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Source: *The American Economic Review*, Mar., 1945, Vol. 35, No. 1 (Mar., 1945), pp. 16-27

Published by: American Economic Association

Stable URL: <https://www.jstor.org/stable/1810106>

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THE EFFECT OF INTEREST RATE INCREASES ON THE BANKING SYSTEM

By PAUL A. SAMUELSON*

Simple truths need constant repetition. Current American discussions suggest that it may be advisable to assert the following propositions:

1. *The banking system as a whole is not really hurt by an increase in the whole complex of interest rates. It is left tremendously better off by such a change.*

2. *A typical single bank, taken by itself, is not really hurt by an increase in the whole complex of interest rates. It is left better off by such a change.*

The author wishes to emphasize that he does not believe interest rate increases to be probable or desirable.

I

If a bank were a university, nobody would doubt that it would be made better off by an increase in the interest rate. At worst, it could continue to hold all existing gilt-edge securities to maturity and be no worse off. As these matured, the proceeds could be invested at higher rates with a resulting increase in income. It would be better off in the sense that *ceteris paribus* it could hire more teachers per year, spend more money on buildings and stadia, engage in more research.

The only exception would be in the limiting and unrealistic case where all its money was invested in perpetuities. But even here it would be no worse off. In every other case it would be better off.

If the treasurer of the college has had a college course in financial mathematics, or if his secretary owns a book of compound interest tables, he should be able at each instant of time to calculate the *present value* of his assets: *i.e.*, the discounted value of all future income streams. In any case, in a reasonably perfect capital market this will be done for him and will be reflected in the quoted prices of the securities he holds.

Obviously, when the rate of interest goes up and is expected to remain up, the present value of his assets goes down. Now there are many purposes for which the reckoning of present value is indispensable.

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But it will be readily seen that the problem of forming a judgment of the good or bad effects of an interest change is not one of them. We have seen that the university is better off in the only reasonable sense of the term (disposable real income over time), and yet *present value* seems to give an opposite indication.

Does this mean that a university should buy bonds without taking account of probable future long-term rates of interest? Of course not. Suppose the treasurer of Siwash buys a bond today, and the treasurer of Sweet Briar does not. Let interest rates rise tomorrow. The price of bonds will drop. Obviously, the woman treasurer has done better than the man. She can buy the same income stream for less money, or can get a larger income stream for the same money.

If, on the morrow, an angel came to Siwash and asked the treasurer whether he wished rates of interest to rise, what would he answer? Unless he were a fool, or an ingrate who valued his own reputation for sagacity more than the welfare of his Alma Mater, he would of course answer, "Yes." It would be but human for him to add wistfully, "If you had only come around yesterday. . . ."

Clearly then, an interest rate increase which you have not anticipated is a good thing, even though an increase you have anticipated and gambled on is a better thing. If interest rates rise without your having speculated on their doing so, you should not feel any worse than at not having picked the winner in yesterday's horse race, or at not having sold short stocks which events later proved would fall. And certainly any unavoidable feelings of recrimination should not cause one to forego very great gains just because only partial advantage of them can be taken. It is better to "place" or "show" than not to be in the money at all. *Ex ante* decisions should be directed to *ex post* advantage; *ex post* advantage should never be sacrificed to *ex ante* decisions.

Conclusion: *A university is not really hurt by an increase in the whole complex of interest rates, declines in its capital values notwithstanding. It is really left better off by such a change.*

II

So much for the case of a university, where no one can fail to draw correct conclusions. Let us turn now to the intermediate case of an insurance company. How does it differ from a university? Each receives inpayments, owns earning assets, and must make outpayments. The contractual nature of these outpayments differs, and therein lies a partial distinction. But not too much should be made of this difference. Many of the expenses of a university are relatively fixed and even

subject to legal commitment, while the insurance companies, by the prevailing practice of setting rates higher than cost (as revealed by subsequent experience), are able by variable dividend policy to control an important part of their outpayments.

As far as the policies already in force are concerned, an insurance company can pretty well tell in advance the whole future pattern of its net outpayments. The contingencies which occasion outpayments are specified in the policy, and the actuarial large-scale frequency of these contingencies is relatively predictable. Indeed knowledge of future outpayments on insurance now in force would be almost perfect were it not for the options (changeover, lapse, waiver, borrowing, etc.) included in insurance policies. But even these factors can be estimated, in terms of various probabilities, with a considerable degree of accuracy.

Of course, insurance companies are not loath to sell new policies. With perfect knowledge of the future course of interest rates, the application of sound actuarial principles makes this a factor of no great importance because each group of like policies can "stand on its own feet." This, after all, is the important purpose of reserves in private insurance. In any case it should be pointed out that the general course of future sales is in large measure predictable as to trend. Except for national income, which is subject to cyclical fluctuations, the relevant factors such as age distribution change slowly. And, in fact, every insurance company tacitly proceeds in its administration upon a "going concern" basis and indeed upon a "growing concern" basis. This is only proper.

If charges in the past have not been set too low, and if dividend policy has not been overly generous, it would be possible for an insurance company to arrange its portfolio in relationship to the future time pattern of commitments so that the company would be perfectly hedged against all future interest rate changes. Bond coupons and retirements would be staggered so as to produce exactly the right amount of cash even if no new business were taken on, and regardless of what happened to the market value of securities held. This is not the current policy of insurance managements. Although no criticism is implied by the statement, they usually take an implicit speculative position.

Can we say then that under these conditions of perfect hedging on old business, insurance operations are not affected by interest rates? No. An increase in rates would still benefit the insurance business and policyholders. But its benefits would go completely to *new* policyholders, who would pay less for the same coverage, or get more coverage for their money.

Realistically, we encounter a combination of these extremes. The benefit is divided between new and old policyholders. Guaranteed interest rates on new policies are (quite properly) relatively slow to change over time. Increased earnings are distributed in dividends to all policyholders, old and new. In addition, because insurance companies take an implicit speculative position, there is a further effect as a result of interest rates increase.

The following theorem will indicate the exact conditions under which interest rates help or hurt a given person or institution: *Increased interest rates will help any organization whose (weighted) average time period of disbursements is greater than the average time period of its receipts.*¹

In our previous discussion we implicitly assumed that the disbursements of a university were spread evenly over an indefinite time in the future, and so an interest rate increase was good for it. *Present discounted value* proved to be a false indicator, not so much because the concept is at fault as because it was applied to only one part of present values, *i.e.*, to the income stream. If we had considered the steady stream of outpayments of the university as negative inpayments, had discounted them and added them *algebraically* to present value, then we should have found the whole expression to be algebraically increased rather than decreased by an increase in interest rates.

The only figures relating to the maturity dates of life insurance portfolios at hand refer to holdings of government bonds. These figures suggest that up to 1943 the average maturity date was less than 10 years. On existing policies in force, the average date of outpayment could not conceivably be less than ten years, because of the fact that there is a growing population of insured individuals who buy level premium policies in the productive age years. Therefore, insurance companies were speculating explicitly or implicitly that interest rates would rise. If we consider insurance as a growing business, which

¹ Let N_t = inpayment t years after the present, C_t = corresponding outpayments, V = present value, i = interest rate per annum averaged over time.

$$\text{Then } V = \sum \frac{N_t}{(1+i)^t} - \sum \frac{C_t}{(1+i)^t}$$

$$\text{and } \frac{dV}{di} = -\frac{\log_e (1+i)}{(1+i)^2} \left\{ \sum \frac{tN_t}{(1+i)^{t-1}} - \sum \frac{tC_t}{(1+i)^{t-1}} \right\}.$$

By rearranging terms, we find that $\frac{dV}{di} > 0$ depending upon whether $\bar{N} > \bar{C}$ where \bar{N} , \bar{C} are respectively weighted average periods of inpayments and outpayments, whose weights are proportional to discounted dollar amounts.

means that net outpayments in excess of inpayments will *not* occur, except temporarily, for a long period of time in the future, this conclusion is strengthened. (It should be pointed out in the last connection that the companies can partially protect themselves from a *fall* in interest rates by revising the terms upon which new business is written.)

TABLE I.—OWNERSHIP OF MARKETABLE SECURITIES ISSUED OR GUARANTEED BY THE UNITED STATES

Securities Due or Callable:	(In billions of dollars)						
	Amounts Held February 29, 1944						
	Com- mercial Banks	Savings Banks	Insur- ance Com- panies	Other In- vestors	All except Govern- ment	Federal Reserve, etc. ^a	All In- vestors
Within 1 Year	22.3	0.3	0.7	13.0	36.2	9.8	46.0
1 to 5 Years	16.0	0.6	1.6	4.4	22.5	1.7	24.2
5 to 10 Years	17.2	2.3	3.3	5.7	28.6	1.4	30.0
10 to 20 Years	3.4	2.2	5.1	4.8	15.5	1.3	16.8
After 20 Years	0.9	1.3	4.7	4.1	11.1	1.5	11.6
Total	59.8	6.7	15.4	32.0	113.9	15.7	129.6
Securities Due or Callable:	Amounts Held November 30, 1942						
	Com- mercial Banks	Savings Banks	Insur- ance Com- panies	Other In- vestors	All Except Govern- ment	Federal Reserve, etc. ^a	All In- vestors
Within 1 Year	10.2	0.3	0.5	3.7	11.6	2.1	16.7
1 to 5 Years	10.5	0.7	1.8	4.5	17.4	2.5	19.9
5 to 10 Years	10.5	2.0	2.6	3.1	18.2	2.2	20.4
10 to 20 Years	2.6	0.8	3.8	2.6	9.8	1.2	11.0
After 20 Years	0.7	0.3	0.6	0.7	2.5	0.3	2.8
Total	34.5	4.1	9.3	14.5	62.5	8.3	70.7

^a Federal Reserve Banks, government agencies and trust funds.

In the last eighteen months, there has been an interesting shift of insurance companies into bonds of long maturity. (See Table I.) With 60 per cent of their bonds having a duration of more than 10 years, insurance companies will be in a fairly neutral position with respect to interest rates as far as their old business is concerned and they would stand to gain on their new if interest rates were to rise. This must be modified by the realization that their non-governmental assets are probably of shorter duration.

Final conclusion: *each insurance company, all companies together, and the families who hold or buy insurance would not be hurt by an increase in interest rates. On the contrary, they would be made really better off, regardless of misleading comparisons of present or market values.* If properly computed along the lines indicated above, present value could be shown to bear out this conclusion.

III

I turn now to the case of the banks, particularly the system as a whole. Let us assume the following specific permanent change in the interest rate structure on government bonds:

Duration to maturity	Assumed average duration	Old rates per annum	New rates per annum
1 year or less	.33 years	0.5%	1.5%
1 to 5 years	2 years	1.0%	2.0%
5 to 10 years	7 years	2.0%	3.0%
10 to 20 years	14 years	2.0%	3.0%
over 20 years	22 years	2.0%	3.0%

This is intended only as an hypothetical example and not as a prediction. The old rates are chosen to be approximately equal to present rates. The new rates represent a flat one per cent increase at all levels. If the present differential between short and long rates can be attributed to a fear that rates will harden, and if after that hardening has taken place there is no further expectation of increase, then it would not be unnatural for the short rates to firm relative to the long rates. Witness the reverse movements from the twenties to the thirties.

Would the banking system be worse off for such a change? Let me ask another question: if the government were to bestow upon the banking system some 60 billion dollars, or what is the same thing under existing rates, grant a perpetual annual subsidy of .6 billion dollars, would the banking system be better or worse off? Would bank stocks—which for some city banks are already beginning to sell for more than the book value of capital plus surplus—go up or down in price? Would public confidence in banks rise or fall? Over a period of years would the capital structure of banking be more or less sound?

Or let me pose the question in another way. What if all banks were to subscribe 2 billions to a perfectly safe but non-negotiable term loan, to be paid back in equal installments over three years' time and to yield a rate of compound interest of some 15 *thousand* per cent per annum! Would any sane bank examiner rule that the non-negotiability of such

a loan, which amounts to less than 2 per cent of all bank assets, overweighs the fabulous return on a safe investment?

To ask such questions is to answer them. Any one of these alternatives would involve the greatest boon in history to the commercial banks, with the possible exception of the stimulus to bank earnings provided by World War II, a stimulus which will not be confined to the war years as in the case of most war producers.

Yet the relatively moderate, permanent increase in rates considered above is essentially equivalent to either of the above alternatives! Only the intricacies of bookkeeping prevent this from being seen.

But what about the collapse of capital values when rates harden? Will not an average doubling of interest rates wipe out 50 per cent of

TABLE II

Securities Due or Callable:	Ratio of New Capital Value to Old	New Yield on New Base	New Yield on Old Base
Within 1 year	.997	1.5%	1.50%
1 to 5 years	.981	2.0%	1.96%
5 to 10 years	.938	3.0%	2.81%
10 to 20 years	.887	3.0%	2.67%
after 20 years	.841	3.0%	2.52%

the value of securities held? Even if it did, we have seen in the previous cases the irrelevance of *present value* as traditionally computed, and I shall show it to be equally so for the banking system. But we need not fall back on this theoretical argument.

Applying the usual bond tables and formulas to a portfolio of the composition given in Table I, we find that its capital value will fall only 3 per cent in going from the old to the new rates. Maintainable net income from governments, however, will almost double even if shorts and longs are held in the same proportions in the new situation. Table II shows the *new* capital value of each dollar previously invested in each maturity. By weighting these factors according to the required proportions, we can make a similar calculation for any portfolio. The results for each of the groups listed in Table I are indicated below in Table III.

On a capital value reduced only by 3.29 per cent, a bank portfolio will earn a yield of 2.15 per cent, which is 2.08 per cent on its old capital value. This is almost double its previous yield of 1.17 per cent. The corresponding old and new yields are shown in Table III, for all groups.

It is occasionally recognized that higher rates will increase earnings

after old bonds mature and their proceeds are reinvested. This is a relatively slow process. It is rarely realized that immediately after interest rates have risen and capital values have been scaled down, *all parts of the portfolio*, old as well as new, begin to earn higher rates. We must not forget that the earning of a bond is *not* its coupon, but rather its coupon corrected for amortization of bond premium or dis-

TABLE III

Ownership of Securities	Percentage Decline in Capital Value	Dollar Decline in Capital Value (in billions)	Old Average Yield	New Average Yield on Old Base
Commercial banks	3.29%	1.96	1.17%	2.08%
Savings banks	9.11%	0.61	1.84%	2.57%
Insurance companies	10.13%	1.56	1.83%	2.53%
Other investors	5.22%	1.67	1.25%	2.10%
All except government	5.11%	5.83	1.33%	2.18%
Federal Reserve	3.40%	0.53	0.96%	1.86%
All investors	4.91%	6.36	1.28%	2.14%

count. In this case bonds which were previously at par will be at a discount, and true earnings or yield will exceed coupon rates by amortization of bond discount.

If the banking system maintains the same operating expenses and dividend policy, it will be able by ploughing back the new higher earnings to replace the 3 per cent decrease in values *in less than three years' time*—without changing its proportions between longs and shorts expressed in value terms. This does not mean that in three years' time the bank will have got over the damage done them by interest rate increases. There is no such damage; from the very beginning banks are “really” better off; and at the end of three years, they are much better off because the old capital value can be invested to give twice the old yield.

One technical point should be mentioned. In the new situation, banks may not choose to keep the same proportions between longs and shorts. Indeed, with the new capitalizations, *all* investors will not be able to do so in value terms even should they wish to. But if a bank or the banking system should wish to do so, and if the new rates remain as stated, there may have to be some reshuffling of portfolios in which other than new issues are bought.

In the above calculations, we have treated the bank portfolio like any other portfolio. But what is the basis for the widespread opinion that what is true for a university or insurance company is not true for

the banking system? Our fundamental theorem provides a rationalization of the answer: *a rise in interest rates hurts the banking system if the average time period of its inpayments exceeds that of its outpayments.*

But what are the future outpayments of the banking system? If it is assumed each night that tomorrow is the day of judgment, that all depositors may wish to withdraw all their money, then the average period of outpayments is one day, and of course the banking system would be hurt by interest rate increases. In such an absurd world, it would be criminal for banks to have anything but 100 per cent reserves. It is equally absurd to assume that savings banks have an average period of outpayments of 30 days.

It should not be necessary to argue before economists that the banking system is a going concern, and is to be treated as such. But some practical bankers, noting that their own business has gone up during the war, share the common opinion that—along with the business of the butcher, the baker, the candlestick maker—after the war their business will go down. When the war is over, it is not impossible that business activity should decline. But as far as volume of deposits is concerned, banking is one business which cannot go back to its previous level.

Deposits are unmade in much the same way that they are made. Deposits were created in banks by the process of expanding earning assets, largely war bonds. Deposits can only be destroyed if banks lose assets. There are only three conceivable ways in which banks could be expected to lose deposits.

1. After the war, the federal government might run surpluses and retire debt. Even high annual surpluses would require a very long time to make a dent in the huge volume of bank deposits. The most confirmed optimist knows that the quantitative rates of surpluses cannot be a fraction of the rate of wartime deficits, although he may hope for a long period of such surpluses. Realistically, there is as yet little reason to believe that economic and political conditions will be such as to permit rapid debt reduction.

In any case, it will be obvious that reduction via this process will create no problems for bank portfolios. Withdrawals and debt retirement will be linked, with equal average periods.

2. The second way in which deposits might decrease is as the result of a changed preference of the public for cash and security. If individuals should come to prefer government bonds to non-earning bank balances, we could witness in the post-war world a gradual purchase of government bonds by the public from bank portfolios, with a resulting destruction of deposits. This second process is the only one of

the three which seems at all probable, and it must be considered as only a doubtful possibility.

But should it materialize, it would obviously not create difficulties for the banks. They would be losing deposits precisely because of an increased demand for government bonds. Interest rates would then be falling, and banks would be making capital gains rather than losses.

3. If the public should distrust banks and wish to hoard cash, deposits would of course decrease. It may be stated pointblank that such a contingency will not materialize, and cannot materialize. Not only does deposit insurance greatly decrease the chance of its happening, but also any sensible conception of public responsibility would envisage drastic use of Federal Reserve and governmental powers to prevent such a situation from developing, and to meet it should it develop. Realistically, banking experts anticipate that peace will cause a reverse flow of currency back to the banks.

The reader may work out for himself the details of the case where the public develops a desire for securities other than governmentals and attempts to use up its deposits in such purchases. Government bond yields could harden but bank outpayments would not increase.

Legalists and bank examiners nevertheless will still worry about the instantaneous effects of higher interest rates on capital values. Balm may be found for them in the following considerations: government securities may be carried at cost rather than market; capital surpluses may be large enough to absorb a 3 per cent drop in portfolio book value; bank stockholders, confronted with the possibility of doubled earnings, will be in a receptive mood to subscribe to new stock issues to meet any deficiencies in *apparent* capital;² in special cases, the government may aid where it is in the public interest to do so. *Conclusion: the banking system as a whole is immeasurably helped rather than hindered by an increase in interest rates. Indeed, it receives much greater benefit than either universities or insurance companies, and commercial banks would profit more than savings banks.*

IV

Since the line of thought and conclusion are fairly obvious, the reader may work out the details of the argument as applied to individual banks. Let him consider the case of a boom-town bank in (say) Bath, Maine or Portland, Oregon; the case of New York banks; the case of rural banks; etc.

²Some city bank stocks are already selling for more than book and market value of the capital account.

It will be seen that problems of bank examination with respect to government securities do not disappear completely. But it will be equally clear that they are to be determined within the framework of a *realistic* appraisal of benefit and harm.

V

Sometimes right policies are followed for the wrong reasons. Not long ago I was privileged to hear a public address by a distinguished American economist, in which he argued in favor of the use of a tight money policy to control a post-war boom. He was immediately pounced upon by *all* his colleagues, and his argument was completely damned by the assertion that such a policy would create great difficulties for the banking system because of its holding of governments. Perhaps the critics argued with tongue in cheek, hoping to gain support for the perfectly sound and eminently desirable policy (of preventing high interest rates) by a faulty but effective argument. And perhaps silence is maintained on the obvious true analytic relationship between interest rates and bank positions by tacit agreement not to debunk a shibboleth which happens to be conducive to correct policy.

Why, then, do I now give away the secret which all wise men know but which no wise man will tell? First, I plead the usual excuse of all scoundrels: if I don't tell, somebody else will, and I at least can make certain that the antidote is given at the same time. Second, if rightly interpreted, it will be seen that mine is an argument against interest rate increases, not one in favor of them. They imply *enormous*, unneeded, unnecessary, undesirable, and arbitrary gifts to certain investors at the expense of the Treasury. In addition, their long-run harmful effects greatly outweigh, in my opinion, the doubtful minor benefits in controlling a hypothetical situation, which can in any case be better handled in other ways, even within the framework of banking policy. I shall not dwell here on the considerations which make it seem likely that the post-war epoch will witness even lower rates than the present.

Finally, and most important, the fancied difficulties arising from a hardening of rates is now being used as an argument against the lowering of rates, on the grounds that there will be great harm if they have to be raised later. I hope to have demonstrated the weakness of this argument.

In truth, the United States Treasury and Federal Reserve have missed a great opportunity. This war is a 2-per-cent war. *It should have been a one-per-cent war.* Literally, nobody has argued that the

interest rates offered have had any substantial effect upon private consumption or investment in a war world of direct controls and inflationary gaps. They may have had some minor effects upon the form in which wealth is held, but to explore the fancied advantages and disadvantages of these would require another, equally long paper.

I hope I am giving away no secret when I say that the American authorities have in this (fortunately relatively unimportant) sphere pursued an uninspired policy whose full implications will be felt for a long time to come. May we hear from the wise men on this subject?