Irving Fisher and His Compensated Dollar Plan

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This is a story that illustrates the interrelationship between economic history and economic thought: more precisely, between monetary history and monetary thought. So let me begin with a very brief discussion of the relevant history.

In 1879, the United States returned to the gold standard from which it had departed at the time of the Civil War. This took place in a period in which "a combination of events, including a slowing of the rate of increase of the world's stock of gold, the adoption of the gold standard by a widening circle of countries, and a rapid increase in aggregate economic output, produced a secular decline :. in the world price level measured in gold:.." (Friedman and Schwartz 1963, p. 91; for further details, see Friedman 1990, and Laidler 1991, pp. 49–50). The specific situation thus generated in the United States was described by Irving Fisher (1913c, p. 27) in the following words: "For a quarter of a century—from 1873 to 1896—the dollar increased in purchasing power and caused a prolonged depression of trade, culminating in the political upheaval which led to the free silver campaign of 1896, when the remedy proposed was worse than the disease." This was, of course, the campaign which climaxed with William J. Bryan's famous "cross of gold" speech in the presidential election of 1896. Fisher's view of this campaign reflected the fact that it called for the unlimited coinage of silver at a mint price far higher than its market value, a policy that would have led to a tremendous increase in the quantity of money and the consequent generation of strong inflationary pressures.

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Though Bryan was defeated in the subsequent election, his objective was nevertheless accomplished by the unprecedented increase in the output of gold that began in the 1890s as a result of the discovery of new gold deposits in South Africa and Alaska, as well as the development of more efficient processes for the extraction of gold from the ore. Thus the world output of gold in 1899 was nearly three times the average annual output during the 1880s, and in 1905 it was nearly four times as large (Wright 1941, pp. 825–26). As a result, the U.S. price level increased from 1896 to 1913 by almost 50 percent—a fact duly noted and emphasized by Fisher (1913b, p. 217).[1] It was this 40-year experience of serious economic, political, and social problems generated by significant changes in the price level—in either direction—that led Fisher to formulate his compensated dollar plan for stabilizing it.

Another important fact is that "guilt by association" with the declared objective of the silver campaign to generate a great increase in the quantity of money and hence in prices had caused the quantity theory itself to fall into disrepute. This situation was clearly reflected in Fisher's statement in the preface to his 1911 *Purchasing Power of Money* that "it would seem that even the theorems of Euclid would be challenged and doubted if they should be appealed to by one political party as against another:.. The attempts by promoters of unsound money to make an improper use of the quantity theory—as in the first Bryan campaign—led many sound money men to the utter repudiation of the quantity theory." In fact, that situation was the immediate reason for Fisher's writing the book; namely, that "the quantity theory needs to be reintroduced into general knowledge" (ibid., p. viii).

Note finally that when in 1913 Fisher proposed his compensated dollar plan, the Federal Reserve System had not yet come into existence. Though the Act establishing it was approved toward the end of that year, the role that it might play in stabilizing the price level did not become part of general thinking about monetary policy until the 1920s. This delay was due in part to the fact that in the first years of the Federal Reserve System, its policy was more or less dictated by the exigencies of World War I and, in part, to the time that was naturally needed for the System to gain experience in the workings of monetary policy (see Barger 1964, Chap. 3; Wicker 1966, pp. 57–58).

[1] Fisher's 50 percent figure was based on the wholesale price index which the Bureau of Labor Statistics had begun to publish only in 1890. Consequently, for the period before that, Fisher (in the statement cited in the preceding paragraph) had to suffice with a general statement about the increased purchasing power of the dollar. This is a minor illustration of another important interrelationship: that between economic thought and economic measurement. For a much more significant illustration, see Patinkin (1976) for the interrelationship between macroeconomic theory and measurement in the 1930s.

1. THE PLAN: RATIONALE AND DETAILS

With that as background, let me begin the story with Fisher's already-mentioned classic exposition of the quantity theory in his *The Purchasing Power of Money.* That—or rather its inverse, the price level—is indeed the major concern of the book. The book, however, also has a subtitle—*Its Determination and Relation to Credit Interest and Crises*—and that is an almost equally important concern.

Though most of *The Purchasing Power of Money* (henceforth, *PPM*) is devoted to the long-run proportionality between the quantity of money and the price level, Fisher attached great importance to Chapter 4 of the book on "transition periods," in which this proportionality did not obtain. And lest the term "transition" mislead, let me point out that Fisher emphasizes that "periods of transition are the rule and those of equilibrium the exception, [so that] the mechanism of exchange is almost always in a dynamic rather than a static condition" (ibid., p. 71).

It is accordingly in this chapter that Fisher develops his theory of "crises," or what we now call "cycles." This was based on the fundamental distinction that (with due acknowledgment to Alfred Marshall and even earlier writers) he had already made in his 1896 *Appreciation and Interest* (Chaps. 1–3 and 12), and again in his 1907 *Rate of Interest* (Chap. 5 and its appendix), between nominal and real rates of interest. Fisher begins his analysis of the period of transition by assuming that the economy is in a state of equilibrium which is disturbed, and adds that "any cause which disturbs equilibrium will suffice to set up oscillations. One of the most common of such causes is an increase in the quantity of money" (*PPM,* p. 70). Accordingly, the "chief factor" that he studies for this purpose is a change in the quantity of money (ibid., p. 55).

As a result of, say, an increase in this quantity, there follows an initial increase in the price level, which in turn causes an increase in the velocity of circulation, for "we all hasten to get rid of any commodity which, like ripe fruit, is spoiling on our hands. Money is no exception; when it is depreciating, holders will get rid of it as fast as possible" (ibid., p. 63). This causes a further increase in the price level. As a result of the increasing price level, the nominal rate of interest also increases. But—because of the failure of people to realize "that they are daily gambling in changes in the value of money" (what in later writings Fisher denoted as "money illusion"), as well as of inadequate "knowledge as to prospective price levels" on the part of lenders—"not sufficiently"; that is, the nominal rate does not increase sufficiently to leave the real rate unchanged (*PPM,* pp. 346, 321, and 63, respectively; see also *Rate of Interest,* p. 86).[2]

[2] In his *Theory of Interest* (1930) many years later, Fisher attributed this insufficiency of adjustment to the "almost universal lack of foresight" (ibid., pp. 43–44).

Because of the consequent decline in the real rate of interest, businessmen's "profits increase, loans expand, and the *Q*'s [i.e., outputs] increase" (*PPM,* p. 63). This expansionary process continues until ultimately lending rates of interest rise to correspond to the rate of inflation, which then causes difficulties for the business-borrowers "who have counted on renewing their loans at the former rates," hence to some bankruptcies, hence to "runs on the banks" and a consequent decrease in bank credit and deposits, and hence in the money supply—as a result of which pressure prices begin to decline (ibid., pp. 65–66).

The decline creates the opposite relationship between the nominal and real rates of interest, this time as a result of the lack of knowledge on the part of the borrowers. This increase in the real rate of interest generates a contractional process—which Fisher pedantically describes in the same step-by-step sequence (with the signs reversed) that he had described in the expansionary one (ibid., p. 69). Indeed, Fisher based his whole theory of the business cycle on the miscalculations of the real rate of interest caused by a fluctuating price level: in the picturesque words with which he entitled one of his later articles on the subject, "The Business Cycle Largely a 'Dance of the Dollar' " (1923b). (In a subsequent article on "Our Unstable Dollar and the So-Called Business Cycle" [1925], Fisher also provided what he regarded as statistical verification of his theory.)[3]

From this analysis of the cycle there immediately followed Fisher's prescription for eliminating, or at least greatly mitigating, it: if the source of the problem is the instability of the price level, then the solution to it is to stabilize this level.[4] Accordingly, Fisher devotes the concluding chapter of *Purchasing Power* to a description and criticism of various proposals to accomplish this purpose, and to the presentation of his own proposal. The following year, he expanded on his proposal in an article in the December 1912 issue of the *Economic Journal.* Shortly afterwards, in the February 1913 issue of the *Quarterly Journal of Economics,* he presented a more detailed description in an article entitled "A Compensated Dollar," under which name his proposal has since been known. And the only significant difference between the "new and revised" 1913 edition of *Purchasing Power* (henceforth, *PPM–2*) and the original one is the addition of the appendix "Standardizing the Dollar," in

[3] In the history of econometrics, this article is notable for Fisher's having introduced and applied for this purpose the technique of the distributed lag, the term for which he then also coined (see Alt 1942, p. 114, n. 4; see also Koyck 1954, pp. 30–32).

[4] It is interesting to note that stabilization of the price level was the policy advocated by many quantity theorists at the time (including Keynes of his quantity-theory period), though not all for the same reason and/or by the same means. See Patinkin (1972) and Laidler (1991, Chaps. 3 and 5). See also the brief discussion of Wicksell on pp. 10–11 below.

which Fisher refers to his *QJE* article and spells out his proposal in greater detail than in the original edition.[5,6]

In the appendix, Fisher considers it "easier to explain the principle of the proposal" by considering the case in which all gold coin has been withdrawn from circulation and replaced by gold certificates which can be redeemed upon demand from the government for a certain quantity of gold bullion (*PPM–2*, p. 495). As an example of this aspect of his proposal, as well as to reassure his reader that its like already existed in the world, Fisher referred to the similar situation that existed under the gold exchange standard that was in operation in India, the Philippines and in other countries (*PPM* and *PPM–2*, pp. 337–40; 1913b, pp. 226–27). Another way in which Fisher tried to present his plan in familiar clothing was by relating it to "the ancient custom of seigniorage" and to refer to it alternatively as "the adjustable seigniorage plan" (1913b, pp. 224, 395–96; see also *PPM* and *PPM–2*, pp. 330–1; *PPM–2*, pp. 498–99), in the sense that his plan called for making adjustments in the amount of dollars that one would receive for a given quantity of gold. In an accompanying footnote (1913b, p. 224, n. 1), however, he admitted that for several reasons (including the fact that it would not provide the government with revenue, which was of course the historical purpose of seigniorage) it was a "peculiar sort of seigniorage." (A similar observation was subsequently made by B.M. Anderson [1913, p. 42; see Section 3 below].)

Fisher then proceeds to explain that if an index of the price level should increase by, say, 1 percent, then the purchasing power of a dollar gold-certificate would be restored by increasing the "gold content" of a dollar by 1 percent; and if during the following quarter that should not succeed in restoring the original price level, the gold content would be further increased—and so forth. Here, then, was a rule in the modern sense of the term (Fischer 1990, p. 1168). Now, to increase the gold content of the dollar means to decrease the dollar price of a given quantity of gold, and vice versa. Thus in the back of Fisher's mind when he formulated his proposal (and more or less explicitly in some of his later discussions of it) there may have been the relation:

dollar price of basket of goods and services =
gold price of basket *times* dollar price of gold.

[5] See the list of differences between the two editions on p. xii of the 1913 edition.

[6] For other discussions of Fisher's proposal, see Lawrence (1928, Chap. 7), Reeve (1943, Chap. 11 et passim), and Dorfman (1959, vol. 4, pp. 288–93). It is also briefly discussed in the respective encyclopedia articles on Fisher by Allais (1968, p. 480) and Tobin (1987, p. 373b). See also Fisher's autobiographical account in his *Stable Money* (1934b, pp. 374–89), as well as the chapters on "The Commodity Dollar" and "Money Illusion" in Irving N. Fisher's biography of his father (1956). See also the discussion in the recent biography by R.L. Allen (1993, pp. 162–67 et passim).

It would thus seem that any change in the gold price of the basket can be offset by an appropriate change by the mint in the dollar price of gold, thereby leaving the dollar price of the basket unchanged.

This relation, however, holds only in an economy in which not only dollars, but physical quantities of gold (in, say, the form of blank gold slugs of a fixed weight, the dollar value of which is determined by the mint price of gold) are part of the circulating medium of exchange, so that the gold price of a basket accordingly means the *number* of gold slugs that have to be paid for a basket. For then a, say, decrease in the mint price of gold, in order to offset an increase in the dollar price of a basket, will in the first instance (i.e., before any subsequent change in that dollar price) decrease the dollar value of a gold slug and hence (by "instant arbitrage" between paying in dollars and paying in slugs) cause a proportionate increase in the slug price (i.e., the number of slugs that have to be paid for a basket). But the decrease in the mint price will also decrease the total quantity of money in the economy to an extent determined by the proportion of this quantity that individuals choose to hold in the form of slugs. And after the "first instance," this decrease will ultimately (on crude-quantity-theory assumptions) generate an equiproportionate decline in both the dollar and slug prices of a basket.[7]

On the other hand, the foregoing relation is obviously not relevant for the pure form of Fisher's plan in which only gold certificates are in circulation, the dollar value of which is not affected by the change in the mint price of gold. Nor would the situation be different if gold coins (the dollar value of

[7] The following example illustrates this process. Assume for simplicity that individuals always hold half of their money balances in the form of dollars and half in the form of gold slugs (evaluated at the mint price). Assume further that initially all prices in the foregoing relation are unity. Denote this as Situation I. Let there now be an increase in the output of gold, hence a 10 percent increase in the money supply (which again is equally divided between dollars and slugs), and hence a 10 percent increase in the price level (Situation II). In accordance with Fisher's plan, let the mint price be reduced by 9 percent so as to offset this price increase, but assume that in the first instance the dollar price of a basket remains unchanged; on the other hand, since the dollar value of a slug has decreased, this means that the slug price has increased (Situation III). Since gold slugs (evaluated at the mint price) constitute only half of the money supply, this 9 percent reduction in their mint price causes a reduction of only 4.5 percent in the total money supply, and hence ultimately a 4.5 percent reduction in both the dollar and slug prices of the basket (Situation IV). These developments are described in the following table:

dollar price of basket = gold-slug price of basket *times* dollar price of gold

I	1.00	= 1.00	x 1.00
II	1.10	= 1.10	x 1.00
III	1.10	= 1.21	x 0.91
IV	1.05	= 1.155	x 0.91

Note that the 9 percent reduction in the mint price does not suffice to restore the original dollar price of a basket, but see next section on subsequent changes.

I am indebted to my colleague Tsvi Ophir for the construction of this example.

which would also not be affected) continued to circulate as well. For as Fisher emphasized, the value of the gold actually contained in such coins generally would be less than the nominal value of the coin itself, so that an anticipated, say, decrease in the price index and hence increase in the mint price of gold would not lead to the melting down of coins in order to obtain gold to sell to the mint. In brief, "Gold dollars would, in such a system, be mere tokens—like brass checks—entitling the holder to gold bullion" (1913b, p. 222).[8]

2. THE PLAN: CRITIQUE

Having briefly indicated the nature of Fisher's compensated-dollar proposal, let me go on to say that it is a most puzzling one to have been advanced by the author of *The Purchasing Power of Money.* First of all, this book (as noted above) regards changes in the quantity of money to be the major cause of changes in the price level. We should accordingly expect that in any stabilization proposal that Fisher would present, he would assign a primary role to the quantity of money. I do not mean that we should expect him to have advocated the policy of, say, the Chicago School 20 years later to stabilize the price level by making offsetting changes in this quantity (see Patinkin 1969, pp. 245-46), for there was as yet no institutional framework in the United States that would have enabled using the quantity of money as a policy variable. In particular, there was as yet no central bank; nor was it part of generally accepted thinking at that time to generate peacetime changes in the quantity of money by having the government deliberately incur budgetary deficits or surpluses. But we should at least have expected Fisher to have emphasized and clearly explained the way in which his proposal would generate the necessary offsetting changes in the quantity of money and hence in the price level. Of this, there are only passing remarks in the appendix that Fisher added to the second edition of his book and in his 1913 *QJE* article.

Second, not only did Fisher not associate his plan with the quantity theory of money, but his presentation of it smacks of the commodity theory of money: the theory that claims that the value of money is determined by the value of the gold which it contains or for which it can be redeemed, and accordingly the theory which is the antithesis of the quantity theory that Fisher was forcefully advocating. In the words of B.M. Anderson, one of its leading advocates at the

[8] Fisher was fully aware of the danger that anticipated changes in the price of gold in accordance with his plan could encourage speculative purchases or sales of gold to the mint that would generate losses for the government. In order to prevent such speculation, he stipulated that there be a difference between the mint buying and selling price (which difference he denoted as a "brassage" charge) and that any change in the mint price of gold as a result of a change in the price index be less than this difference (1913b, pp. 227, 385–88).

time, the commodity theory contends "that by putting more bullion behind the coin you can *ipso facto* raise the value of the dollar" (1913, p. 42).[9]

Third, even Fisher's aforementioned passing remarks on the quantity of money refer only to the changing amounts of money (i.e., gold certificates) that miners would receive when they sold new gold to the mint, and that "jewelers and others who desire gold bullion" would have to pay when they bought gold from it (1913b, pp. 222–23; see also *PPM* and *PPM–2*, p. 343). But Fisher's argument in *Purchasing Power* is that it is the *stock* of monetary gold that influences the price level, not the *flows* into or out of it. In fact, he distinguishes sharply between these two concepts, and even illustrates this distinction with one of his ingenious and complicated diagrams (*PPM* and *PPM–2*, p. 105). These flows are, to begin with, small relative to the stock. Furthermore, even they would be affected only to a minor extent; namely, to an extent determined by the elasticity of supply of the gold mines, and the elasticity of demand of the arts, with respect to small percentage changes in the price of gold. Thus changes in that price cannot be expected to exert any significant short-run influence on the price level.

Fourth, in his exposition of the quantity theory in terms of his famous equation of exchange

$$MV + M'V' = PT,$$

it is the total quantity of money, currency (M) *plus* demand deposits (M')—what we today denote as $M1$—that matters. But the compensated dollar plan directly affects only M. Now, it is true that in his *Purchasing Power,* Fisher assumed that "deposits are *normally* a more or less definite multiple" of M (*PPM* and *PPM–2*, p. 50, italics added; see also pp. 53–54). But in periods of transition—which, as we recall, "are the rule," and which surely are the periods for which his plan was designed—the ratio of M' to M changes (ibid., p. 61). It is, however, also true that Fisher assumed that this change reinforces the effect of the change in M: that, say, a price rise generated by an increase in the quantity of money also "increases the ratio of M' to M" (ibid.). Still, it is puzzling that he completely disregarded the role of demand deposits.

Fifth, Fisher does not indicate that, under the gold standard that then prevailed, changing the dollar price of gold in accordance with his proposal meant changing the foreign exchange rate. At the same time, he was in favor of fixed exchange rates in order to avoid "again restoring the uncertainties

[9] Anderson's full statement is cited below. In order to avoid possible misunderstanding, let me emphasize that the long-run implications of the quantity theory, on the one hand, and of the commodity theory, on the other, are the same in the sense that both imply that the marginal cost of producing gold equals its mint price. But whereas the quantity theory explains that this equality is achieved over a period of time during which, say, an increase in the quantity of money raises prices and hence this marginal cost until it equals the mint price of gold (i.e., until equilibrium is achieved), the commodity theory contends that this equality always obtains.

of international exchange" (*PPM* and *PPM–2*, p. 340). And in an amazing statement, he declared in his 1913 *QJE* article that his plan did not involve "abandoning the gold standard" (ibid., p. 221), for "it is the possibility of turning gold dollars or gold certificates into commercial bullion which is the essence of the gold standard" (ibid., p. 223, n. 1)—as if the price at which this was done, and hence the exchange rate thereby determined, was of no consequence. In all fairness, however, I must note that there is one discussion in *Purchasing Power* (pp. 341–43) which might be interpreted as advocating the adoption of the compensated dollar proposal by all gold-standard countries of the world in a way which would leave their exchange rates unchanged. On the other hand, though the numerical illustration of the operation of the plan in Appendix II of the 1913 QJE article (here described as "the adjustable seigniorage plan") is based on the assumption that it is adopted only in the United States (ibid., p. 394), there is no indication in it of the consequent effect on the exchange rate. In Appendix III to the article, however, there is a brief consideration of the case in which all countries adopt the proposal (ibid., p. 396).[10]

There is, however, a simple answer to most of the above puzzles; namely, that the person who is our present concern is not Irving Fisher the author of the scientific work on *The Purchasing Power of Money,* but Irving Fisher the deviser of a plan to be "sold" to the economics profession as well as to the business community and government—and to be "packaged" accordingly. The quantity theory of money was out of favor in some circles, so the plan should not be explicitly associated with it. The commodity theory of money had influential supporters, so the plan should be presented in language that had the sounds of that theory. The gold standard was sacred, so it should be emphasized that the plan did not involve its abandonment.

3. THE RECEPTION BY THE PROFESSION

The foregoing criticisms of Fisher's plan are not new. Indeed, most of them were raised immediately after its publication, though they did not deter Fisher from persisting in advocating the plan for many years to come. Thus in the issue of the *QJE* following the one with Fisher's article, Frank Taussig (1913)—the doyen of American economists—published a critique of Fisher's plan in which he said:

> More stress should be laid, however, than Professor Fisher does, on the fact that the plan can work out its results only through its effects on

[10] I should note that Allais (1968, p. 480) presents a more favorable view of Fisher's plan in a long-run context. He claims that if it had been in operation during the nineteenth century, then "the long-run increases and declines in the price level, which actually occurred and whose drawbacks are evident, could have been avoided." Fisher, however, regarded his plan as one that would deal with short-run problems as well.

> the *quantity* of coined gold :.. The consequences on prices [of an increase in the gold content of the dollar] will be precisely the same as those of diminished production or limited coinage. Professor Fisher seems to expect a closer connection. His analysis implies, almost states in terms, that prices will accommodate themselves at once or very promptly to the bullion equivalent of the coined dollar; that as the bullion required for the dollar increases, prices will fall quasi-automatically in proportion; and that as the bullion equivalent lessens, prices will be correspondingly affected at once. Now, no one has stated more clearly and explicitly than Professor Fisher himself, in his *Purchasing Power of Money,* the grounds for maintaining that the connection between the bullion equivalent in the coined dollar and prices will work out its effects solely through changes in quantity. He has shown that the connection between the quantity of coined money and general prices is by no means a close one. It is not only loose and uncertain, but we are much in the dark concerning the degree of looseness and uncertainty. Economists should be very chary of prediction in such matters, and Professor Fisher makes predictions which the event might greatly falsify. (1913, pp. 402–3; italics in original)

As might be expected from an economist with a primary interest in international trade theory and policy, Taussig (1913, pp. 410–11) also pointed out the effect of Fisher's plan on the exchange rate. He stressed that while that effect would be immediate, the effect on domestic prices would at best take place with a lag. Thus if in the face of an inflationary process the gold content of the dollar were increased—which would mean that the dollar appreciated in the foreign exchanges—the receipts of exporters would immediately be affected adversely, while their domestic costs of production would decline only after a lag. Exporters would then put pressure on Congress and the government to abandon the policy. Furthermore, Taussig left no doubt about his opinion that an "international agreement" for the adoption of the compensated dollar plan–which would have the benefit of obviating the need for changes in the exchange rate–seemed to him "in the highest degree unlikely" (ibid., p. 407).

In light of these as well as other objections, Taussig concluded, "On the whole, I conclude that this proposal for radical change gives better opportunity for ingenious intellectual exercise than for practical efficacy" (ibid., p. 416).

Interestingly enough, Fisher's *Quarterly Journal of Economics* article also evoked a critical reaction from Knut Wicksell. In a note entitled "Another Method of Regulating the Value of Money" which he submitted in 1913 to that journal, Wicksell began with a criticism of Fisher's plan on the grounds that

> although of course the method proposed by professor Fisher always must be regarded as a step in the right direction, it will generally prove to be *too small a step* to have immediately any practical bearing at all on the level of prices. Fisher forgets, it seems to me, that an alteration of the mint price will directly influence only the *new* gold, and as the gold produced every year is only a small fraction of the whole amount of gold and hence of the volume of money,

> the possible alteration of the value of money and of the level of prices will at first only be a *fraction of a fraction* or practically nil. (emphasis in original)

As an alternative to Fisher's plan, Wicksell then went on to spell out the details of the policy that he had advocated in his 1898 *Geldzins und Güterpreise*[11] and in his 1907 *Economic Journal* article on "The Influence of the Rate of Interest on Prices" to stabilize the price level by means of central-bank interest-rate policy. In a very polite and respectful letter of rejection to Wicksell dated January 7, 1914, however, Taussig (then editor of the *QJE*) did not refer to Wicksell's criticism of the plan, but simply explained that since Wicksell's policy proposal was familiar to American economists from his two aforementioned publications, he (Taussig) had reluctantly concluded that the journal could not publish the note.[12]

Fisher also presented his plan at the 1912 Meetings of the American Economic Association. And here the sounds of the commodity theory of money are unmistakable:

> Both on the basis of theory and of facts, we may accept as sound the principle that the lighter the gold dollar the less its purchasing power and the more magnified the scale of prices; and that the heavier the dollar the greater its purchasing power and the more contracted the scale of prices. Evidently if we can find some way to increase the weight of the dollar just fast enough to compensate for the loss in the purchasing power of each grain of gold, we shall have a fully "compensated dollar," that is, a dollar which has constantly restored to it any purchasing power it may lose by gold depreciation. (1913c, pp. 20–21)

Again, the value of a gold coin "would be determined just as the value of a gold certificate or any other paper money is today determined, by the ultimate bullion with which it would be interconvertible" (1913c, p. 24).

In any event, one Albert C. Whitaker (1913, pp. 31–32) began his discussion of the paper with the statement that "at one place in his paper Professor Fisher has followed the instincts of a good propagandist and has invited even

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[11] See pp. 189–92 of the 1936 translation of this book under the title *Interest and Prices.*

[12] I am indebted to Lars Jonung for providing me with a copy of Wicksell's note, as well as of Taussig's reply, and granting me permission to cite from them here.

In a comment on this paragraph, David Laidler has pointed out to me that the English version of Wicksell's *Lectures on Political Economy,* Vol. II: *Money* (which was translated from the third [1929] edition of the Swedish original) contains a "Note on Irving Fisher's Proposal for the Regulation of the Purchasing Power of Money" (ibid., pp. 225–28). An attached editorial footnote explains that this "Note" was added by Wicksell to the second (1915) Swedish edition, and that Wicksell had indicated in the preface to that edition that it constituted a brief resume of a 1913 paper which he had published in *Ekonomisk Tidskrift.* The title of that paper was similar to the one he submitted to the *QJE,* and so I presume that its contents were also similar. In any event, the "Note" in the English translation contains the same criticism of Fisher's plan cited here–including the same emphasis on "*fraction of a fraction.*"

those who repudiate the quantity theory to join with him in support of the adjustable seigniorage plan"[13] and then went on to emphasize that "it is clear the author of the plan himself conceives it simply as one which will provide for an approximate stability in the purchasing power of the money unit *merely by way of and through its effects upon the quantity of standard coin in circulation"* (italics in original).

At the same time, Whitaker questioned the practicality of the plan because he

> [did] not at all follow Professor Fisher in his assumption that the *amount* of change of seigniorage [i.e., in the gold content of the dollar] required to correct a *given* change in the price level can be clerically or ministerially determined, or even approximately so determined. (ibid., p. 32; italics in original)

And again:

> I may be wrong, but I think the assumed substantial proportionality between seigniorage change and consequent price level change (or correction), would be likely to prove so far away from what we should actually experience as to suggest strongly the abandonment of the ministerial or clerical determination of the seigniorage. (ibid., p. 34)

With these last two comments, another discussant, O.M.W. Sprague (1913, p. 40), who played an important role in the discussions that led up to the Federal Reserve Act (Warburg 1930, vol. 1, pp. 35–6; Friedman and Schwartz 1963, pp. 410–11), expressed his agreement.

Whitaker also pointed out that, in order to avoid fluctuations in the exchange rate,

> the only method to be recommended for putting Professor Fisher's general plan for an adjustable seigniorage into effect, would be to have an international agreement between the leading nations providing for equal and simultaneous alterations of the seigniorage charge in all, determined upon the basis of a world's index number. (ibid., p. 35)

Of particular interest is the comment of a then leading exponent of the commodity theory of money, B.M. Anderson (1913, p. 42), part of which I have cited above:

> Because I am *not* a quantity theorist, I am disposed to believe that Professor Irving Fisher's plan of stabilizing the dollar might be feasible. If he put it on a quantity theory basis, and tried to raise the value of the dollar by charging a real seigniorage, and so checking the increase in the number of dollars, I should be very skeptical. But his plan is not a real seigniorage

[13] No such statement appears in the published version of Fisher's paper. Presumably, however, he did make it in his oral presentation. In any event, he did make it in some of his later writings (see below).

> plan. The coined dollar is *inter*convertible with the gold bullion, and you can always get your bullion back. I believe that by putting more bullion behind the coin you can *ipso facto* raise the value of the dollar, and consequently lower the level of prices. But I do not see how, on the basis of the quantity theory, you could be sure of getting any definite result by Professor Fisher's plan. (ibid., italics in original)

Another discussant was E.W. Kemmerer (1913, p. 45), a staunch advocate of the gold standard, who accordingly opposed the plan on the grounds that "its adoption would demoralize the international exchanges." He also described as "visionary" the "hope of securing a comprehensive international agreement on this scheme" and thereby enabling the plan to operate without causing changes in exchange rates.

In his reply to his critics, Fisher (1913d) agreed with Kemmerer's statement about the effect on the exchange rates, and said that "for this reason I should not advocate the plan for one nation alone, but should advocate it only under international agreement" (ibid., p. 48). But in the paragraph following that statement, Fisher explained to another of his critics that one of the ways in which a reduction in the price of gold would "tend to contract the currency" would be by "diverting gold :. to countries where the price had not been changed"—a diversion which would take place only with respect to countries that were not part of an "international agreement" and with respect to which the dollar would accordingly appreciate.[14] Nor did he address the basic question that had been raised by both Whitaker and Anderson as to the questionable quantitative effect that changing the gold content of the dollar would have on the total stock of money, as distinct from its effect on the inflow and outflow of gold into this stock.

During 1913 there appeared many other articles on Fisher's plan by both American and European economists. In one of them, David Kinley (1913, pp. 9–10, 16–17), an influential monetary economist of the period (see Dorfman 1959, vol. 4, p. 313 n.) in effect pointed out that Fisher's proposal would change only the quantity of currency in circulation, whereas the price level also depended on the quantity of demand deposits as determined by the volume of bank credit—and in this context rejected Fisher's assumption of a constant ratio

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[14] Further evidence on Fisher's ambivalent treatment of this issue is provided by the following footnote in a 1913 article objecting to his plan by one E.M. Patterson:

> [Fisher's] ready admission of the serious effect on foreign trade is surprising. In reply to the question, "Would not the adoption of the plan by the United States alone play havoc with our foreign trade?" he answers "Yes, most certainly. Foreign exchange would become uncertain and variable. While the plan could be worked if adopted by one nation without the concurrence of others, its benefits would be best secured through its adoption by a number of nations." *The New York Times*, December 22, 1912. (ibid., p. 869, n. 14)

between the two.[15] J.M. Clark (1913) wrote that the plan was an improvement over the gold standard, but pointed out possible complications.

Fisher's reaction to these articles was presented in his "Objections to a Compensated Dollar Answered" (1914), which included a selected bibliography of the literature that had grown up about his plan. In his article Fisher intensified his effort to sell his plan by means of arguments which made it all things to all men (ibid., pp. 820–22).

Thus it was not true that "the plan assumes the truth of the quantity theory of money.... On the contrary, the plan will seem simpler, I think, to those who believe a direct relationship exists between the purchasing power of the dollar and the bullion from which it is made—without any intermediation of the quantity of money—than it will seem to quantity theorists"—and here Fisher cites B.M. Anderson's aforementioned statement at the 1912 meetings of the American Economic Association. On the other hand, it was not true that "it contradicts the quantity theory" for, say, "an increase in the weight of the virtual dollar, i.e., a reduction in the price of gold bullion, would tend to contract the currency, by diverting gold from the mint into the arts :.. A decrease, of course, would have the opposite effect."

There was no reason to fear that "the correction of the price level would be too sudden," for

> all adjustments require time. Changes of the flow of gold into or out of circulation are like changes in a mill pond from the sluice gates. The pond does not jump its level down or up every time the gate is opened or closed. The change of level begins immediately but it is not *completed* immediately. (italics in original)

On the other hand, there was no reason to fear that "the correction of the price level would be too slow":

> How prompt the effect would actually be, we have no exact means of knowing. I should expect *an appreciable effect within a week.* One can scarcely deny that the effect would *begin* at once, for the instant that the price of gold is decreased, even a little, there would be at least *some* tendency to increase the use of gold in the arts and, consequently, an *immediate* reduction in the amount of gold taken to the government for money. *If this be conceded, the plan would surely, under any conceivable circumstances, have a great and quick influence toward stability.* (first and last set of italics in this passage added)

Fisher then proceeded to support his plan with misleading examples. "The closure of the Indian mints in 1893[16] had an almost immediate influence in raising the value of the rupee"—as if a valid inference could be drawn from

[15] Actually, as noted above, Fisher did not maintain this assumption for "periods of transition" (*PPM* and *PPM–2*, p. 55).

[16] For details, see Nambudiripad (1955), pp. 57 ff.

a situation in which there was a complete stoppage of the sales of bullion to the mint in exchange for new coinage, to a situation in which net sales to the mint were slightly reduced as a result of the decrease in the output of gold and increased diversion into the arts caused by a decline of 1 percent in the mint price. "The rate of exchange on London in New York has often changed from the maximum to the minimum inside of a fortnight"—as if the arbitrage that rapidly adjusted exchange rates between those two gold-standard countries by shifting amounts of gold from an *existing* monetary stock of gold from the market for dollars to that for sterling (or vice versa) is of any relevance for the speed of adjustment of the price level involved in the compensated dollar plan—which depends on a *change* in the level of the stock (see p. 8 above).

4. THE HIGH POINT OF THE COMPENSATED DOLLAR

In his 1914 article (p. 818), as well as in the appendix that he had added to the revised edition of *Purchasing Power of Money* (1913a, p. 494), Fisher referred to a book that he hoped shortly to publish about his plan. So let me skip the many additional discussions of his plan in the immediately following years and turn to the book in question. This finally appeared in 1920 under the title *Stabilizing the Dollar* and is the most systematic and detailed presentation of the compensated dollar proposal. Here again we find statements that sound more like those of a commodity theorist than a quantity theorist, such as the following example:

> I do not think that any sane man, whether or not he accepts the theory of money which I accept,* will deny that the weight of gold in a dollar has a great deal to do with its purchasing power. More gold will buy more goods. Therefore, more gold than 23.22 grains will, barring counteracting causes, buy more goods than 23.22 grains will buy. Therefore if the dollar, instead of being 23.22 grains, or about one-twentieth of an ounce of gold, were an ounce or a pound or a ton of gold, it would, other things equal, surely buy more than it does now, which is the same thing as saying that the price level would be lower than it is now.
>
> A Mexican gold dollar weighs about half as much as ours and therefore has less purchasing power. If Mexico should adopt the same dollar that we have, no one could doubt that its purchasing power would rise about twofold, that is, the price level in Mexico would fall about half. Likewise, if we should adopt the Mexican dollar, our prices would about double.
>
> * Thus B.M. Anderson, Jr., probably the ablest writer among the few who still dissent from the "quantity theory" in any form, nevertheless approves of the proposal to stabilize the value of a dollar by adjusting its weight.
>
> (ibid., p. 90)

Note, too, the misleading nature of the argument in the second paragraph: for the changes in the price level there described are not the short-run ones that

Fisher claimed for his plan, but the long-run changes associated with the new equilibrium that would be established after the monetary stock of gold (and hence the quantity of money) had been slowly and fully adjusted to the change in the gold content of the dollar in question—including the adjustment generated by the specie-flow mechanism activated by the change in the exchange rate.

In this book, Fisher (ibid., pp. 87–96) again emphasized that his plan did not involve the abandonment of the gold standard. Under the heading "The Essentials of a Gold Standard," he justified this statement on the grounds that the mint would continue to buy and sell gold in exchange for gold certificates, which he termed "yellowbacks"—presumably to distinguish them from the famous greenbacks, which could not be redeemed for gold. In this context, he also mentioned importers and exporters as buyers and sellers, respectively, of gold. But he did not point out that his plan, based as it was on a varying price of gold, meant (in basic contrast with the gold standard as it then operated) that the exchange rates at which they carried out their international transactions would also vary. This fact was, however, pointed out in an appendix to the book on "Technical Details," but with practically no indication of the difficulties for international trade that this would generate, and only with the expression of the hope and anticipation that the plan would be adopted by other countries as well (ibid., pp. 172–82; see also p. 235, sec. D).

In another appendix to the book (ibid., pp. 214–51), Fisher repeated his presentation of the plan as one that could be supported whether or not one believed in the quantity theory, and also discussed criticisms that had been levied against the plan. Though he did not explicitly refer to the one about the slowness with which the plan would affect prices, he did make a major modification in it which could increase this speed. In particular, Fisher added the possibility of adopting a "definite–reserve system" in which any change in the price of gold also revalued the existing monetary stock of gold with a consequent change in the quantity of gold certificates that could be issued. This was contrasted with the "indefinite-reserve system," which is how he termed the system he had until then advocated. In Fisher's words:

> Under the "indefinite-reserve" system the only inflow and outflow of [gold] certificates would be through the deposit and withdrawal of gold, just as at present; whereas under the "definite-reserve" system there would be, in addition, an inflow and outflow of certificates through special issues or cancellations to keep the total outstanding volume of certificates in tune with the gold reserve :..
>
> The "definite" system would act more promptly to stabilize the price level than would the "indefinite," because, for one reason, the change in the circulation would be more prompt. The instant any change in the dollar's weight is made there is a change in the number of dollars of the reserve, and the volume of certificates is readjusted to this changed reserve immediately. Under the "indefinite" system, on the other hand, the circulation would be affected somewhat more slowly and only as the flow of gold deposits and withdrawals became changed. (ibid., pp. 129–31)

Significantly enough, however, Fisher does not explain the mechanism by which "the volume of certificates [in circulation] is readjusted." Furthermore, in view of the smallness of the flows relative to the stock of gold, surely the term "more slowly" grossly understates the difference in speed at which these two systems would operate.

There are also three minor and somewhat piquant points about the book that I would like to mention. First, Fisher rhetorically asked, "Why did not our civilization improve [i.e., standardize] its monetary units years ago, as it improved all other units? Why was so simple an idea overlooked or ignored?" To this he replied, "because until recently *it lacked the necessary instrument, the index number*" (ibid ., p.113, italics in original)—an allusion (inter alia) to the fact that the United States began publishing such numbers only in 1890 (see n. 1 above), and a nice example of Fisher's concern with the relation between theory and measurement. Correspondingly, he attributed the continued resistance to his plan even after such numbers were available to conservatism, to "resistance to change" (ibid., p. 237). In this context he added:

> And now this obstacle of conservatism—the one great obstacle—has been considerably lessened by the Great War, which has shaken the whole world out of old ruts. Even Great Britain is considering giving up her ancient monetary system—of pounds, shillings, and pence—in favor of a decimal coinage. (ibid., p. 239)

He was one "Great War" too early.

Second, in this book Fisher coined the term "money illusion" to denote "the illusion that money is always fixed in value," and that it is only the prices of goods that change (ibid., pp. 35–39; see also pp. xxxii–xxxiii). (Several years later, he published a book with this title; see below.)

The third point is the dedication of *Stabilizing the Dollar* to "John Rooke, Simon Newcomb, and Alfred Russel Wallace." In another of its appendixes entitled "Precedents," under the rubric "Direct Anticipations," Fisher lists Rooke as the one who (in 1824) had first published a proposal "substantially like that proposed in this book," and after him under that rubric lists Simon Newcomb (ibid., p. 293).[17] What intrigues me, however, is the dedication to Wallace, by many considered the joint discoverer with Charles Darwin of the theory of evolution.

[17] Under this rubric, Fisher also lists Alfred Marshall, as well as three obscure American and English writers of the 1890s. It was, of course, to Newcomb as an anticipator of the equation of exchange that Fisher had also dedicated his *Purchasing Power of Money* (see p. 25, n. 2). In his later book on *Stable Money* (1934b, pp. 26–28), Fisher presents a more detailed account of Rooke's proposal. Fisher lists Marshall on the basis of the second of two plans described in a footnote in the latter's 1887 article on "Remedies for Fluctuations of General Prices" (p. 206, n. 2), which Fisher (1920, p. 294) describes as "in principle, virtually that of this book." Note, however, that as Fisher (ibid, p. 293) himself points out, Marshall states in that footnote that he does not advocate either of the two plans. Note, too, the excerpt from an October 1912 letter which Marshall wrote Fisher in which he expresses some reservations about the plan (reproduced in Pigou, ed. 1925, pp. 477–78).

Wallace is listed in the aforementioned appendix under the rubric "Remote Anticipations of the Plan to Stabilize the Dollar," in the category of those who advocated doing so by printing irredeemable paper money "regulated by an index number of prices" (ibid., pp. 290–91). Thus in the 1898 paper to which Fisher refers, Wallace explains that if the index should show a decline in prices, the "Mint" would "issue fresh money," and that

> This money is sent to the Treasury and is at once brought into circulation by being paid away in salaries, wages, purchase of materials, &c., in the various Government departments :.. On the other hand, when prices are rising, owing to there being rather more money in circulation than is necessary, instructions are sent to the Treasury to cancel a certain amount of the money paid in for taxes, stamps, &c., till the balance is restored. (Wallace, 1898, p. 148).

In this appendix, Fisher (1920, p. 291) explains that the "essential difference" between plans such as those of Wallace and his own "is that between redeemability and irredeemability." But is there really an essential difference between always being able to "redeem" a gold certificate for a possibly *varying* quantity of gold, on the one hand, and always being able to purchase with irredeemable money a given quantity of gold at a possibly *varying* market price, on the other?

So as an outsider to economics, Wallace was free from the attachment to gold and thus advocated a stabilization policy that was more in the spirit of the quantity theory. He was also explicit about what Fisher (in his definite-reserve system) left unspecified; namely, the role of the Treasury in injecting or withdrawing quantities of money from circulation. Here was a true anticipator of the Chicago School of the 1930s. But what remains a puzzle for me is why Fisher chose to dedicate the book to Wallace in preference to the well-known economists he cited in the same category with him—among them Carl Menger and Charles Gide (Fisher 1920, p. 291).[18]

Let me finally turn to that part of the book which in effect constituted a most significant turning point in Fisher's campaign for the compensated dollar, even if he did not at the time recognize it as such. I am referring to the last clause in Fisher's "Tentative Draft of an Act to Stabilize the Dollar" that also appears in the book's appendix on "Technical Details." It reads:

> The Federal Reserve Board could assist in the prompt and efficient operation of the new system by having due regard to the rise and fall of the Index Number, as suggested by Mr. Paul Warburg. This would help [by] its adjustment of the rate of discount and its general loan policy to be such as to keep the volume of individual deposits subject to check approximately proportional both to bank reserves and to the Government gold reserve against gold bullion dollar certificates. (ibid., p. 213)

[18] It is interesting to note that Fisher had already referred to Wallace in his 1914 article (p. 818, n. 1).

Presumably, this clause represented Fisher's response to those who criticized his plan (including Warburg[19]) on the grounds that it dealt only with the currency component of the money supply. But Fisher failed to recognize that far from strengthening the case for the compensated dollar, this clause actually undermines it. For if success of the plan is dependent on the ability of the Federal Reserve to control the volume of demand deposits, then one might as well dispense with the plan and depend solely upon the Federal Reserve to stabilize the price level directly by controlling the *total* money supply!

The high point in Irving Fisher's protracted campaign for the compensated dollar was reached when two years later the House Committee on Banking and Currency held hearings on such an act (subsequently described by Fisher [1934b, p. 152] as "practically in the form" of his aforementioned "Tentative Draft") which had been submitted by Congressman T. Alan Goldsborough (the "First Goldsborough Bill"). Interestingly enough, this bill provided for a modified version of Fisher's definite-reserve system. In particular, it called for maintaining a 50 percent gold reserve against gold certificates and stated that:

> If on any date the reserve falls short of 50 per centum [as it would if the price of gold were reduced—i.e., the gold content of the dollar increased—in order to offset an increase in the price level] it is to be restored by withdrawing from circulation and canceling gold bullion dollar certificates.
>
> If on any date the reserve exceeds said 50 per centum it is to be restored by issuing and putting into circulation the requisite number of new gold bullion dollar certificates.
>
> The Secretary of the Treasury is authorized to make said withdrawals of certificates from circulation by withdrawing from the Government deposits in national banks and to issue certificates and place them in circulation by adding to those deposits. (H.R. 11788, 1922, p. 3)

So the bill was more specific than Fisher had been in *Stabilizing the Dollar* (see above) about the role of the Treasury in the case of the definite-reserve system. But it too did not make explicit the implications of this system for the Treasury's budgetary deficit or surplus. It should also be emphasized that neither the bill nor Fisher's "Tentative Draft" stipulated that the plan should only be adopted as part of an international agreement.

Needless to say, the first witness in the hearings on the bill was Fisher himself (1922, 1923a), who in his book-length testimony (which at times clearly tried the patience of the committee) repeated much of what he had written on the evils of an unstable dollar, the workings of the compensated dollar proposal, and his arguments in favor of it—including (in a more egregious form) his aforementioned misleading argument about Mexico.[20] In his testimony, he

[19] See Warburg (1920, pp. 702–3). Warburg was one of the five members of the original (1914–18) Federal Reserve Board; see Barger (1964, pp. 50–51).

[20] "The Mexican dollar now is half the value of ours. On the other side of us, across the

also stressed the importance of the cooperation of the Federal Reserve for the success of the proposal, and explicitly referred in this context to the aforementioned last clause of the "Tentative Draft" of the bill that he had presented in his *Stabilizing the Dollar* (Fisher 1922, p. 27; see also pp. 46–47).

Kemmerer (who as a result of his having repeatedly preached the virtues of the gold exchange standard to the new countries that had been established after World War I had become known as "the international money doctor"[21]) also presented a statement to the Committee. Though agreeing with the importance of stabilizing the price level, he pointed out that "how long a time would be required for such changes in the size of the bullion dollar, working through the money and deposit currency supply, to reduce the price level, say, 1 percent, is a debatable question" (Kemmerer 1923, p. 158). And in the concluding paragraphs of his statement he stated:

> In the judgment of the writer any plan for stabilizing the monetary unit to be successful should be international in its scope, including at least three or four of the leading commercial nations and more if possible. For one country to adopt the plan alone would throw its exchanges entirely out of adjustment with those of gold-standard countries (and also of silver-standard countries), and would give rise to all the evils of widely fluctuating exchange rates. (ibid., p. 160)

Significantly enough, in his summary many years later of the hearings on the bill, Fisher (1934b, p. 155) said that Kemmerer "wrote (among other things) a strong endorsement of the 'Compensated Dollar' plan," and made no mention whatsoever of the serious reservations that Kemmerer had expressed, which—in view of the absence of any reference in the bill to an international agreement—were tantamount to a recommendation to reject it.

5. THE DECLINE OF THE COMPENSATED DOLLAR

Neither the First Goldsborough Bill, nor the second (1924) slightly revised version,[22] was reported out of Committee. And with the increasing importance of Federal Reserve monetary policy in the years which followed, Fisher slowly came around to accepting the view that the objective of stabilizing the price

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Canadian border, they have the same dollar as we have. Suppose Mexico :. would say :. 'we are going to have on this continent just one dollar of equal value in Canada, Mexico, and the United States.' *Immediately* prices in Mexico would be cut in two :.. Is there any doubt about that?" (Fisher 1922, pp. 23–24, italics added)

[21] See Groseclose (1965), p. 141. See also Barber (1985), pp. 59–60, and his reference (ibid., p. 209, n. 48) to Kemmerer's presidential address to the American Economic Association (1927), in which the latter described the advice that he had given to many countries in connection with the "establishment of the gold standard" (ibid., p. 4).

[22] The revision consisted of the deletion of the clause that required a 50 percent reserve against gold certificates. See H.R. 494, 68 Cong. 1 Sess., December 5, 1923.

level could be achieved by this policy alone, without the need for a compensated dollar. Thus his 1928 *The Money Illusion* includes a discussion of the Federal Reserve's "duty to control or influence credit" by means of its open market operations, as well as by the fixing of its rediscount rates (ibid., pp. 131–35). Though in this book Fisher again presented his compensated dollar proposal (in its definite-reserve version), he concluded this presentation by saying:

> When my *Stabilizing the Dollar* was written, I relegated credit control to the Appendix, assuming that all banking, even central banking,[23] would still be conducted purely for private profit. My aim was to make the whole plan of stabilization—both gold control and credit control—as "automatic," that is as free from discretion, as possible.[24]
>
> Since that time, however, as has been shown in this book, discretionary credit control has actually come into existence. This, when duly perfected and duly safeguarded, will greatly simplify and improve the technique of stabilization and will make gold control secondary to credit control. (*Money Illusion,* pp. 192–93)

Even though it includes *The Money Illusion* in its list of references, there is no mention of "credit control," and accordingly no indication of this shift in emphasis, in the entry "Compensated Dollar" that Fisher wrote for the 1930 *Encyclopaedia of the Social Sciences.* On the other hand, this shift is expressed in an even more marked way in Fisher's 1932 *Booms and Depressions.* The roughly 20 percent decline in prices that had taken place in the preceding two years had greatly increased the real burden of debt with a resulting wave of bankruptcies, and had led Fisher to assign great importance to this factor as a generator of depressions.[25] Correspondingly, he stressed the desirability of "reflating" the price level to its original level—and then stabilizing it there. Chapter 10 of the 1932 book is accordingly devoted to a description of "Remedies" to accomplish this subsequent stabilization. Most of this chapter is devoted to the role that can be fulfilled by Federal Reserve monetary policy in accomplishing this objective by effecting changes in the quantity of money and hence on the price level. There is only a brief mention of the compensated

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[23] This is a most disingenuous statement for Fisher to have made: it is certainly not the view that he expressed in the 1913 Hearings before the Senate Committee on Banking and Currency on the Federal Reserve Act (Fisher 1913e, pp. 1129–59). Nor does it accord with his description of this act in his *Stable Money* (1934b, p. 148).

[24] Another questionable aspect of Fisher's discussion on these pages is his presentation of the compensated dollar plan as being necessarily more "automatic" than a Federal Reserve monetary policy that would also be based on the price index.

[25] See also his "Debt-Deflation Theory of Great Depressions" (1933a). Note that in contrast with his *Purchasing Power of Money* (1911, 1913)—in which a depression was explained as the result of the fact that the price level was *decreasing* (see p. 4 above)—Fisher now emphasized the role played by the fact that it was *low.* That is, his emphasis shifted from the rate of change of prices to their absolute level. See Patinkin (1972, pp. 5–10). This aspect of Fisher's analysis of the depression has been much emphasized by Tobin (1985, p. 36b; 1987, p. 375b).

dollar plan, and even then not as the first choice. In Fisher's words:

> A simple application of the compensated dollar plan would be to rely principally upon credit control, and only at long intervals regulate the weight of the dollar when other means proved inadequate. (ibid., p.139)

But Fisher does not explain why the compensated dollar plan would help in cases where "credit control" proved "inadequate."

Another significant aspect of this chapter is that in it Fisher comes full circle in the sense that (to the best of my knowledge) it is the first time he explicitly discussed stabilization policies within the analytical framework of the equation of exchange that he had developed in his 1911 *Purchasing Power of Money.* Similarly, he does so more explicitly than before in terms of the quantity theory. And since (T given), the equation implies that P is affected by V as well as by M, he also proposed a policy of influencing the price level by what he called "velocity control" (*Booms and Depression,* pp. 140–1). This was to be based on Silvio Gesell's plan of issuing "stamped money," which (Fisher said) "would operate as a stamp tax on hoarding—increasing the velocity as well as the quantity of money" (ibid., pp. 226–28). Fisher's subsequent book on *After Reflation, What?* (1933b) again assigns the major responsibility for stabilizing the price level to Federal Reserve monetary policy, and again does so within the analytical framework of the equation of exchange (ibid., Chap. 7; Chap. 8 of the 1934 edition). Velocity control also earns brief mention (1933b, pp. 95–98; 1934a, pp. 106–9). Fisher spelled out this last proposal in greater detail in a book on *Stamp Scrip* that he also published in 1933.

So that is the anticlimactic denouement of the story of the compensated dollar plan. I should however note that in *After Reflation, What?,* Fisher again mentioned the compensated dollar plan as one that could be brought into operation if a "reasonable credit" policy would not be able to deal adequately with great inflows or outflows of gold (1933b, pp. 93–95; 1934a, pp. 104–5). But Fisher's reference to this as a serious possibility was at variance with the enthusiastic description he had presented in his 1928 *Money Illusion* (pp. 131–35) of how the open market sales of the Federal Reserve in 1922 had prevented the monetary expansion and consequent inflation that otherwise would have taken place as a result of its "huge gold reserves." Furthermore, even if a central bank in a gold-standard country should have to take additional steps in order to deal with undesired gold movements, those steps are usually described as the appreciation or depreciation of the exchange rate, and surely it is misleading to describe them in terms of the compensated dollar plan.

In a section entitled "My Personal Views" in his book *Stable Money* (1934b)—which in many ways can be regarded as Fisher's concluding work on the subject—he wrote:

> As to the problem of stable money in the United States, while a rough stabilization could be obtained by sole reliance on adjusting the price of gold

> according to the compensated dollar plan, I do not think a really accurate stabilization is feasible without also a direct control of the total volume of checking deposits or what may be called checkbook money :.. I would depend for a stable dollar mainly on open market operations and occasional adjustments of rediscount rates :.. (ibid., pp. 396–97)

So even at the end Fisher could not bring himself to giving up his compensated dollar plan entirely. Indeed, only in his 1935 *100% Money*—a book which (as Fisher indicates in its preface [p. ix]) was much influenced by the memoranda on this subject prepared by Henry Simons and his colleagues at the University of Chicago—is there no mention whatsoever of the compensated dollar plan. Here (once the 100 percent system was installed) stabilization of the price level was to be achieved by open market operations and velocity control alone (ibid., pp. 89–91). Fisher, however, might have felt that since 100 percent money would prevent sharp fluctuations in the volume of demand deposits and hence of the quantity of money, there would be no need for any further action.

"On January 15, 1934, President Roosevelt sent a special message to Congress, which was again a confirmation of his intention of '*:*. restoring the price level, and, *:*. arriving eventually at a less variable purchasing power for the dollar*:..*' " (*Stable Money*, 1934b, p. 369, ellipses in original). That was Fisher's description of Roosevelt's decision to devalue the dollar, a decision that was put into effect at the end of that month, when Roosevelt raised the price of gold from $20.67 to $35.00 an ounce. So the question naturally arises as to the role that Fisher and his compensated dollar plan played in this decision to (in his terms) decrease the gold content of the dollar. In his fascinating paper on "Irving Fisher, F.D.R., and the Great Depression" (1977), William R. Allen cites a letter that Fisher wrote Roosevelt in April 1933 in which he referred to "the compensated dollar plan to which devaluation is the natural introduction" (ibid., p. 570, n. 44). Allen also refers to letters that Fisher subsequently wrote Roosevelt suggesting various levels to which the price of gold should be raised, as well as a letter that Fisher wrote his wife in August 1933 reporting on a conversation that he had had with Roosevelt on the subject. Allen, however, adds that "apparently, Fisher gave the President no hint of what 'the compensated dollar plan' was" (ibid.).[26]

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[26] In this footnote, Allen also cites a letter that Fisher had written to President Hoover in July 1931, in which Fisher had disingenuously written:

> On thinking over our talk of Wednesday, I wonder if, when you expressed the fear that stabilizing the purchasing power of money would change the basis of contracts, you thought I was pleading for support by you of my old "Compensated Dollar Plan." I was not. It became evident long ago that immediate, practical progress lay along other lines.

It would, however, appear that Fisher's main influence on Roosevelt was exerted at one remove by people who had accepted his policy view. This was particularly true of George F. Warren, who was one of Roosevelt's chief monetary advisers in the last half of 1933 (Dorfman 1959, vol. 5, p. 581 n.). In particular, Warren's book with Frank A. Pearson on *Prices* (1933, pp. 163–66, 168) provides a sympathetic account of the compensated dollar plan. This situation was also reflected in the following passage from a letter that Fisher wrote his son in February 1934:

> :. it was a "proud moment" when the President signed the devaluation bill. I often wonder how much he realizes that his monetary policy goes back to me in large part—through Warren and Rogers and Rand, as well as directly. And the public doesn't know it except here and there. But I take a lot of satisfaction in the mere *adoption* of the policy of course. (emphasis in original letter; cited by W.R. Allen 1977, p. 576, n. 67)

6. CONCLUDING OBSERVATIONS

In his posthumously published *History of Economic Analysis* (1954), Schumpeter wrote that "some future historian may well consider Fisher as the greatest of America's scientific economists up to our own day" (ibid., p. 872). Similarly, Samuelson (1967, p. 17) wrote that from the viewpoint of analytical contributions, "Irving Fisher would emerge as perhaps the greatest single name in the history of American economics." I would, however, associate the compensated dollar plan less with Fisher the scientific and analytical economist (with his notable contributions to capital theory as well as monetary theory) than with Fisher the possessor of two other character traits. The first is Fisher the gadgeteer. This trait manifested itself early in the form of the gadget that he invented in 1884 at the age of 17 to improve the internal mechanism of the piano—what was subsequently described in his son's biography as "the first of a long line of brain-waves with which he bombarded the patent office" (I.N. Fisher 1956, p. 13).[27] In his scientific writings, Fisher also made use of pedagogical gadgets: like the hydraulic mechanism which he depicted on p. 38 of his 1892 doctoral dissertation on *Mathematical Investigations in the Theory of Value and Prices* (and of which he actually constructed a model a year later[28]) to illustrate the utility-maximizing conditions of general-equilibrium analysis. Similarly, there were the diagrams in *The Purchasing Power of Money* (pp. 21,

[27] For details of other inventions, see the page references listed under the entry "inventions" in the index to this biography. See also the references listed under the entry "as inventor" on p. 317 of the index to R.L. Allen's recent biography of Fisher (1993).

[28] See its photograph, as well as that of the second model which he constructed in 1925, at the beginning of the reprint of this dissertation as listed in the References below.

23) which explain the equation of exchange in terms of weights on the two sides of a fulcrum; and the diagrams (on pp. 116–19 and 128) of the flows of gold into, between, and out of interconnected vessels which explain the relation between these flows, on the one hand, and the level of the monetary stock of gold, on the other. Then, of course, there was the gadget which he invented that in the 1920s made him a multi-millionaire; namely, the "visible card index system" (I.N. Fisher 1956, pp. 160–3 et passim; R.L. Allen 1993, pp. 109–10, 136, 185–86). The compensated dollar plan was also in the nature of a gadget: for in the eyes of its deviser, here was an automatic device which, by simply changing one price in the economy, achieved the stabilization of the price level in general.

The second of Fisher's character traits with which I would associate his plan was Fisher the inveterate crusader for different causes during his long life; e.g., healthy living, world peace, and prohibition.[29] In the zeal to advance his cause, a crusader is less concerned than the scientist with the requirements of objectivity, consistency, careful analysis of causal relations, and strict adherence to rules of evidence. Fisher was no exception. Indeed, his recent biographer has observed that

> [Fisher's] devotion to his multiple crusades was so complete that on occasion he used all the tools of science he could muster to support them. He occasionally bent a few facts and twisted logic slightly to make his case. When this occurred, which was not common, it was rhetoric and likely entirely unconscious on Fisher's part. He was incapable of intended dishonesty or deliberate deceit, but he was capable and occasionally guilty of self-delusion. The conflict between his two roles, besides competition for time and energy, was apparent only to others, not to Fisher. (R.L. Allen 1993, p. 6)

And on the basis of the foregoing account of the way in which Fisher repeatedly evaded criticisms of his plan (particularly in its original form) and continued over the years to support it by sometimes questionable arguments, I would cite Fisher's crusade for his compensated dollar plan as an example *par excellence* of Allen's general observation. At the same time, we should not overlook the fact that Fisher's persistent advocacy of this plan played a major role in placing the problem of stabilizing the price level on the agenda of U.S. monetary policy in the interwar period.

POSTSCRIPT

In the extensive literature on price stabilization that has developed since the early 1980s, there are frequent references to Fisher's compensated dollar plan,

[29] See the biographies by I.N. Fisher (1956) and R.L. Allen (1993). It is also instructive to see the large number of items dealing with these and similar subjects among the 2,500-odd entries in the *Bibliography of the Writings of Irving Fisher* that was compiled by I.N. Fisher (1961, 1972).

and to his 1920 *Stabilizing the Dollar* in particular. But sometimes this name is taken in vain. Thus Philip Cagan's 1987 paper on "A Compensated Dollar: Better or More Likely than Gold" suggests (inter alia) preserving the purchasing power of money, not by stabilizing the price level, but by issuing indexed money (i.e., money whose nominal value changes equiproportionately with the price index), which would become "the primary medium of exchange" (ibid., p. 272). As I have, however, shown elsewhere (Patinkin 1993, pp. 122–24), and as illustrated by the Israeli experience of the early 1980s, an economy whose money supply is mostly indexed will generate a frictionless inflationary process, which will accordingly continue indefinitely at indeterminate rates.

In his article on "Explorations in the Gold Standard and Related Policies for Stabilizing the Dollar," Robert Hall (1982) has suggested stabilizing the price level by modifying Fisher's rule for achieving this objective by making offsetting changes in the price of gold to making such changes in the price of a fixed basket of commodities, and thus (presumably by the operation of substitution effects) generating similar changes in the prices of other commodities. The efficacy of such effects for this purpose is itself doubtful. But quite apart from that is the basic problem that arises from the fact that, in contrast with Fisher's proposal that the government buy and sell gold at the price that it fixes in order to make it effective, Hall emphasizes that the government should *not* make purchases or sales of the basket of commodities used to define the value of the dollar (ibid., pp. 120–21). But how else can the government make effective its announced price for the basket? Surely, the announcement per se will not do so. And surely we have had enough experience to demonstrate that administrative price controls break down in the face of pressures created by inflationary policies that generate increases in the money supply.[30]

On the other hand, Fischer Black's proposal in his "A Gold Standard with Double Feedback and Near Zero Reserves" (1981) can rightly be regarded as a generalization of the modified version of Irving Fisher's compensated dollar proposal in its definite-reserve form that was incorporated in the First Goldsborough Bill (see above, p. 19). In particular, whereas that bill required the Secretary of the Treasury to take action after an offsetting change in the price of gold in order to maintain a 50 percent gold reserve against gold certificates in circulation, Fischer Black's plan is a bit different. It leaves the monetary authority free to fix the reserve ratio between gold reserves and the quantity of money in circulation at a level that it chooses and places the responsibility for establishing and maintaining this ratio on open market operations that change the quantity of money. (It also advocates fixing this ratio as close as possible to zero.) I should, however, point out that this affinity with Fisher's plan leaves Fischer Black's plan open to the same criticism leveled above (pp. 8–9 and 16) about the misleading nature of associating with the gold standard (whose

[30] For a detailed critique of Hall's proposal, see McCallum (1985, pp. 26–32).

hallmark is the fixed exchange rate) a plan based on changes in the price of gold and hence in the exchange rate.

I hope on some future occasion to deal at greater length with the issues raised in the aforementioned literature.

A PERSONAL NOTE

In a paper some years ago, I expressed puzzlement that "in its policy discussions, the Chicago school of the 1930s and 1940s did not do justice to Irving Fisher—despite the fact that long before the Chicago school, Fisher had advocated the policy of stabilizing the price level as a means of mitigating—if not avoiding—cyclical fluctuations" (Patinkin 1973, p. 280).[31] My work on the present paper has suggested an answer to that puzzle. Because of his many persistent crusades, as well as his also having persisted in losing a fortune in the 1929 crash and its aftermath, Fisher had by the 1930s come to be regarded as a crank, with his reputation as a scientist suffering accordingly (see Tobin 1987, pp. 370a and 371a–b, and Schumpeter 1954, p. 873; on his persistent losses, see I.N. Fisher 1956, pp. 262–67). Furthermore, his name was still associated with the outmoded compensated dollar plan, which for the Chicago school (with its policy of stabilizing the price level by directly changing the quantity of money through open market operations as well as by the generation of budget deficits) was simply an encumbrance. So in addition to the natural process of the succession of generations, of the young taking over leadership from the old, there was no reason for the Chicago school to have invoked Fisher's name in support of its program. Indeed, in view of his reputation at the time, it would have been counterproductive for it to have done so. In brief, by that time the Chicago school had become a leader on questions of monetary policy, and Fisher a follower—as exemplified by his acknowledgment to Henry Simons and his colleagues in his 1935 book *100% Money.* And perhaps that too was a reason that in this book Fisher did not mention his compensated dollar plan (see p. 23, above).

On one occasion in my life I had the privilege of meeting Irving Fisher personally. It was at the January 1947 meetings of the Econometric Society in Atlantic City, the first scientific conference that I ever attended, at which I also presented a paper. Fisher was chairman of my session, and I remember him as a short, bearded, and wizened old man. Three months later he died at the age of 80.

[31] The emphasis is on "policy discussions": for in both the undergraduate and graduate courses on monetary theory that I attended at the University of Chicago in the early 1940s, Lloyd Mints devoted much attention to Fisher's transactions approach to the quantity theory. To the best of my memory, he also had us read chapters from *The Purchasing Power of Money.* Fisher's equation of exchange also provided the theoretical framework for the policy proposals of the Chicago school. On all this, see Patinkin (1969).

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A Quantity Theory Framework for Monetary Policy

Robert L. Hetzel

One of the oldest and most useful ideas in economics is the quantity theory of money. The quantity theory explains the determination of variables measured in dollars such as the price level. Modern expositions of the quantity theory assume that the monetary authority controls directly a reserve aggregate like the monetary base (currency plus bank deposits with the monetary authority). In actual practice, however, monetary authorities use an interest rate rather than a reserve aggregate as their policy variable. This fact poses a challenge to the quantity theorist. How does he reconcile his theory with actual policy procedures? There are no modern expositions of the quantity theory that assume interest rate targeting by the monetary authority.

This article provides such an exposition. The exposition brings out the standard quantity theory distinction between the determination of the real and nominal quantity of money and explains changes in the price level as equating the nominal demand with the nominal supply of money.

Modern expositions of the quantity theory assume reserve control in part because reserve control constitutes a major item on the reform agenda of quantity theorists. Control of reserves and, at one remove, a monetary aggregate constitutes control of a nominal variable and, therefore, draws attention to the responsibility of the monetary authority to control the price level, also a nominal variable. Quantity theorists dislike the interest rate as a policy variable. Interest rate control suggests that the monetary authority is controlling the

The views expressed in this article are those of the author and do not necessarily reflect those of the Federal Reserve Bank of Richmond or the Federal Reserve System.

price of resources made available to investors. The analysis here retains these concerns. In particular, the article explains how rate targeting encourages the public to confuse the monetary authority's control over nominal variables with control over real variables. These concerns motivate a proposal for a change in monetary policy procedures designed to help the Fed achieve its goal of price stability.

1. AN EXAMPLE AND SOME BASIC PRINCIPLES

An Example of Money Creation

Suppose the monetary authority sets a target for the interest rate and follows a "lean-against-the-wind" policy of raising its rate target when economic activity strengthens and lowering it when economic activity weakens. Because information on the economy becomes available with a lag, the monetary authority would then supply reserves when economic activity strengthens and withdraw them when economic activity weakens. Furthermore, it would not necessarily offset these changes in reserves later. As a result, random disturbances would be permanently incorporated into future levels of reserves and money. By following a "let bygones-be-bygones" policy of base drift in reserves, the monetary authority causes the price level to wander randomly.[1]

Suppose also that introduction of a new technology raises the rate of return on capital and, therefore, investment demand. When the market rate, reflecting this higher return, begins to rise above its targeted level, the monetary authority buys securities. As a result, the monetary base and the money stock increase.[2]

The individuals who sold securities to the monetary authority did so because they were offered a good price, not because they wanted to reduce their holdings of assets. After selling securities, they allocate their additional money among different assets to replace the securities sold. Temporarily, the increased demand for financial assets depresses the interest rate. Consequently, real expenditure rises until the price level increases sufficiently to return real money balances to their original level. Real money balances return to their original level through a rise in the price level, not through a fall in the nominal quantity of money.

[1] The idea that rate pegging by the monetary authority makes nominal variables into a random walk is mentioned in Friedman's (1969, p. 104) "The Role of Monetary Policy" and is developed systematically in Goodfriend (1987).

[2] This exposition can be compared to Friedman (1969), who uses the notion of a helicopter drop of money. The counterpart here to the helicopter is rate smoothing in the presence of a positive real sector disturbance.

Real Versus Nominal and the Natural Rate Assumption

An understanding of the consequences of the monetary authority's reserve injection begins with the distinction between real and nominal variables. Real variables are real quantities or relative prices. A real quantity is usually measured in physical units. The real quantity of money is a measure of the purchasing power or command over goods represented by the nominal quantity of money. A relative price is the price of a commodity expressed in terms of another commodity. The real rate of interest is a relative price measuring the price of commodities today in terms of commodities in the future. It is the market interest rate adjusted for expected inflation. In contrast to real variables, nominal variables are dollar amounts or dollar prices. Thus the nominal quantity of money is the number of dollars the public holds. A special case of a nominal variable is the market interest rate, which is the price of a dollar today in dollars tomorrow.

An individual's welfare depends upon his real income (the purchasing power of income measured in terms of goods) and the relative prices of the goods he consumes (the scarcity of those goods in terms of other goods). An individual is better off if his real income increases so he can consume more of all goods. He is no better off if his dollar income (and cash balances) increases, but at the same time all dollar prices increase by the same amount so his real income is unchanged. The idea that people care about real, not nominal, variables is called the natural rate assumption (hypothesis).[3]

The monetary authority controls a nominal variable—the monetary base. It follows from the natural rate assumption that the rise in the real rate of interest, which is governed by real factors like investment opportunities and the public's thrift, can only be restrained temporarily by changes in money creation. Similarly, the real quantity of money desired by the public is not changed by an injection of reserves. After the reserve injection, at the original price level, the public holds a larger quantity of real money balances than desired. The price level must rise to return real money balances to their desired, lower value.

The natural rate assumption thus implies that the monetary authority cannot maintain an arbitrary target for the interest rate. Although the interest rate is a nominal variable, its equilibrium value is the sum of the real rate consistent with equilibrium in the economy (the natural rate) and an inflation premium equal to the inflation expected by the public. If the monetary authority sets a

[3] Alternatively, one can say that individual choice is not affected by money illusion. Different economists, of course, give empirical content to the natural rate assumption in different ways. Most monetarists, for example, assign considerable importance to temporary effects of money on real variables because of transitory confusion between changes in the price level and changes in relative prices and because of the existence of contracts in nominal terms. The key assumption is that these monetary nonneutralities are transitory so that the monetary authority has no ability to affect real variables in a sustained or systematic way.

rate target below the equilibrium market rate (the nominal natural rate), banks have an incentive to acquire assets and their deposits and the money stock increase.[4] The public's money balances then rise above their desired level. The public responds by spending at a faster rate and the inflation rate rises.

Nominal Determinacy

A corollary to the natural rate assumption that the public cares only about real variables is the proposition that only the monetary authority can give nominal variables well-defined (determinate) equilibrium values. Patinkin (1965) showed that when the monetary authority targets the monetary base, the price level is made determinate through a real balance effect. A rise in the price level above its equilibrium value reduces the real value of the base and nominal money. This fall in real balances restrains the public's real expenditure until the price level falls back to its equilibrium value.

When the monetary authority targets an interest rate, however, the monetary base varies endogenously, that is, with the demand for it by the public. If the monetary authority does no more than specify an interest rate target, even one equal to the economy's nominal natural rate, a random movement in the price level will induce a corresponding change in the demand for nominal bank credit and, consequently, in the supply of nominal bank deposits and money. Changes in the money supply then validate the changes in money demand produced by changes in the price level, and the price level possesses no equilibrium value.

If the monetary authority targets an interest rate, it must provide a nominal reference point that gives nominal variables well-defined values. It does so by giving the expected future price level a well-defined value. Although with a rate target the monetary base is determined endogenously, the monetary authority limits the public's demand for it indirectly by giving the future price level expected by the public a well-defined value (Dotsey and King 1983; McCallum 1986). One way to understand nominal determinacy with rate targeting is to compare it to the way a monetary authority achieves nominal determinacy by exchange rate targeting. Assume the Fed targets the Deutsche mark price of a dollar. As shown in equation (1), the DM/$ exchange rate equals the product of the ratio of the German price level (DM/German good) to the U.S. price level ($/U.S. good) and the real terms of trade (German good/U.S. good). The nominal reference point or benchmark for the dollar is the German price level. If the U.S. price level rises above its equilibrium level, the foreign exchange value of the dollar falls, and the Fed buys dollars with Deutsche marks. The monetary

[4] The terminology "nominal natural rate" and "natural rate" is in Friedman's (1969, p. 101) "The Role of Monetary Policy."

base and the money stock fall and the price level returns to its equilibrium level.

$$\frac{DM}{\$} = \frac{\dfrac{DM}{German\ good}}{\dfrac{\$}{US\ good}} \cdot \frac{German\ good}{US\ good} \tag{1}$$

With a rate target, the nominal benchmark is the expected future price level. In the case of a rate target, the Fed targets the price of today's dollars ($\$_t$) in terms of tomorrow's dollars ($\$_{t+1}$), or one plus the interest rate ($1 + r_t$). As shown in equation (2), this price equals the product of the ratio of the future price level expected by the public to the contemporaneous price level and the real terms of trade with the future. If the price level were to rise above its equilibrium value, the ratio of the expected future price level to the contemporaneous price level would fall, that is, expected inflation would fall. Consequently, the inflation premium in the interest rate would decline. The resulting decline in the interest rate would increase the demand for money. It would also prompt the monetary authority to sell securities and decrease the monetary base. Because the demand for money would increase, while the supply would decrease, an excess demand for money would return the price level to its equilibrium value. If the price level were to deviate from its equilibrium value, a relative price effect would be created, analogous to a real balance effect, that would return the price level to its equilibrium value.[5]

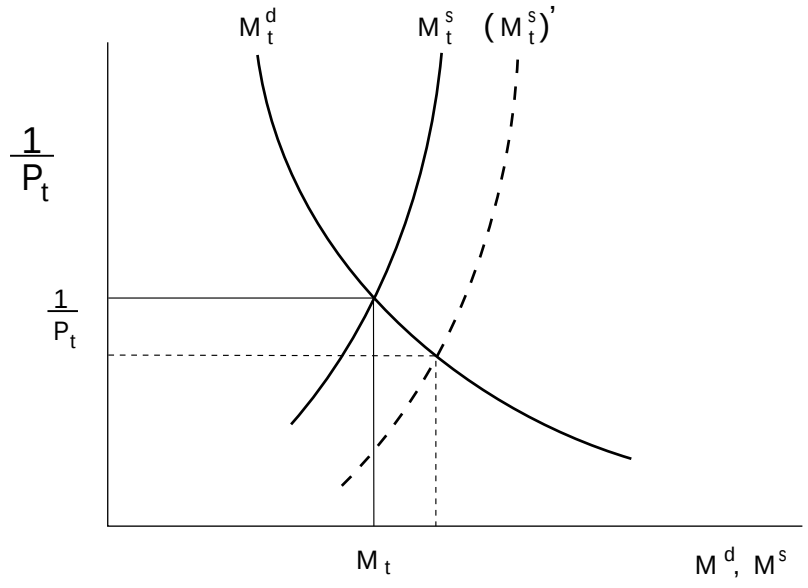
$$1 + r_t = \frac{\$_{t+1}}{\$_t} = \frac{E_t\left(\dfrac{\$}{good}\right)_{t+1}}{\left(\dfrac{\$}{good}\right)_t} \cdot \frac{(good)_{t+1}}{(good)_t} \tag{2}$$

A Graphical Presentation of the Quantity Theory

The quantity theory can be summarized with the money demand and supply schedules of Figure 1, which determine the nominal money stock and the goods price of money (the inverse of the price level). For the reasons explained in

[5] In practice, the monetary authority does not tie down the expected future price level by targeting a fixed value of the price level. Instead, it allows the price level to vary in response to shocks. It must, however, impart inertia to changes in the public's expectation of the future price level relative to changes in its contemporaneous value. It does so through its dislike for large jumps in nominal prices. Goodfriend (1987) defines jumps relative to expected values. He assumes that the monetary authority dislikes both discrepancies between the contemporaneous price level and the prior period's expectation of the contemporaneous price level and between the contemporaneous price level and the expected future price level. In this way, the monetary authority imposes a level and a change constraint on prices that make the public's expectation of the future price level well defined, while still allowing it to vary.

Figure 1 The Supply of and Demand for Money



the preceding section, the schedules are well defined because the monetary authority behaves in a way that allows the public to form an expectation of the future price level. (See also Hetzel [1988].)

The nominal money demand schedule (M_t^d) is the product of the price level and the demand for real money. Because increases in the price level (reductions in the inverse of the price level) cause proportional increases in the demand for nominal money, the demand schedule is negatively sloped. The schedules in Figure 1 are drawn for a given expectation of the future price level. A rise in the price level above its equilibrium value, given the public's expectation of the future price level, causes a reduction in expected inflation. As a consequence, the market rate of interest falls through a reduction in the inflation premium. The reduction in the market rate generates an increase in the quantity of money demanded, which adds to the curvature of the money demand schedule.

Under the assumption that the central bank smooths the market rate, the fall in the market rate due to the rise in the price level just described causes the monetary authority to reduce the monetary base and the money supply. The nominal money supply schedule (M_t^s), therefore, is positively sloped. In contrast to the money demand schedule, which depends primarily on the behavior of the public, the money supply schedule depends upon the reserve-supplying behavior of the monetary authority. Shifts in the money supply schedule depend upon the extent to which the monetary authority smooths the interest rate, that

is, the extent to which it varies reserves when the interest rate changes. Shifts in the money supply schedule also depend upon the extent of base drift, that is, the extent to which, if at all, the monetary authority subsequently offsets changes in reserves induced by changes in the interest rate. Finally, shifts in the money supply schedule depend upon the trend rate of growth of reserves, money, and prices the monetary authority allows.[6]

These schedules are summarized in the quantity equation (3):

$$M^s = (k \cdot y) \cdot P, \text{ where } (k \cdot y) \cdot P = M^d. \tag{3}$$

The fraction of real output (y) the public wants to hold as money is k, which is a function of variables like the interest rate. The public's demand for real money then is $(k \cdot y)$, and its demand for nominal money is $(k \cdot y)$ times the price level P. The price level varies to make the nominal value of real money desired by the public (M^d) equal to the nominal supply (M^s).

The schedule $(M_t^s)'$ shows the rightward shift in the money supply schedule discussed in Section 2, where the monetary authority smooths the interest rate during a positive real sector disturbance to aggregate demand. The graphical illustration of this example highlights the key ideas of the quantity theory. First, it is useful to organize an understanding of the price level by classifying variables according to the way in which they affect money demand and supply schedules. Second, the money supply schedule, whose behavior is dominated by the monetary authority, shifts independently of the money demand schedule. Third, because the equilibrium values of real variables are ultimately tied down by real factors, shifts in the money supply schedule eventually appear as changes in the price level.

Over periods of time too short for the price level to vary sufficiently to equate the nominal quantity of money supplied and demanded, it is useful to view nominal output, rather than the price level, as the equilibrating variable, as in equation (4).

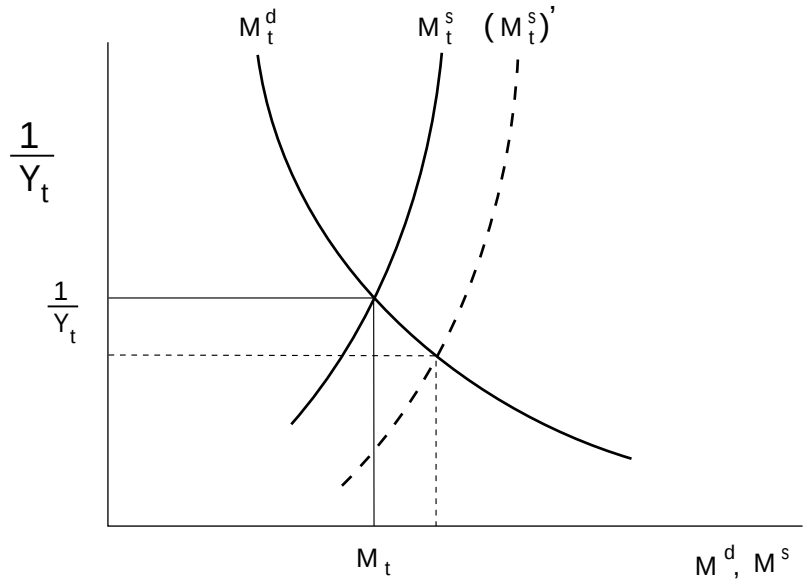
$$M^s = k \cdot (y \cdot P) = k \cdot Y, \text{ where } k \cdot Y = M^d \tag{4}$$

Nominal output (Y) is the product of real output (y) and the price level (P).

Figure 2 illustrates equation (4). If at the actual level of nominal output money supply M^s exceeds money demand M^d, $1/Y_t$ exceeds its equilibrium

[6] The money supply schedule depends upon the behavior of the monetary authority summarized in its reserves-supply function and the behavior of commercial banks and the public summarized in the reserves-money multiplier. With rate targeting, the key behavioral relationships of the money supply function concern the former rather than the latter relationship. Fluctuations in the reserves-currency and reserves-deposits ratios of the reserves-money multiplier are automatically offset at the prevailing funds rate target. For example, if currency flows out of banks or if banks increase the desired level of excess reserves, the funds rate rises. In order to maintain its funds rate target, the monetary authority supplies reserves, thereby accommodating changes in these ratios and avoiding a change in deposits.

Figure 2 The Supply of and Demand for Money



value, and the public will increase its expenditure in an attempt to reduce its money holdings. The result will be to raise nominal expenditure until nominal output rises ($1/Y$ falls) to its equilibrium value.[7]

Quantity Theory and Monetarist Hypotheses

Milton Friedman and Anna Schwartz (1963) have given the quantity theory a specific form, often referred to as monetarism, through their hypothesis that shifts in the money supply schedule have been large relative to shifts in the money demand schedule.[8] Their hypothesis possesses two distinct parts. The first is that large shifts in the money supply schedule have destabilized the

[7] Figure 2 is drawn assuming a given expectation of the future level of nominal output. Because nominal output is the product of the price level and real output, the slopes of its schedules are determined by the relationship of the contemporaneous price level relative to the expected future price level, as explained for Figure 1. The relationship of contemporaneous real output relative to expected future real output reinforces these price relationships. A level of real output that is high relative to expected future real output causes the public to save a relatively large fraction of its income and depresses the real rate. The resulting decline in the market rate increases the demand for money by lowering money's opportunity cost. Also, the supply of money falls because of rate smoothing by the monetary authority.

[8] Friedman prefers the term quantity theory to monetarism, which was coined by the staff of the Federal Reserve Bank of St. Louis for an article in their *Review* by Karl Brunner (1968). A number of economists helped revive the quantity theory in the United States, for example, Karl Brunner and Allan Meltzer, Phillip Cagan, Thomas Mayer, William Poole, and Clark Warburton.

behavior of nominal and real income. Their empirical evidence for this part is twofold. They show that turning points in the rate of growth of the money stock have preceded turning points in the business cycle. They also argue that shifts in the money supply schedule can often be attributed to specific historical circumstances rather than to contemporaneous changes in economic activity. The second part of their general hypothesis is that much of the observed variability in real money demand has resulted from prior actions of the monetary authority. Specifically, destabilizing shifts in the money supply schedule have produced destabilizing shifts in the money demand schedule. These empirical generalizations lead Friedman (1959) to recommend moderate, stable money growth.

There is now a consensus that the quantity theory is the only useful framework for explaining the long-run behavior of prices. The monetary authority can shift the money supply schedule independently of the money demand schedule so that it can control the long-run behavior of the price level. The magnitude of secular shifts in the money demand function is limited by real factors like growth in real income and payments technology. There is no such limitation on the behavior of the money supply. Over long periods of time, inflation has reflected the behavior of the money supply. There is less consensus over Friedman and Schwartz's hypotheses about the monetary causes of the business cycle and the stability of money demand. The basic quantity theory assumption that the price level is a monetary phenomenon does not require acceptance of these latter two hypotheses, however.

2. THE QUANTITY THEORY AS A GUIDE FOR POLICY

Interest rate targeting encourages the public to confuse the role of the monetary authority, which is to control the nominal quantity of money and the price level, with the role of commercial banks, which is to set a real rate of interest that rations available resources to investors. The quantity theory counters this confusion through its distinction between money and credit and between nominal and real variables.

The monetary authority is responsible for the money creation of commercial banks. In addition to creating deposits, commercial banks ration credit by setting its price, the real interest rate. When the monetary authority targets an interest rate, the public is encouraged to assume that the monetary authority can control the credit rationing of commercial banks. The public then assumes that the monetary authority can ensure a steady flow of credit to the economy and can avoid "large" changes in the price of credit. When the monetary authority tries to manage the extension of credit, the money supply becomes a function of credit demand. The resulting changes in money require changes in the price level. The view of monetary policy as the management of credit has at times produced large deflations as in the Depression and, at other times, large inflations as in wartime.

When the commercial banking system extends credit by adding to the assets it holds, it must persuade the public to hold a larger real value of deposits. If this intermediation does not simply draw funds away from other forms of intermediation, the increase in bank deposits must correspond to a reduction in consumption by the public. When the monetary authority extends credit by acquiring an asset, however, it does no more than create through a bookkeeping operation the corresponding liabilities (the monetary base). Because monetary base creation requires no one to refrain from consumption, it does not increase the resources available to investors. A "central bank" does not intermediate between savers and investors. It is not a bank, and it cannot increase the resources commercial banks make available to investors.

The belief that the monetary authority regulates the flow of credit entails the implicit assumption that the quantity of money is self-regulating. The fallacy in this assumption is the failure to distinguish between the mechanism for limiting real credit extension and that for limiting money creation. As explained below, the real interest rate limits the quantity of real credit demanded, but not the nominal quantity of money demanded.

If money were a commodity, its equilibrium quantity would depend upon its real resource costs of production. The market mechanism that limits the supply of a commodity through the real costs of production, however, does not limit the quantity of bank deposits. It is true that banks incur resource costs in providing deposits. The resources that can be obtained in exchange for a dollar of deposits, however, greatly exceed the bookkeeping cost of creating that dollar. Because the resources obtained from creating an additional dollar exceed the cost of creating that dollar, the monetary authority must limit the nominal quantity of deposits and money.

The way market forces limit the availability of real credit differs from the way the monetary authority limits the nominal quantity of money. When a bank extends credit, it credits the deposits of the borrower. The borrower then draws down those deposits in order to purchase goods and services. The bank loses reserves when it loses the deposits. When the bank goes into the market for reserves (issues CDs or borrows federal funds) to replace the lost reserves, it must pay the market rate of interest. The real rate implicit in the market rate limits the real amount of credit banks extend because it conveys information about the scarcity of resources. The interest rate does not, however, convey information about the "scarcity" of nominal money.

3. FOMC PROCEDURES IN A QUANTITY THEORY PERSPECTIVE: A PROPOSED CHANGE

How can the natural rate assumption that the monetary authority cannot control the real rate in a sustained way be reconciled with the fact that the Federal Open

Market Committee (FOMC) uses the funds rate as its policy instrument?[9] The FOMC can use the funds rate to target a nominal variable. The simplest case would be to set the funds rate to achieve a target for money (McCallum 1981). As part of such targeting procedures, the Fed shapes the way the public forms its predictions of the future values of nominal variables. Those predictions, in particular the expected future value of the price level, make the contemporaneous price level well defined. With a target for the rate of growth of nominal output, for example, the expected inflation rate would equal the targeted growth in nominal output minus the expected growth in real output.

An implication of the quantity theory is that, to stabilize the price level, the monetary authority must set its interest rate target equal to the economy's equilibrium rate. Because an interest rate consists of two parts, a real rate and an inflation premium, it follows that the monetary authority must perform two tasks in setting its rate instrument. First, it must change its instrument in line with changes in the economy's equilibrium real rate. Second, as explained above, it must set the interest rate in a way that allows the public to predict the future price level.

This section suggests two changes designed to help the monetary authority achieve these two tasks. The first requires an explicit target for inflation. The second involves the use of indexed bonds to measure the correspondence between the monetary authority's implicit target for inflation and the public's expectation for inflation.[10]

Milton Friedman (1959) for one has argued that targeting inflation or the price level directly would be destabilizing. For this reason, it would be useful to use nominal output as an intermediate target. With the suggested changes, for example, at its December meeting, the FOMC would vote on an explicit multi-year target path for inflation. At the February meeting, FOMC members would submit their predictions for real output growth for the current year

[9] At times, the FOMC has targeted the funds rate directly. Other times it has targeted the funds rate indirectly by setting the discount rate and a target for the level of borrowed reserves. Given the positive relationship between borrowed reserves and the difference between the funds rate and the discount rate, the latter procedure amounts to an indirect funds rate target.

[10] Implementation of the proposal advanced here would require creation of a measure of expected inflation through the issue of Treasury zero-coupon bonds with different maturities. Half the bonds would be indexed to the price level and half would be conventional, nonindexed bonds. Unlike holders of the nonindexed bonds, holders of the indexed bonds would not have to worry about the depreciation due to inflation of the dollar payment they receive when their bonds mature. For this reason, the difference in yield between the nonindexed and indexed bonds would provide a measure of expected inflation. Moreover, the existence of bonds of different maturities would provide a term structure of expected inflation. Given the current value of the price level, this term structure would yield estimates of the price level expected in future years.

The Fed could issue the indexed bonds. (It would buy short-term securities to offset the resulting decline in the monetary base.) It would be better for the Treasury to issue the bonds, however, because it could issue them in sufficient quantities to ensure a liquid market. For more discussion, see Hetzel (1992), U.S. Congress (1992a), and the testimony by Michael Boskin, Alan Greenspan, Representative Stephen Neal, William Poole, and Alan Walters in U.S. Congress (1992b).

consistent with the long-run inflation target. When combined with the current-year inflation target, the median value of FOMC members' predictions for real output growth would yield an intermediate target for nominal output growth. The Board staff would convert the target for nominal output growth into an intra-yearly target path in level form. At subsequent FOMC meetings, the Board staff would display its predictions of nominal output relative to this target path.

Also at the February meeting, the Board staff would continue to make predictions for money growth for the current year consistent with the inflation target. Subsequent observations of money and nominal output relative to their intra-yearly paths would offer information useful in assessing whether the FOMC was achieving its inflation target.

Assuming the existence of indexed bonds with varying maturities, the FOMC would have available a measure of the price level expected by the public in succeeding years. These observations on the expected price level would be displayed relative to the multi-year target path for the price level consistent with the FOMC's inflation targets. In setting the funds rate, the FOMC would take account of the gap between the targeted path for the price level and the path expected by the public.

These procedures would keep the funds rate equal to the economy's equilibrium rate. They would also make the inflation premium in the equilibrium rate, that is, the inflation expected by the public, consistent with the Fed's objective for inflation. Responding to the measure of expected inflation made available by indexed bonds, the Fed would keep expected inflation on target.

4. CONCLUDING COMMENT

With the suggested policy procedures, the FOMC could still use the funds rate as its policy variable. Changes in the funds rate would appear reasonable in that they would respond to changes in the real rate as reflected in the yield on the indexed bond. However, changes in the funds rate would be explicitly directed toward achieving an inflation target.

These procedures possess a quantity theory spirit in that they keep the monetary authority's attention focused on nominal variables under its control—the rate of growth of nominal output and the price level. Despite their quantity theory spirit, the suggested procedures do not depend on stability of the public's demand function for money. Money, nevertheless, would play an important role. The money targets advertise to the public that the price level is a monetary phenomenon and that monetary authority alone has the responsibility for control of the price level. Public discussion by the FOMC of its targets for money would constitute an important way of influencing the public's expectation of the future price level and of keeping that expectation in line with the FOMC's target.

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Credit Aggregates from the Flow of Funds Accounts

Milton P. Reid, III and Stacey L. Schreft

One reason analysts study financial variables is to determine how activity in financial markets affects the macroeconomy. For example, there is evidence that reduced credit flows contributed to the Great Depression (Bernanke 1983). Likewise, the Federal Reserve's Credit Restraint Program of 1980 magnified the 1980 recession by increasing uncertainty about credit availability (Schreft 1990). More recently, analysts have debated the implications of rapid credit growth for financial stability (Federal Reserve Bank of Kansas City 1986) and argued that debt repayment by consumers and businesses contributed significantly to the 1990–91 recession and the unusually weak recovery that followed (*1992 Economic Report of the President,* p. 27). The link between financial intermediation and economic growth and development is an ongoing area of study (e.g., McKinnon 1973; Greenwood and Smith 1993).

Analysts use both broad and narrow measures of credit in macroeconomic research. Support for using broad measures of credit comes from the ease with which different forms of credit substitute for one another. Because of this substitutability, broad measures reflect more accurately, for example, the extent to which credit availability is reduced during a credit crunch. Moreover, broad measures complement the monetary aggregates. In fact, since 1983, the Federal Open Market Committee, the Federal Reserve System's monetary policymaking arm, has set monitoring ranges for domestic nonfinancial debt.

In contrast, narrow measures focus only on specific types of credit. Some researchers focus on bank credit, for example, because they argue that it plays

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a crucial role in the mechanism by which monetary policy is transmitted to the real economy (see Morgan [1992] for a summary of this position). These researchers justify the use of the narrow measure by arguing that for some borrowers bank credit is the only form of credit available to finance spending plans; substitutability of bank and nonbank credit is not possible for these borrowers.

The leading source of data on credit aggregates is the Flow of Funds Accounts (FOFA). This article provides an introduction to the accounts. The first section describes the nature, history, and availability of the accounts. Section 2 explains the accounts' organization by sector and transaction. The third section traces the behavior over time of various credit measures from the FOFA. Section 4 highlights features of the accounts that warrant caution, and finally Section 5 provides suggestions for additional readings that provide a more thorough discussion of the accounts.

1. AN INTRODUCTION TO THE FLOW OF FUNDS

Nature of the Accounts

The FOFA are designed to measure the financial and nonfinancial transactions associated with sectoral and aggregate investment activity. By cataloging the financial flows associated with current income and production, the FOFA complement the National Income and Product Accounts (NIPA). While the NIPA measure total saving and investment in a particular sector, the FOFA reveal how a sector finances investment in excess of its saving. That is, according to economist James Tobin (1962, p. 190), the FOFA are an

> ex post record of the processes by which supplies and demands for various financial assets are balanced. . . . The basic behavior behind the flow of funds is the adjustment of the balance sheets, or portfolios, of individuals, business firms, and financial enterprises toward a desired allocation of wealth among holdings of various assets and debts. In this adjustment, the basic decision variables are stocks; and flows will be dominated by attempts to adjust stocks to changes in total wealth, interest rates, and other determinants.

The information in the FOFA is potentially of great use to economists, policymakers, and financial market participants. Surprisingly, however, knowledge and use of these accounts for economic analysis has been limited. This reserved reaction to the FOFA data is similar to that initially given to the NIPA data that were first developed in the early 1930s. Economist James Duesenberry (1962, p. 173) has noted that national income analysis was not embraced until John Maynard Keynes' work in *The General Theory of Employment, Interest, and Money* (1936) created interest in the interaction of macroeconomic aggregates. However, according to Duesenberry, "the Keynes of flow of funds analysis has not yet revealed himself." Perhaps the wait is over. The past decade has

witnessed renewed interest and advances in studying the interaction of the real and financial sectors of the economy. Moreover, the increasingly rapid pace of financial innovation will surely add to this interest.

History

The FOFA are based on research by Morris A. Copeland (1952), who had been studying financial flows when the NIPA became available in the early 1930s. With his training in accounting and with the NIPA in mind, Copeland began to calculate financial flow measures for the banking sector, and then, over a decade later, he compiled aggregate data for all sectors. In 1944, the National Bureau of Economic Research invited Copeland to develop a more complete system to account for financial flows. Copeland accepted the invitation, and in 1952, the Bureau published the results: U.S. financial flows and related balances for 1936 through 1942.

The Board of Governors of the Federal Reserve System continued the project and presented the result of its efforts in late 1955 in *Flow of Funds in the United States, 1939–1953.* The data, however, were on an annual basis and available only with a substantial time lag. In 1959, the Federal Reserve published a revised presentation with quarterly data. Since then the Federal Reserve has published regularly quarterly FOFA data.

Availability

Quarterly estimates are available for most series dating back to 1952, and annual estimates exist as far back as 1946. In general, FOFA data for a given quarter are first released about two months after the quarter ends. These data are only preliminary estimates because some of the source data needed to more accurately represent flows of funds are not yet available. Thus, with each new release of FOFA data, estimates for previous quarters may be revised. Generally, data for only the five most recent quarters are revised. Annually, however, the Federal Reserve revises the entire FOFA to incorporate methodological and definitional changes and new source data. These adjustments are usually released with the second-quarter estimates. While these revisions often are not large, in some instances they can be substantial. The 1992 annual revision, for example, caused the estimate of home mortgage debt for the nonfarm noncorporate business sector to more than triple, from $42.5 billion to $151.1 billion for 1991:1.

2. STRUCTURE OF THE ACCOUNTS

The FOFA are organized along two dimensions: by economic sector and by transaction type. The FOFA partition the economy into financial and nonfinancial

sectors. The nonfinancial sector is then divided further into three categories: Private Domestic Nonfinancial, U.S. Government, and Foreign. Thus, the FOFA split the economy into four broad sectors: Financial, Private Domestic Nonfinancial, U.S. Government, and Foreign. In contrast, the NIPA traditionally break down the economy into four different sectors: Consumer, Business, Government, and Foreign.

The FOFA also are organized by the types of transactions among these sectors. Financial claims, such as demand deposits, bonds, corporate equities, and mortgages, represent different financial transaction categories. Nonfinancial capital transactions, which consist of saving and investment flows, constitute another transaction category. Estimates of the nonfinancial capital flows come directly from the NIPA. Data on income, transfer payments, and expenditures on goods and services, are not included in the FOFA, except to the extent that saving is the balance of current receipts less current outlays.

In addition to being organized along those two dimensions, the FOFA also report data in two different but related ways: for stocks of financial assets and liabilities and for financial and nonfinancial capital flows. For each sector, the reported stocks provide a balance sheet of the financial assets and liabilities of that sector. The reported flows record the change in balance sheet holdings of financial assets and liabilities between the current period and the previous one. The flow data also report nonfinancial capital transactions from the NIPA.

Sectors

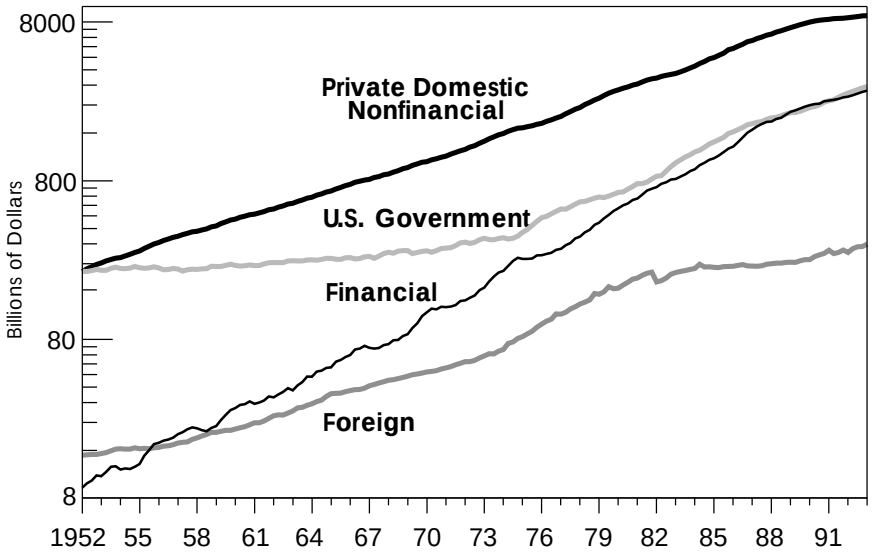
Figure 1 shows the level of credit market debt owed by each sector from 1952:1 to 1993:1. Descriptions of each sector follow.

Private Domestic Nonfinancial Sector

Households. The household sector is composed primarily of individuals, but also includes personal trusts and nonprofit organizations that serve individuals. Unlike its treatment in some other accounts, the household sector does not include directly any data on business activities.

Nonfinancial Business. The nonfinancial business sector includes farm business, nonfarm noncorporate business, and corporate nonfinancial business. Estimates of all farming activity in the United States, including corporate farm activity, are counted in the farm business sector. Unincorporated business enterprises, such as partnerships and proprietorships, engaged in nonfinancial, nonagricultural activities comprise the nonfarm noncorporate business subsector. Finally, the corporate nonfinancial business subsector is the same as the nonfinancial corporate group of the NIPA with the exception that farm corporations are omitted. This subsector, therefore, includes all private corporations not included in the farming or financial sectors. Since the FOFA include a

Figure 1 Credit Market Debt by Sector



Source: Federal Reserve Board, FOFA.

foreign sector, only the domestic activities of these corporations are included in the private domestic nonfinancial business sector.

State and Local Governments. The state and local government sector embodies the governments of all 50 states, their localities, United States territories, and the District of Columbia, as well as the economic institutions (e.g., debt-issuing authorities and trust funds) operated by these governments. Only retirement funds for employees of state and local governments are excluded; they are considered part of the financial sector.

Foreign

Only data on capital transactions between the United States (including its territories) and foreign economic entities are included in the foreign sector. Flows of funds between two foreign economic agents are excluded entirely from the FOFA. In general, the location of an economic entity is the basis for determining whether its activities are foreign or domestic. Thus, the activities of a subsidiary of a U.S. corporation located in a foreign nation are included in the foreign sector. Likewise, the activities of a subsidiary of a foreign corporation located in the United States are considered domestic activities in the FOFA.

U.S. Government

The U.S. government sector includes the activities of all agencies that are part of the budget of the United States and all off-budget activities, with the exception of certain financial activities. The Federal Reserve System is not included in this sector, nor are certain Treasury accounts related to monetary policy. Also, some federally sponsored credit agencies are not considered part of the United States government sector. Specifically, the financial sector includes the activities of the Federal Home Loan Banks, Federal Home Loan Mortgage Corporation, Federal National Mortgage Association, Federal Land Banks, Federal Intermediate Credit Banks, and Banks for Cooperatives.

Financial Sector

Federally Sponsored Credit Agencies and Federally Sponsored Mortgage Pools. Federally sponsored credit agencies are considered private financial institutions despite their close legal association with the federal government. These institutions typically engage in very specific lending activities (e.g., the making of residential mortgages and farm loans). Federally sponsored mortgage pools include the Government National Mortgage Corporation, the Federal Home Loan Mortgage Corporation, and the Farmers Home Administration. These agencies raise funds by issuing securities that are backed by a pool of mortgages.

Monetary Authority. This sector includes the Federal Reserve System and certain Treasury accounts related to the conduct of monetary policy.

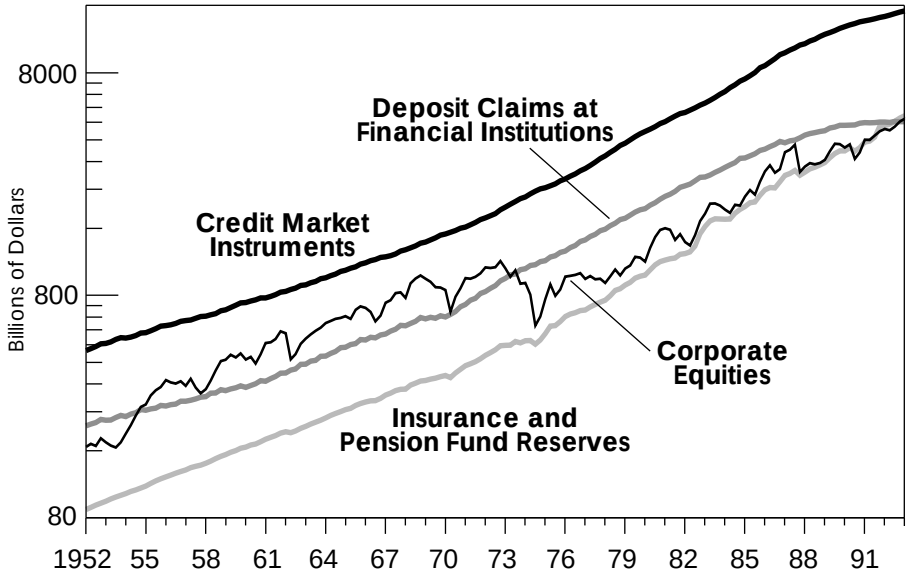
Commercial Banking. The commercial banking sector includes all banks that have head offices in the 50 states, U.S. branches of foreign banks, Edge Act and agreement corporations, U.S. agencies of foreign banks, bank holding companies, and banks in U.S. territories and possessions.

Private Nonbank Finance. Private nonbank finance includes all private financial institutions that are not part of the commercial banking sector. Included in this sector are deposit-taking firms such as savings and loan associations, mutual savings banks, and credit unions. In addition, insurance companies, private pension funds, state and local government employee retirement funds, finance companies, real estate investment trusts, money market and other mutual funds, and securities brokers and dealers are among those counted in this sector.

Transaction Categories

The FOFA are also organized by transaction categories. Transaction categories are broadly divided into two subcategories: nonfinancial and financial. The nonfinancial subcategory includes current transactions and capital transactions.

Figure 2 Financial Liabilities by Transaction Category



Source: Federal Reserve Board, FOFA.

In the FOFA, current transactions are summarized by total saving for each sector as in the NIPA, where saving is defined as the excess of current receipts over current outlays. Saving then enters as a source of funds for each sector in the capital account. Investment expenditures are the other half of the capital account. Financial transactions account for the remainder of the transactions in the FOFA. Figure 2 shows the level of financial liabilities for the major financial transaction categories.

Financial Transaction Categories

Monetary Reserves. Monetary reserves are financial assets that can be used for intervention in foreign exchange markets by monetary authorities and for settlement of international transactions. The primary financial instruments included in this transactions category are gold, foreign currencies, and special drawing rights (SDRs). Transactions in these instruments occur among the U.S. government, monetary authorities, and the foreign sector.

Insurance and Pension Fund Reserves. Financial assets held by insurance companies and pension plans for payment of claims to household beneficiaries are included in this category.

Net Interbank Claims. Interbank claims involve transactions occurring between depository institutions and either the Federal Reserve or the foreign sector. Loans by the Federal Reserve to member banks, as well as depository institution reserves and vault cash held at the Federal Reserve, are included in this category. Federal funds and security repurchase agreements, however, are not included.

Deposit Claims on Financial Institutions. Deposit claims can be held in a number of different forms, including demand deposits, time deposits, federal funds, and money market fund shares. In all instances, the deposit claim is a liability of the financial institution receiving the funds and an asset of the individual or institution that lends or deposits the money.

Credit Market Instruments. Credit market instruments represent the primary source of funds to the nonfinancial sector. Instances of both direct and indirect finance are included in this category. One example of direct finance occurs when corporations issue bonds directly to the nonfinancial sector. The auctioning of U.S. government securities to private firms is another example of direct finance. Home mortgages, on the other hand, are an example of indirect finance where funds flow through the financial sector; mortgages are typically issued by a financial company using money that has been deposited with the institution by the nonfinancial sector.

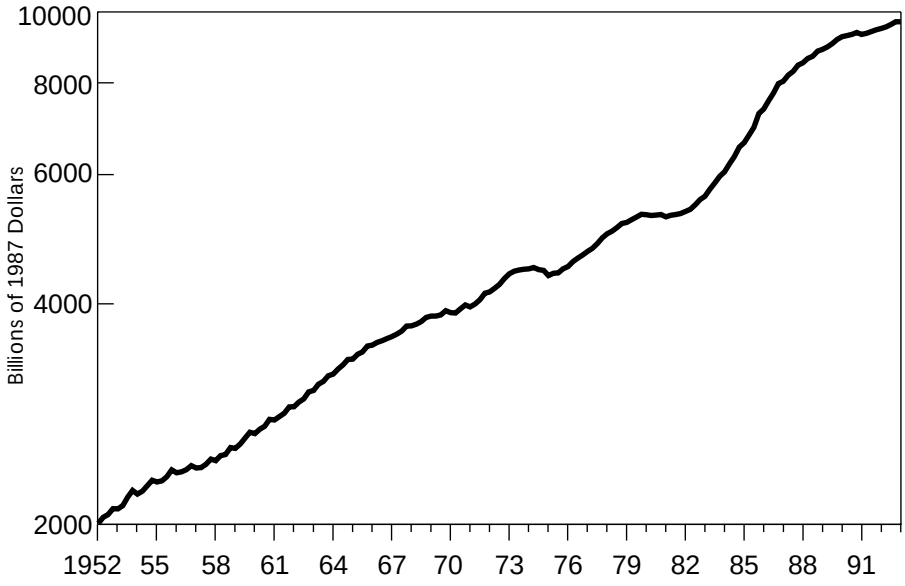
Corporate Equities. Corporate equities are not debt. Instead, equities represent claims of ownership on a corporation. Unlike the treatment of most other financial instruments in the FOFA, equity issues are considered an asset of the holder, but not a liability of the issuer.

Other Claims. Any financial transaction that is not included in any transaction category described above is included in the "other claims" category. Security credit, trade credit, and equity in noncorporate business are among the items included in this category.

3. MOVEMENTS OVER TIME

The FOFA data include narrowly defined measures of credit, such as bank credit or trade credit, and broader aggregations of these more narrow measures. At times the Federal Reserve System has monitored various measures of credit—both narrow and broad—in attending to the financial problems affecting credit markets. The broad credit aggregate most commonly used in policymaking and economic research is domestic nonfinancial debt. As Figure 3 indicates, in real terms this credit aggregate exhibited steady growth of 3.75 percent per

Figure 3 Real Domestic Nonfinancial Debt



Source: Federal Reserve Board, FOFA.

year from 1952:1 through 1993:1. In 1993:1, it made up 78.5 percent of total debt owed by all sectors. Table 1 shows that between 1980:4 and 1993:1 the U.S. government's debt outstanding grew by more than 400 percent, thereby increasing its share of total debt relative to the debt of the private and foreign sectors. As Table 2 indicates, however, the U.S. government's share of the financial assets of the nonfinancial sector actually fell from 2.6 percent to 2.0 percent over the same time period.

4. CAUTIONS

No data source is perfect, and the FOFA are no exception. The following are some potential shortcomings of the FOFA of which the user must be aware.

Double Counting

The FOFA data are supposed to measure borrowing to finance purchases of real goods. Some borrowing, however, may finance purchases of financial assets. This results in a "double counting" of debt. Although this double counting rarely inflates debt above its underlying trend (Wilson et al. 1986, p. 519), caution

Table 1 Credit Market Debt Owed by All Sectors

	1980:4		1993:1	
	Billions of Dollars	Percent of Total	Billions of Dollars	Percent of Total
Total	4,731.0	100.0	15,163.3	100.0
Private Domestic Nonfinancial	3,200.5	67.6	8,756.9	57.8
Household	1,405.8	29.7	4,191.5	27.6
Nonfinancial Business	1,484.3	31.4	3,603.8	23.8
State & Local Governments	310.4	6.6	961.6	6.3
U.S. Government	735.0	15.5	3,140.2	20.7
Foreign	191.7	4.1	319.5	2.1
Financial	603.8	12.8	2,946.6	19.4

Source: Federal Reserve Board, FOFA.

Table 2 Total Financial Assets of Nonfinancial Sectors

	1980:4		1993:1	
	Billions of Dollars	Percent of Total	Billions of Dollars	Percent of Total
Total	8,688.2	100.0	22,308.9	100.0
Private Domestic Nonfinancial	8,000.6	92.1	19,860.3	89.0
Households	6,390.5	73.6	16,147.1	72.4
Business	1,363.2	15.7	2,973.2	13.3
State & Local Governments	246.9	2.8	740.0	3.3
U.S. Government	228.7	2.6	455.8	2.0
Foreign	458.8	5.3	1,992.8	8.9

Source: Federal Reserve Board, FOFA.

should nevertheless be used in interpreting higher debt levels reported in the FOFA data. Such debt levels may appear to reflect an overleveraged financial position, when in reality they only indicate greater financial intermediation in the economy.

Flows, Not Transactions Volumes

The flows reported in the FOFA do not necessarily indicate the total volume of transactions in a period. For instance, a flow of $200 would be recorded in the FOFA in both of the following hypothetical examples, although the total volume of transactions is different. Both cases assume that the commercial banking sector has $1,000 of home mortgages as assets on its balance sheet,

and that this $1,000 is a financial liability of the household sector. An additional assumption is that the household sector is comprised of five individuals each owing $200 to the banking sector. In the first case, one individual repays his mortgage, thereby lowering the assets of the banking sector and the liabilities of the household sector by $200. In the second case, the same individual and two other individuals repay their mortgages. This action decreases the assets of the banking sector and liabilities of the household sector by $600. Meanwhile, the remaining two individuals borrow an additional $200 each in mortgage debt. Because of these actions, the assets of the banking sector and liabilities of the household sector are increased by $400. On net, the second case leads to a decrease of $200 in the assets of the banking sector and in the liabilities of the household sector. In both cases, the reported flows are equal, but the gross volume of transaction activity is much greater in the second example.

Comparisons with Other Data Sources

Estimates in the FOFA can differ significantly from data in other sources. In most instances, these differences can be reconciled. For instance, private domestic nonfinancial debt measures in the FOFA are reported on a quarter-end basis. Furthermore, unlike data on flows, the data on levels are not adjusted to remove discontinuities in the series caused by definitional changes, loss of the underlying data source, valuation adjustments, or other statistical problems. The debt measures reported with the monetary aggregate data, however, have been adjusted to eliminate these problems and are reported as a monthly average obtained by computing the mean of consecutive month-end levels.

In addition, personal saving, as estimated by the FOFA, differs significantly from the corresponding figure reported in the NIPA. One reason for this difference is the treatment of consumer expenditures for durable goods. The FOFA consider consumer durable expenditures to be investment; therefore, these expenditures are included in personal saving. In the NIPA, durable goods purchases are part of the current account. Additionally, saving by farm corporations and government insurance and pension fund reserves are contained in the personal saving measure of the FOFA. The remaining difference between the NIPA and FOFA measures of personal saving equals the statistical discrepancy of the household sector.

Estimates of international capital flows also can differ significantly depending on the source of the data. Hooker and Wilson (1989) document these differences between international transactions estimates in the FOFA and balance of payments statistics.

Zero Government Investment

Another shortcoming, one shared by the NIPA, is the treatment of government expenditures. All government expenditures are considered current consumption, not saving or investment. Some government expenditures, however, such

as spending for the construction of highways and new buildings, are similar to private spending that is included in the capital account. Additionally, treatment of the social security program is not consistent with the treatment of private pension programs. Payments by individuals to private pension programs are a form of saving in the FOFA, but social security payments are not. As a result, many analysts would question the FOFA estimate of saving and investment by the government sector.

Valuation

For corporate equities and mutual fund shares, levels are reported at market values, but flows are not. Instead, flows are net purchases plus reinvested dividends. Debt instruments, however, are not adjusted for fluctuations in their market prices (i.e., "marked to market"). In general, financial instruments are valued at acquisition cost.

Sectoring

When using FOFA data, one should give careful consideration to the exact definition of the sectors of the economy because the sector names can be misleading. Two instances of this deserve special attention. First, the household sector includes nonprofit organizations and trusts. Second, the private sector includes state and local governments.

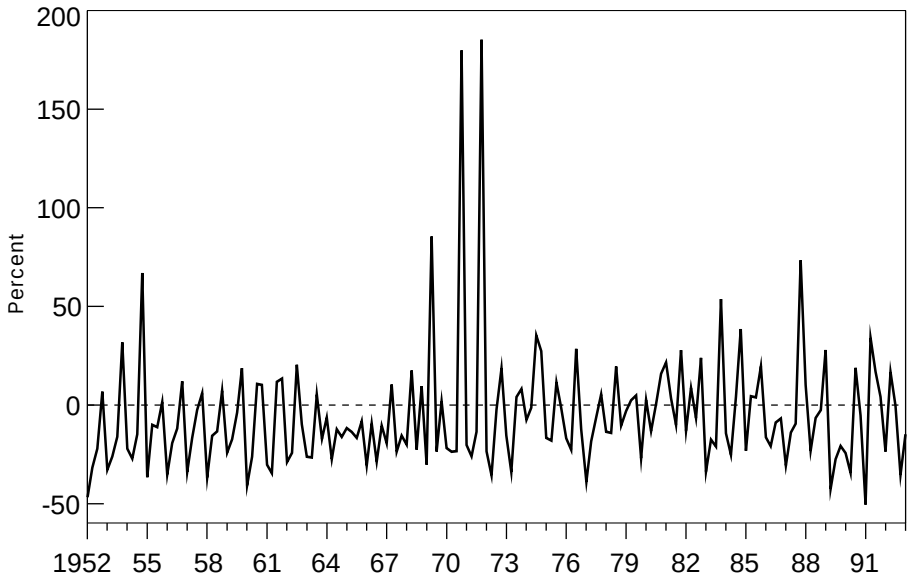
Statistical Discrepancies

The user of FOFA data should be aware of the statistical discrepancies that balance the system. The FOFA contain discrepancies for every sector and every transaction category in the economy. As seen in Figure 4, the magnitude of the FOFA household discrepancy can be quite large relative to personal saving. On average, the household discrepancy was 21.3 percent of personal saving in absolute terms for the 1952:1 to 1993:1 period.

Residual Estimation of the Household Sector

Many transactions categories of the household sector are measured as residuals. That is, estimates for holdings of the household sector are determined by subtracting estimates for all other sectors from the estimate of the total holdings for the entire economy. Therefore, errors in estimates for other sectors of the economy lead to inaccurate calculation of the household sector's holdings. In recent years, several authors have cited this method as the explanation for the widening household discrepancy and consequently for the divergent measures of personal saving by the FOFA and NIPA (see, for example, Wilson et al. 1989).

Figure 4 Ratio of Household Discrepancy to Personal Saving



Note: The figure shows two large spikes in the periods of 1970:4 and 1971:4. These spikes represent periods of low saving, not extremely large discrepancies. The estimated savings for the periods were $31.1 and $34.7 billion, respectively, while the discrepancies were $55.9 and $64.2 billion. In fact, the discrepancy/saving ratio was −50.5 in 1991:1 when the discrepancy reached its largest absolute value of $316.5 billion and personal saving measured $626.3 billion.

Source: Federal Reserve Board, FOFA.

5. SUGGESTIONS FOR FURTHER READING

Much has been written about the FOFA. The following articles and publications provide additional guidance in understanding the FOFA. The Federal Reserve Board's *Guide to the Flow of Funds Accounts* provides a complete overview of the accounts. Particularly important is its discussion of the various sectors and transaction categories. This publication also provides, in line-by-line detail, a description of the source and/or construction of each data series. Additionally, it presents the accounting identities that constrain the FOFA using a matrix representation of the FOFA system. It also analyzes the movement of the data over time. Wilson, Freund, Yohn, and Lederer in "Measuring Household Saving: Recent Experience from the Flow-of-Funds Perspective" furnish an excellent analysis of the gap between the NIPA and FOFA measures of personal saving in their discussion of the growing household sector discrepancy. Hooker and Wilson in "A Reconciliation of Flow of Funds and Commerce Department

Statistics on U.S. International Transactions and Foreign Investment Position" explain the differences between the international transactions statistics reported in the FOFA and the Commerce Department's Balance of Payments Statistics. Finally, Ritter's "The Flow of Funds Accounts: A Framework for Financial Analysis" and Van Horne's "Flow-of-Funds Analysis" detail the theoretical background for the accounts' construction.

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Over-the-Counter Interest Rate Derivatives

Anatoli Kuprianov

Over-the-counter (OTC) interest rate derivatives include instruments such as forward rate agreements (FRAs), interest rate swaps, caps, floors, and collars. Broadly defined, a derivative instrument is a formal agreement between two parties specifying the exchange of cash payments based on changes in the price of a specified underlying item or differences in the returns to different securities. Like exchange-traded interest rate derivatives such as interest rate futures and futures options, OTC interest rate derivatives set terms for the exchange of cash payments based on changes in market interest rates. An FRA is a forward contract that sets terms for the exchange of cash payments based on changes in the London Interbank Offered Rate (LIBOR); interest rate swaps provide for the exchange of payments based on differences between two different interest rates; and interest rate caps, floors, and collars are option-like agreements that require one party to make payments to the other when a stipulated interest rate, most often a specified maturity of LIBOR, moves outside of some predetermined range.

The over-the-counter market differs from futures markets in a number of important respects. Whereas futures and futures options are standardized

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agreements that trade on organized exchanges, the over-the-counter market is an informal market consisting of dealers, or market makers, who trade price information and negotiate transactions over electronic communications networks. Although a great deal of contract standardization exists in the over-the-counter market, dealers active in this market custom-tailor agreements to meet the specific needs of their customers. And unlike futures markets, where futures exchange clearinghouses guarantee contract performance through a system of margin requirements combined with the daily settlement of gains or losses, counterparties to OTC derivative agreements must bear some default or credit risk.

The rapid growth and energized pace of innovation in the market for interest rate derivatives since 1981, the date of the first widely publicized swap agreement, has proven truly phenomenal. The advent of trading in interest rate swaps was soon followed by FRAs, caps, floors, collars, as well as other hybrid instruments such as forward swaps, options on swaps (swaptions), and even options on options (captions).

This article offers an introduction to OTC interest rate derivatives. The first five sections describe some of the most common types of OTC derivatives: FRAs, interest rate swaps, caps, floors, and collars. The final section discusses policy and regulatory concerns prompted by the growth of the OTC derivatives market.

1. FORWARD RATE AGREEMENTS

FRAs are cash-settled forward contracts on interest rates traded among major international banks active in the Eurodollar market. An FRA can be viewed as the OTC equivalent of a Eurodollar futures contract. Most FRAs trade for maturities corresponding to standard Eurodollar time deposit maturities, although nonstandard maturities are sometimes traded (Grabbe 1991, Chap. 13). Trading in FRAs began in 1983 (Norfield 1992).

Banks use FRAs to fix interest costs on anticipated future deposits or interest revenues on variable-rate loans indexed to LIBOR. A bank that sells an FRA agrees to pay the buyer the increased interest cost on some "notional" principal amount if some specified maturity of LIBOR is above a stipulated "forward rate" on the contract maturity or settlement date. The principal amount of the agreement is termed "notional" because, while it determines the amount of the payment, actual exchange of the principal never takes place. Conversely, the buyer agrees to pay the seller any decrease in interest cost if market interest rates fall below the forward rate. Thus, buying an FRA is comparable to selling, or going short, a Eurodollar or LIBOR futures contract.

The following example illustrates the mechanics of a transaction involving an FRA. Suppose two banks enter into an agreement specifying:

– a forward rate of 5 percent on a Eurodollar deposit with a three-month maturity;

– a $1 million notional principal; and
– settlement in one month.

Such an agreement is termed a 1×4 FRA because it fixes the interest rate for a deposit to be placed after one month and maturing four months after the date the contract is negotiated. If the three-month LIBOR is 6 percent on the contract settlement date, the seller would owe the buyer the difference between 6 and 5 percent interest on $1 million for a period of 90 days. Every 1 basis point change in the interest rate payable on a principal of $1 million for a 90-day maturity changes interest cost by $25, so that the increase in the interest cost on a three-month Eurodollar deposit over the specified forward rate in this case is $\$25 \times 100$ basis points = $2,500. But the interest on a Eurodollar deposit is paid upon maturity (at the end of the term of the deposit), whereas FRAs are settled on the contract maturity date (which would correspond to the date the underlying hypothetical deposit would be placed). Therefore, to make the cash payment on the FRA equivalent to the extra interest that would have been earned on a Eurodollar deposit paying 6 percent, the $2,500 difference in interest costs calculated above is discounted back three months using the actual three-month LIBOR prevailing on the settlement date. Thus, if 90-day LIBOR turns out to be 6 percent on the contract maturity date the buyer would receive

$$\$2{,}463.05 = \$2{,}500/[1 + 0.06(90/360)].$$

More generally, final settlement of the amounts owed by the parties to an FRA is determined by the formula

$$\text{Payment} \;=\; \frac{(N)(LIBOR - FR)(dtm/360)}{1 + LIBOR(dtm/360)},$$

where

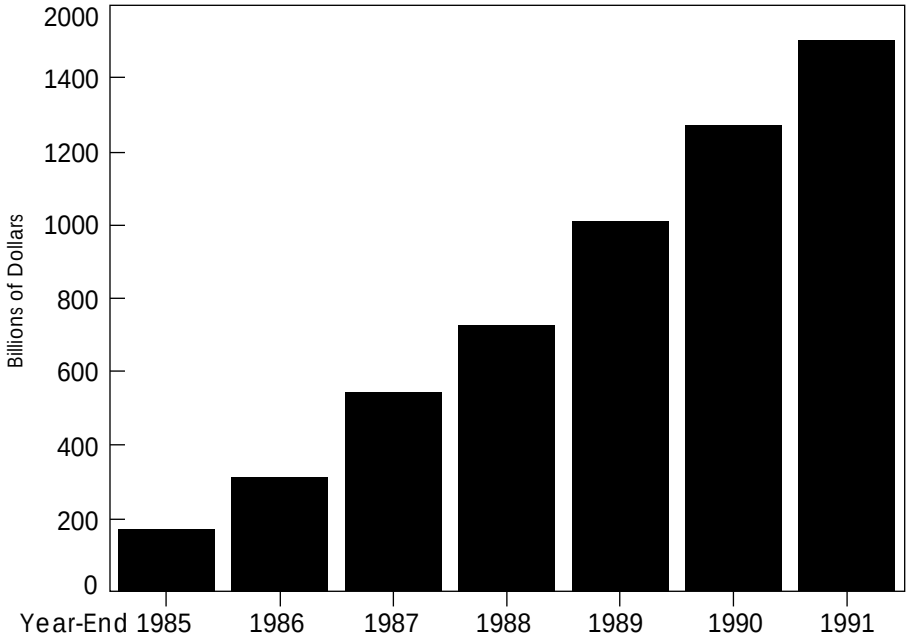
N = the notional principal amount of the agreement;
$LIBOR$ = the value of LIBOR for the maturity specified by the contract prevailing on the contract settlement date;
FR = the agreed-upon forward rate; and
dtm = maturity of the forward rate, specified in days.

If $LIBOR > FR$ the seller owes the payment to the buyer, and if $LIBOR < FR$ the buyer owes the seller the absolute value of the payment amount determined by the above formula.

2. INTEREST RATE SWAPS

A swap is a contractual agreement between two parties to exchange, or "swap," future payment streams based on differences in the returns to different securities or changes in the price of some underlying item. Interest rate swaps constitute the most common type of swap agreement. In an interest rate swap, the parties to the agreement, termed the swap counterparties, agree to exchange payments

Figure 1 U.S. Dollar Interest Rate Swaps



Source: *Market Survey Highlights, Year End 1991,* International Swap Dealers Association, Inc.

indexed to two different interest rates. Total payments are determined by the specified notional principal amount of the swap, which is never actually exchanged. Financial intermediaries, such as banks, pension funds, and insurance companies, as well as nonfinancial firms use interest rate swaps to effectively change the maturity of outstanding debt or that of an interest-bearing asset.[1]

Swaps grew out of parallel loan agreements in which firms exchanged loans denominated in different currencies. Although some swaps were arranged in the late 1970s, the first widely publicized swap took place in 1981 when IBM and the World Bank agreed to exchange interest payments on debt denominated in different currencies, an arrangement known as a currency swap. The first interest rate swap was a 1982 agreement in which the Student Loan Marketing Association (Sallie Mae) swapped the interest payments on an issue of intermediate-term, fixed-rate debt for floating-rate payments indexed to the three-month Treasury bill yield. The interest rate swap market has grown rapidly since then. Figure 1 displays the year-end total notional principal of U.S. dollar

[1] See Wall and Pringle (1988) for a more comprehensive survey of market participants.

interest rate swaps outstanding from 1985 to 1991. Based on market survey data published by the International Swap Dealers Association (ISDA), U.S. dollar interest rate swaps comprise about one-half of all interest rate swaps outstanding: the notional principal amount of U.S. dollar interest rate swaps outstanding as of the end of 1991 was just over $1.5 trillion, compared to almost $3.1 trillion for all interest rate swaps.

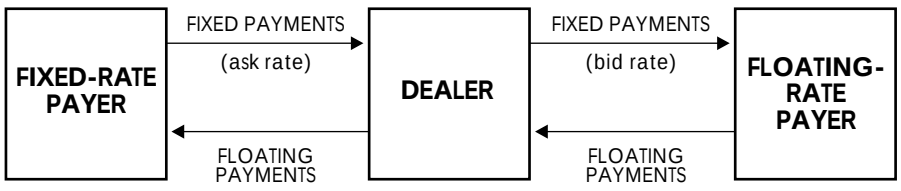
Swap Dealers

Early interest rate swaps were brokered transactions in which financial intermediaries with customers interested in entering into a swap would seek counterparties for the transaction among their other customers. The intermediary collected a brokerage fee as compensation, but did not maintain a continuing role once the transaction was completed. The contract was between the two ultimate swap users, who exchanged payments directly.

Today the market has evolved into more of a dealer market dominated by large international commercial and investment banks. Dealers act as market makers that stand ready to become a counterparty to different swap transactions before a customer for the other side of the transaction is located. A swap dealer intermediates cash flows between different customers, or "end users," becoming a middleman to each transaction. The dealer market structure relieves end users from the need to monitor the financial condition of many different swap counterparties. Because dealers act as middlemen, end users need only be concerned with the financial condition of the dealer, and not with the creditworthiness of the other ultimate end user of the instrument (Brown and Smith 1990).

Figure 2 illustrates the flow of payments between two swap end users through a swap dealer. Unlike brokers, dealers in the over-the-counter market do not charge a commission. Instead, they quote two-way "bid" and "asked" prices at which they stand ready to act as counterparty to their customers in a derivative instrument. The quoted spread between bid and asked prices allows an intermediary to receive a higher payment from one counterparty than is paid to the other.

Figure 2 The Dealer Market for Interest Rate Swaps



Swap Market Conventions

There are many different variants of interest rate swaps. The most common is the fixed/floating swap in which a fixed-rate payer makes payments based on a long-term interest rate to a floating-rate payer, who, in turn, makes payments indexed to a short-term money market rate to the fixed-rate payer. A fixed/floating swap is characterized by:

- a fixed interest rate;
- a variable or floating interest rate which is periodically reset;
- a notional principal amount upon which total interest payments are based; and
- the term of the agreement, including a schedule of interest rate reset dates (that is, dates when the value of the interest rate used to determine floating-rate payments is determined) and payment dates.

The fixed interest rate typically is based on the prevailing market interest rate for Treasury securities with a maturity corresponding to the term of the swap agreement. The floating rate is most often indexed to three- or six-month LIBOR, in which case the swap is termed a "generic" or "plain vanilla" swap, but can be indexed to almost any money market rate such as the Treasury bill, commercial paper, federal funds, or prime interest rate. The maturity, or "tenor," of a fixed/floating interest rate swap can vary between 1 and 15 years. By convention, a fixed-rate payer is designated as the buyer and is said to be long the swap, while the floating-rate payer is the seller and is characterized as short the swap.

Timing of Payments

A swap is negotiated on its "trade date" and takes effect two days later on its initial "settlement date." If the agreement requires the exchange of cash at the outset, as in the case of a "nonpar" swap, the transaction takes place on the initial settlement date. Interest begins accruing on the "effective date" of the swap, which usually coincides with the initial settlement date. (Forward swaps, in which the effective date of the swap is deferred, are an exception to this rule.) Floating-rate payments are adjusted on periodic "reset dates" based on the prevailing market-determined value of the floating-rate index, with subsequent payments made on a sequence of payment dates (also known as settlement dates) specified by the agreement. Typically, the reset frequency for the floating-rate index is the term of the interest rate index itself. For example, the floating rate on a generic swap indexed to the six-month LIBOR would, in most cases, be reset every six months with payment dates following six months later. The floating rate can be reset more frequently, however, as in the case of swaps indexed to Treasury bill rates, which are reset weekly.

Fixed interest payment intervals can be three months, six months, or one year. Semiannual payment intervals are most common because they coincide with the intervals between interest payments on Treasury bonds. Floating-rate payment intervals need not coincide with fixed-rate payment intervals, although they often do. When payment intervals coincide, it is common practice to exchange only the net difference between the fixed and floating payments.

Price Quotation

The price of a fixed/floating swap is quoted in two parts: a fixed interest rate and an index upon which the floating interest rate is based. The floating rate can be based on an index of short-term market rates (such as a given maturity of LIBOR) plus or minus a given margin, or set to the index "flat"—that is, the floating interest rate index itself with no margin added. The convention in the swap market is to quote the fixed interest rate as an All-In-Cost (AIC), which means that the fixed interest rate is quoted relative to a flat floating-rate index.

The AIC typically is quoted as a spread over U.S. Treasury securities with a maturity corresponding to the term of the swap. For example, a swap dealer might quote a price on a three-year generic swap at an All-In-Cost of "72–76 flat," which means the dealer stands ready to "buy" the swap (that is, enter into the swap as a fixed-rate payer) at 72 basis points over the prevailing three-year interest rate on U.S. Treasuries while receiving floating-rate payments indexed to a specified maturity of LIBOR with no margin, and "sell" (receive fixed and pay floating) if the other party to the swap agrees to pay 76 basis points over Treasury securities.

Bid-asked spreads in the swap market vary greatly depending on the type of agreement. The spread can be as low as 3 to 4 basis points for a two- or three-year generic swap, while spreads for nonstandard, custom-tailored swaps tend to be much higher.

The Generic Swap

As an illustration of the mechanics of a simple interest rate swap, consider the example of a generic swap. Fixed interest payments on a generic swap typically are based on a 30/360 day-count convention, meaning that they are calculated assuming each month has 30 days and the quoted interest rate is based on a 360-day year. Given an All-In-Cost of the swap, the semiannual fixed-rate payment would be

$$(N)(AIC)(180/360),$$

where N denotes the notional principal amount of the agreement.

Floating-rate payments are based on an actual/360-day count, meaning that interest payments are calculated using the actual number of days elapsed

since the previous payment date, based on a 360-day year. Let d_t denote the number of days since the last settlement date. Then, the floating-rate payment is determined by the formula

$$(N)(LIBOR)(d_t/360).$$

To illustrate, suppose a dealer quotes an All-In-Cost for a generic swap at 10 percent against six-month LIBOR flat. If the notional principal amount of the swap is $1 million, then the semiannual fixed payment would be

$$\$50{,}000 = (\$1{,}000{,}000)(0.10)(180/360).$$

Suppose that the six-month period from the effective date of the swap to the first payment date (sometimes also termed a settlement date) comprises 181 days and that the corresponding LIBOR was 8 percent on the swap's effective date. Then, the first floating-rate payment would be

$$\$40{,}222.22 = (\$1{,}000{,}000)(0.08)(181/360).$$

Often a swap agreement will call for only the net amount of the promised payments to be exchanged. In this example, the fixed-rate payer would pay the floating-rate payer a net amount of

$$\$9{,}777.78 = \$50{,}000.00 - \$40{,}222.22.$$

A payment frequency "mismatch" occurs when the floating-rate payment frequency does not match the scheduled frequency of the fixed-rate payment. Mismatches typically arise in the case of swaps that base floating-rate payments on maturities shorter than the six-month payment frequency common for fixed-rate payments. Macfarlane, Ross, and Showers (1990) discuss swap mismatches in some detail.

Day-Count Conventions

A wide variety of day-count conventions are used in the swap market. Fixed payments can be quoted either on an actual/365 (bond equivalent) basis or on an actual/360 basis. Floating-rate payments indexed to private-sector interest rates typically follow an actual/360 day-count convention commonly used in the money market. Floating-rate payments tied to Treasury bill rates are calculated on an actual/365 basis, however.

Nongeneric Swaps

An interest rate swap that specifies an exchange of payments based on the difference between two different variable rates is known as a "basis swap." For example, a basis swap might specify the exchange of payments based on the difference between LIBOR and the prime rate. Other interest rate swaps include the forward swap, in which the effective date of the swap is deferred;

the swaption, which is an option on an interest rate swap; and puttable and callable swaps, in which one party has the right to cancel the swap at certain times. This list is far from exhaustive—many other types of interest rate swaps are currently traded, and the number grows with each year. Abken (1991b) describes a variety of different swap agreements.

Swap Valuation

Interest rate swaps can be viewed as implicit mutual lending arrangements. A party to an interest rate swap implicitly holds a long position in one type of interest-bearing security and a short position in another. Swap valuation techniques utilize this fact to reduce the problem of pricing an interest rate swap to a straightforward problem of pricing two underlying hypothetical securities having a redemption or face value equal to the notional principal amount of the swap. The method used to value a fixed/floating swap is outlined below.

Partitioning a Swap

A fixed/floating swap can be partitioned into (1) a bond paying a fixed coupon and (2) a variable-rate note with payments tied to the variable-rate index. Let $S(0,T)$ denote the value of a T-period swap on its initial settlement date (date 0), $B(0,T)$ the value of a hypothetical T-period fixed-rate bond paying a coupon equal to the fixed-rate payments specified by the agreement, and $V(0,T)$ the value of a variable-rate note maturing at date T. Assuming that the face or redemption value of both hypothetical securities is equal to the notional principal amount of the swap, the value of the swap to a fixed-rate payer can be expressed as

$$S(0,T) = V(0,T) - B(0,T).$$

Pricing the Variable-Rate Note

A variable-rate note whose payments are indexed to market interest rates is valued at par upon issuance and just after each interest payment is made. Thus, assuming that payment dates coincide with interest rate reset dates, the value of the hypothetical variable-rate note $V(0,T)$ will just equal the notional principal amount of the swap on every reset date. On any other date the value of a variable-rate note—exclusive of accrued interest—is just the present value of the next known interest payment plus the present value of the face value of the note, the latter amount representing the value of all remaining payments on the note as of the next settlement date.

Pricing the Fixed-Rate Note

The hypothetical fixed-rate note $B(0,T)$ can be priced using standard bond valuation techniques. The convention in swap markets is to quote the AIC

as a semiannual bond-equivalent rate. The formula for valuing a bond paying semiannual fixed coupon payments is

$$B(0,T) = \sum_{t=0}^{2T} [(C/2)/(1 + y/2)^t] + [N/(1 + y)^T],$$

where C is the annual coupon payment, T the number of years to maturity, N the principal or face value, and y the yield-to-maturity of the bond.

By definition, the All-In-Cost of a fixed/floating swap is the yield to maturity that just makes the value of the hypothetical fixed-rate bond equal to the notional principal amount of the swap. The annual coupon payment for this hypothetical bond is determined by the AIC and the notional principal amount of the agreement:

$$C = (AIC/100)(N),$$

where AIC is expressed as a percentage rate. It is easy to see that the value of the hypothetical bond implicit in this fixed/floating swap will be par (the notional principal amount of the swap) when

$$y = AIC/100.$$

Nonpar Swaps

In most cases swaps are priced so that the initial value of the agreement is zero to both counterparties; that is, so that the value of both hypothetical component securities is just equal to the notional principal amount of the swap. Occasionally, however, a swap may be priced such that one party owes money to the other at initial settlement, resulting in a "nonpar" swap. Nonpar swaps are used to offset existing positions in swaps entered into in previous periods where interest rates have changed since the original swap was negotiated, or in cases where a given cash flow needs to be matched exactly (Dattatreya 1992). Valuation methods for nonpar swaps are somewhat more involved than the simple case discussed above. Interested readers can find more comprehensive discussions of swap valuation in Beckstrom (1990), Iben (1990), and Macfarlane, Ross, and Showers (1990).

The Effect of Changes in Market Interest Rates on Swap Values

A change in market interest rates affects the value of a fixed/floating swap in much the same way that it affects the value of a corporate bond with a comparable maturity. To see why, note that a change in market interest rates will have no effect on the value of the hypothetical variable-rate note implicit in a fixed/floating swap on interest rate reset dates. Therefore, on reset dates a change in market interest rates will affect the value of the swap only through its effect on the value of the hypothetical fixed-rate bond. Since an increase in

interest rates lowers the value of the bond, it increases the value of the swap position for a fixed-rate payer to the same degree it would increase the value of a short position in a fixed-rate bond.

Between interest rate reset dates the amount of the next payment due on the variable-rate note is predetermined. Thus, a change in market interest rates affects the values of both the hypothetical variable-rate note and the hypothetical fixed-rate bond. The change in the value of the variable-rate note partially offsets the change in the value of the fixed-rate note in this case. As a general rule the price behavior of a fixed/floating interest rate swap will approximate the price behavior of a fixed-rate note with a maturity equal to the term of the swap less the maturity of the variable interest rate. For example, a two-year generic swap indexed to six-month LIBOR will approximate the behavior of a fixed-rate bond with a term to maturity of between 18 and 24 months, depending on the amount of time since the last interest rate reset date (Burghardt et al. 1991, p. 86).

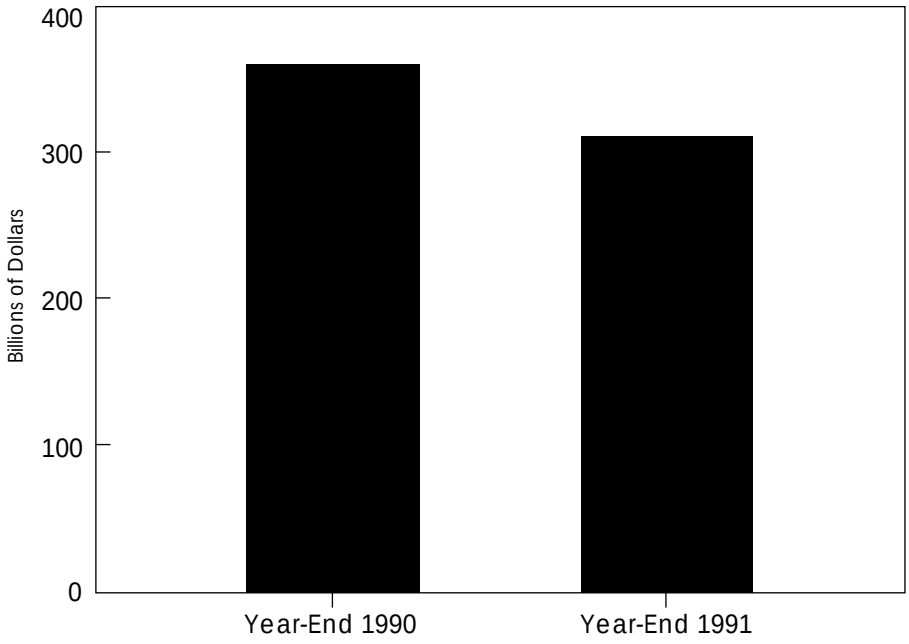
The value of a fixed/floating swap generally changes over time when the term structure of interest rates is upward-sloping. Only when the term structure is flat and market interest rates remain unchanged will the value of an interest rate swap remain unchanged over the life of the agreement (Smith, Smithson, and Wakeman 1988).

3. INTEREST RATE CAPS

The buyer of an interest rate cap pays the seller a premium in return for the right to receive the difference in the interest cost on some notional principal amount any time a specified index of market interest rates rises above a stipulated "cap rate." The buyer bears no obligation or liability if interest rates fall below the cap rate, however. Thus, a cap resembles an option in that it represents a right rather than an obligation to the buyer.

Caps evolved from interest rate guarantees that fixed a maximum level of interest payable on floating-rate loans. The advent of trading in over-the-counter interest rate caps dates back to 1985, when banks began to strip such guarantees from floating-rate notes to sell to the market (Kahle 1992). The leveraged buyout boom of the 1980s spurred the evolution of the market for interest rate caps. Firms engaged in leveraged buyouts typically took on large quantities of short-term debt, which made them vulnerable to financial distress in the event of a rise in interest rates. As a result, lenders began requiring such borrowers to buy interest rate caps to reduce the risk of financial distress (Burghardt et al. 1991). More recently, trading activity in interest rate caps has declined as the number of new leveraged buyouts has fallen. Figure 3 shows that the total notional principal amount of caps, floors, and collars outstanding at the end of 1991 actually fell to $311 billion from $360 billion at the end of

Figure 3 U.S. Dollar Caps, Collars, and Floors



Source: *Market Survey Highlights, Year End 1991*, International Swap Dealers Association, Inc.

1990 (floors and collars are discussed below).

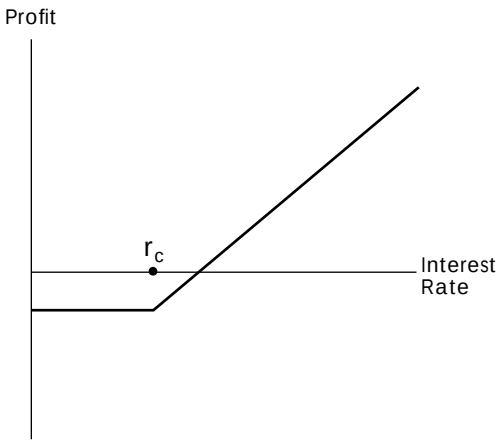
Market Conventions

An interest rate cap is characterized by:

- a notional principal amount upon which interest payments are based;
- an interest rate index, typically some specified maturity of LIBOR;
- a cap rate, which is equivalent to a strike or exercise price on an option; and
- the period of the agreement, including payment dates and interest rate reset dates.

Payment schedules for interest rate caps follow conventions in the interest rate swap market. Payment amounts are determined by the value of the index rate on a series of interest rate reset dates. Intervals between interest rate reset dates and scheduled payment dates typically coincide with the term of the interest rate index. Thus, interest rate reset dates for a cap indexed to six-month LIBOR would occur every six months with payments due six months

Figure 4 The Payoff to Buying a One-Period Interest Rate Cap



later. Cap buyers typically schedule interest rate reset and payment intervals to coincide with interest payments on outstanding variable-rate debt. Interest rate caps cover periods ranging from one to ten years with interest rate reset and payment dates most commonly set either three or six months apart.

If the specified market index is above the cap rate, the seller pays the buyer the difference in interest cost on the next payment date. The amount of the payment is determined by the formula

$$(N)\max(0, r - r_c)(d_t/360),$$

where N is the notional principal amount of the agreement, r_c is the cap rate (expressed as a decimal), and d_t is the number of days from the interest rate reset date to the payment date. Interest rates quoted in cap agreements follow money market day-count conventions, so that payment calculations assume a 360-day year.

Figure 4 depicts the payoff to the buyer of a one-period interest rate cap. If the index rate is above the cap rate, the buyer receives a payment of $(N)(r - r_c)(d_t/360)$, which is equivalent to the payoff from buying an FRA.[2] Otherwise, the buyer receives no payment and loses the premium paid for the cap. Thus, a cap effectively gives its buyer the right, but not the obligation, to buy an FRA

[2] One difference between the payoff to an FRA and the payoff to an in-the-money cap is that an FRA pays the present value of the change in interest payable on the notional principal at settlement (which corresponds to the reset date of a cap), while payments on caps are deferred. The value of the payment has the same present value in both cases, however, so that the comparison between the payoff to a cap and a call option on an FRA remains accurate.

with a forward rate equal to the cap rate. Such an agreement is known as a call option. A one-period cap can be viewed as a European call option on an FRA with a strike price equal to the cap rate r_c.[3] More generally, multi-period caps, which specify a series of future interest rate reset and payment dates, can be viewed as a bundle of European call options on a sequence of FRAs.

Example of an Interest Rate Cap

Consider the example of a one-year interest rate cap that specifies a notional principal amount of $1 million and a six-month LIBOR cap rate of 5 percent. Assume the agreement covers a period starting January 15 through the following January 15 with the interest rate to be reset on July 15. The first period of a cap agreement typically is excluded from the agreement, so the cap buyer in this example will be entitled to a payment only if the six-month LIBOR exceeds 5 percent on the July 15 interest rate reset date. Suppose that six-month LIBOR is 5.5 percent on July 15. Then, on the following January 15 (184 days after the July 15 reset date) the seller will owe the buyer

$$\$2{,}555.56 = (\$1{,}000{,}000)(0.055 - 0.050)(184/360).$$

Comparison of Caps and Futures Options

A one-period cap can be compared to a put option on a Eurodollar futures contract. To see why, note that the payoff at expiration to a put option on Eurodollar futures is

$$(N)\max(0, K - F)(90/360),$$

where N is the notional principal amount of the agreement ($1 million for a Eurodollar futures option), K is the strike price and F is the price of the underlying futures contract. The price index used for Eurodollar futures can be written as $F = 100 - r$, where r is the three-month LIBOR implied by the futures price. Now, write $K = 100 - r_k$, where r_k is the futures interest rate implied by the strike price K. Then, the payoff at expiration to a Eurodollar futures option can be expressed as

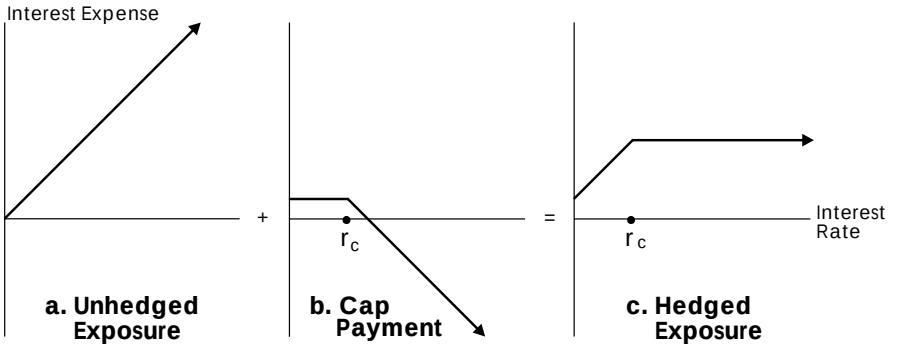
$$(N)\max[0, 100 - r_k - (100 - r)](90/360) = (N)\max(0, r - r_k)(90/360).$$

The right-hand side of this expression is just the payoff to a one-period interest rate cap indexed to three-month LIBOR with a cap of r_k.

Despite the similarities between the caps and Eurodollar futures options, the two instruments differ in a number of noteworthy respects. First, futures

[3] A European option can be exercised only on its expiration date. Similarly, a cap buyer can only "exercise" his option if the index rate is above the cap rate on the interest rate reset date, so that the interest rate reset date corresponds to the expiration date on a European-style option.

Figure 5 The Effect of Buying a Cap on Interest Expense

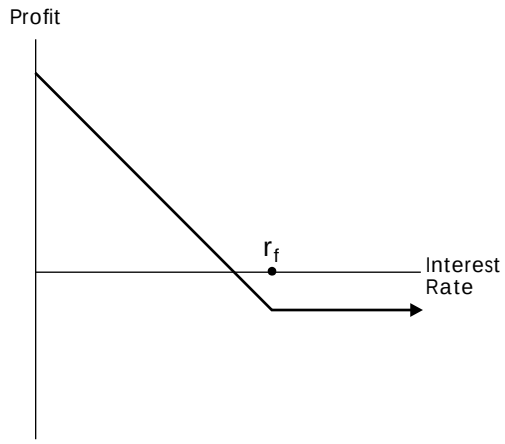


options are standardized, exchange-traded instruments, whereas caps are over-the-counter instruments whose payments can be tailored to match the payment schedule of any variable-rate loan. Eurodollar futures options are based on three-month LIBOR, whereas caps can be bought over the counter to match virtually any maturity interest rate up to one year. Second, futures options are American-style options that can be exercised at any time before the expiration date. In contrast, caps resemble a strip of European options—a cap can be "exercised" only if the specified index rate is above the cap rate on a given reset date. Third, Eurodollar futures options are cash settled on the option expiration date, while a cap is settled in arrears—that is, the payment period falls some time after the interest rate reset date.

Hedging Uses of Caps

Figure 5 illustrates the effect that buying a cap has on the interest expense associated with a floating-rate loan. The first panel depicts the unhedged or inherent exposure of a firm with a loan tied to six-month LIBOR. The firm is exposed to the risk that market interest rates will rise before the next interest rate reset date on the loan and drive up its interest costs. The second panel illustrates the effect that buying a cap has on interest expense. If interest rates rise above the 5 percent cap rate, the payment received from the cap seller offsets the firm's increased interest expense. The hedged position, illustrated in the third panel, shows how buying a cap limits the firm's interest expense to a maximum amount determined by the cost of servicing the debt at the cap rate plus the premium paid for the instrument.

Figure 6 The Payoff to Buying a One-Period Interest Rate Floor



4. INTEREST RATE FLOORS

The buyer of an interest rate floor pays the seller a premium in return for the right to receive the difference in interest payable on a notional principal amount when a specified index interest rate falls below a stipulated minimum, or "floor rate." Buyers use floors to fix a minimum interest rate on an asset paying a variable interest rate indexed to some maturity of LIBOR. Like an interest rate cap, a floor is an option-like agreement in that it represents a right rather than an obligation to the buyer. The buyer of an interest rate floor incurs no obligation if the index interest rate rises above the floor rate, so the most a buyer can lose is the premium paid to the seller at the outset of the agreement.

The payment received by the buyer of an interest rate floor is determined by the formula

$$(N)\max(0, r_f - r)(d_t/360),$$

where N is the notional principal amount of the agreement, r_f is the floor rate or strike price, and d_t is the number of days from the last interest rate reset date to the payment date. Figure 6 depicts the payoff to a one-period floor as a function of the value of the underlying index rate. If the index rate is below the floor rate on the interest rate reset date the buyer receives a payment of $(N)(r_f - r)(d_t/360)$, which is equivalent to the payoff from selling an FRA at a forward rate of r_f. On the other hand, if the index rate is above the floor rate the buyer receives no payment and loses the premium paid to the seller. Thus, a floor effectively gives the buyer the right, but not the obligation, to sell an FRA, which makes it equivalent to a European put option on an FRA. More

generally, a multi-period floor can be viewed as a bundle of European-style put options on a sequence of FRAs maturing on a succession of future maturity dates.

Comparison of Floors and Futures Options

Purchasing a one-period interest rate floor yields a payoff closely resembling that of a long Eurodollar futures call option. The payoff to a call option on a Eurodollar futures contract is

$$(N)\max(0, F - K)(90/360),$$

where $F = 100 - r$ is the index price of the underlying futures contract and K is the strike price. As before, write $K = 100 - r_k$. Then, the payoff to a Eurodollar futures call option can be expressed in terms of the underlying interest rate as

$$(N)\max(0, r_k - r)(90/360),$$

which is the same as the payoff to a one-period interest rate floor indexed to 90-day LIBOR with a floor rate equal to r_k. The one noteworthy difference between the two instruments is that a Eurodollar futures option can be exercised at any time, while a floor resembles a European option that can only be exercised on its expiration date. Like caps, interest rate floors settle in arrears, whereas a futures option settles on its expiration date.

5. INTEREST RATE COLLARS

The buyer of an interest rate collar purchases an interest rate cap while selling a floor indexed to the same interest rate. Borrowers with variable-rate loans buy collars to limit effective borrowing rates to a range of interest rates between some maximum, determined by the cap rate, and a minimum, which is fixed by the floor strike price; hence, the term "collar." Although buying a collar limits a borrower's ability to benefit from a significant decline in market interest rates, it has the advantage of being less expensive than buying a cap alone because the borrower earns premium income from the sale of the floor that offsets the cost of the cap. A zero-cost collar results when the premium earned by selling a floor exactly offsets the cap premium.

The amount of the payment due to or owed by a buyer of an interest rate collar is determined by the expression

$$(N)[\max(0, r - r_c) - \max(0, r_f - r)](d_t/360),$$

where, as before, N is the notional principal amount of the agreement, r_c is the cap rate, r_f is the floor rate, and d_t is the term of the index in days. Figure

Figure 7 The Payoff to Buying a One-Period, Zero-Cost Collar

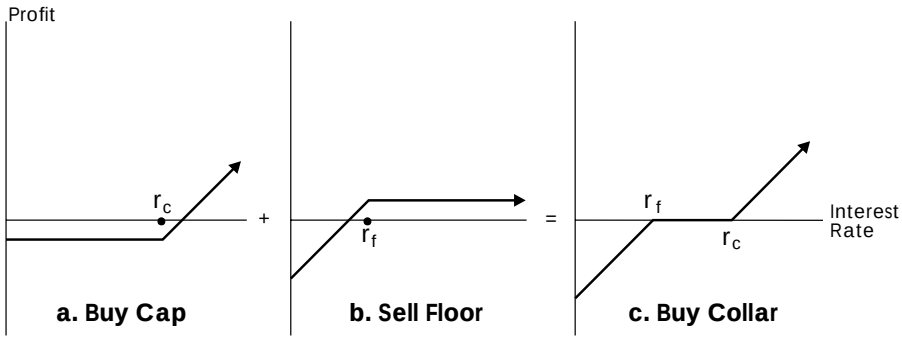
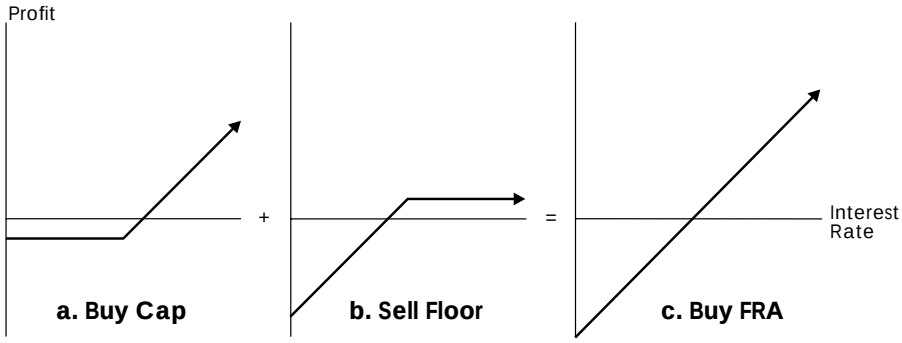


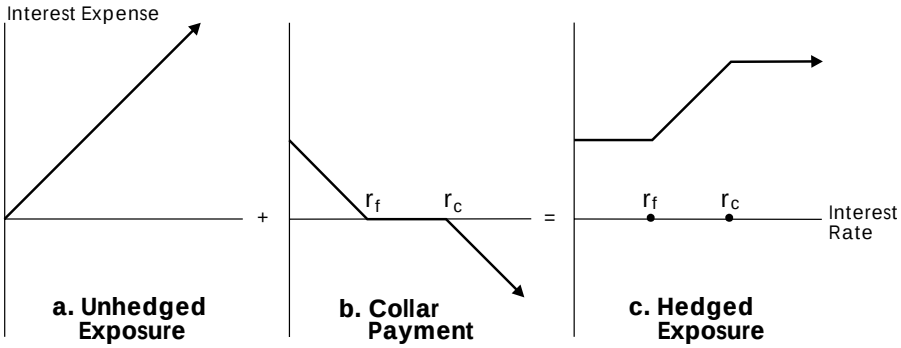
Figure 8 Put-Call Parity



7 illustrates the payoff to buying a one-period zero-cost interest rate collar. If the index interest rate r is less than the floor rate r_f on the interest rate reset date, the floor is in-the-money and the collar buyer (who has sold a floor) must pay the collar counterparty an amount equal to $(N)(r_f - r)(d_t/360)$. When r is greater than r_f but less than the cap rate r_c, both the floor and the cap are out-of-the-money and no payments are exchanged. Finally, when the index is above the cap rate the cap is in-the-money and the buyer receives $(N)(r - r_c)(d_t/360)$.

Figure 8 illustrates a special case of a zero-cost collar that results from the simultaneous purchase of a one-period cap and sale of a one-period floor when the cap and floor rates are equal. In this case the combined transaction replicates

Figure 9 The Effect of Buying an Interest Rate Collar on Interest Expense



the payoff of an FRA with a forward interest rate equal to the cap/floor rate. This result is a consequence of a property of option prices known as put-call parity.

More generally, the purchase of a cap and sale of a floor with the same notional principle, index rate, strike price, and reset dates produces the same payout stream as an interest rate swap with an All-In-Cost equal to the cap or floor rate. Since caps and floors can be viewed as a sequence of European call and put options on FRAs, buying a cap and selling a floor with the same strike price and interest rate reset and payment dates effectively creates a sequence of FRAs, all with the same forward rate. But note that an interest rate swap can be viewed as a sequence of FRAs, each with a forward rate equal to the All-In-Cost of the swap. Therefore, put-call parity implies that buying a cap and selling a floor with the same contract specifications results in the same payment stream that would be obtained by buying an interest rate swap.

In recent years dealers in the OTC derivatives market have shown a great deal of ingenuity in devising new hybrid instruments yielding an almost endless variety of payout patterns. Interested readers can find descriptions of other types of derivatives in Abken (1989), Burghardt et al. (1991), Smith and Smithson (1990), and Smith, Smithson, and Wilford (1989).

Hedging Uses of Interest Rate Collars

Figure 9 illustrates the effect that buying a one-period, zero-cost collar has on the exposure to changes in market interest rates faced by a firm with outstanding variable-rate debt. The first panel depicts the firm's inherent or unhedged interest exposure, while the second panel illustrates the effect that buying a

collar has on interest expense. Finally, the third panel combines the borrower's inherent exposure with the payoff to buying a collar to display the effect of a change in market interest rates on a hedged borrower's interest expense. Note that changes in market interest rates can only affect the hedged borrower's interest expense when the index rate varies between the floor and cap rates. Outside this range, the borrower's interest expense is completely hedged.

6. RISK AND REGULATION IN THE OVER-THE-COUNTER DERIVATIVES MARKET

Regulatory Concerns

The OTC derivatives market is often characterized as unregulated because no federal regulatory agency oversees trading activity in this market, as the Commodity Futures Trading Commission (CFTC) does with futures markets or the Securities and Exchange Commission (SEC) does with securities markets.[4] Yet it would be misleading to characterize the OTC derivatives market as completely unregulated. Many of the largest derivatives dealers are affiliates of commercial banks, which rank among the most heavily regulated of all firms. Bank regulatory agencies routinely conduct on-site examinations to review procedures in place for controlling risks at the institutions they supervise. Additionally, regulations imposed by the federal banking agencies include minimum capital requirements designed to take account of credit risk exposure arising in connection with derivative instruments.[5] While not subject to the comprehensive regulatory oversight applied to commercial banks, investment banks dealing in OTC derivatives are subject to SEC scrutiny. And the International Swap Dealers Association (ISDA)—an industry association organized by the major OTC derivatives dealers—sets standards for market practices and addresses the legal and public policy issues affecting the market.

Nonetheless, the rapid growth and sheer size of the OTC derivatives market has sparked debate over the risks posed by the growth of trading in derivative instruments and the appropriate scope of market regulation.[6] When all types of derivative agreements are taken into account, including currency swaps, caps, floors, collars, and swaptions, the total notional principal amount of outstanding agreements exceeded $4 trillion at the end of 1991, with derivatives dealers acting as middlemen to most transactions. Much of the trading activity in this market takes place between a relatively small number of large dealers, resulting in an interdependent web of obligations among those dealers.[7] Unlike

[4] See Abken (1991a) for a description of these other markets.

[5] Rogers (1990) discusses capital requirements for OTC derivatives.

[6] For example, see Corrigan (1992), Bank for International Settlements (1992), and Hansell and Muehring (1992).

[7] Data in ISDA's *Market Survey Highlights*, Second Half 1991, indicates that 47 percent of all new interest rate swaps arranged in 1991 were between ISDA member organizations.

exchange-traded derivatives such as futures contracts and futures options, where the exchange clearinghouses guarantee contract performance through a system of margin requirements, daily settlement of gains and losses, and the backing of the capital of clearing member firms, OTC derivative instruments are bilateral arrangements that carry no independent third-party guarantee. As a result, counterparties to OTC instruments face the risk of default, known as counterparty credit risk. Moreover, the absence of contract standardization means that OTC derivatives tend to be less liquid than exchange-traded derivatives, which can make it difficult to execute transactions in periods of extreme price volatility or when a counterparty's credit standing is questioned.

A recent joint study by the three federal banking agencies examined the risks posed by the growth of trading in OTC derivatives (Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, and Office of the Comptroller of the Currency 1993). The study found that risks associated with OTC derivatives differed little from the risks traditionally borne by financial intermediaries. Although it did identify a number of concerns, the study concluded that trading in derivative instruments has not contributed to the overall fragility of the financial system and does not pose undue risks for organizations active in this market. To the contrary, it cited at least one instance—namely, the period of exchange rate turbulence in European currencies in September of 1992—where it concluded that foreign currency markets were not likely to have performed as well as they did during the crisis without the existence of foreign currency derivatives that enabled financial institutions to manage their currency positions.

The joint study identified six different types of risks in connection with derivative instruments: credit risk, market risk, liquidity risk, settlement risk, operating risk, and aggregation risk. As noted earlier, much of the concern over the growth of the market has centered around the issue of counterparty credit risk because of the sheer size of the market and the size of credit exposures borne by dealers. Because derivative instruments tie together so many different markets around the world, regulators have expressed concerns that aggregation, or interconnection risk, might make it difficult to contain a financial crisis to keep it from spreading to other markets. The remainder of this article discusses some of the risks associated with OTC derivatives and the legal, regulatory, and market arrangements that have developed to deal with such risks.

Counterparty Credit Risk

Measuring the Credit Risk Exposure of an FRA

The credit risk exposure associated with an FRA, or any other derivative instrument for that matter, differs from that of a debt instrument because an FRA is not a funding transaction and therefore involves no exchange of principal. At its inception the value of an FRA is zero to both parties, so there is no initial credit risk. Potential credit risk is bilateral: a party to an FRA is exposed

to credit risk when the value of the agreement becomes positive to him or her, and the value of an FRA can change so as to gain value to either party. Unlike a loan agreement, where financial distress on the part of a borrower always exposes the lender to default risk, financial distress on the part of an FRA counterparty does not necessarily expose the other counterparty to the risk of default. A financially distressed firm has no incentive to default on an agreement that has positive value to it—and even if such a counterparty were to default, the nondefaulting party would suffer no loss.

Since an FRA involves no exchange of principal, potential credit risk exposure is a small fraction of the notional principal amount of the agreement. Credit risk exposure is determined by the value of the FRA, which corresponds to the cost of replacing the FRA. To illustrate, recall the earlier example of a 1×4 FRA with a notional principal of \$1 million and a forward rate of 5 percent. If market interest rates rise by 50 basis points immediately after the agreement is negotiated, the value of the FRA to the buyer is just the current present value of \$1,250 (50 basis points $\times$ \$25 per basis point), or

$$\$1{,}229.51 = \$1{,}250/[1 + 0.050(120/360)].$$

This calculation determines the value of the agreement exactly 30 days before its scheduled settlement, or maturity date. The credit risk exposure borne by the FRA buyer in this example is just over 1/10 of 1 percent of the notional principal amount of the agreement.

Measuring the Credit Risk Exposure of an Interest Rate Swap

A swap counterparty's credit risk exposure is determined by the cost of replacing the agreement in the event of a default. The cost of obtaining a replacement swap is determined by the difference between the All-In-Cost of the old swap and the AIC on a replacement swap. As an illustration, consider the case of a fixed-rate payer in a swap with one year left to maturity and a 7 percent AIC. If the floating-rate payer defaults when the prevailing market rate on a one-year replacement swap is 8 percent, the nondefaulting party will be required to pay an extra 1 percent per year on the notional principal to replace the swap. The replacement value of the swap is just the net present value of the difference in interest payments.

In discussing swap valuation methods it was useful to view a swap as an implicit mutual lending arrangement in which the counterparties exchanged loans indexed to two different interest rates. In looking at credit risk exposure, however, it can be useful to view a swap as a bundle of FRAs, all with forward rates equal to the All-In-Cost of the swap. Thus, the swap in the above example can be viewed as a combination of a 0×6 FRA and a 6×12 FRA, each with a forward rate of 7 percent. The replacement cost of the swap is just equal to the value of the two component FRAs when the underlying index rate is 8 percent.

As with FRAs, the potential credit risk exposure of an interest rate swap typically is a small fraction of the notional principal amount of the agreement. By one estimate, the expected lifetime credit exposure associated with an interest rate swap varies from 0.002 percent of the notional principal for a swap with a one-year maturity to 4.5 percent for a swap with a ten-year maturity (Simons 1989).

Credit Risk Exposure of Caps, Floors, and Collars

Sellers of caps and floors face no credit risk, since neither type of agreement requires the buyer to make any payments other than the initial premium. But cap and floor buyers face the risk of nonperformance on the part of the seller any time a cap or floor goes "in-the-money"—that is, any time the seller is required to make payments to the buyer. Since a collar involves a short position in a floor and a long position in a cap, it can expose both the buyer and seller to counterparty credit risk.

The credit risk exposure faced by the buyer of an interest rate cap can be compared to the risk exposure of a fixed-rate payer in an interest rate swap. In both cases, the buyers face the risk that the seller will default when interest rates rise. Similarly, the buyer of an interest rate floor faces a credit risk exposure analogous to that of a floating-rate payer, or seller, of an interest rate swap. The total credit risk exposure in each case is determined by the cost of buying a replacement cap or floor.

Netting Arrangements

When dealers first began acting as intermediaries in swap agreements the risk associated with each swap was accounted for separately. As the market grew, swap dealers found themselves parties to multiple agreements with the same counterparty. Concern over their growing aggregate exposure led many dealers to adopt "master" agreements that treated all their transactions with a given counterparty as supplements to a single consolidated agreement. These master agreements gave swap counterparties the right to terminate all supplemental swap agreements in the event of default on any one of the swaps. The advent of the master agreement represented an attempt by swap dealers to limit the credit risk exposure with any single counterparty to the net value of all swaps with that counterparty. Today virtually all OTC derivatives utilize a standardized master agreement designed by the International Swap Dealers Association (Gooch and Pergam 1990).

The Status of OTC Derivatives Under Bankruptcy Law

Before the enactment of recent amendments to the Bankruptcy Code, there was some question as to whether master swap agreement netting provisions would

be legally enforceable in the event of bankruptcy. The U.S. Bankruptcy Code grants a firm in bankruptcy proceedings an "automatic stay" from the claims of its creditors. The automatic stay allows a bankrupt firm to postpone scheduled debt payments and overrides most other contractual obligations pending the resolution of all claims against the firm. Thus, although virtually all lending agreements give creditors the right to demand accelerated repayment of a loan in the event of a default on a scheduled payment, default inevitably delays repayment in practice. Often, creditors of the bankrupt firm receive only a fraction of the amounts owed them even if the firm ultimately emerges from bankruptcy proceedings as a reorganized entity. Swap market participants faced the risk that the Bankruptcy Courts might enforce the automatic stay against swap agreements, making the netting provisions of the ISDA master swap agreement unenforceable. Nondefaulting counterparties would then face the risk that a bankruptcy trustee might selectively default only on swaps having a negative value to a bankrupt counterparty, a practice known as "cherry picking."

Public Law 101–311, enacted on June 25, 1990, amended the Bankruptcy Code to exempt swap agreements executed under a single master agreement such as the ISDA master agreement from the automatic stay normally applicable to creditors of a bankrupt firm. The amendments were enacted to make the netting provisions of the ISDA master swap agreement enforceable in the event of bankruptcy. The Bankruptcy Code amendments also authorize nondefaulting swap counterparties to utilize any collateral posted in connection with a swap agreement to offset the net amount owed by a bankrupt counterparty (Rogers 1990). In this respect, the law treats OTC derivatives analogously to exchange-traded futures contracts.[8] These provisions greatly mitigate the potential loss faced by swap counterparties when the parties involved have multiple agreements with one another.

The Status of Swap Agreements Under Banking Law

Commercial banks and thrift institutions are not subject to the provisions of the Bankruptcy Code. Instead, bank failure resolution is governed by federal and state banking laws, which gives the Federal Deposit Insurance Corporation (FDIC) and the Resolution Trust Corporation (RTC) (in the case of certain savings and loan institutions) considerable discretion in dealing with failing federally insured depository institutions. The FDIC and RTC may act in the capacity of either a conservator or a receiver. An institution placed in conservatorship is not declared legally insolvent. It continues its normal business operations under the close scrutiny of federal regulators pending resolution of

[8] Williams (1986) stresses the importance of the exemption of futures margin requirements from the automatic stay as a prime reason for the existence of futures markets.

its financial difficulties. Institutions in conservatorship are either returned to private sector control, through a sale or merger, or they are eventually declared insolvent. When a federally insured depository institution is declared legally insolvent either the FDIC or RTC becomes the receiver for the institution. Regulators may resolve bank failures either through a "purchase and assumption" transaction in which the failed institution is taken over by another bank or thrift or, less often, through liquidation.[9]

The Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) contains provisions similar to the netting provisions of the Bankruptcy Code requiring the receiver of a failed bank or conservator of a failing bank to treat all supplemental swap agreements executed under a single master agreement as a single contract. In the event of a default or liquidation of a bank or thrift, the institution's counterparties maintain the right to accelerate repayment of all swap agreements made under a single master agreement. Counterparties do not have an automatic right to terminate existing swap agreements when an institution is placed into conservatorship, however, because an institution in conservatorship has not legally failed (although they do retain the right to demand accelerated repayment in the event of a default or breach of another covenant). FIRREA gives bank regulators the express right to transfer all derivative instruments covered by a single master agreement, along with other bank assets, to another institution, either when the institution is in conservatorship or in the case of a purchase and assumption transaction. But in this latter case the master agreement and all its supplements must be treated as a single agreement and transferred together with all applicable collateral. Thus, the law discourages federal regulators from cherry picking among individual OTC agreements that are part of a larger master agreement.[10] Nondefaulting counterparties still face the risk that their agreements might be assigned to a counterparty with a relatively weak credit standing, however.

Although recent legislation has reduced the legal risks faced by domestic counterparties, derivatives dealers with exposures to counterparties outside of the United States still face risks arising from the uncertain legal status of netting arrangements under foreign laws. At present, ISDA is working with authorities in other countries to enact bankruptcy legislation resembling the recent Bankruptcy Code amendments enacted in the United States. Until such legislation is enacted, however, internationally active OTC derivatives dealers face considerable legal risk.

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[9] Dotsey and Kuprianov (1990) describe bank failure resolution policies in more detail.

[10] See Gooch and Pergam (1990) and Rogers (1990) for more details on banking law and netting arrangements.

Aggregation or Interconnection Risk

Aggregation or interconnection risk refers to the risk that a disruption in one market, caused by the default of a major institution or some other event, might cause widespread difficulties throughout the OTC derivatives market or even spread to other financial markets. Market liquidity risk is one source of interconnection risk. OTC derivatives dealers operate in many different markets at once. They must often execute complex, multi-legged transactions to create custom-tailored instruments for their customers while attempting to hedge the resulting exposure to market risk. The successful execution of such operations depends on the ability to complete a number of transactions in different markets almost simultaneously. But experience shows that market liquidity can evaporate quickly, especially in times of financial stress when market participants have reason to question the creditworthiness of potential counterparties. Reduced liquidity can make it difficult for a dealer to hedge its exposure to market price risk or, in the event of a default by a counterparty, make obtaining a replacement swap a costly proposition.

Counterparty credit risk can also be a source of aggregation risk because such a large fraction of trading in OTC derivatives takes place between the dealers themselves. The default of a single major dealer could have a significant effect on the outstanding positions of other major dealers. In addition to potential losses from credit risk exposures, a default by a major derivatives dealer would leave other dealers exposed to considerable price risk. Dealers use derivatives both to hedge their outstanding commitments to other OTC counterparties as well as other asset holdings. These dealers would need to rebalance their portfolios, either by buying or selling new derivative instruments or by quickly selling existing asset holdings. The resulting flurry of activity might conceivably disrupt not only the OTC derivatives market, but other markets as well.

To date, losses incurred by counterparties to OTC derivatives have yet to even approach the magnitude of losses incurred in the course of more traditional lending and investment activities. Worth noting in this regard is that financial markets have survived at least one default by a major derivatives dealer—that of Drexel Burnham Lambert in 1990—without serious disruption, although it has certainly provided headaches for Drexel's former counterparties. Recent legislation recognizing netting arrangements was designed to help contain the consequences of a default by a major derivatives dealer in the United States, although, as noted earlier, other countries have been slow to enact such legislation.

Market Arrangements for Controlling Risks

Managing the credit risk associated with a position in an instrument such as an interest rate swap requires credit evaluation skills of the type commonly associated with bank lending. Thus, as the swaps market evolved into a dealer

market where financial intermediaries assumed the role of counterparty to the end users of swap agreements, commercial banks, which have traditionally specialized in credit risk evaluation and have the capital reserves necessary to support credit risk management, came to dominate the market for swaps and other OTC derivatives. Only in cases where a counterparty is deemed a poor credit risk are performance bonds, such as margin requirements of the type employed by futures exchanges, used to substitute for credit evaluation. When performance bonds are used, the agreement often provides for the periodic settlement of changes in the value of a derivative instrument using a process resembling the daily marking-to-market of futures contracts, although settlement generally takes place at less frequent intervals with OTC derivatives (Smith, Smithson, and Wakeman 1986).

The widely publicized financial difficulties of many firms and banks in recent years has made market participants sensitive to the issue of counterparty credit risk. As a result, dealers with less than AA credit ratings have found it increasingly difficult to trade in OTC derivatives. The heavy loan losses and resulting financial difficulty experienced by many commercial banks in recent years has hampered the ability of such institutions to compete in this market. At the same time, a number of investment banks have formed separately capitalized subsidiaries so as to enhance their credit standing and remain competitive in the derivatives market.[11] Thus, market discipline has had the salutary effect of restricting the activities of less creditworthy counterparties.

7. CONCLUDING COMMENTS

The evolution of the over-the-counter derivatives market has revolutionized the nature of financial intermediation in money markets in a span covering a little more than a decade. Along with the benefits derivatives offer firms in managing cash flows, however, the rapid growth of the market has raised new concerns for regulators and policymakers. Industry spokesmen argue that existing market arrangements are adequate to address such concerns, a view increasingly shared by regulators and policymakers.[12] The development of the ISDA master agreement in recent years, along with recent changes in banking laws and in the U.S. Bankruptcy Code, has gone far to minimize the potential for widespread market disruption that could result from a default on the part of a major dealer in the swaps market. And concerns about counterparty credit risk have led market participants themselves to limit the activities of dealers with less than outstanding credit ratings.

[11] Federal regulators have yet to grant commercial banks approval to form separately capitalized subsidiaries of the type investment banks have begun to use. See Chew (1992, 1993) and Peltz (1993) for a more detailed discussion of this trend.

[12] For example, see Hansell and Muehring (1992), Phillips (1992), and Shale (1993).

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