Percentage Weekly Change in GNMA Prices

Sample Period	Constant	Lagged Percentage Change in Price	Standard Error	Durbin-Watson
May 30, 1973-	−0.00016	0.224	0.0075	2.04
December 28, 1977	(−0.32)	(3.46)		
May 30, 1973-	−0.00053	0.246	0.0091	2.03
October 15, 1975	(−0.61)	(2.66)		
October 22, 1975-	0.00024	0.153	0.0056	2.04
December 28, 1977	(0.47)	(1.66)		

(Numbers in parentheses are t-statistics.)

IV. Summary and Conclusions

The empirical results presented in this paper all suggest that the GNMA spot market has improved its performance in the period since futures trading began in those securities. The spot market has become more efficient in processing new information; it has shown less purely random price variability; and it has become more closely integrated with the rest of the bond market. It is impossible to say with certainty how responsible futures trading has been for any of these beneficial developments. But it seems clear that futures trading in GNMA certificates has not had a destabilizing effect on spot market prices.

The significance of this conclusion extends beyond the GNMA market. Financial futures markets are still in their infancy. Proposals for still more of them are constantly being made. The results of this study of GNMA futures suggests that we have nothing to fear and potentially much to gain from the further development of these markets.

FOOTNOTES

1. See, for example, the discussion by B.A. Goss and B.S. Yamey in their introductory essay in **The Economics of Futures Trading,** ed. Goss and Yamey (New York: John Wiley and Sons, 1976), pp. 29-32.
2. "Stability in a Swinging Market," **Business Week** (August 8, 1977), p. 70.
3. **Federal Reserve Bulletin** (February 1978), p.A41.
4. "A Fever of Speculation Afflicts Ginnie Mae," **Business Week** (July 18, 1977), p. 28.
5. "Interest Rate Futures Gain Popularity," **Wall Street Journal** (February 2, 1978), p. 1.
6. This section draws heavily on the article by Richard L. Sandor, "Trading Mortgage Interest Rate Futures," **Federal Home Loan Bank Board Journal** (September 1975), pp. 2-9.
7. Futures markets exist for other reasons than merely to accomodate "hedging" in the narrow sense of risk avoidance in which that term is commonly used. See Holbrook Working, "Economic Functions of Futures Markets," in **Futures Trading in Livestock—Origins and Concepts,** ed. Henry Bakken (Madison, Wisconsin: Mimir Publications, Inc., 1970), pp. 29-41. Also Roger W. Gray, **The Feasibility of Organized Futures Trading in Residential Mortgages,** FHLMC Monograph No. 3 (November 1974), p. 6.
8. John R. Hicks, **Value and Capital** (London: Clarendon Press, 1946), pp. 144-147; Paul H. Cootner, "Common Elements in Futures Markets for Commodities and Bonds," **American Economic Review** (May 1961), pp. 173-183.
9. Gray (p. 13) notes some offsetting advantages of mortgages over commodities, such as lack of storage and transportation problems.
10. Winfield A. Boileau, "GNMA Pass Through," in **Investment Opportunities, The GNMA Story,** Mortgage Bankers Association (1977), pp. 5-9.
11. For a general discussion of governmental programs to aid the secondary mortgage market, see Peggy Brockschmidt, "The Secondary Market for Home Mortgages." Federal Reserve Bank of Kansas City **Monthly Review** (September-October 1977), pp. 11-20.
12. The forward market is described in Thomas C. Miller, "Growth, Acceptance to Improve Liquidity of GNMA Security," **Investment Opportunities, The GNMA Story,** Mortgage Bankers Association (1977), pp. 19-22.
13. Lester Telser and Harlow Higinbotham, "Organized Futures Markets: Costs and Benefits," **Journal of Political Economy** (October 1977), pp. 969-1000. Also, Gray, p. 10.
14. These figures have been taken from various issues of the **Interest Rate Futures Newsletter** of the Chicago Board of Trade.
15. For example, Neil A, Stevens, "A Mortgage Futures Market," Federal Reserve Bank of St. Louis **Review** (April 1976), pp. 12-19.
16. John Stuart Mill, **Principles of Political Economy** (London, 1848), Book 4, Chapter 2, Section 4, as quoted in Goss and Yamey, p. 30.
17. "Stability in a Swinging Market," **Business Week** (August 8, 1977), p. 71.
18. Working, p. 47.
19. Milton Friedman, "The Case for Flexible Exchange Rates," **Essays in Positive Economics** (Chicago: University of Chicago Press, 1953) p. 175.

20. Friedman, p. 175.
21. Nicholas Kaldor, "Speculation and Economic Stability," **Review of Economic Studies** (1939-40), pp. 2-3. An alternative model involving two groups of speculators has been suggested by Fred Glahe, "Professional and Nonprofessional Speculation, Profitability, and Stability," **Southern Economic Journal** (July 1966), pp. 43-48.
22. See the discussion (and references) in Robert M. Stern, **The Balance of Payments** (Chicago: Aldine Publishing, 1973), pp.77-89. Also, Jorg Schimmler, "Speculation, Profitability, and Price Stability," **Review of Economics and Statistics** (February 1973), pp. 110-114.
23. Abba Lerner, quoted in Goss and Yamey, p. 32.
24. All of the regressions presented in this article were also run for subsamples which omitted the months immediately surrounding the start of futures trading. Similarly, they were run using different proxies for the market index. The qualitative results were not different for any of these alternatives.
25. For a full discussion of this approach to measuring an asset's risk, see Michael C. Jensen, "The Foundations and Current State of Capital Market Theory" in **Studies in the Theory of Capital Markets,** ed. Jensen (New York: Praeger, 1972), pp. 3-43.
26. The F-value calculated for these regressions is 0.085, which is well below the critical value of 3.04. See Jan Kmenta, **Elements of Econometrics** (New York: Macmillan, 1971), p. 373.
27. The F-statistic for a reduction in the standard error across the two samples is the ratio of the two sums of squared residuals, each divided by the respective degrees of freedom. The calculated F-value is 2.39, compared to the critical value of 1.59.
28. George E. P. Box and Gwilym M. Jenkins, **Times Series Analysis** (San Francisco: Holden-Day, 1970).
29. The calculated F-value for the test of equality of coefficients is 2.31, which is below the critical value of 2.65. The calculated value for the test of reduction in standard error is 2.57, which is greater than the critical value of 1.59.
30. See Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," **Journal of Finance,** (May 1970). Although the regressions presented in Table III show that past movements in GNMA prices formerly contained information useful for predicting future movements in those prices, it is not necessarily the case that profitable arbitrage possibilities existed during the first sub-period. Transactions costs may have been too high for investors to exploit the predictive content of past price movements. The futures market, by reducing the costs of taking a short position, may have allowed investors to exploit the information in past prices. This interpretation of the results in Table 3 was suggested by Kurt Dew.