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PENSION COLAs

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ABSTRACT

This paper studies cost of living adjustments in pensions from the perspective of labor economics. Evidence from longitudinal data on pension and annuity incomes of retirees suggests that pension COLAs are less important in the 1980s than in the 1970s, but that through 1987 they continued to cover about half of cost of living increases. Data from a longitudinal sample of pension benefit formulae and COLA provisions collected by the Wyatt Company for the fifty largest industrial companies indicate that if the 1968-78 decade persisted, cost of living adjustments would increase basic pension benefits for retirees by a half; while if the inflation experience were that of the 1978-88 period, pension COLAs would raise the present value of pensions by only fourteen percent.

Simulation analysis allows an examination of the effects of pension COLA provisions on the key incentives emphasized in the pension literature, incentives affecting the retirement, turnover and shirking decisions. Pension COLAs are found to have very small effects on these incentives. Finally a simulation analysis demonstrates that when the contribution side of COLAs is taken into account, pension COLAs do not necessarily dampen the variation among generations in real incomes realized under alternative inflation shocks.

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INTRODUCTION

This paper studies cost of living adjustments in pensions from the perspective of labor economics. Its aim is to describe more fully pension COLAs and their effects on the level of compensation and pension wealth, on the rate of accrual in pension wealth and compensation with continued work, and on variation in compensation among generations of retirees. The paper also attempts to derive implications for the role of pension COLAs in the labor market, and discusses whether there is a strong case from the labor market perspective for or against policies which would mandate pension COLAs or regulate the availability and funding of pension COLAs.

Defined benefit pension plans, the type of primary plan that covers the greatest number of workers (Gustman and Steinmeier, 1992), typically pay the same dollar benefit in each year of retirement[1]. Accordingly, the real value of the yearly pension declines with years in retirement, at a more rapid rate the higher is the rate of inflation.

The effect of inflation on the real value of a pension is sometimes mitigated by a cost of living adjustment (COLA). Not all firms adjust benefits after retirement to reflect cost of living changes. For example, there are results from the Bureau of Labor Statistics, Employee Benefit Survey (EBS), a survey of medium and large sized firms. In each of the years from 1983 through 1989, from just below a quarter, to just over a half of the full-time pension participants from firms covered in the EBS were in plans that made at least one adjustment in the five year period preceding the survey date (Mitchell, 1991).

Although some pension plans have provisions whereby pensions are adjusted automatically in response to cost of living changes, almost all pension COLAs are not declared prospectively[2]. There are no promises to adjust pension benefit amounts after retirement under certain prespecified

conditions. Rather, adjustments are made on an ad hoc basis.

Typically, COLAs do not adjust pensions to cover the full amount of the cost of living change. Both the frequency with which pension benefits are adjusted for cost of living changes, and also the size of the adjustments in benefits, vary widely, both among firms and over time (Allen, Clark and Sumner, 1986, Allen, Clark and McDermed, 1991, BLS, Employee Benefits In Medium And Large Sized Firms, various issues).

The basic benefits in a defined benefit pension plan accrue nonlinearly with continued employment. The accrual rate increases with tenure, and is characterized by sharp discontinuities upon qualification for early and normal retirement benefits (Bulow, 1982). In addition to affecting the real value of any nominal pension, the level of inflation may affect the shape of the pension accrual profile (Kotlikoff and Wise, 1985 and 1987).

Labor economists have argued that the shape of the accrual profile creates incentives affecting worker mobility, productivity and retirement, and that creation of these incentives is a major reason why firms adopt pensions with the provisions that are observed in the market. (For a review of this literature, see Gustman and Mitchell, 1991.)

Because inflation may affect the key incentives which have been the focus of labor market analysis, pension COLAs may also affect these incentives. From the perspective of labor economics, a central concern of an analysis of the effects of inflation and pension COLAs is with the implications of alternative levels of inflation, and COLA provisions, on the valuation of pensions and the incentives which they create.

The paper begins by describing briefly the stylized facts about pension COLAs, and some detailed features of the formulae specifying COLA

adjustments. The next step is to use available data to describe changes in pension benefits of retirees over time, and the effects of pension COLAs on pension benefits. Estimates of changes in the values of pensions received by retirees are calculated from available longitudinal surveys of individuals. COLA provisions are evaluated along with the basic pension benefit by constructing a twenty year longitudinal file from reports published by the Wyatt Company for the fifty largest industrial companies.

The second part of the study is an attempt to increase our understanding of the role of pension COLAs in the labor market. What progress we make is in some sense negative, in that we rule out what we considered on apriori grounds to be promising explanations for pension COLAs.

Because the data do not allow us to isolate the effects of changing inflation on the incentives affecting the retirement, mobility and shirking decisions, we construct a simulation model of the firm and its pension plan. The model is used to examine the consequences of the leading theories which have been used to explain pensions when these theories are used to explain pension COLAs. We find that pension COLAs have too small an effect on the key incentives emphasized by labor market theories of pensions, for provision of COLAs to be motivated by the firm's desires to preserve these key incentives in the face of inflation. In particular, pension COLAs have small or inconsistent effects on the incentives affecting mobility, shirking and retirement decisions. Although for retirees pension COLAs smooth the course of their retirement incomes, we also find that once pension contributions and compensating wage differentials are taken into account, pension COLAs may not necessarily act to reduce the variance among cohorts in real lifetime incomes. In the face of inflation shocks, the distribution of real incomes among cohorts may be

reduced, unchanged, or increased.

On the basis of the simulation analysis and the empirical studies, a section is presented which draws implications for relevant policies.

A DESCRIPTION OF THE PROVISIONS OF PENSION COLAS

It is useful to begin with some examples of provisions describing pension COLAs which are taken from the Wyatt surveys. The provisions prescribing ad hoc COLA adjustments may take a number of forms. One apparent distinction is between plans that express COLA adjustments in marginal terms and those that express them as cumulative adjustments. As will be seen below, most changes occur only sporadically. Accordingly, pension benefit changes will often have to provide higher increases for those who have been retired for a longer time, even if their aim cumulatively is to provide a proportionate adjustment for all retirees to offset the effects of inflation.

As a first example from The Wyatt Company data, consider three post-retirement increases that are reported for Eastman Kodak in the last decade analyzed with these data. Each is a marginal increase to be paid according to year of retirement. These increases were granted in 1979, 1980 and 1985, with, for example, the 1980 increase calling for an increase of 12 percent for those retired before 1973, 8 percent for those retired between 1973 and 1978, and 4 percent for those who retired in 1979. In the case of the 1980 increase, even though an increase was also granted in 1979, the percent of increase varies with year of retirement.

AT&T granted five increases from 1979 through 1988, all in the form of marginal increases, which for most retirees were at some specified maximum rate, like 7.5 percent in 1982. For any increase, the proportionate change was somewhat lower for those retired for only one year (5 percent for those

retired one year in 1982).

Coca Cola, on the other hand, reports cumulative increases through 1988 by single year of retirement, ranging from 3.3 percent for those who retired in 1984, to 297.3 percent for those who retired in 1948. BP America utilizes a similar scheme, with a cumulative increase over the pension at retirement varying with year of retirement.

Although there are some exceptions, firms appear to grant pension cost of living increases both to early and to normal retirees. Excluding early retirees from COLA adjustments would have more strongly encouraged delayed retirements. Still other plans specify service requirements for the COLA adjustments even though they provide adjustments in proportion to years of retirement.

Maximum and minimum levels of adjustments are also noteworthy. Sometimes these are specified in proportionate terms and sometimes in dollar amounts.

According to the Employee Benefit Survey (EBS) for 1988 (BLS, 1988), for 3 percent of those who have experienced a cost of living adjustment, the benefit increase formula involves a dollar amount per month which does not vary by date of retirement. For 4 percent of COLA participants, the adjustment involves a monthly dollar amount which does vary with date of retirement. For 28 percent of participants, the adjustment is based on a percent of present benefits which does not vary with date of retirement. For 20 percent of participants, the adjustment is based on a percent of present benefit which does vary with date of retirement. For another 20 percent of participants, the adjustment involves a proportionate increase per year of retirement, and for 21 percent of participants, there is an increase of a dollar amount per year of service.

Again, the effect of these increases on the marginal reward for

remaining with the firm would depend on the extent to which the reported changes occur on a fairly regular basis and are truly marginal changes, or whether they are inframarginal changes which are made available every few years, or even over longer periods. Thus from these statistics alone, one cannot determine how the marginal benefits affect the reward for continued work with the firm. In particular, given the irregular timing for granting cost of living increases, the fact that for forty four percent of participants, increases vary with years of retirement may reflect the need to make adjustments for long term retirees whose benefits had not been adjusted for a number of years. The alternative interpretation would be that the adjustments were designed to encourage earlier retirement.

If adjustments which vary with years of retirement encourage earlier retirement, the opposite effect is achieved by the adjustments made by the plans covering twenty percent of the covered workers. In these plans, the adjustment is larger the longer the years of service.

EMPIRICAL ANALYSES OF PENSION COLAS

Pension COLAs In Surveys Of Retirees

The empirical analysis to follow investigates the size of the pension cost of living adjustments in a number of data sets, covering the period (1973 to 1979) studied by Allen, Clark and Sumner (1986), and also other years.

A number of longitudinal surveys include older individuals and report some measure of pension incomes for the retired. If family structure and labor market status remain unchanged, then once reporting error is eliminated, variation in pension incomes should reflect either the effect of cost of living adjustments, or the impact of other scheduled adjustments of the pension. An example of other changes is a reduction in pension

benefits at the time the individual becomes eligible for social security benefits. Another example is a yearly adjustment in an annuity that has a cost of living component attached.

Longitudinal information on pension benefits received will be analyzed using a number of leading surveys of households and individuals, but will emphasize results from the longest of the available panel data sets, the Panel Study On Income Dynamics (PSID). Other data sets used are the Retirement History Survey (RHS), the National Longitudinal Surveys of Older Men and of Mature Women (NLS), and the Survey of Consumer Finances (SCF).

Data from these surveys is presented in Table 1. It is apparent that these surveys do not cover the same years. Moreover, some collect information annually, while others resurvey every two or even three years. Even the same survey may not maintain a constant time period between waves. Accordingly, analysis of the changes in pension benefits among surveys will require some adjustment to differing time periods.

The periods over which the changes in pension benefits have been computed are indicated by the range of observations appearing in the relevant columns. When a change has been computed over more than one year, the relevant years are bracketed. To avoid the possibility that in the initial year, the pension was paid over only a part of the year, in calculating pension changes the pension observations for the first year of retirement are excluded.

Table 1: Mean of Log Benefit Changes In Pensions In Five Micro Data Sets

	NLS Men's	NLS Women's	PSID[b]	RHS	SCF	Allen Clark Sumner	CPI
71-72			0.038	(.028			.033
72-73			0.030	(			.062
73-74	(0.034[a]		0.018	(.032		.036	.110
74-75	(		0.061	(		.041	.091
75-76	-0.009		0.048	(.051		.038	.058
76-77	(0.036		0.035	(		.029	.065
77-78	(		0.016	(.040		.045	.077
78-79	(0.035		0.031	(		.029	.113
79-80	(		0.044				.135
80-81	0.037		0.042				.104
81-82	(0.031		0.038				.061
82-83	(	(0.099	0.025				.032
83-84		(	0.013		(0.006		.043
84-85		(0.025	0.025		(		.036
85-86		(	0.015		(		.019
86-87		0.002	0.023				.037

Notes. a. A change over a two or three year period is indicated when a number, preceded by a bracket, is followed by two or three brackets vertically aligned. Whatever number is followed by a sequence of brackets reports the percent change over the full indicated period.

b. With regard to the results for the PSID, the first two cells in the tables may contain observations of government pensions, since there is no way in the PSID to divide pensions into private vs. government without reference to the job from which the pension came. Particularly for the early years, information about the pension job is not generally available.

The PSID covers the longest time period, and is conducted annually. There is a six year period, 1973-74 through 1978-79, for which the results are available for the PSID, the NLS Men's survey, and the RHS. This period is the same one studied by Allen, Clark and Sumner (ACS) using a nationally representative sample of persons in defined benefit plans. Calculating the simple average of the annual increases, the average increases in the samples, and the corresponding increase in the CPI, were as follows:

Table 2: Simple Average Of Annual Changes In Pension Income From 1974 Through 1979

Survey	
NLS Men	.013
PSID	.035
RHS	.021
ACS	.036
CPI	.085

The pension changes calculated from the PSID match those in the Allen, Clark and Sumner study (ACS). The increases from the NLS Men's Survey are only about a third of the size of those from the PSID and ACS studies, with the results from the RHS falling between these. According to these results, a simple average of pension and annuity increases accounted for between fifteen percent and forty two percent of the increases in cost of living.

The differences among the micro surveys may have a number of causes. Different questions were asked by the different surveys. And the sampled populations differ.

If the different outcomes result because the surveys include different cohorts, the findings in Table 2 would suggest that older cohorts receive larger increases. For example, participants in the Retirement History Study were born between 1906 and 1911, and thus in 1976 were 65 to 70 years old. Those in the NLS Men's were born between 1913 and 1922, and were only 54 to 63 in 1976. The NLS participants report lower benefit increases. Allen, Clark and Sumner do find that increases are larger the greater the number of years since retirement, a finding consistent with the COLA provisions summarized previously. We will provide further evidence on this

relationship below.

There is an additional question suggested by the finding in Table 1 of a negative change in the pension reported between 1975 and 1976 for the NLS Men's Survey. It is possible that some pensions have fallen, perhaps because some early retirement adjustments were provided only until the individual qualified for social security benefits. To allow for this possibility, we recalculated the results for those who were 67 or older. When one takes the percent increase in pensions for those 67 or older, and divides by the percent increase in pensions for all individuals in the sample, the ratios average about .9 when the PSID sample is used, and about 1.09 when the NLS Men's survey is used. From these results, we cannot determine that systematic effects of temporary early retirement incentives account for the negative pension increases. The less comforting alternative is that there are substantial errors in reported pensions and annuity incomes.

What do these figures suggest about the extent to which post-retirement benefit increases tracked the CPI in recent years? First, using the PSID, the one survey which covers most of the period of interest, and comparing pension and annuity changes from the PSID with the CPI changes, it appears that there are no major differences in the ratio of the COLA to CPI change between the period of the 70's and the years for which we have data in the 80's. According to the results in Table 3, the ratio of average cost of living change to average CPI change is about forty six percent for the 1970's, and only slightly higher for the 1980's. The average of the ratios is also similar between the periods.

Table 3: Changes In Incomes From Pensions And Annuities, And In Cost Of Living

	Increase From 1971-79	Increase From 1979-87	Increase From 1971-87
PSID	.035	.028	.031
CPI	.076	.058	.068
Ratio Of Row 1 to Row 2	.46	.48	.45
Average Of Pension Change Over CPI Change In Each Year	.54	.56	.55

As noted previously, there is some evidence in the structure of the increases that some older cohorts have been receiving increases which disproportionately benefit long term retirees, perhaps catching up for the period of high inflation in the late 1970's and early 1980's. The data in Table 4 suggest, for the period after 1982, when the inflation rate fell from double digit levels, that there is some tendency toward a "catch-up" of the pension changes to cost of living changes. This is evident from the numbers for 1982 onward in the last column of the table, where for five out of six years the ratio of pension change to CPI change exceeds 0.6[3].

Finally, the data in Table 4 clearly reflect the effects of declining inflation. In contrast to changes in pension and annuity incomes which reached over six percent in 1974-75, from 1982 through 1987, the yearly increase in pension and annuity income falls to about two percentage points[4].

Table 4: Pension Changes In The PSID Verses Cost Of Living Changes

	PSID COLA	CPI Change	Ratio COLA/CPI
71-72	0.038	.033	1.15
72-73	0.030	.062	.48
73-74	0.018	.110	.16
74-75	0.061	.091	.67
75-76	0.048	.058	.83
76-77	0.035	.065	.54
77-78	0.016	.077	.21
78-79	0.031	.113	.28
79-80	0.044	.135	.33
80-81	0.042	.104	.40
81-82	0.038	.061	.62
82-83	0.025	.032	.78
83-84	0.013	.043	.31
84-85	0.025	.036	.70
85-86	0.015	.019	.77
86-87	0.023	.037	.63

Pension COLAs In A Survey Of Large Firms-- The Wyatt Sample.

We have constructed a longitudinal survey from public information from the Wyatt company on the pension plans of the fifty largest industrial firms[5]. The survey covers a twenty year period. It is unbalanced in that the top fifty is comprised of a changing set of firms. Fortunately, the survey inquires about COLA increases granted over a number of years in the past. In particular, the surveys until 1978 asked about COLA increases back to 1969. After that, they inquired about COLA increases over the past decade. As a result, COLA increases are available for a number of years in which the firm is not included in the sample.

Post-retirement increases sometimes have a minimum service requirement. For all calculations of eligibility for post-retirement increases, the following tables assume that the individual had 30 years of service and retired at 60. Basic conclusions are not changed when calculations are made for three other combinations of retirement age and service, age 60 and 20 years of service, age 65 and 30 years of service and

age 65 and 20 years of service.

Whenever weighting is required, the number of employees is taken from COMPUSTAT. Compensation numbers for use in calculating the value of the pension from the pension formula are also taken from COMPUSTAT. Earnings growth assumptions are based on the Economic Report of The President.

Table 5: Wyatt Data, Mean Percentages of Years During Which Post-Retirement Benefit Increases Were Granted, By Decade and Year of Retirement

Year of Retirement	1968-78	1978-88	1968-88
1968	25.5%	28.3%	26.3%
1970	25.2	26.3	24.8
1971	24.6	26.3	24.6
1972	26.6	26.0	25.2
1973	26.8	25.7	25.0
1974	24.8	25.5	24.2
1975	23.6	25.7	24.9
1976	22.8	25.6	24.7
1977	24.2	23.2	23.4
1978		23.6	23.6
1980		17.9	17.9
1982		12.6	12.6
1983		9.3	9.3
1984		7.1	7.1
1985		7.2	7.2
1986		0.0	0.0
1987		0.0	0.0

Table 5 reports on the relative frequency of pension COLA adjustments by year of retirement. Those who retired between 1968 and 1977 received pension increases in 25 percent of the years from 1968 through 1978. From 1978 through 1988, these same cohorts received pension increases in 26 percent of the years, and this is despite the fact that average CPI changes were lower in these years. However, it is clear from the results that those retiring in 1980 and later received increases in fewer years than those with the same years of retirement in the earlier decade.

Table 6: Wyatt Data, Mean Post-Retirement Benefit Increases as Percentages of Current Benefits by Years Since Retirement and Year of Benefit Increase

Year of Increase	Years Since Retirement 1-5	6-10	11-15	16-20
1969	1.9%			
1970	1.9			
1971	15.6			
1972	1.2			
1973	2.0			
1974	3.4	4.3%		
1975	2.6	3.1		
1976	2.9	3.6		
1977	2.3	2.4		
1978	4.7	5.5		
1979	4.3	5.1	6.4%	
1980	5.5	6.3	7.0	
1981	5.5	6.3	7.5	
1982	0.6	0.7	0.8	
1983	1.2	1.3	1.4	
1984	1.0	1.0	1.1	1.2%
1985	1.6	2.0	2.5	2.9
1986	1.6	1.9	2.2	2.6
1987	0.8	1.0	1.1	1.2
1988	1.7	2.2	2.6	3.1
Simple Average, 1984-88	1.3	1.6	1.9	2.2

Table 6 reports on the size of the yearly COLA increases relative to the base pension. The base pension, in turn, is calculated from the reported pension formula, using assumed levels of retirement age and service, and the calculated earnings from COMPUSTAT.

By comparing increases across each row it can be seen that COLA increases are proportionately larger for those who have been retired longer. For example, those retired 16 to 20 years received increases which averaged 2.2 percent per year between 1984 and 1988, while those retired 1 to 5 years received increases averaging only 1.1 percent over the same period.

It can also be seen that the sample is thin enough that results in

particular cells may be very sensitive to changes at a single firm. In the case of the 15.6 percent increase in 1971, that unusual outcome is attributed to the COLA adopted by General Electric.

Table 7: Wyatt Data, Cumulative Post-Retirement Increases in Benefits and Corresponding Increases in the Consumer Price Index During the 1968-78 and 1978-88 Decades, by Year of Retirement

Year of Retirement	Pension Benefit Increases			Consumer Price Index Increases			Pension Benefit Increases as a Percentage of of CPI Increases		
	1968 -78	1978 -88	1968 -88	1968 -78	1978 -88	1968 -88	1968 -78	1978 -88	1968 -88
1968	54.9%	40.1%	115.4%	97.8%	70.8%	237.9%	56.1%	56.6%	48.5%
1970	38.6	32.8	84.6	79.3	70.8	206.2	48.8	46.4	41.0
1971	33.4	31.0	75.0	73.7	70.8	196.7	45.4	43.8	38.2
1972	17.2	29.5	52.4	63.5	70.8	179.3	27.0	41.7	29.2
1973	14.4	27.5	46.5	47.3	70.8	151.5	30.6	38.8	30.7
1974	11.2	26.2	41.0	34.9	70.8	130.5	32.2	37.0	31.5
1975	6.8	25.4	34.3	27.6	70.8	117.9	24.7	35.8	29.1
1976	4.7	23.3	29.3	19.8	70.8	104.6	23.8	32.8	28.0
1977	2.7	19.5	23.0	11.3	70.8	90.2	24.0	27.5	25.5
1978	0.6	17.7	18.4		70.8	70.8		25.0	26.0
1980		10.4	10.4		36.4	36.4		28.7	28.7
1982		4.3	4.3		24.5	24.5		17.7	17.7
1983		2.8	2.8		19.3	19.3		14.4	14.4
1984		1.4	1.4		15.2	15.2		9.3	9.3
1985		1.0	1.0		13.1	13.1		8.0	8.0
1986		0.0	0.0		9.2	9.2		0.4	0.4
1987		0.0	0.0		4.8	4.8		0.8	0.8

Table 7 reports on the cumulative values of the post-retirement benefit increases by year of retirement, and compares those increases with cumulative cost of living changes. Again we find that COLA increases are larger for those who have been retired longer. For example, between 1978 and 1988, those retired in 1968 received payments in the form of increases that had a value averaging 40.1 percent of the payments under the base pension, while those retiring in 1976 received increases under COLA adjustments averaging 23.3 percent of the payments under the base pension. There are comparable results for those retiring in intervening years.

COLA increases are concentrated in the later years of retirement. Therefore, they have a proportionately smaller impact on the present value of the pension than does the basic pension. To explore the relative importance of pension COLAs to the present value of pension incomes, in the next two tables, all dollar amounts are discounted to the date of retirement and expressed in dollars as of the date of retirement. The discount rate used in evaluating wages received in the years prior to retirement is the current long-term interest rate, while the discount rate used in years after retirement is the long-term interest rate as of the date of retirement.

Table 8: Wyatt Data, Present Discounted Values of Initial Pensions and Post-Retirement Benefit Increases Granted During The 1967-78 and 1978-88 Decades, By Year of Retirement

Year of Retirement	Initial Value of Pension	Value of Post-Retirement Increases During:			Percentage Increase in Pension Value Due to Post-Retirement Increases		
		1968 -78	1978 -88	1968 -88	1968 -78	1978 -88	1968 -88
1968	$20437	$5801	$2279	$8079	28.5%	8.6%	39.7%
1970	21099	4974	2190	7165	22.4	7.9	32.2
1971	26099	5711	3116	8828	21.8	9.2	33.1
1972	27985	3098	3255	6353	10.4	9.7	21.2
1973	29069	2756	3386	6142	9.0	9.7	19.8
1974	32664	2520	3804	6324	7.2	10.0	18.2
1975	36600	1643	4367	6010	4.7	10.6	15.9
1976	42559	1495	5302	6797	3.7	11.2	15.4
1977	49430	1048	5586	6635	2.4	10.2	12.9
1978	52235	319	5658	5977	0.6	10.1	10.8
1980	55181		3354	3354		5.9	5.9
1982	62459		1442	1442		2.3	2.3
1983	76701		1188	1188		1.7	1.7
1984	75700		672	672		0.9	0.9
1985	86952		638	638		0.7	0.7
1986	110568		37	37		0.0	0.0
1987	110338		38	38		0.0	0.0

Table 8 indicates the value of the basic pension, the COLA increase, and the fraction of the pension accounted for by COLA increases.

For someone retired at the beginning of the period, pension COLAs accounted for $8079 compared to $20437 in basic pension received over the next two decades, which amounts to forty percent of the present value of pensions received between 1968 and 1988. At least partly because the inflation rate was greater in the first decade than in the second, seventy two percent of the present value of COLA adjustments received over the next twenty years was received from 1968 through 1978. Analogous comparisons for the later cohorts shown in the table are not possible because they received benefits only for a fraction of the 1968-78 period.

Table 9 projects the pension and COLA increases into the future on the assumption that future increases will be the same as those observed in the indicated period. The covered individual is one who retired at age 60 with 30 years service in 1968 or 1978.

Table 9: Wyatt Data, Wage and Pension Values for Selected Retirement Years, Calculated on Presumption that Future Increases by Firm Will Be in the Same Percentage as the Increases During the Indicated Period
(Retire at 60, 30 Years Service)

Year of Retirement	1968	1968	1978
Period for Projection	1968-78	1968-88	1978-88
Present Value of Wages	$195055	$195055	$522850
Present Value of Initial Pension	20437	20437	52235
Present Value of Pension with Post-Retirement Increases	30882	29096	59879
Percent Increase in Pension Value Due to Post-Retirement Increases	51.6%	42.6%	13.8%
Ratio of Pension Value to the Present Value of Wages			
Without Post-Retirement Increases	10.4	10.4	9.8
With Post-Retirement Increases	15.6	14.7	11.2

As would be expected, the importance of pension COLAs varies very widely with the inflation rate. Given the inflation experience of the 68 to 78 period, the COLA may account for half again the value of the basic

pension, raising the fraction of benefits accounted for by the pension from 10.4 percent to 15.6 percent of the present value of the wage. On the other hand, given the inflation experience of the 1978 to 1988 period, for the retiree in 1978, pension COLAs account for only 14 percent of the present value of the basic pension. In the case of the more modest inflation, and perhaps due to adjustments in the basic pension formula, the pension COLA raises the present value of benefits from 9.8 percent of the present value of the wage to 11.2 percent.

Similar calculations have been made using combinations of retirement ages of 60 and 65 and of 20 and 30 years of service. Under the environment of the 1968-78 period, the fraction of benefits accounted for by COLAs would range from between 40 and 50 percent, while with the environment of the 1980s, the range is from 12 to 15 percent.

Of course, these findings do not provide a definitive answer as to the relation of the pension COLA to the level of inflation. Given the intermittent nature of the COLA changes, it difficult to isolate the pattern of any lags in the system. Nevertheless, from the information presented above, it is apparent that such lags do exist. Accordingly, the COLA increases in the later years overstate the likely level of adjustment that would be observed were the steady state inflation to remain at the level observed for the 1978-88 period.

EXPLANATIONS FOR PENSION COLAS

Bodie (1990) explores a number of reasons why pension indexing may be incomplete and made available on an ad hoc basis. His analysis is from the perspective of finance theory. The pension is seen as a device to provide retirement insurance. He describes the pension promise, together with an ad hoc pension COLA, as a participating annuity that offers a guaranteed minimum benefit.

Much of the pension literature has focused on explaining the consequences of long term attachment of the worker to the firm for the financing of pensions, for defining property rights in the pension, for defining the obligation of the firm to the worker, for determining the implications of pensions for wage profiles, and for evaluating the consequences of pensions for turnover. (For a review, see Gustman and Mitchell, 1991.) However, the discussion of the theories explaining pensions leaves us skeptical of the power of two of the explanations -- that, except for effects through regulation of retirement age, pensions are used to enhance productivity by discouraging shirking, and that they are used to regulate mobility so as to economize on costs of hiring and training (See Gustman and Steinmeier, 1987, 1989a, 1990 for extensive evidence). At a minimum, the unanswered questions about the empirical importance of alternative explanations for pensions suggest the difficulty, at this stage in the development of the literature, of using these theories to explain the provisions of pension COLAs. Nor is there substantial direct evidence explaining plan characteristics or accrual profiles which would allow us to choose among these competing explanations for defined benefit plans, or to weight the competing explanations according to their relative importance.

In contrast, the literature on retirement does suggest a strong relation between pension incentives and retirement outcomes. These findings suggest that if inflation and pension COLAs importantly affect retirement incentives from pensions, firms may design COLAs with an eye toward influencing retirement outcomes.

The available explanations for pensions focus attention on certain incentives. Among these are the increment in pension wealth which

influences the decision to remain until normal retirement age after qualifying for early retirement benefits, and the increment which influences the mobility decision and the cost of dismissal for shirking. Our strategy is to investigate the likely importance of these alternative explanations for pensions in explaining pension COLAs by examining the effects of inflation and pension COLAs on the key incentives emphasized by these theories. If we were to find that pension COLAs had important effects on these incentives, then we would consider the case open, with the doubts about some of the explanations for pensions yet to be resolved. On the other hand, if we find that inflation and pension COLAs do not have important effects on the incentives to retire, to move, and not to shirk, incentives which are emphasized by pension theories, then it is unlikely that firms' policies regarding pension COLAs are being shaped by these motivations.

THE EFFECTS OF PENSION COLAS ON KEY LABOR MARKET INCENTIVES: A SIMULATION ANALYSIS

A further aim of this study is to investigate the effects of inflation on the incentives which are central to available explanations for pensions. There are a number of formidable problems which prevent us from trying to isolate these effects with the empirical data utilized to this point. With the data available to us, we cannot calculate many key pension incentives. The micro data report only pension incomes, not the pension values at alternatives which were not taken.

The Wyatt data would seem to be most suited for such an analysis. However, the Wyatt data are missing the portion of the benefit formula that indicates benefits for vested-terminated workers. This means that it is not possible to calculate the accrual profile approaching early retirement age, which is central to the calculation of the incentive to move and the

incentive to shirk. Thus the only incentive that could be related to changes in the inflation rate and to the COLAs observed in the data is the incentive to postpone retirement from early to normal retirement age.

Even for calculation of this incentive, there would be enormous problems to overcome. The sporadic adoption and idiosyncratic nature of the pension COLA formulae make it difficult to isolate any causal relation between the inflation rate and the accrual rate between early and normal retirement age. Although we would like to add the effects of the COLA on to a known pension formula, varying the COLA with inflation but not the base formula, the parameters of the formula continue to evolve. Indeed, changing the parameters of the basic pension in response to changing inflation environments is an alternative to changing the COLA provisions. However, inflation is not the only reason for changing plan parameters. Market and economy wide forces may also foster such changes, as may new regulations. Even though we have a panel of pension formulae, the panel is short enough that it would be extremely difficult to distinguish the effects of inflation on the pension formula from those of other influences, and thereby to isolate the full effects of inflation on the accrual rate from early to normal retirement age.

All of these factors make it extremely difficult if not impossible to use the available data to isolate the effects of inflation on incentives affecting retirement, mobility and the likelihood of shirking. Therefore, in analyzing the relation of pension COLAs to these key incentives, we turn to a simulation analysis in which it is possible to standardize for the influence of other factors, isolating the effects of inflation on incentives. Fortunately, that analysis will enable us to determine orders of magnitude, indicating the potential importance of each of these key

incentives. Most importantly, we will see from that analysis that mechanically, pension COLAs are not likely to have important effects on these key incentives. Therefore, whatever would be the behavioral response to changes in these incentives, the changes in incentives are not large enough to have motivated adoption of pension COLAs.

Because the value of the pension varies with the extent of inflation, and is affected by COLA provisions, at least in alternative steady states, one would expect the value of the compensation package to adjust to different rates of inflation and to the presence of COLA protection. In the sections which follow, we analyze the effects of steady inflation and alternative COLA provisions in the context of a model which assumes that there are full compensating adjustments which arise through the wage. In some cases, we find that it is important to take the compensating differences into account. For a number of important results, however, the findings do not depend on the size of any compensating differences in the wage. Note also that the model does not take account of any feedback effects from the pension to productivity or hiring.

The simulation model of the firm and its pension plan used for this analysis includes the four key elements of compensation, the wage, the basic pension, cost of living adjustments to the pension, and contributions to the pension fund.

Description Of The Simulation Model.

The description of the model that follows is from Gustman and Steinmeier (1989b). Our earlier working paper contains a more complete description, and presents a number of simulations that explore the effects of pension start-up and termination. In the past we have used the model to analyze the effects of major policies regulating pension benefits, such as vesting rules, provisions for crediting work after normal retirement, early

retirement bonuses, mandatory coverage, provisions setting maximum service to be credited, and other related policies.

The simulation model begins with a firm in steady state. The first set of calculations pertains to the structure of the labor force, to each worker's productivity, and to the group of retirees. A distribution is specified for age of hire and desired age/and or service at retirement. Every year, one of each type of worker is hired. Total employment at the firm is then set equal to the steady state work force that is consistent with the hiring and retirement (turnover) scheme. For example, if two 25 year old workers were hired each year, one who would retire at 55 and one at 62, the steady state labor force for the firm would number 67. All workers are assumed to die at 80. The plan is instituted for a firm in such a steady state in an initial year, arbitrarily set to 1970, and the pattern of steady state hiring and retirement continues after the plan is adopted. Assumptions are made about base productivity, the economy wide and individual productivity growth rates, the interest rate for discounting the benefits, and the return on plan investments if different from the interest rates the covered individuals use.

The next set of calculations pertains to pension benefits for each worker, computed conditional on the wage. Each pension plan, once instituted in 1970, runs through to termination in 2080. All pension plans investigated are built around final average salary defined benefit formulae, with parameters representing alternative treatments of the eligibility requirements for early and normal retirement, vesting requirements, crediting of work before formulation of the plan, post-retirement increases, the period over which earnings are averaged, actuarial bonuses for early retirement and other major characteristics

which play a central role in determining pension values and key pension incentives (Bulow, 1982, Kotlikoff and Wise, 1985, 1987, Gustman and Steinmeier, 1989a).

The liabilities of the pension plan, and thus the contribution rate required to balance the pension fund, are conditional on the wage. Each individual's wage is a fraction of current year productivity, where the fraction is one minus the contribution rate. Accordingly, the wage depends on the contribution rate. The model solves simultaneously for the wage and contribution rate that balance the pension fund and leave total compensation, the sum of all contributions and wages paid in any year, equal to total worker productivity.

A $10000 productivity base is assumed in 1970. Economy wide wage growth is assumed at either 5 or 10 percent per year. Productivity growth due to tenure is 1 percent. The interest rate is either 6 percent or 11 percent. (For the period of the 70's and 80's examined in our data, the interest rate exceeded average compensation growth by about 3 percentage points. Results from a sensitivity analysis to the differences between the rate of wage growth and the interest rate are discussed below.) The benefit formula pays 1 percent of the average salary in the last three years of attachment times years of service. A proportionate contribution rate to finance the pension is imposed, with the plan being funded on a projected liability basis. It is assumed that there is a payout at plan termination, in 2080, which is made either to cover the legal liability or the projected liability, as specified for the particular run.

The Effects Of Inflation And Pension COLAs On Incentives From Pensions For Retirement And Mobility.

Now turn to examine the effects of alternative inflation rates, COLA provisions and COLA funding schemes, on the incentive for early retirement

verses normal retirement, and the penalty created by backloaded pensions for turnover at an early age, which affects both the incentive to stay until retirement age rather than quit, and the incentive not to shirk on the job and risk being fired (Lazear, 1979, 1983).

For this simulation the worker joins the firm at age 25, and retires either at age 55 or at age 62. Thus by working to normal retirement age, an individual who stays to age 62 works an additional 7/30 years, that is, 23.3 percent more, or 3.3 percent of the basic 30 year period of attachment for each additional year of work.

Table 10: Implications Of Inflation And COLAs For Pension Incentives To Retire At Early Vs. Normal Retirement Age

(Results Are For Cohort Hired In 1980, Reported In 1970 Dollars)

A. 6 Percent Interest, 5 Percent General Wage Growth, 1 Percent Experience Growth, No COLA

	Leave At 55	Leave At 62
Pension Benefits	17286	32162
Total Compensation	269848	344168
Pension/Wage Ratio	0.068	0.103
Compensation/Productivity Ratio	0.982	1.014
Compensation 62/Compensation 55		1.275
Compensation 62 - Compensation 55		74320

B. 6 Percent Interest, 5 Percent General Wage Growth, 1 Percent Experience Growth, 3 Percent COLA

	Leave At 55	Leave At 62
Pension Benefits	25706	38890
Total Compensation	271522	342560
Pension/Wage Ratio	0.105	0.128
Compensation/Productivity Ratio	0.988	1.009
Compensation 62/Compensation 55		1.262
Compensation 62 - Compensation 55		71308

C. 11 Percent Interest, 10 Percent General Wage Growth, 1 Percent Experience Growth, No COLA

	Leave At 55	Leave At 62
Pension Benefits	8939	23034
Total Compensation	272238	348796
Pension/Wage Ratio	0.034	0.071
Compensation/Productivity Ratio	0.981	1.015
Compensation 62/Compensation 55		1.281
Compensation 62 - Compensation 55		76558

D. 11 Percent Interest, 10 Percent General Wage Growth, 1 Percent Experience Growth, 5.5 Percent COLA

	Leave At 55	Leave At 62
Pension Benefits	17854	31626
Total Compensation	273353	347735
Pension/Wage Ratio	0.070	0.100
Compensation/Productivity Ratio	0.985	1.012
Compensation 62/Compensation 55		1.272
Compensation 62 - Compensation 55		74382

Table 10 pertains to a worker hired in the hypothetical year 1980, ten years after the pension plan is adopted at the firm. Dollar figures reported in the table are deflated to the initial year of plan adoption, 1970. The first row of each panel reports the pension benefit. The next row reports total compensation, which is the sum of the pension plus the wage, where the wage is calculated as the difference between the individual's productivity and the pension contribution. Next is the pension-wage ratio, followed by the ratio of compensation to productivity, and lastly the ratio of and then the difference between compensation for working until age 62 and compensation for working until age 55.

There are four panels in the table. Two panels use a 6 percent interest rate, one without a COLA and the other with a fully anticipated automatic cola at 3 percent, which is funded on a projected liability basis. The other two panels report results for an 11 percent interest rate, with and without a 5.5 percent automatic COLA. Economy wide wage growth is 1 percent less than the interest rate, and wages increase by 1 percent with each year of tenure[6].

The fact that pension backloading is an important phenomenon can be seen by examining row 1 in each panel. In panel A, for example, the ratio of the pension at 62 to the pension at 55, which involves an actuarially fair reduction for early retirement, is 1.86 to 1. Row 3 reports the ratio of pension benefits to the wage. For those who leave after age 55, the ratio is .068, while it is .103 for those who leave at age 62. Although working seven additional years after a career from age 25 to 55 increases work effort by 23.3 percent, lifetime compensation is increased by 27.5 percent for the additional work, a compensation rate that is 18 percent higher than in the first 30 years. (If there are special early

retirement incentives, the backloading will, of course, be less. But other simulations, not reported here, indicate that the thrust of the following discussion is not substantially affected by the presence of early retirement incentives.)

The impact of inflation on the incentives, created by pensions, to keep working, reflects the effects of a number of forces. The net effect is that the degree of backloading increases with inflation. The ratio of the value of the pension for working seven more years increases from 32162/17286 = 1.86 to one, as seen in panel A, to 23034/8939 = 2.58 to 1, as seen in panel C. On the other hand, the value of the pension falls with the higher interest rate, from 32162 to 23034 for those retiring at age 62, and from 17286 to 8939 for those retiring at age 55. The increased backloading results because the benefits at age 62 fall to .716 of their initial value when the interest rate is increased, but the benefits at age 55 fall to

is the incremental reward for continued work. That pension reward declines slightly at the higher interest rate, from 32162 - 17286 = 14876 at the 6 percent discount rate to 23034 - 8939 = 14095 at the 11 percent rate. That is despite the effect on the base pension of the higher wage to be received at the 11 percent interest rate.

In addition, because the increase in the interest rate reduces the value of the pension to 52 percent and 72 percent of its value for those retiring at ages 55 and 62 respectively, there will be a direct effect on incentives of a wage increase. A 4 percent increase in the wage will compensate for a 40 percent decline in the pension. Altogether, the increment for working seven more years is greater at the higher interest rate, increasing from 344168 - 269848 = 74320 at six percent interest to 348796 - 272238 = 76558 at 11 percent interest. The higher wage generates

a second order effect on the pension, which has been taken into account.

At the lower level of inflation, the pension COLA reduces the reward for working from early until normal retirement age by four percent. At higher inflation rates, the COLA reduces the reward from working until normal retirement age by 2.8 percent. Thus the COLA modestly reduces the incentive to remain with the firm from early to normal retirement age. To the extent that a higher COLA is granted to those who have retired longer, the reward to working until normal retirement age would be further reduced. Clearly, an actuarial bonus of modest size is capable of offsetting the effects of a higher steady state level of inflation. A COLA is not necessary to restore any incentive to leave early that is eroded by a higher level of inflation.

Incentives For Mobility And Productivity.

When the incentive not to leave the firm at an early age is examined in the context of the simulation model, again the effects of inflation are found to be of only marginal importance.

When granted for a vested, terminated employee, a cost of living increase typically begins from the date of eligibility for early or normal retirement. That means that the COLA has the same proportionate effect on the benefits of leavers and stayers.

The simulation in Table 11 provides some idea of the orders of magnitude. This example starts the COLA from the day of leaving the job, even if well before early retirement age, and for that reason overstates the effect of the COLA on the incentive for mobility. That is, in Table 11 it is assumed that a worker who leaves after five years can take a benefit that is reduced on an actuarially fair basis from the benefit that is paid at normal retirement, and that for such an early leaver, the COLA adjustment will be made from the date of leaving the firm. In this

simulation, for the same benefit formula, age of hire, and other factors as assumed previously, the reward for those who leave the firm at age 30 is compared with the reward for those who stay to retire at age 62. Despite the upward bias, the potential effect of pension COLAs on the incentives not to leave the firm is very weak.

Table 11. Implications Of Inflation And COLAs For Pension Incentives To Remain From Five Years After Hire At Age 25 To Normal Retirement At Age 62

(Results Are For A Cohort Hired In 1980)

A. 6 Percent Interest, 5 Percent General Wage Growth, 1 Percent Experience Growth, No COLA

	Leave At 30	Leave At 62
Pension Benefits	660	31979
Total Compensation	42273	342213
Pension/Wage Ratio	0.016	0.103
Compensation/Productivity Ratio	0.929	1.008
Compensation 62/Compensation 30		8.095
Compensation 62 - Compensation 30		299940

B. 6 Percent Interest, 5 Percent General Wage Growth, 1 Percent Experience Growth, 3 Percent COLA

	Leave At 30	Leave At 62
Pension Benefits	2062	38808
Total Compensation	42711	341845
Pension/Wage Ratio	0.051	0.128
Compensation/Productivity Ratio	0.938	1.007
Compensation 62/Compensation 30		8.004
Compensation 62 - Compensation 30		299134

C. 11 Percent Interest, 10 Percent General Wage Growth, 1 Percent Experience Growth, No COLA

	Leave At 30	Leave At 62
Pension Benefits	106	22837
Total Compensation	43133	345816
Pension/Wage Ratio	0.002	0.071
Compensation/Productivity Ratio	0.943	1.007
Compensation 62/Compensation 30		8.017
Compensation 62 - Compensation 30		302683

D. 11 Percent Interest, 10 Percent General Wage Growth, 1 Percent Experience Growth, 5.5 Percent COLA

	Leave At 30	Leave At 62
Pension Benefits	813	31483
Total Compensation	42738	346168
Pension/Wage Ratio	0.019	0.100
Compensation/Productivity Ratio	0.934	1.008
Compensation 62/Compensation 30		8.100
Compensation 62 - Compensation 30		303430

At an 11 percent rather than 6 percent discount rate, the value of the pension for an individual who leaves the firm at age 30 is reduced from $660 to $106. At the 11 percent discount rate, the gain in the value of the pension from staying until age 62 is much lower than it is at the 6 percent discount rate, falling by almost a third with an increase in inflation, from 31319 to 22731. However, after the compensating difference in the wage, the net reward to staying at the firm until age 62 is left almost unchanged, increasing from 299940 to 302683 with the increase in the interest rate. Although there is more backloading of the pension at the higher interest rate, the value of the pension declines with the higher

interest rate, and the wage is increased to compensate for the fall in the pension value, so that the net compensation for staying another thirty years is increased by only one percent at the higher inflation rate.

Analogously, the COLA also makes very little difference to the reward for working an additional thirty years. For example, as can be seen by comparing panels A and B, at a six percent discount rate, the presence of a COLA reduces the reward for working another thirty years from 299940 to 299134, or by three tenths of one percent. The COLA increases the value of the pension for those who leave at age 30 by 1406, and the value of the pension for those who leave at age 62 by 6829, but the compensating reduction in the wage has a greater effect on the long stayers.

Findings With Alternative Interest, Wage Growth and COLA Assumptions

The empirical data on pension changes that we have analyzed spans the period from 1971 through 1987. Over that period, the interest rate on Moody's AAA bonds averaged 10.1 percent, while compensation increased by 7.1 percent, and the CPI increases by 6.7 percent (Economic Report Of The President, Tables B68, B55 and B13 respectively). In view of these figures, it is of interest to investigate the sensitivity of the simulation results to alternative assumptions. Accordingly, we reran the model on the assumption that economy wide productivity growth was three percentage points less than the interest rate. In addition, for these runs it was assumed that COLA increases were half of the rate of wage growth.

Table 12 reports the differences between compensation for remaining until age 62 and compensation from remaining until an earlier age, first for the eight runs previously reported, and then for the comparable outcomes under the revised assumptions.

As can be seen by comparing the differences in compensation between those cases in which the indicated COLA is offered and the comparable case

where there is no COLA, pension COLAs have relatively small effect on the reward either for staying from early to normal retirement, or from staying from five years after hire until qualifying for normal retirement.

Table 12: Compensation Differences Between Working Until Age 62 And The Indicated Age Under Alternative Assumptions.

Assumptions	55 to 62	30 to 62
6% interest 5% wage growth no COLA	74320	299940
6% interest 5% wage growth 3% COLA	71308	299134
11% interest 10 % wage growth no COLA	76558	302683
11% interest 10% wage growth 5.5% COLA	74382	303430
6% interest 3% wage growth no COLA	31966	168541
6% interest 3% wage growth 1.5% COLA	31203	168288
11% interest 8 % wage growth no COLA	34498	174711
11% interest 8% wage growth 4% COLA	33702	174931

Effects Of COLAs On The Variation In Real Income As Inflation Varies

The analysis has considered the effects of alternative steady state discount rates on the incentives for mobility, shirking and retirement which are created by pensions The next and final exercise with the simulation model investigates the effects of pension COLAs in the face of

varying rates of inflation and corresponding changes in discount rates. These simulations suggest that when account is taken of: a) the redistribution to first generation members of a pay as you go system; b) the feedback effects from pension contributions to the wage; and c) the timing of any inflationary experiences, it may be found that pension COLAs exaggerate rather than dampen the variance in compensation resulting from varying inflation rates[7].

In dealing with changes in the inflation rate, the period of adjustment becomes a crucial issue. The assets in the pension fund are all real, so that a once and for all, unforeseen change in the inflation and discount rates are immediately reflected in the return to assets. There is no evidence about the adjustment mechanism governing changes in pension contributions in response to changes in the steady state inflation rate. The simulation model assumes that when a surplus develops, the contribution rate has a minimum value of zero. When a deficit develops, it assumes that the contribution rate can rise up to twenty five percent of compensation. Thus immediately after inflation accelerates, there is a surplus which may take six to eight years or so to dissipate. During that time workers are making no contribution to the plan. When the inflation rate declines, the contribution rate is increased so as to eliminate the deficit within a few years. Those on board during those years find their compensation reduced substantially. The resulting adjustment rate after a decline in the inflation rate is rapid, and does not amortize over an extended period. Therefore, the observed cycles have wider amplitude and shorter duration than those that will be observed in the market.

In this simulation, the COLA is not anticipated. That is, as is current practice, the worker has no legal right to a COLA adjustment, and the accounting scheme does not assume that a COLA adjustment will be made.

In the earlier simulations, which were based on steady state assumptions, the COLA was assumed to be funded on a projected liability basis.

Table 13 summarizes the distribution of compensation/productivity ratios for each of the 80 cohorts hired from 1946 through 2025 under the assumption that the inflation rate, and thus the discount rate, varies due to unforeseen shocks. For these simulations, the firm is assumed to hire all employees at age 25, and to retire them at the normal retirement age of 62. Thus for each cohort, compensation and productivity are measured over the thirty seven years of employment and the retirement period. In the first column, the discount rate is assumed to begin at 6 percent, to increase to 11 percent from 2000 through 2020, with the change not foreseen by the workers or the firm, and to fall again to 6 percent after 2020. For the second column, the sequence is reversed. The discount rate begins at 11 percent and falls to 6 percent in 2000, rising again to 11 percent in 2020. In columns 3 and 4, the sequence is repeated, but in each case there is a COLA which amounts to half of the discount rate.

Beginning with the scenario which underlies the descriptive statistics in column 1, an acceleration in inflation in the year 2000 reduces the real compensation of those who are retired at the time inflation accelerates and reduces the real value of the fixed, nominal pension. The cohort hired on January 1, 1947 at age 25, is the earliest one affected. Those in this cohort are retired for one year at the higher inflation rate just before dying on the eightieth birthday. The cohort hired in 1963 will spend their entire working period at the lower interest rate, while retiring just after inflation accelerates, receiving their pensions entirely in a period of higher inflation. This unfortunate timing depresses their compensation-productivity ratio to .973, i.e., by 2.7 percent, which equals one year's

compensation.

Among the gainers are those who work during a period of higher inflation, when their wages are increased to compensate for the expectation of a lower real pension, and then are lucky enough to retire under a lower inflation regime. Other gainers are those who are contributing just after the inflation rate increases. Their contributions are reduced to zero until the surplus in the fund is exhausted.

Table 13: Effects Of Varying Inflation Rates On The Compensation-Productivity Ratios Of Cohorts By Year Of Hire
(COLAs are at half of the interest rate. Interest rates are either 6% or 11%, wage growth is either 5% or 10%. Inflation changes in 2000, and again in 2020.)

	Inflation Rises Then Falls (No COLA)	Inflation Falls Then Rises (No COLA)	Inflation Rises Then Falls (COLA)	Inflation Falls Then Rises (COLA)
No. Obs.	80	80	80	80
Average	0.999	1.001	1.004	1.007
Minimum	0.973	0.970	0.978	0.979
Maximum	1.031	1.027	1.030	1.039
Stand. Dev.	0.0129	0.0131	0.0139	0.0146
St. Dev/Mean	0.0129	0.0131	0.0138	0.0145

The descriptive statistics for the four simulations suggest that pension COLAs do not necessarily dampen the variation in income. Mechanically, the COLA would widen the variation in income-compensation ratios if it raised the ratios for those who, in the absence of a COLA, would have a compensation-productivity ratio that was greater than one. It also would widen the variation if the COLA reduced the ratio of compensation to productivity for those who would have a ratio, in the absence of a COLA, that was less than one.

Consider the changes experienced by some illustrative cohorts. Focus first on those on board when a pay as you go COLA system starts up. In the sequence where inflation rises and then falls, if there is not COLA, cohorts hired from 1946 through 1955 have replacement rates that are at or just below 1.0. When there is a COLA, these cohorts exhibit replacement rates that are one to two percentage points above 1.0. Thus the cohort hired in 1950 has the same productivity in both sequences, pays about $400 more in contributions with a COLA, receives about $100 more in basic benefits, and receives $4800 worth of COLA adjustments that would not otherwise be received. When inflation falls and then rises, even stronger gains accrue to those hired from 1946 through 1974, again raising the intergenerational variation in benefit-compensation ratios.

For the sequence where inflation rises and then falls, cohorts hired in the 1970s, who will retire seven years after inflation accelerates, have compensation-productivity ratios that are one half to two percentage points above 1.0. With a COLA, these ratios are even higher. For those hired from 1980 to 2000, when the sequence is a rise and then a fall in inflation, the COLA reduces compensation-productivity ratios, from one half to two and a half points above 1.0, to ratios that are closer to 1.0. In these cases, the COLA reduces the variation in compensation-productivity ratios.

For the scenario where inflation falls and then rises, the COLA reduces the variation for cohorts hired in the 1980's, increasing ratios of compensation to productivity which are one to three percentage points below 1.0.

In the scenario of increasing and then falling inflation, the COLA raises the variation in compensation-productivity ratios among generations

hired from 2005 to 2025. It does so by reducing replacement rates that were already below 1.0. Thus for someone hired in 2010 who will retire in 2047, when there is a COLA the contribution rate to the basic pension is about $7000 higher than when there is no COLA, the basic benefit is about $700 lower than when there is no COLA, and the COLA benefit itself amounts to $5700. Even without the COLA, the compensation-productivity ratio is below 1.0, so that when the COLA reduces the net value of the pension further for this cohort by requiring an incremental contribution which exceeds the incremental benefit, the variation in the compensation-productivity ratio increases.

In contrast, in the scenario where the inflation rate falls and then rises, the effect of the COLA is to reduce the variation among cohorts hired from 2005 to 2025. It does so by reducing compensation-productivity ratios from a level that is one half to two percentage points above 1.0 when there is no COLA, to lower ratios which nevertheless remain above 1.0 when there is a COLA.

Thus it can be seen that the net effect of a COLA on the distribution of compensation-productivity ratios depends on the aggregat of results for separate cohorts which are affected differently by the introduction and funding of a COLA, with the effect for each cohort depending on how the change in this ratio brought about by the induced changes in benefits and contributions is related to the basic compensation-productivity ratio in the absence of a COLA.

Note also that those who are on board at the time of plan termination for a system which included a pay as you go COLA will be adversely affected. While working, they will have made contributions under a pay as you go system to supports COLAs for those in earlier generations. But when their turn comes, there will be no flow of contributions to support their

benefits. The statistics on intergenerational inequality reported in Table 13 do not include those generations affected by plan termination, however.

To isolate the effects of start up, it is useful to recalculate the descriptive statistics from Table 13 for the cohorts who spend an entire 37 years covered by the plan. For the fifty five cohorts in the simulation who are covered for their full working lives, the effects of the pension COLA are found to depend on the sequence of inflation shocks. On the one hand, even when those in start up are eliminated, if the sequence is a rising and then a falling inflation, the COLA increases the coefficient of variation of the ratio of compensation to productivity, from 0.0120 to 0.0149. On the other hand, when the sequence is falling and then rising inflation, the coefficient of variation computed for the cohorts hired from 1970 through 2025 falls from 0.0140 when there is no COLA, to 0.0091 when there is a COLA.

In sum, pension COLAs do not necessarily reduce the variation in pension benefits. To be sure, a person who has just retired will experience lower variation in real income if covered by a COLA. And under some scenarios, COLAs may have the effect of reducing the variation in lifetime real incomes among cohorts. But again, they may not. Careful analysis of the timing and funding of the scheme are required before one can reach any conclusions as to the importance of pension COLAs for reducing the risk to lifetime incomes from varying inflation rates.

SUMMARY AND POLICY IMPLICATIONS

This paper has studied cost of living adjustments in pensions from the perspective of labor economics. Our aim was to describe more fully pension COLAs and their effects on the level of pension wealth and the rate of accrual in pension wealth with continued work, and to derive implications

for the role of pension COLAs in the labor market. After reviewing the findings, we discussed whether there is a strong case from the labor market perspective for or against policies which would mandate pension COLAs or regulate the availability and funding of pension COLAs.

For the period 1974 to 1979, retirees surveyed by the Panel Study On Income Dynamics report that their pension and annuity income increased by 3.5 percent per year. The increase in the cost of living for the same period was 8.5 percent per year. These findings are in line with those from an earlier study by Allen, Clark and Sumner (1986). Lower changes in retirement income are found with data from the National Longitudinal Survey of Older Men, averaging 1.3 percent per year over the same period, with the changes computed for the same period from the Retirement History Survey falling in between at 2.1 percent per year. Some of the difference in findings is attributable to the different ages of the cohorts, with those retired for a longer period receiving larger adjustments.

With the declining importance of inflation, the absolute size of pension changes for most of the 1980s is below the changes observed for the 1970s. The absolute size of the increase in pension incomes in the 1979 to 1987 period is eighty percent of the increase from 1971 through 1979, reflecting a lower inflation experience. From 1982 through 1987, the average of the yearly pension income increases fell to two percent per year.

According to the data from the PSID, in the decade of the 1970's, the ratio of simple averages of percent change in pension income to percent change in CPI averaged .46. For the period from 1979 though 1987, the ratio was .48, suggesting that the fraction of cost of living increases reflected in pension adjustments has been only marginally larger in the 1980's than in the 1970s. There is some evidence, however, of catch-up,

with pension changes exceeding 60 percent of the cost of living change in five of six years from 1982 through 1987.

In contrast to these findings, for a sample of medium and large size firms, for the period of the 1980s, Allen, Clark and McDermed find a substantial decline in the ratio of pension increases from COLAs to the CPI increase. There is some difference in the period covered, but even for the comparable period, the findings differ.

The data from a survey by the Wyatt Company of the Top Fifty Industrial Companies, covering the period 1968 through 1988, provides information on the year of each COLA adjustment for the firm, and on the formula for both the COLA and for the basic pension. We have calculated the frequency and size of COLA increases.

In the Wyatt sample, those who retired between 1968 and 1977 received pension increases in 25 percent of the years. From 1978 through 1988, these same cohorts received pension increases in 26 percent of the years. This is despite that fact that average CPI changes were lower in the later years.

COLA increases are larger for those who have been retired longer. For example, those retired 16 to 20 years received increases which average 2.2 percent per year between 1984 and 1988, while those retired 1 to 5 years received increases averaging 1.1 percent per year. Between 1978 and 1988, those retired in 1968 received increases averaging 40.1 percent of the base pension, while those retired in 1976 received increases averaging 23.3 percent, with comparable results for those retiring in the intervening period.

For someone retired at the beginning of the period, pension COLAs granted over the next two decades, but evaluated over the life of the

individual, accounted for $8079 compared to $20437 received under the basic pension, which amounts to forty percent of the present value of pensions received between 1968 and 1988 for employees in the Wyatt top fifty. Because the inflation rate was greater in the first decade than in the second, and because those who have been retired longer are granted greater increases, 72 percent of the present value of COLA adjustments received over the next twenty years were received from 1968 through 1978.

Projecting over the full lifetime, a person retiring from the Wyatt top fifty at age 60 with 30 years of experience in 1968, who experienced the inflation of the 1968 to 1978 period over the full period of retirement, would receive over half of the present value of his pension in the form of COLA increases. This raises the present value of the pension from 10.4 percent of the value of wages paid over the period of attachment to 15.6 percent.

On the other hand, for a comparable person who retired in 1978, and had experienced the inflation of the 1978-88 period for the full period of retirement, only fourteen percent of the pension income would be due to COLA increases. Given the lower rate of inflation in the later period, and perhaps adjustments in benefit formulae to contend with higher inflation rates, the pension COLA would increase the ratio of pension benefits paid to the wage from 9.8 percent to 11.2 percent. Similar results are obtained for other retirement scenarios.

Moreover, there is clear evidence that conditional on years since retirement, the frequency and size of COLA increases are lower, relative to cost of living increases, in the 1978-88 than in the 1968-78 period.

To explore the effects of inflation and pension COLAs on incentives to retire, move or to shirk, we turned to a simulation analysis. From that analysis, we conclude that the COLA provisions observed for pension plans

are probably not primarily motivated by desires to preserve the incentives which are strongly emphasized in the leading theories which have been used to explain the structure of pension plans. The reason is that the pension COLAs have only a small effect on these incentives.

Thus analogous to the findings of financial economists, we also find that the standard motivations for pensions which are analyzed by labor economists will not generate a strong demand for pension COLA protection.

The investigation of the effects of pension COLAs on variation in compensation associated with inflation shocks also reveals an interesting finding. Pension COLAs do not necessarily reduce the variation in compensation among generations of employees, even in the face of sharp inflation shocks. Indeed, when account is taken not only of the pension benefits, but also of the contributions to support the pension plan, and thus of any feedback effect on wages, under certain circumstances pension COLAs are found, in the face of inflation shocks, to exacerbate the variation in compensation among cohorts. Careful analysis of the timing and funding of the pension and COLA is required before one can determine the effects of pension COLAs on the risk to compensation from varying inflation rates.

Policy Implications

Our analysis does not provide any strong argument in favor of expanding pension regulation to cover pension COLAs.

Although we have considered some important evidence about the behavioral motivations for pension COLAs and their role in the market, there remains much to be learned about the behavior which underlies the choice of pensions and pension COLAs. Until we are closer to having a a plausible structural explanation, and some estimates of the key parameters,

it would be injudicious to make strong statements about policy.

Pension COLAs account for a significant fraction of pension incomes. The fundamental purpose of ERISA is to protect pension benefits of covered workers. Changes in the price level over time will have the effect of eroding the real value of a pension benefit that is fixed in nominal terms. At recently experienced inflation rates, without pension COLA coverage, near the end of the retirement period, a pension may have only a fraction of the purchasing power that it afforded just after retirement. When there is COLA coverage, a significant fraction of the pension may be accounted for by the COLA provision. Thus we find empirically that pension COLAs are an important phenomenon. The relative importance of pension COLAs, and the fact that they are unfunded, certainly justifies closer examination of the economic behavior which underlies COLAs, and the search for any market failure which might justify the regulation of pensions. But we have found no indication that market failure is a problem.

We have found no evidence that pension COLAs are likely to play an important role in preserving incentives affecting worker turnover, retirement decisions, or shirking behavior. The effects of pension COLAs on the relevant incentives appear to be small, and alternative adjustments in the wage or pension benefit levels may provide superior ways to adjust to unforeseen inflation. Accordingly, policies regulating COLAs cannot be justified by a desire to increase the efficient operation of the labor market and related personnel policies. On the other hand, it would not be appropriate to oppose regulation of pension COLAs on the grounds that there will be severe consequences for productivity should the government decide to regulate or promote pension COLAs.

As long as compensating differentials are an important phenomenon,

justifications for any public policy which mandates cost of living adjustments for pensions would have to be developed in the context of an argument of market failure: that workers misunderstand pension promises, that firms renege on these promises, especially if they are underfunded, that insurance is required against the effects of fluctuations in inflation over the cycle, and the market is failing to provide such insurance. If insurance is cost effective, as partial insurance may be (Feldstein, 1983), firms do have the incentives to provide it. So the question is, where is the market failure? Fear of firms reneging on an implicit contract would seem to provide only a weak justification for policies regulating pension COLAs and their funding. Current policy already permits a sharp discrepancy between the insured and projected liability from pensions, and requires funding only for the accrued liability (Ippolito, 1986). The liability from an unfunded pension COLA which has not yet been granted would seem to represent an obligation that is even of lower order of priority.

Although any policy prescriptions should depend on finding market imperfections affecting economic behavior, we do not have a sufficiently close idea of the importance of alternative behavioral motivations which underlie the pension outcome to allow us to determine whether there are fundamental flaws in behavior. Thus while there is some evidence that raises questions about the extent of understanding that covered workers have about their pensions (Mitchell, 1988, Gustman and Steinmeier, 1989a), we do not have sufficient information to determine that firms or individuals are so poorly informed about the workings of pensions that plan provisions should be determined outside the market. Moreover, although workers must be convinced that pension COLAs will be forthcoming before compensating differentials will arise, and without compensating

differentials competitive firms will be unable to offer cost of living adjustments to their workers, we do not know whether the fact that COLAs are ad hoc is evidence of rents, or evidence that ad hoc COLAs are sufficiently valued that workers have accepted reductions in wages to pay for them.

Finally, our analysis should make clear that whether or not there is some market failure which would justify mandating and closely regulating the provision and funding of pension COLAs, market adjustments in the wage and other provisions of the pension plan are going to make it extremely difficult to achieve any desired outcomes through regulation.

FOOTNOTES

1. Defined benefit pensions promise to pay a yearly pension benefit to workers who qualify on the basis of age and service. The benefit is based on a formula. In the simplest formula, the benefit is determined by multiplying a generosity factor, say one percent, by average salary in the last or highest paid years of employment, and then multiplying by years of covered service. In the case of the other leading type of plan, the defined contribution plan, funds are accumulated in an account and retirement benefits are determined by the returns to the accumulated funds. For details on frequency of plan type, other pension characteristics, and the values of benefits promised by a representative sample of U.S. plans, see Gustman and Steinmeier (1989a).

2. Using the Employee Benefit Survey (EBS), the BLS finds that "Only 4 percent of all participants were in plans that provided for automatic increases in pension benefits to compensate for increases in the cost of living." (BLS, 1989, p. 80)

3. There is additional evidence that cost of living changes are made with a lag, creating a catch-up phenomenon. Using data from the Employee Benefit Survey, from 1982 through 1987, for those retired five years, total ad hoc COLA increases were roughly seven percent. The increases were roughly 21 percent over that same period for those retired fifteen years. Over this five year period, the cost of living increase (CPI-U) was 18 percent (BLS, 1989, p. 80).

4. Using the Employee Benefit Survey, a participant weighted survey, Allen, Clark and McDermed (1991) find evidence that "by the end of the decade, the average increase in benefits across all plans had fallen relative to inflation". (p. 8) This decline is not evident in the PSID data for the period which overlaps with that in the ACM study. ACM attribute much of

the decline to a fall in incidence of COLA adjustments. In the next section, we consider incidence and the value of COLA adjustments in the context of a sample of very large firms.

5. Over the 1968-88 period, ninety six firms appear in the top fifty of the Wyatt sample. Of those, firms which appeared for less than six years were eliminated from the sample. In addition, we did not attempt to code plans at Ford, General Motors, Goodyear, Proctor and Gamble and Xerox, which include profit sharing. Further details on the composition of the sample are available on request.

6. Note that the use of the same 1 percent personal productivity growth factor at both a 6 percent and 11 percent discount rate, and the changing ratio between economy wide growth and the interest rate, 5 and 6 percent verses 10 and 11 percent, produces some slight discrepancy between the levels of productivity in the examples which use the different interest rates. An analogous phenomenon may be observed between the overall compensation levels resulting when the two different interest rates are used.

7. To the extent that variation in inflation is expected to be symmetric around the steady state value, the possibility that there will be random shocks to the inflation rate should have no major effects on incentives from pensions to retire, to move or to shirk. Risk averse individuals might undervalue the pension in these circumstances.

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