Discussion (as of April 20, 1999) by Mark J. Warshawsky* of "The Role of Real Annuities and Indexed Bonds in An Individual Accounts Retirement Program" by Jeffrey R. Brown, Olivia S. Mitchell and James M. Poterba, presented at the NBER Conference on Risk Aspects of Investment-Based Social Security Reform, January 16, 1999, Cheeca Lodge, Islamorada, Florida

In this paper, Brown, Mitchell and Poterba (BMP) collect interesting institutional information and empirical evidence concerning the operation of, and pricing in, nominal and inflation-indexed individual annuity markets in the UK and the US. They also present empirical evidence on the historical correlation of inflation and the nominal returns on the main US asset classes. Finally, BMP show simulation results of an expected utility model estimating the relative benefits of different annuity types, including nominal fixed, inflation-indexed, and equity-indexed variable payouts, in two inflation regimes—independently distributed and a persistent process. By presenting in one location different types of information, empirical evidence, and simulation modeling, this paper is extremely useful, I think, to current policy discussions regarding both individual account proposals for Social Security reform and pension plan design. The modeling of the inflation environment is quite novel and sophisticated. My comments follow the flow of the paper, touching on most of its parts, but will focus mainly on the broad question of the investor demand for inflation indexation in annuity products.

In the first section of the paper, BMP assemble a data set based on August 1998 quotes from brokers in the UK for "compulsory" nominal and inflation-indexed individual annuities. They find that the first-month payout for the inflation-indexed annuities is about 30 percent lower than the payout on the nominal annuity. BMP also find that, while there is substantial variation across insurers in the pricing of all annuity types, variation is higher in the indexed market. Finally, when BMP do the now familiar "money's worth" calculation, they find that the expected present discounted value of the payouts from nominal annuities is about five percent higher than the expected value of payouts from inflation-indexed annuities, 90 percent compared to 85 percent. They also state that these EPDVs are uniformly higher than the EPDVs for nominal individual annuities in the US- - 83-½ percent. BMP also note that EPDVs decline with issue age.

In explaining the money's worth results, BMP cite adverse selection as a possible explanation, that is, those who expect to live longer will prefer inflation-indexed annuities to nominal annuities (which have shorter duration), and that as people age, they will have better and more specific information about their own mortality prospects. In addition, in the entirely voluntary US market, adverse selection will be a greater factor than in the compulsory UK market. This is

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a nice coherent story, and it is bolstered because BMP have calculated their mortality probabilities for the UK population correctly, that is, they are using a cohort table which includes expected improvements in mortality, as they used in the calculations for the US. Mortality improvements will affect the EPDVs of inflation- indexed annuities more than those of nominal annuities. BMP state that their interpretation would be confirmed if evidence were found that those who purchase inflation-indexed annuities have longer life expectancies than those who select nominal annuities. It is worth noting, however, from TIAA-CREF mortality experience that TIAA (fixed) annuitants have slightly longer life expectancies than CREF (variable) annuitants, an outcome which runs somewhat counter to the BMP hypothesis.

An alternative or additional explanation for the better pricing of nominal as compared to inflation-indexed annuities in the UK, and of UK as compared to US annuities, is that there is simply more volume (that is, demand) in the UK nominal annuity market than in other market segments and therefore that market is more competitive and efficient. The price variation evidence is consistent with this latter explanation. It is also possible, despite their somewhat breezy assertion that "the availability of such [indexed] bonds has made it possible for U.K. insurers to offer real annuity products without bearing inflation risk", that U.K. insurers bear greater risks in offering real as opposed to nominal annuities, and must charge for these risks. In particular, the insurer of a fixed real annuity must bear the risk of unexpected changes in the real interest rate, and also must bear inflation risk for those durations not available in the bond market or not covered by futures, options, and swap contracts. Also, because the investments underlying the real annuity market are more predominantly Treasury than corporate securities, there is an opportunity cost from the loss of the corporate bond risk and tax premium, which in the United States runs at almost 100 basis points.

In the second part of the paper, BMP turn to the nascent US market for inflation-indexed annuities, represented by one company, Irish Life of North America. They compare the monthly payouts of nominal and inflation-indexed annuities issued by Irish Life in the US and, similar to their finding in the UK, discover that the first monthly payout from the inflation-indexed annuity is 30 percent smaller than the payout from the nominal annuity. But, unlike their finding in the UK, when BMP do the money's worth calculation for the US, they find that the EPDV for the Irish Life inflation-indexed annuity is much lower (70 percent) than for its nominal annuity (86-½ percent). I would suppose that these findings, taken together, are explained by a lower (expected) inflation rate in the US than in the UK, or a higher real interest rate. Of course, as the only issuer of inflation-indexed annuities in the US (with no reported issues to date), Irish Life's pricing strategy is probably not too influenced by concerns about competition and will not benefit much from economies of scale and scope. In addition, the benefits of financial technology and market development are not yet available in the US in the inflation-indexed bond arena; there are no swaps, futures, options, or corporate bond issuers yet.

BMP next explain well the CREF Inflation Linked Bond Account (ILBA) variable annuity, and cite the unique TIAA graded benefit payment method. They outline the mechanics of how a variable annuity works in the payout phase, and appropriately note the importance of the assumed interest rate (AIR), which for all CREF accounts is 4 percent. In this section of the paper, however, I differ somewhat from BMP's interpretation of the empirical evidence in two areas. While it is certainly true that the value of the ILBA is not guaranteed, with the exception of some volatility when the Treasury first issued TIPS and recently, the unit value of the ILBA has been quite steady, rising slowly, and is less volatile than the (nominal) CREF Bond account. Chart 1 plots the month-to-month change over the period May 1997 through December 1998 in

the unit values of the inflation-indexed and nominal bond accounts. The nominal bond account shows a higher return, but also higher volatility. Also I would give a somewhat different interpretation of the relative size of the small ILBA compared to the massive CREF Stock account. While it is true that, theoretically, when the ILBA was introduced, all CREF participants could have transferred the entire value of their equity accounts to the ILBA, participant behavior is not so volatile. A more appropriate volume comparison is probably to other newly introduced TIAA-CREF variable accounts; this is done in Chart 2. There we see that while ILBA asset growth has indeed trailed that of other new accounts, its lower return and lack of investor familiarity probably explain most of the divergence.[1]

BMP state that the ILBA variable annuity could improve its ability to deliver a inflation-indexed payout stream by having the AIR reflect the expected real interest rate on TIPS, perhaps with a haircut for conservatism; in current conditions this would suggest an AIR of 3-¼ or 3-½ percent. This is a good suggestion *if* the ILBA is viewed in isolation. Except in the rare cases, however, for TIAA-CREF participants without Social Security coverage and who are quite risk-averse, it probably is more sensible for a typical annuitant to have a mix of fixed, equity-indexed variable, and inflation-indexed payout streams; for such a mix, a 4 percent AIR overall probably is more logical. Also, states impose various upper and lower limits on the allowable AIR in a variable annuity, and therefore, practical business considerations for an insurer issuing annuities in all fifty states may dictate restrictions on feasible AIRs. Finally, contrary to the statement in the paper, and as noted above, TIAA and CREF annuity payouts are priced using two different mortality tables.

In the third section of the paper, BMP examine briefly whether the historical performance of bills, bonds, stocks and inflation would lead one to believe that the correlation of returns and inflation could let equities serve as a replacement for inflation-indexed securities. While BMP caveat their evidence on this score, their findings are largely negative; equities do not offer an inflation hedge. The historically high return of equities seems to be explained by the equity premium rather than a correlation with inflation.

In the fourth section of the paper, BMP evaluate the utility gains from, that is, the willingness to pay for, access to inflation-indexed annuities, nominal fixed annuities, and equity-indexed variable annuities. They utilize an expected utility model with an additively-separable utility function and mortality, inflation, and real return uncertainty. The model is calibrated at various levels of risk aversion found in the literature, general population cohort mortality probabilities, and simple uncorrelated six-point distributions of inflation and equity returns related to the historical record (with some adjustments for conservatism and current market conditions). In a major improvement over the version of their paper presented at the conference, BMP also model an inflation process which is persistent from one year to the next. Under these assumptions, BMP find that, at median levels of risk aversion and with a pre-existing real annuity (that is, Social Security), the willingness to pay for inflation-indexed annuities is

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[1]BMP also comment on the relative expense charges among the CREF accounts. It should be noted that a smaller share of the expense charge is devoted to investment expenses; most of the charge is for administrative costs and is equal across all the accounts. Investment expenses are related to the size of the account, as well as the investment strategy used.

positive, but modest. [2] When inflation is a persistent process, however, the (relative) willingness to pay for inflation-indexed annuities is significantly larger, particularly for higher levels of risk aversion. By contrast, they find that, for plausible risk aversion and rate of return assumptions, a significant willingness to pay exists for equity-indexed variable annuities compared to inflation-indexed annuities. This result owes to the superior return on equity investments which more than compensates annuitants for the investment risk that they bear. In this latter comparison of annuity types, BMP apparently did not consider the impact of inflation uncertainty, either of the independently distributed or persistent process varieties.

There are several real world complexities which both decrease and increase the importance of inflation risk relative to the original BMP model; on net, I believe, these complexities make inflation risk more significant than that portrayed in the model. Historical inflation, as measured by the CPI, may be overstated; this is certainly the conclusion of the Boskin Commission, seems to be the consensus of the economics profession, and indeed recent actions by the Bureau of Labor Statistics (BLS) are tending to lower the reported inflation rate. By contrast, the CPI measures generally used to measure inflation may understate rate of inflation relevant to the elderly population most likely to purchase life annuities; because of heavier expenditure weights on medical care and housing, the BLS's experimental CPI-E index indicates that since 1988 the elderly have been exposed to greater inflation than the rest of the population.

Most importantly, in contrast to their original simple several-point distribution model of the annual inflation rate, and as they now note, in the real world, inflation has been a persistent process. Once inflation gets started, it is hard to contain, and inflation rates tend to ratchet upwards. By contrast, once inflation is low, virtuous expectations take hold and wage and price pressures are held in check. As shown in Table 1, simple regression analysis where the dependent variable is the quarterly percent change in CPI-U over the period 1950 to the present indicates that there is significant autocorrelation in inflation rates; summing the coefficients on lagged terms indicates that the inflation process is, almost, a unit root. Admittedly the historical period over which this regression is estimated includes some bad experience and presumably some lessons were learned and therefore the regression may overstate somewhat the expected persistence of inflation in the future. Nevertheless, I believe BMP originally leaned too much in the opposite direction, and therefore I appreciate the difficult, but ultimately rewarding, work, that they recently undertook to model a persistent inflation process. Temporal persistence effectively increases the risk that inflation represents, particularly to the elderly whose remaining lifetime is uncertain and whose human capital has effectively been completely depreciated. In fact, it might be interesting to see the impact on their results of a different modeling strategy for inflation; as opposed to an AR (1) process, they could model independently distributed draws of five- or ten-year inflation rates.

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[2] It would be interesting to reconcile the results of the BMP simulation model with evidence on the inflation risk premium extant in the bond market; see Hammond, Fairbanks and Durham (1999) for a model supporting an estimate that the inflation risk premium in the United States has been 41 basis points in the past several decades.

Despite its adverse implication for the level of risk being borne, inflation persistence has a somewhat perverse impact on the psychology of the average investor/plan participant and the demand for inflation indexation. When inflation rates are low and heading downwards, as in recent years, the demand for inflation indexation will also be low. Thus, cost of living adjustments in private defined benefit pension plans shrink and disappear. Similarly, the inclusion of inflation-indexation in investment and annuity products is a hard sell. By contrast, when inflation rates are rising, inflation-indexation becomes more popular. Although this is a bit like buying fire insurance after the barn has burnt down, pure rationality is not the only influence on human behavior.

BMP end their paper with three conclusions: inflation-indexed annuities can be made available in the private US market, probably at little extra cost; equities, owing to their higher expected return, should have a role in the retirement income portfolio; and equity-indexed variable annuities offer more to most individuals than inflation-indexed annuities. I agree with all three conclusions, although I believe that the benefits of inflation-indexed annuities of some form are probably a bit higher than those stated by BMP and, paradoxically, that it will be a bit more difficult to offer inflation-indexed annuities in the US than BMP imply.

In summary, Brown, Mitchell and Poterba have authored a fascinating and important paper. Their analytical conclusions seem to lead to certain policy recommendations and research agenda ideas. In both Social Security reform and pension plan design, the best policy is probably to offer a choice of some combination of nominal fixed, inflation-indexed, and equity-indexed variable annuities. Further research on the appropriate portfolio mix among these forms in the presence of both inflation and investment return uncertainty would be very helpful.

References

P. Brett Hammond, Andrew C. Fairbanks, and J. Benson Durham, "Understanding the Inflation Risk Premium," Chapter 11 in John Brynjolfsson and Frank J. Fabozzi (editors), Handbook of Inflation Indexed Bonds (1999:Frank J. Fabozzi Associates, New Hope, Pennsylvania).

Table 1

Dependent Variable:INFLPCT

Method: Least Squares

Sample: 1950:1 1998:3

Included observations: 195

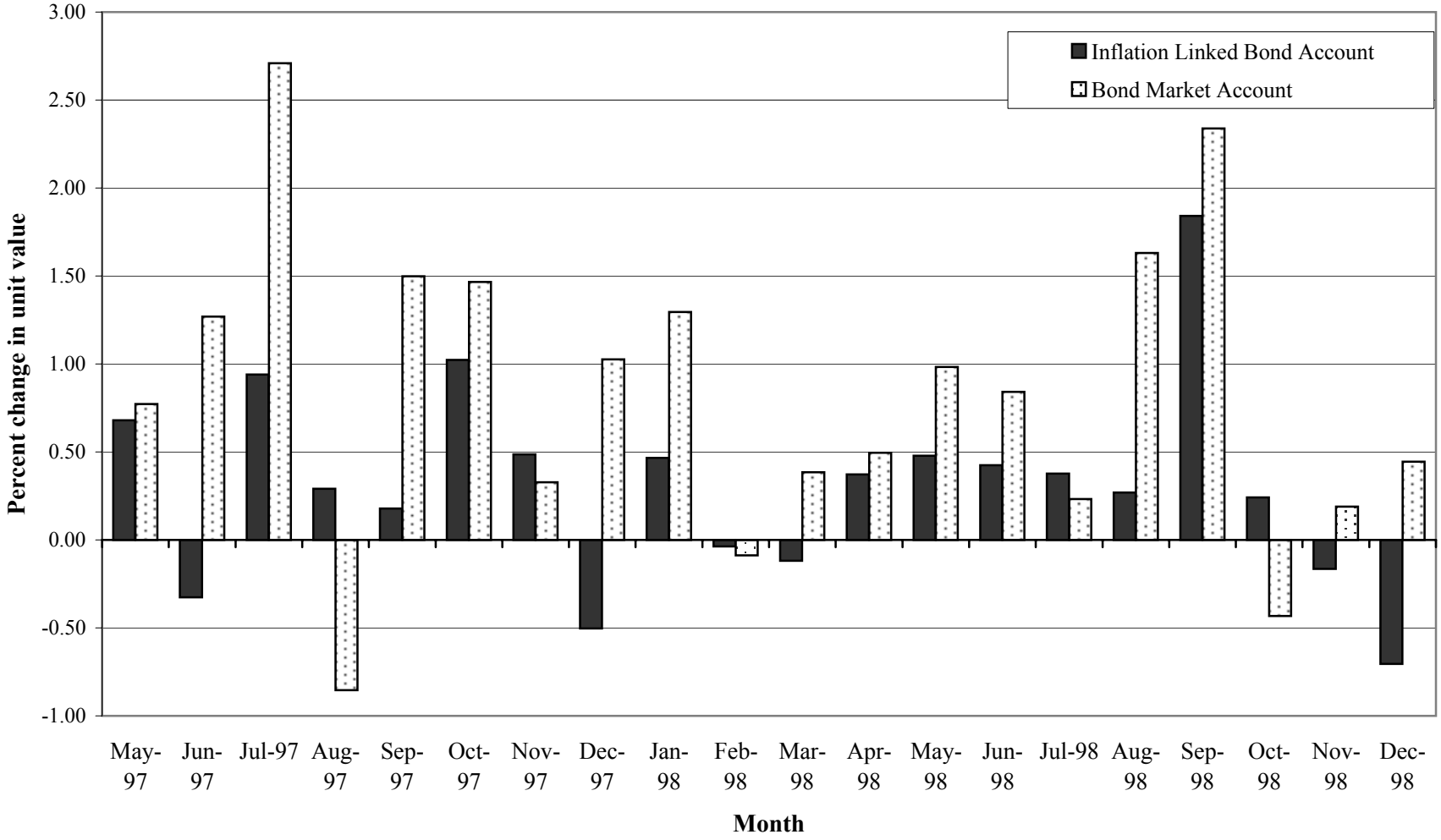
Variable	Coefficient	Std. Error	t-Statistic	Prob
C	1.038227	0.215709	4.813088	0.0000
AR(1)	0.390129	0.071770	5.435854	0.0000
AR(2)	0.134883	0.074733	1.804873	0.0727
AR(3)	0.235019	0.070494	3.333877	0.0010
SAR(4)	0.135348	0.075979	1.781392	0.0764

R-squared	0.509494	Mean dependent var	1.001664	
Adjusted R-squared	0.499168	S.D. dependent var	0.881805	
S.E. of regression	0.624049	Akaike info criterion	1.920131	
Sum squared resid	73.99306	Schwarz criterion	2.004054	
Log likelihood	-182.2128	F-statistic	49.33878	
Durbin-Watson stat	1.971298	Prob(F-statistic)	0.000000	

Inverted AR Roots	0.86	0.61	.00-.61i	-.00+.61i
	-.24+.47i	-.24-.47i	-.61	

Note: Author's calculations based on data from the U.S. Bureau of Labor Statistics.

Chart 1
Month-to-month Percent Change in Unit Value for the Inflation Linked Bond Account and the Bond Market Account May 1997 - December 1998



Data for May 1997 is from the close on May 1, 1997. Disclosure requirements mandate the inclusion of the following additional information: For the CREF Bond Account, average annual compound rates of total return for the period ending 12/31/98 were as follows: one year: 8.60%; five year: 6.77%; since inception on 3/1/90: 8.73%. For the CREF Inflation Linked Bond Account, average annual compound rates of total return for the period ending 12/31/98 were as follows: one year: 3.48%; since inception on 5/1/97: 3.65%. Past performance data in this exhibit is not indicative of future rates of return. Performance data are after expenses. These returns and the value of invested principal will fluctuate, so units owned may be worth more or less than their original price. For more complete information, including charges and expenses, read the prospectus carefully.

Chart 2
Net Asset Growth for New TIAA-CREF Accounts