TECHNICAL STUDY ON RETIREMENTS AND PENSION PROJECTIONS OF THE CENTRAL GOVERNMENT

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ABSRACT

The general concern over the salary and pension liabilities of the government and the concomitant government announcements in the recent past to contain them at a sustainable level need to be contingent upon realistic assessment of future growth in such manpower related cost of the government. The prevailing state of information and analysis on these issues seem to be highly unsatisfactory and conclusions have mostly been drawn on the basis of assumptions, which are neither founded on reality nor backed by rigorous theory. The purpose of this study is to provide rational estimates of the future behaviour of government employment and pension liabilities by applying theoretically justifiable methods on available data so that informed decisions can be taken regarding manpower planning in government. The study also seeks to highlight the weaknesses of the pension administration, which can lead to gross misuse.

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Technical Study on Retirements and Pension Projections of the Central Government

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The fiscal stress being faced by governments, both at the Centre and in the states, especially after the implementation of the Fifth Central Pay Commission (FCPC) award, has led to a sudden upsurge of interest in controlling the wages & salaries and the pension liabilities of government. Whether such a level of concern is entirely justified is still an open issue. In the case of the Central government at least, it would appear that there should be no real cause for worry.[1] As can be seen from Graph 1 below, salary and pension payments to Central Government employees as a percentage of GDP is *lower* at the end of the decade of the 1990s than it was at the beginning despite the surge that took place as a consequence of the FCPC award. As far as salaries alone are concerned, the ratio in 1999-2000 was almost the same as it had been in 1994-95. More importantly, it is starting to display a declining trend again.

Graph 1 : Salary and Pension Payment to Central Government Employees as Percent of GDP

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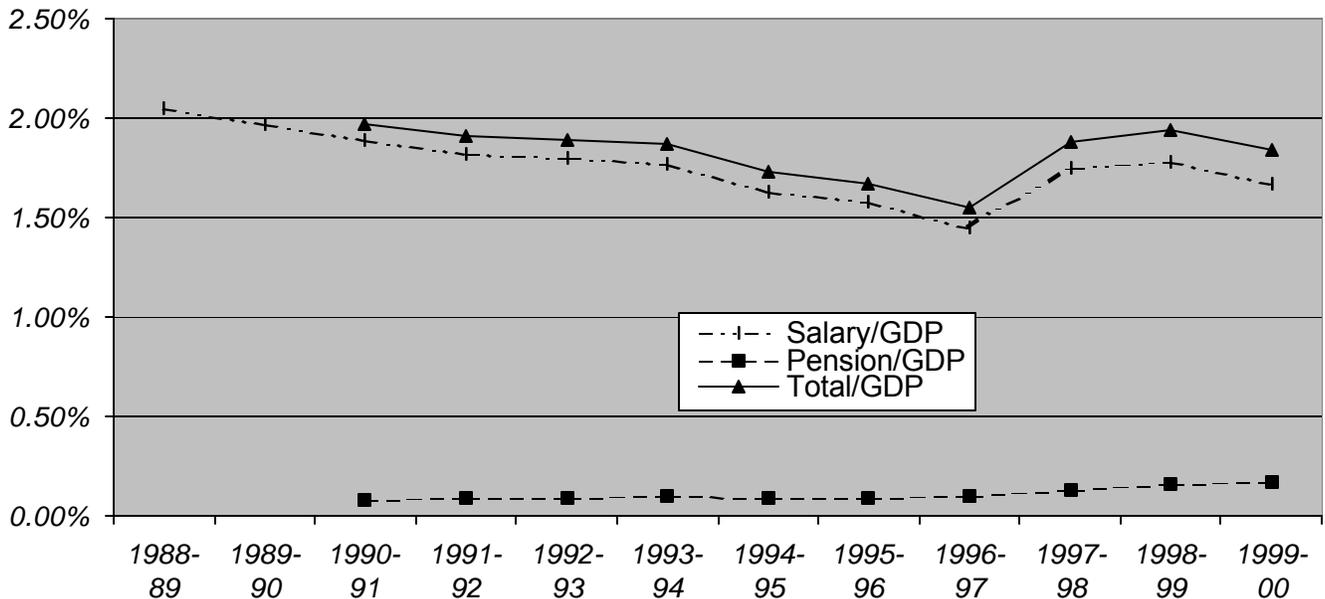
[1] The position of the state governments is much worse and certainly deserves greater consideration.

The pension bill is another matter altogether. As can be seen, although it is small relative to the salary bill, it displays an increasing trend and could, therefore, raise some concern in the future. As a percentage of GDP, the pension bill of the Central Government (Civil and Defence), has increased from 0.24% of GDP in the year 1980-81 to 0.73% of GDP in the year 1999-2000, growing at a rate of about 22% annually in nominal terms during the past two decades. At present the pension bill constitutes 5.7% of the total revenue expenditure in the union budget reflecting a quantum jump from the 1980-81 level of 2.4%.

More important than the share of the pension bill in the revenue expenditure is its share in the revenue receipt of central government, which has implication for the size of revenue deficit and future sustainability of such expenditure. The combined Pension bill of defence and civil department consumed a little less than 8% (7.9%) of the revenue receipts in the year 1999-2000 as against 2.9 % in the year 1980-81. The pension bill of civil department alone, as percent of revenue receipts, has been more than doubled during the last decade (Graph 2). Civil pension accounted for 1.8% of the revenue receipt of the Central Government in the year 1999-2000 compared to 0.9 % in the year 1990-91.

Graph 2 : Trend in Pension Bill as Percent of Revenue Receipt
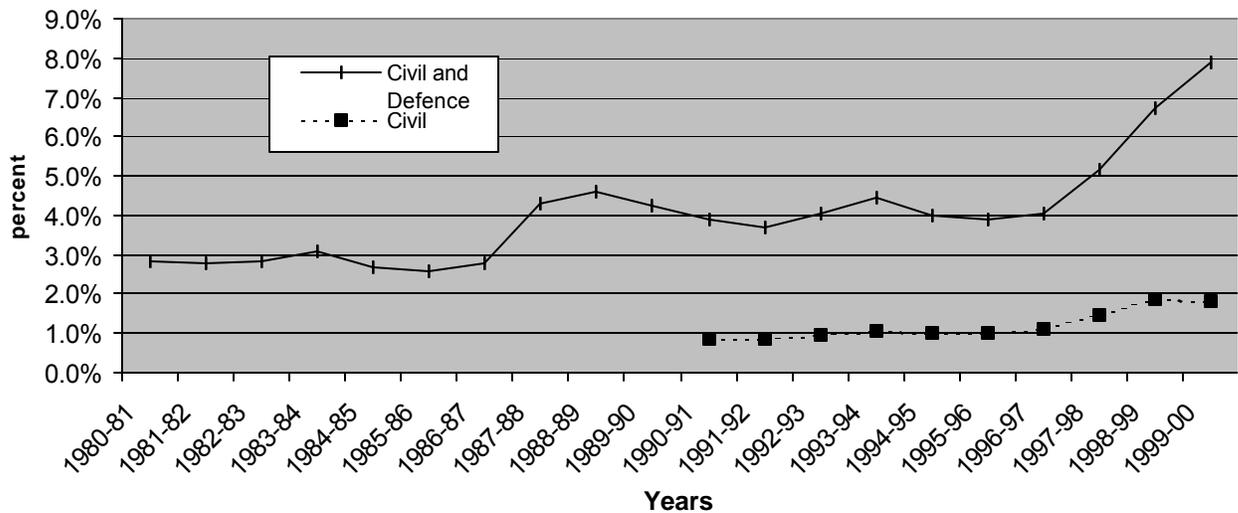
To complicate matters, the past trend in the pension bill does not follow a steady state growth path. Sudden step-ups in the annual growth rate of pension payments (Graph 3) at discrete points of time reflects the impact of two Pay Commission awards, which were implemented during the 1980s and 1990s. The budgetary implication of the Fourth Central Pay Commission Award in terms of pension payment is indicated by a 72% annual increase in the year 1988-89;

whereas the financial burden of the FCPC recommendations has been spread over three years averaging at an annual growth rate of above 40% during the period 1997-98 to 1999-2000. These are understandable, but not the other spikes that have occurred. The implementation of successive Pay Commissions' recommendations have been compounded by the gradual liberalisation of pension rules so as to : (a) accommodate and absorb increasing number of pensioners over time; and (b) revise and modify all the three variants of pension structure namely pension formula; reckonable emoluments and qualifying service. The phenomenal increase that has resulted in this non-productive committed liability of the government assumes significance because of the non-contributory, but defined-benefit nature of the present pension scheme, a substantial portion of which is indexed. Going by the past trend, the pension payment by the government in its present form seems to be unsustainable.

Graph 3 : Annual Growth Pattern in Pension Bill of Central Government
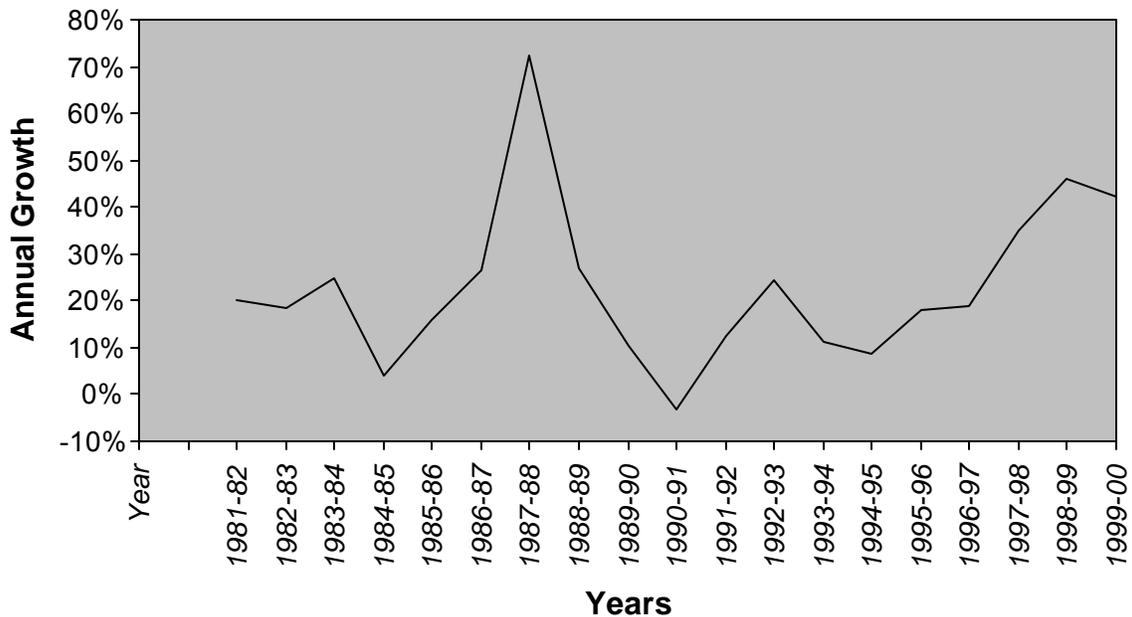
In this context of general concern over the salary and pension liabilities of the govertnment, two recent announcements are of great significance. First, the Prime Minister has announced that employment in the Central government will be reduced by 10 per cent over the next five years, primarily through attrition. A limited voluntary retirement scheme (VRS) is also under consideration. Second, it has been proposed that all Central government employees recruited after October 1, 2001 will not be eligible for the existing pension benefits, but will be

put on a contributory pension scheme.[2] In other words, the government appears to be laying considerable emphasis on controlling its manpower related costs. It needs to be mentioned, however, that the various components of these costs are not unrelated, and decisions taken in one dimension may have unintended repercussions elsewhere. It is, therefore, of utmost importance that a holistic view be taken of how best to tackle these issues.

Decisions of this nature clearly are, or at least should be, contingent upon a realistic assessment of the trends in government employment, retirements and future pensionary liabilities. The prevailing state of information and analysis on these issues is highly unsatisfactory, and important decisions are being taken on the basis of assumptions which may not be founded on reality or even on rigorous theory. The costs of such ill-informed decisions can be substantial. The principal objective of this study is to clear up some popular misconceptions and to provide more rational estimates and projections than exist at the moment by applying theoretically justifiable methods on the available data. A secondary objective is to highlight not only the unsatisfactory state of information on government employment, retirements and pensions, but also the weaknesses of the pension administration which can lead to gross misuse.

Downsizing through Attrition : The Theory

It may be useful to begin with the Prime Minister's stated intention to reduce the size of the central government by 2 per cent annually for the next five years. It appears that this objective is sought to be achieved mainly through attrition by retirement, whereby the 3 per cent of government employees who are presumed to superannuate each year are not fully replaced by fresh recruitment, which is limited to only 1 per cent of the existing work force. This relatively painless methodology for downsizing quite clearly is crucially dependent upon the rate of attrition that is assumed to obtain. However, the basis of the 3 per cent annual attrition that underlies the Prime Minister's statement, and indeed has become an accepted element of the current discourse on this issue, is not at all clear.

Its genesis appears to lie in the Fifth Central Pay Commission (FCPC) Report, where it is recommended that the government be downsized by 30 per cent over the next ten years through a total freeze on recruitment. A careful study of the document, however, failed to reveal any explicit basis for the estimated attrition that would follow. It would appear, therefore, that the FCPC had followed a rule-of-thumb approach in arriving at this figure. In all probability, it was assumed that since the average length of service of government employees would be about 33 years, one-thirty third or 3% would retire or die each year. Although this sounds eminently reasonable, all such rules-of-thumb can go terribly awry. Given the importance of this number in framing the

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[2] The latest position is that this proposal will be implemented from April 1, 2002

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government's approach to down-sizing, it may be preferable to obtain it from a more rigorous theoretical model.

The starting point for developing such a model is to recognise that the net addition to the number of government employees in a given year is the number of fresh recruits less the retirements and in-service deaths during the year :

$$\Delta N_t = (N_t - N_{t-1}) = F_t - R_t - D_t \qquad (1)$$

where: N_t = number of government employees at end of year t
F_t = number of fresh recruits in year t
R_t = number of retirees in year t
D_t = number of in-service deaths in year t

Let the average death rate for government employees, given the age distribution, be denoted as 'δ'. Thus :

$$D_t = \delta.N_{t-1} \qquad (2)$$

Substituting and dividing through by N_{t-1} yields :

$$g_t = f_t - r_t - \delta \qquad (3)$$

where : g_t = growth rate of government employment in year t
f_t = percentage fresh recruitment in year t
r_t = percentage retirements in year t

It may be noted that equations (1) and (3) are identities and, as such, cannot be used to make projections. Projections require that the target variable, in this case R_t or r_t, to be related either to variables which can be projected independently or to lagged values of endogenous variables. The choice of explanatory variables is also limited by data availability. For instance, the variable 'F', and therefore also 'f', is unobservable since data is not maintained on fresh recruitments on an annual basis. The only data available are on the total number of employees at any given point in time, i.e. 'N' and the number of retirees in any given year, i.e. 'R'. Therefore, in order to express equation (1) or (3) in terms of observable variables, it becomes necessary to eliminate 'F' or 'f' through a suitable substitution.

In order to do so, it is assumed that the average length of service in government is 'λ' years, so that the survivors of a given cohort of fresh recruits can be assumed to retire simultaneously 'λ' years later. It is also assumed that the relevant death rate 'δ' remains constant over the entire average length of service, so that at the end of the period $(1 - \lambda.\delta)$ percent of the concerned cohort survive. Therefore, we can specify the number of retirees in any given year as :

$$R_t = (1 - \lambda.\delta)F_{t-\lambda} \tag{4}$$

From equations (1) and (2), it is possible to specify :

$$F_{t-\lambda} = \Delta N_{t-\lambda} + \delta N_{t-\lambda-1} + R_{t-\lambda} \tag{5}$$

Substituting equation (5) into equation (4) yields the expression for the predicted number of retirees in any given year on the basis of past employment and retirement data :

$$R_t = (1 - \lambda.\delta)[N_{t-\lambda} - (1 - \delta)N_{t-\lambda-1} + R_{t-\lambda}] \tag{6}$$

The percentage attrition through retirement can be obtained from equation (6) by dividing through by N_{t-1} :

$$r_t = (1 - \lambda.\delta)[g + \delta + r_{t-\lambda}]/(1 + g)^\lambda \tag{7}$$
$$\text{where : g = average growth rate of the number of government employees over the period } (t - \lambda) \text{ to } t$$

Although the above expressions for the number of retirees and the retirement rate are theoretically valid, they depend upon the availability of accurate data not only on the number of government employees but also on retirements for an extended period of time. If there is an insufficiently long time series on retirement data or if the data is not considered entirely reliable for whatever reason, an alternate methodology can be developed which seeks to project the retirement rates directly from the employment data.[3] The starting point for this alternative formulation is equation (4), which divided by N_{t-1} yields :

$$r_t' = (1 - \lambda.\delta)F_{t-\lambda}/N_{t-1} \tag{8}$$

and which may be respecified by dividing both the numerator and the denominator by $N_{t-\lambda-1}$ to obtain :

$$r_t' = (1 - \lambda.\delta)f_{t-\lambda}/(1 + g)^\lambda \tag{9}$$

If it is now assumed that government employment follows a steady-state growth path, then :

$$g_t = g \text{ and } f_t = f_{t-\lambda}$$

Therefore, from equations (3) and (9) we can derive :

$$g = \{(1 + g)^\lambda.r_t' - (1 - \lambda.\delta)r_t' - \delta(1 - \lambda.\delta)\}/(1 - \lambda.\delta) \tag{10}$$

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[3] As will be argued later, there are serious concerns about the data available on retirements.

Collecting terms and rearranging, yields the alternative final expression for the annual percentage attrition through retirements or the retirement rate:

$$r_t' = (1 - \lambda.\delta)(g + \delta)/\{(1 + g)^\lambda - (1 - \lambda.\delta)\} \qquad (11)$$

As may be noted, equation (11) does not require past data on retirements, and is thereby informationally less demanding than equation (7). This informational efficiency, however, comes at the cost of a somewhat stringent assumption – namely, steady-state growth of government employment. The choice between the two alternative methodologies for projection purposes will, therefore, have to be determined by validation against the actual experience.

Before doing so, however, it is to be noted that the total attrition of the government work-force in a given year is the retirement rate *plus* the in-service death rate during the year. Therefore, the total attrition rate is :

$$a_t' = r_t' + \delta \qquad (12)$$

Substituting from equation (11) yields :

$$a_t' = \{(1 - \lambda.\delta)g + \delta(1 + g)^\lambda\}/\{(1 + g)^\lambda - (1 - \lambda.\delta)\} \qquad (13)$$

Equations (11) and (13), which represent the retirement and total attrition rates respectively in a steady-state situation, can be used to examine the condition under which the FCPC estimate of 3% annual attrition makes sense. It may be seen from equations (11) and (13) that as:

$$g \to 0 \left| \begin{array}{l} r_t' \to (1 - \lambda.\delta)/\lambda \\ \text{and} \\ a_t' \to 1/\lambda \end{array} \right. \qquad (14)$$

It may be noted from the above relation that the FCPC presumption of the rate of attrition being the inverse of the average length of service holds true only under the specific condition that the growth rate of the number of government employees has been zero for an extended period of time. The retirement rate in general will be significantly below this figure.[4] In other words, the rule-of-thumb works only if the number of government employees has been constant for the past 33 years.[5] In all other cases, the retirement and attrition rates will be significantly different.

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[4] Except of course in the limiting case where it is presumed that there are no in-service deaths, i.e. $\delta = 0$. In such a situation, the retirement rate and the attrition rate are identical.

[5] In the alternative formulation given by equation (7), the condition for the rule-of-thumb to work is even more stringent. As may be seen, if g = 0, then :

$$a_t = r_t + \delta = (1 - \lambda.\delta)(\delta + r_{t-\lambda}) + \delta$$

Therefore :

In order to appreciate the extent to which the theoretically justifiable retirement and attrition rates will differ from the rule-of-thumb, the methodology to directly compute these rates from employment data given by equations (11) and (13) is more suitable than that given by equation (7), since the latter involves making further assumptions about past retirement rates.[6]   In the rest of this section, therefore, the focus will be on equations (11) and (13) in order to elaborate on the strengths and limitations of the theoretical model.

Some indicative figures of retirement and attrition rates given by the model at different rates of growth of the number of government employees are presented in **Table-1**. These figures have been derived under the assumptions that the average length of service (λ) is around 33 years and the average annual rate of in-service deaths (δ) is 0.32%.[7] In interpreting this table, it must be borne in mind that the retirement and total attrition rates relate to a particular year, while the growth rate of government employment is the average over the previous 33 years. As may be seen from the table, the 3% attrition rate obtains only when the rate of growth of the number of government employees over the past 33 years has been zero. If the growth rate had been positive, the retirement and attrition rates will be progressively lower. On the other hand, as the process of downsizing continues, i.e. the growth rate turns negative, the retirement and attrition rates tend to rise sharply. Thus, it becomes virtually impossible to specify a unique retirement or attrition rate independently of the past behaviour of government employment. It must further be noted that the numbers shown in the table are applicable only to civilian government employees. In the case of the armed forces, the numbers would be very different since both the average length of service and the in-service death rate would vary significantly from those of civilians.[8]

$$a_t = 1/\lambda \ \text{ iff } \ r_{t-\lambda} = (1 - \lambda.\delta)/\lambda$$

which, from equation (14), can be seen to hold only if the number of government servants had remained constant between $(t - 2\lambda)$ and $(t - \lambda)$. In other words, the growth rate of employment would have had to be zero not just for 33 years, but for 66.

[6] The two formulations given by equations (7) and (11) become equivalent only if $r_t = r_{t-\lambda}$; which requires zero employment growth as a precondition. Thus this equivalence becomes trivial.

[7] This value of δ has been obtained from the age-specific death rates for urban males in India for the age-group of 23 to 58 years.

[8] The average length of service in the Armed Forces has been indicated to be in the range of 20 years, with the average age of induction being lower than among civilian employees. In the absence of death by violence during war or other such events, these would imply a significantly lower 'normal' in-service death rate.

Table 1: Retirement and Attrition Rates at Different Rates of Growth

Rate of growth of government employment	Retirement Rate	Attrition Rate
-3.0%	4.51%	4.83%
-2.5%	4.20%	4.52%
-2.0%	3.92%	4.24%
-1.5%	3.65%	3.97%
-1.0%	3.41%	3.73%
-0.5%	3.41%	3.73%
0.0%	2.68%	3.00%
0.5%	2.55%	2.87%
1.0%	2.36%	2.68%
1.5%	2.17%	2.49%
2.0%	1.99%	2.31%
2.5%	1.82%	2.14%
3.0%	1.66%	1.98%
3.5%	1.51%	1.83%
4.0%	1.38%	1.70%

Note : Columns 2 and 3 are computed from equations (11) and (13) respectively with assumed parameter values of $\delta = 0.0032$ and $\lambda = 33.33$.

Having established on theoretical grounds that the rule-of-thumb estimate of 3% annual attrition rate is likely to obtain only under an extremely unlikely set of conditions, and derived a somewhat better basis for obtaining future retirement and attrition rates, it may be tempting to use the formulae derived above or even the numbers given in Table-1 unquestioningly. However, it needs to be realised that these formulae and numbers have been derived on the basis of one critical assumption – namely, that government employment has followed a steady-state growth path. This is clearly not a very realistic assumption, and it becomes necessary to examine the implications of non-steady-state growth paths on the behaviour of future attrition rates.

In order to illustrate the different time profiles that can emerge, we consider a situation where the government wishes to hold its employment constant at the base year level. Thus it needs to know the likely attrition rates (inclusive of both retirements and in-service deaths) in the future in order to plan its recruitment. It is assumed that government employment has been growing at a steady-state rate of 3% per annum for an extended period of time, but the 33-year period immediately preceding the base year can be presented in the form of two alternative scenarios. In Scenario-I, the first 10 years experience employment growth of 5% per annum, while in the last 23 years it averages 2.2%, yielding a 33-year average of 3%. In Scenario-II, on the other hand, the

33-year average of 3% employment growth is broken up into 2.2% average during the first 23 years and 5% during the last 10 years. Therefore, in the base year, both scenarios have the same absolute number of employees. The future time paths of the attrition rate under the two scenarios are presented in the figure below :

Graph 4 : Time Profile of Attrition Rates
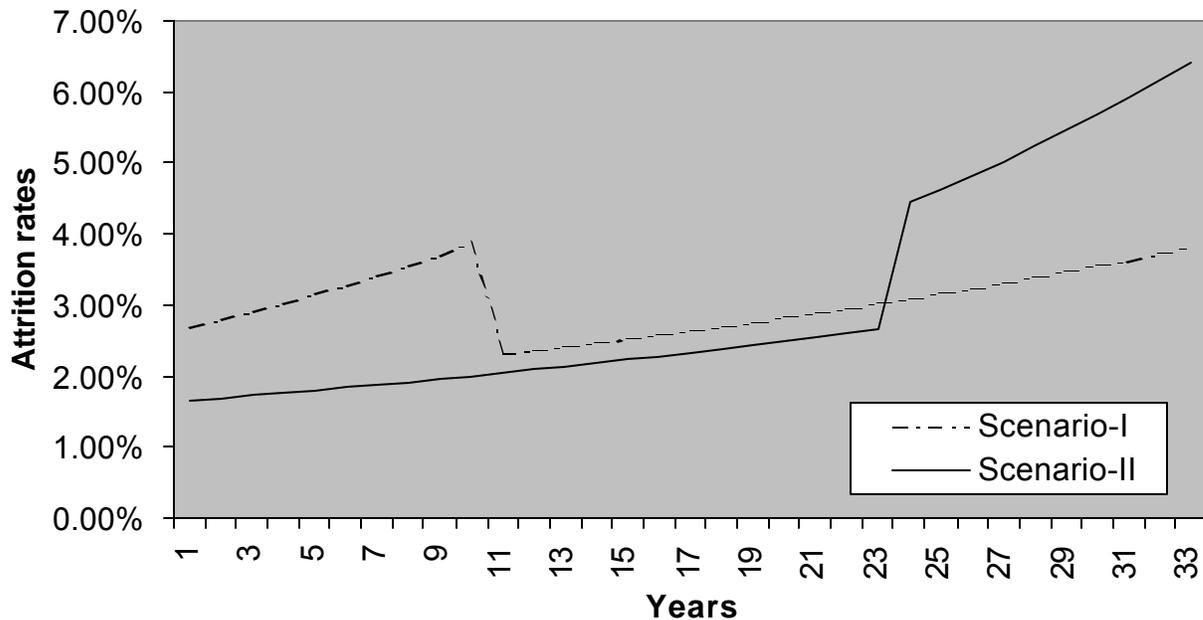
As can be seen, although the attrition rates for both the scenarios average 3% over the next 33 years, as is to be expected from Table-1, the time paths are very different.[9] Under Scenario-I, the attrition rate is 2.7% in the first year, rising to 3.9% by the tenth year, dropping sharply to 2.3% in the eleventh year, and then gradually rising to 3.8% in the thirty-third year. In Scenario-II, however, it is only 1.7% in the first year, rising gradually to 2.7% in the twenty-third year, jumping to 4.5% in the twenty-fourth year, and then rising further to 6.4% in the thirty-third year.[10] In other words, the range over which the attrition rate varies is much narrower under Scenario-I (1.6 percentage points) than under Scenario-II (4.7 percentage points).

Therefore, if the government adopts a constant model-based 3% replacement recruitment rate, it is not likely to go very wrong under Scenario-I,

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[9] In the previous period, i.e. the 33 years preceding the base year, the attrition rates in both cases are around 2% per year with some small variations. This is consistent with the assumed 3% average annual growth of employment.

[10] From the 34th year onwards, the attrition rates in both scenarios settle down to the 3% level consistent with the zero-growth assumption.

but will end up with a sizeable unintended increase in employment under Scenario-II. In the first five years itself, the total number of employees would have risen by 6.4 per cent. In short, the analysis carried out thus far indicates that not only does the past rate of growth of government employment matter in determining future attrition rates, its time profile is equally important. By and large, it can be stated that if the growth in government employment in the past was concentrated in the early years, then the theoretical approach to estimating attrition is more likely to work. If, however, the growth was back-loaded, then serious errors may occur.

Downsizing through Attrition : The Reality

The real puzzle, however, is that why would a body as eminent as the Fifth Central Pay Commission rely on what appears to be a rule-of-thumb estimate of future attrition by retirement while framing its recommendations? Surely hard data on the number of central government employees and on annual retirements would have been available to it. Estimates of past attrition rates would certainly have thrown some light on what could be expected in the future. It would, therefore, be useful to examine the available data on government employment and retirements, if for no other reason than to understand the weaknesses of the data and to validate the theoretical findings.

A major complicating factor in carrying out such an analysis relates to the consistency between the definitions of employees and retirees. There are 5 main accounting formations in the central government – *viz.* (i) Civil; (ii) Defence; (iii) Postal; (iv) Railways; and (v) Telecom – collectively accounting for almost 5.2 million central government employees. Each of these maintains separate sets of data of varying quality on both the number of employees and retirees. Clubbing all of these together is problematic since the underlying dynamics and the conditions of employment/retirement are very different. It is, therefore, preferable to treat each of these separately for analytical purposes. For this study, it has been decided to focus attention on only the first – namely, the Civil – component of central government employees, which accounts for approximately 1.3 million people. **Therefore, it must be borne in mind that in all that follows the definition of central government employees is restricted to its civil component, and excludes both defence and departmental enterprises.**

A second complication in linking employment and retirement data is the time dimensionality that is involved. Since the average length of service in the central government is between 33 and 35 years, it becomes necessary to access the relevant data at least as far back as the mid-1960s. As it turns out, data on the number of government employees on a reasonably comparable basis is not readily available in the form of a continuous time series. There are no doubt a number of data sources, but each suffers from one infirmity or another. It was, therefore, necessary to pull together such data as could be made comparable

from different sources and carry out the necessary adjustments. This was possible only for discrete time periods, with a continuous series being available only from 1990-91.[11] Fortunately, the earliest year for which such data could be obtained was 1957. Thus an adequate, although non-continuous, time series could be obtained. The remaining data gaps were filled through straightforward interpolation techniques to yield a continuous time series. Therefore, although the year-to-year variations may not always be completely accurate, the broad trends will remain unexceptionable.

As far as data on retirements are concerned, the problem is even more intractable. Despite best efforts, no data on retirements *per-se* were available from any source. The closest analogue was information on the number of pension orders issued on an annual basis. Although this may appear to be an adequate substitute, it is not necessarily so. In order to derive usable retirement rates, it is essential that there is a one-to-one relationship between the definition of the number of employees and that of retirees. If there are categories of government employees which are not eligible for pensions, then the data on the number of pensioners will necessarily understate the actual retirements. Work-charged and other contractual/temporary employees fall into this category. In order to at least partially obviate this problem, the data on the number of government employees has been restricted to the "permanent" categories, and excludes those that are obviously non-pensionable. This may not, however, entirely solve the problem, since there may still be sub-categories of permanent employees which are not or have not been eligible for pensions. A related problem, which operates in the opposite direction, is that from time to time non-pensionable categories of employees have been granted pensionary benefits, sometimes with retrospective effect.[12] As a result, the data on the number of pensioners can exhibit sharp discontinuities, and thereby affect the measured 'retirement' rates upwards.

There is, however, little that can be done about these problems of inconsistency in definitions and measurement. The best that can be done under the circumstances is to let the data speak for itself. It is also possible to use the theoretical model developed earlier to gauge the degree of accuracy and consistency given by the data on pensioners as a proxy for retirements. In other words, the validation process will have to be a two-way street in which the theory and the empirics are used as crosschecks on each other.

Keeping these various limitations in mind, it may now be useful to examine the basic data, which are presented in **Table-2**. A few words on the presentation

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[11] Unfortunately, the most easily accessible and reliable current data source – the Expenditure Budget of the Union Government – did not provide employment data during the earlier years.

[12] An analogous problem also exists with regard to permanent government employees who were on deputation to various central public sector enterprises. In such cases, the person would not be counted among the employees, but would get reflected in the pension data, thereby overstating the measured 'retirement' rate.

of the data are in order. The year refers to the financial year ending on March 31st of the year indicated; thus 1960 refers to the financial year 1959-60. Two sets of growth rates of the number of government employees have been presented. The first are the average growth rates over the preceding 5-year period, which gives an indication of the time path of government employment over the full 40-year period covered. The second set gives the average growth rates over the past 33 years and are the relevant figures for consideration in the context of the theoretical model. The column on the number of retirees, as has already been mentioned, actually represents the number of pension orders issued during the course of the year to all categories of pensioners other than family and freedom fighters. The final column on the 'retirement' rate is simply the ratio of the fifth column to the second.

The first, and the most important, point to be noted from the table is that **at no time during the past 40 years has the measured retirement rate come anywhere close to the FCPC assumption of 3%**. The maximum has been around 2.5%, but by and large it has remained below the 2% mark. Thus, use of the rule-of-thumb approach is not justified either by the theory or by past experience. It becomes necessary, therefore, to use an alternative methodology for making future projections, and the model developed earlier holds some promise in this regard. Before it can be used with any confidence, however, it becomes necessary to check the validity of its forecasts with the actual experience.

Since retirement rates are closely linked to past growth rates of employment, it is useful to first examine the time path of the latter. As can be seen from the table, the ten-year period between 1955 and 1965 witnessed extremely rapid growth in the number of permanent government employees. The rate of growth steadily reduced thereafter until the mid-1980s, and then again accelerated sharply between 1985 and 1990. During the 1990s, however, the number of government employees has remained more or less stable with a very mild upward trend in the latter half of the decade. This pattern of growth has led to the 33-year average growth rates to peak at almost 4.6% in 1990 and then drop steadily to about 3% in 2000.

Table-2 : Employment and Retirements in Central Government

Year	Number of Employees	Quinquennial growth rates	Growth rate over 33 years	Number of Retirees	Retirement Rate
1960	348600	5.95%		3407	0.98%
1961	370800			3628	0.98%
1962	393000			3864	0.98%
1963	415200			4115	0.99%
1964	437400			4382	1.00%
1965	459600	5.68%		4570	0.99%
1966	481800			4420	0.92%
1967	504000			11457	2.27%
1968	526200			11493	2.18%
1969	548400			11714	2.14%
1970	570600	4.42%		11939	2.09%
1971	593000			12168	2.05%
1972	614690			12401	2.02%
1973	636380			12639	1.99%
1974	658070			12882	1.96%
1975	679760	3.56%		13129	1.93%
1976	701450			13382	1.91%
1977	723140			13639	1.89%
1978	744830			13900	1.87%
1979	766520			14167	1.85%
1980	788210	3.00%		14439	1.83%
1981	809900			14716	1.82%
1982	831590			14999	1.80%
1983	853280			15287	1.79%
1984	875000			15581	1.78%
1985	937000	3.52%	4.35%	15880	1.69%
1986	999000		4.43%	16185	1.62%
1987	1061000		4.47%	16495	1.55%
1988	1123000		4.51%	16812	1.50%
1989	1185000		4.54%	17135	1.45%
1990	1247000	5.88%	4.57%	17464	1.40%
1991	1244530		4.45%	17788	1.43%
1992	1242060		4.33%	22622	1.82%
1993	1241000		4.10%	31279	2.52%
1994	1199000		3.79%	22938	1.91%
1995	1222000	-0.40%	3.65%	21215	1.74%
1996	1218000		3.46%	19302	1.58%
1997	1272000		3.41%	21037	1.65%
1998	1258000		3.22%	21048	1.67%
1999	1266000		3.08%	22647	1.79%
2000	1286000	1.03%	2.98%	21653	1.68%

The behaviour of the 'retirement' rates over the past 50 years is presented in the figure below. It is interesting to note that this rate was around only 1% up to 1966-67, when it suddenly jumps to nearly 2.3%. This discontinuity arises out of a decision taken in 1966 to substantially widen the ambit of government's pension scheme to cover virtually all permanent employees. Prior to this, a large number of government employees were uncovered and, as a result, the data on pensioners was certainly an unsatisfactory proxy for retirements. In the subsequent period, however, it is believed that this surrogate measure is probably a reasonably accurate reflection of the true retirement picture, except for certain *caveats* that need to be noted.

Graph 5 : Retirement Rates of Central Government Employees
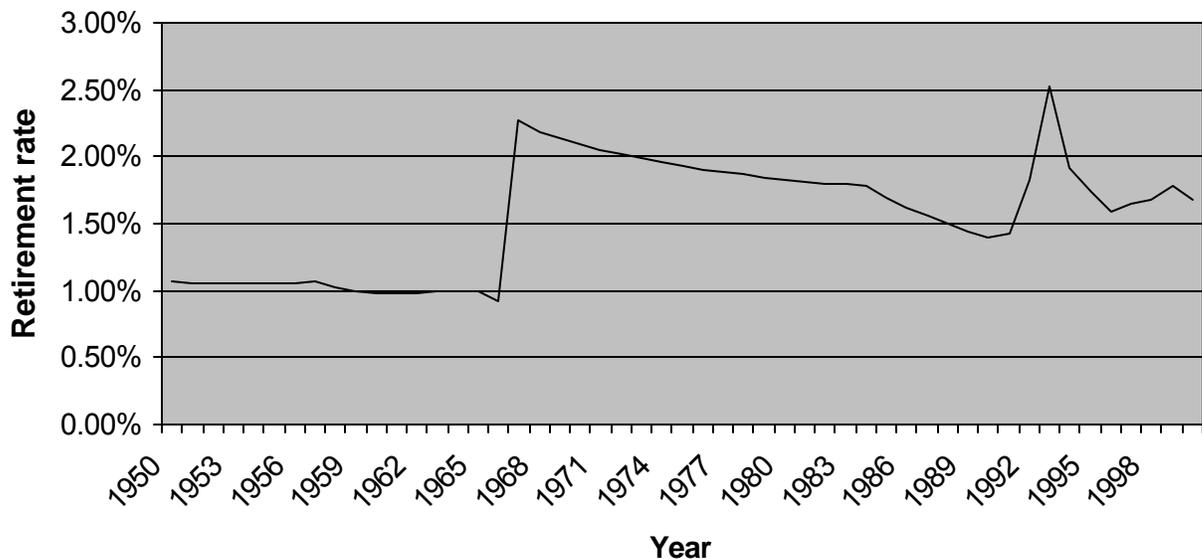
First of all, it needs to be explained why the 'retirement' rate rises so sharply in 1967 and remains at a relatively high level for more than 20 years. The rapid growth of government employment in the 1950s and 1960s should have resulted in a relatively low attrition rate, even with the extended coverage under pensions. According to the model, the recorded retirement rates during 1967 to 1970 would be consistent with average annual employment growth rates of 1.25 to 1.5 per cent, and perhaps even substantially less if cognizance is taken of the back-loaded nature of the growth trend. Such low employment growth rates over the previous 30 years appear most unlikely. Although the data does not exist to prove the point, but a backlog of people already retired and being brought under the pension scheme could explain this phenomenon for this short period. It cannot, however, explain the persistence of high retirement rates in the subsequent years. A possible explanation could lie in the fact that there was substantial expansion in central government employment in the years immediately following independence, and that perhaps this recruitment covered a much wider range of age groups than would normally occur. As a consequence,

the average length of service may have been significantly shorter than the 33+ years assumed in the theoretical estimates.[13]

The second issue relates to the sharp increase in the retirement rates that takes place during 1992 to 1995, particularly in 1993. This phenomenon arises out of two factors : (a) an actual reduction in the number of government employees; and (b) a sharp increase in the number of pensioners, especially in 1992 and 1993. The latter effect occurs primarily from an increase in what is termed as "absorption pensions" – i.e. government employees being absorbed by PSUs. A similar phenomenon is also noticed in 1999, which partially explains the upward movement in the retirement rate for that year despite the extension of the age of superannuation from 58 to 60 years.

Having prepared the groundwork, it would now be instructive to examine how well the theoretical behaviour of retirements or of the retirement rate correspond to the actual in order to assess the applicability of the theory for making projections. Since the primary interest is in projecting the absolute number of retirements, the direct methodology embodied in equation (6) may be examined first. This comparison is presented in the figure below. Since the model is based on estimating the fresh recruitment cohort of 33 years ago, the exercise could be carried out only for the 17-year period from 1983 to 2000.

Graph 6 : Actual and Predicted Retirements in Central Government

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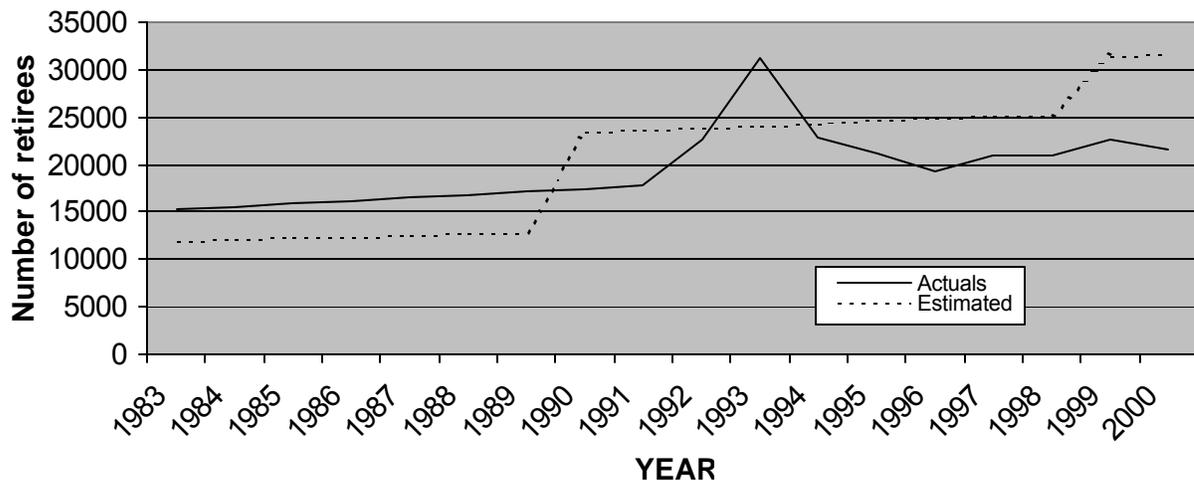
[13] It may be noted from equation (8) that : $\delta r/\delta \lambda < 0$; which implies that lower the average length of service, the higher should be the retirement rate. For instance, at 3% employment growth, the retirement rate will be 3.6% if the average length of service (λ) is 20 years as against 1.66% when λ is 33 years (*vide* Table-1).

It is evident that this methodology does not track the actual behaviour of retirements particularly well. As discussed above, there are no doubt reasons to expect that the retirement data may overstate the true position in the early years and again around 1993. However, the divergent trends, both during the 1980s and from 1994 onwards, suggest that this methodology may not be particularly accurate for making projections for the next few years. It should be pointed out, nevertheless, that once the definitional and measurement discrepancies get sorted out, this is probably the most appropriate methodology for assessing future retirements.

The alternative is to use the projections of the retirement rates given by equations (7) and (11). The comparison between the actual retirement rates and the predicted is given in the figure below. Estimate 1 refers to the predictions made from equation (7), which uses both employment growth rates and past retirement rates. The Estimate 2 series is derived from equation (11), which uses only the employment growth rates for making predictions.

**Graph 7 : Actual and Predicted Retirement Rates in the
Central Government**
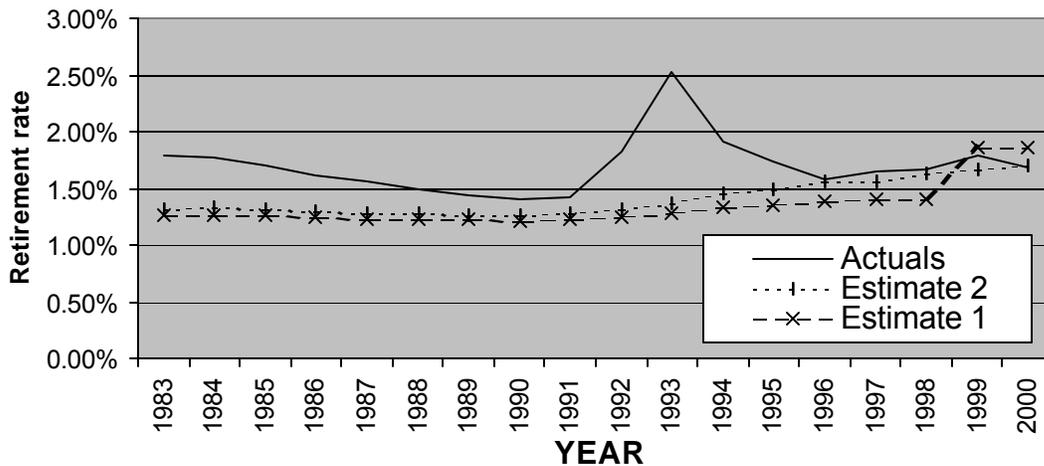
At first glance it may appear that there are substantial divergences between the actual and both the theoretical series. However, if cognizance is taken of the two *caveats* discussed earlier, then the discrepancies do not appear very significant. As may be seen, the actuals' series steadily converges towards the predicted up to 1991, as the age distribution problem in the immediate post-independence recruitment works itself out, and then again from 1996 onwards. Of the two predicted series, Estimate 2 appears to consistently outperform Estimate 1. In particular, it may be noted that for five years in the latter half of the 1990s, the estimates from Estimate 2 show very close correspondence indeed with the actuals. Estimate 1, on the other hand, does not perform quite

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so well and tends show a mild divergent trend.[14] On the whole, therefore, it is felt that the results of the theoretical model are quite robust and can be used to project the future course of retirements and attrition with reasonable accuracy. However, the applicability of the three different formulations that have been derived needs to be considered with some care.

As mentioned earlier, theoretically the most acceptable methodology is the one given by equation (6), which projects the number of retirees on the basis of cohort-wise recruitments. Unfortunately, this formulation does not work particularly well up to the present time mainly due to the non-systematic nature of the age distribution of recruits during the late-1940s and 1950s. It is expected that this problem would have more or less worked itself out by the mid-1980s and, therefore, this methodology would start yielding accurate results from the late-2010s. Until then it would be better to rely on the other two formulations given by equations (7) and (11). The choice between the two is difficult to make on any *a-priori* basis, but the data suggests that Estimate 2 – given by equation (11) – may serve better in the immediate future. Nevertheless, it may be wise to use both to get an indication of the range in which the actuals may occur.

What can then be expected in the immediate future, given the past behaviour of growth in government employment? As it turns out, not entirely surprisingly, the two formulations for the retirement rate yield very similar numbers for annual retirements up to 2006-07. By Estimate 1, the annual number of retirees in the next 5 years will average about 24,000, while Estimate 2 predicts the number to be 23,400.[15] With a base-year (2000-01) estimate of the number of employees being 1,318,000, both these projections imply an average retirement rate of only about 1.8%. ***Therefore, any down-sizing strategy based on a presumed annual retirement rate of 3% is likely to go terribly wrong***.[16]

Does this then mean that the Prime Minister's stated intention of reducing the size of the central government by 10 per cent over the next 5 years purely through a process of attrition is not feasible? In fact, this target is feasible once cognizance is taken of the fact that the attrition rate is the sum of the retirement rate and the annual percentage of in-service deaths (*vide* equation (12) above). The in-service death rate, as has already been mentioned, is around 0.3% per

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[14] Interestingly, the actual retirement rates for 1998-99 and 1999-2000 correspond very closely to the predicted values of Estimate 2 despite the fact that the age of retirement was raised by 2 years from 58 to 60 in 1998. This should have led to a sharp decline in the actual retirement rates in these two years as compared to the predicted. This expectation is satisfied by the predictions of Estimate 1. As it happens, however, the number of normal superannuations during these two years did decline sharply, but was compensated by an almost equal increase in voluntary retirements. The reasons for this behaviour need to be investigated.

[15] The third method gives a significantly higher prediction of around 32,500.

[16] A 3% retirement rate implies that over 39,500 employees would have to retire each year.

annum; which, together with the estimated retirement rate of 1.8%, yields an annual attrition rate of slightly above 2.1%. ***Therefore, the down-sizing target can be met provided that practically no fresh recruitment is made for the next five years across all categories of central government employees.*** In other words, the government will have to be prepared to countenance a situation where there will be a severe shortage of people in the younger age group for an extended period of time.[17] In a context where promotions are time-bound, this can wreak havoc at the working level.

There is, however, yet another, and perhaps more difficult, complication that needs to be highlighted. At present, about 40 per cent of central government employees, numbering some 530,000, belong to the police and para-military forces, which has been the fastest growing category of government employment in recent years. The feasibility of down-sizing through attrition needs to take into account both the feasibility and desirability of reducing this category on a *pari-passu* basis. The issue of ageing of the work force has much more grave implications in this case than for others. If it is assumed that no reduction can be made in this category of government employees, and the onus of down-sizing has to fall on others, then the situation looks very different. The 2% annual reduction in the total number of employees then translates to a 3.3% reduction in the non-police/paramilitary cadres. Since the attrition rate for this category is about 2.3%, either an additional 1% (numbering about 8,000 people) will have to be shed annually through VRS and other such separation schemes or the period of zero recruitment will have to be extended to over 7 years.[18] Each of these alternatives has its own disadvantages, which would need to be considered while determining the desired course of action.

In brief, therefore, reliance on a rule-of-thumb estimate has led to a serious under-evaluation of the difficulties that can arise in reducing the number of central government employees. The process of downsizing the central government is not going to be as painless as is believed presently, and difficult decisions will have to be taken.

Pension Projections : A Critique

Errors made in the assessment of the annual number of retirements are likely to get reflected in the projections that are made regarding future pension liabilities. It becomes essential, therefore, to examine the existing projections on pensions in order to evaluate their accuracy. One estimate in this regard, probably the first and only of its kind, has been made by the Working Group on

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[17] It can be shown that the average age of government employees will rise by 1.5 years over the concerned 5-year period.

[18] The total retirement rate of 1.8% arises out of a 1.6% retirement rate for the police/para-military and 1.95% for the other categories on the basis of their relative numbers in the late-1970s and early-1980s.

An Assessment of Government of India's Pensionary Liability.[19] The report of this Group compiles the pension projections of five categories of central government employees made by the respective departments namely (i) Civil, (ii) Defence, (iii) Postal, (iv) Railways and (v) Telecommunications.

The results of this exercise are extremely reassuring, and suggest that pension liabilities may not present as great a problem in the future as is commonly believed. The combined pension bill of all departments is projected to grow at an average annual rate of only 4.5% in nominal terms with an assumed annual inflation rate of 6% during the years 2000 to 2010. The projected pension bill of civil departments alone has been estimated to grow at an even lower annual rate of about 3.8%. Consequently, the sharp upward trend in the Pension/GDP ratio that has been observed in the past is expected to reverse and the ratio to become lower than the 1990-91 figure by 2006-07.[20]

Before one is lulled into a state of complacency by these projections, it may be desirable to give them some thought. There are at least two reasons to believe that there may be some serious problems with these estimates. First, the projection of annual average pension growth at 4.5% during the current decade is made against the trend growth rate of about 15% per annum in the pension bill during the 1990s after controlling for the FCPC effect. The reasons for the sharp discontinuity between the observed trend growth and projected growth of pension outlays, though highlighted in the Working Group report itself, has neither been reconciled nor been explained. The Working Group finalised its report while admitting the inexplicability of its results. But things surely cannot be allowed to rest there.

Second, besides the inter-decadal inconsistency, the projection clearly suffers from some arithmetical fallacy by projecting an annual average growth rate of 4% in the pension bill in nominal terms under a scenario of 6% annual inflation, while total pensioners are projected to grow annually at 2.4% on average. Given the functional relationship between the number of pensioners, the pension bill and the existing pension structure, which includes quite a sizeable proportion of indexed elements, any reasonable future projection in the pension liability of the central government should yield an estimate of the annual average growth rate of the pension bill close to the sum of the inflation rate and the growth rate of pensioners. There is, therefore, *a-priori* reason to believe that

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[19] Government of India, Ministry of Finance set up a Working Group on An Assessment of Government of India's Pensionary Liability in October 1999 under the chairmanship of Shri A.M. Sehgal to make a scientific and comprehensive assessment of the Government's liability arising from pension payments to current and future pensioners. The Group submitted its report in June 2001.

[20] The Working Group has of course listed several *caveats*, but these are eminently reasonable assumptions for making projections.

there are some flaws in the estimation process itself, and a closer examination of the Working Group report is merited.[21]

A useful starting point for such an examination is the underlying assumptions, which form the basis for the projections made in the report. The key assumptions are as follows:

- The number of retirees and of fresh family pensioners each year is assumed to be constant over the ten year period, and is equal to the average number of retirees during the previous 5 years.

- Attrition rate of 5% per year for a normal service pensioner (SP) on the basis of an assumed average life expectancy of 20 years for a person after retirement.

- Attrition rate of 10% per year for the switchover family pensioners (FP) on the grounds that the 'widow' would, on the average, survive 10 years after the death of the pensioner. In other words, on average, pension liability of the government per retiree would continue for 30 years, of which 20 years would be on account of superannuation pension and the remaining 10 years would be on account of family pension.[22]

- Attrition rate of 4% for fresh family pensions on the basis of an assumed life expectancy of 25 years after the death of the spouse.

- Average pensions are based on the average pay of government employees. For retirees it is calculated as a weighted average, whereas for family pensions it is a simple average.

- Pension expenditure has been worked out after reducing the value of commutation.

- Basic pension of a retiree would not change. In other words, impact of any future revision of salary structure has been ignored.

- Full neutralization of inflation on the basic pension has been assumed.

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[21] The pension projection of the Defence Department, which accounts for about 50% of the pension liability of the Central Government, fails to take into account the impact of inflation on the pension projections. This arithmetic inadequacy probably explains some of the discrepancies between trend growth rate and projected growth rate of the pension bill of central government, but it is not the full story.

[22] Department of Defence assumes an attrition rate of 2.5% per annum for its service and family pensioners.

These assumptions suffer from some basic flaws. First and foremost, it is evident that the same rule of thumb approach that has been used in the case of retirements, and which has been shown to be most misleading, has also been applied to estimate attrition in the case of pensioners. The errors arising from this are addressed later in this paper, but its correction does not resolve the contradictions mentioned above.

Of more immediate import is the fact that the pension estimates made in the Report classifies the total pensioners into two categories, namely Service Pensioners (SPs) and Family Pensioners (FPs). In reality there are three categories of pensioners. They are Service Pensioners (SPs), Switch Over Family Pensioners (SOFP) and Fresh Family Pensioners (FFP).[23] These distinctions are important for two reasons. First, the dynamics of each of these categories are very different. The number of SPs is derived from the past recruitment of government employees. The SOFPs are entitled to receive family pension after the death of their spouse, who were already in receipt of pension. Thus, the number of SOFPs is a function of SPs and their attrition rate. FFPs join the group of family pensioners due to in-service death of their spouses. The number of FFPs can be directly derived from the employees' strength and the death rate of the age cohort to which the government employees belong. Thus these three categories of family pensioners are driven by different demographic factors and it is important to treat them separately for the purpose of projection. Second, the pension entitlements of the two categories of family pensioners are different, and clubbing them together can lead to serious errors.

The methodologies used to assess the future pensionary liabilities per pensioner are also of questionable validity. The complexity of the pension system in the Central Government demands that every item of these liabilities be separately accounted for in order to ensure that each has been calculated as precisely as possible and that none has been overlooked. An examination of the Report suggests that both these problems exist in the projections of future pension liabilities.

This section, therefore, attempts to make a re-assessment of the future pension liability of Central Government as given in the Report by correcting the obvious *lacunae* noted above. At this stage, the assumptions made in the Report regarding accretion and attrition to the number of pensioners have been retained in order to highlight the magnitude of the errors arising from the other methodological problems. Keeping in view the data limitation and time constraint as indicated earlier in this paper, the exercise is confined to the 'Civil' component of the Central Government only.

The pension liability of the Government, which includes payment of pension and other retirement benefits to the government employees, has a number of components. Broadly they are grouped under Basic pension,

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[23] The Report recognises this distinction, but does not appear to utilise it in any meaningful way.

Dearness Relief (DR), Death-cum-Retirement Gratuity (DCRG), Commutation of Pension and Restoration of Commutation. While Basic Pension and DR are admissible to all pensioners with different formula for different category of pensioners; Commutation and Retirement Gratuity are payable only to new retirees. Death Gratuity, a onetime payment, is payable to the survivor of the deceased employee, and commutation is restored to the pensioners (survivors) after 15 years of availing commutation. A realistic estimation of the future pension bill of the government has to necessarily make use of the number of existing pensioners along with their break-up category-wise, number of new retirees, number of in-service deaths and projection of each of these categories so as to make a basis for component-wise projection of the pension liability of the central government.

Disaggregation of Family Pensioners

The base year for the projection is the year 1999-2000 for which the total number of family pensioners and service pensioners are provided in the Working Group Reports. However, as explained earlier, it is necessary to split the total number of FPs into two categories, namely, SOFP and FFP since these two categories of FPs neither follow uniform attrition rate nor do they get covered under uniform pension rules. This study accepts the total number of family pensioners in the base year (1999-2000) as given in the Working Group Report as the basis and distributes the same among SOFPs and FFPs as described subsequently.

The number of PPOs[24] issued to family pensioners are available year wise since 1990-91. For the years prior to the year 1990-91, the number of FFPs has been estimated from the employment figure of Central Government employees by applying an annual in-service death rate of 0.32 per cent.[25] This is the average death rate observed during the last 10 years. The cumulative number of FFPs surviving as on 1999-2000 has been obtained with the assumption of an annual attrition rate of 4% among FFPs.[26] The SOFPs for the year 1999-2000 are taken as the residual.

On the basis of the base year figure of all three categories of pensioners so arrived at, the projection has been made up to the year 2009-10 with the same assumptions relating to the attrition rate of pensioners as contained in the report of the Working Group. To recapitulate, these are: (a) attrition rate of 5% per year for a normal service pensioner (SP); (b) attrition rate of 4% per year for the fresh family pensioners (FFP); and (c) attrition rate of 10% per year for the switch over family pensioners (SOFP). In addition, the annual numbers of

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[24] PPOs are Pension Payment Orders, which are issued to different categories of pensioners. Year wise data on PPOs are obtained from CPAO.

[25] See footnote 8.

[26] This is as per the assumption made in the Working Group Report.

retirees and new family pensioners have been taken to be 25,500 and 4500 respectively, as also assumed in the Working Group report.

Even with the same assumptions and using the same data, our projections of the number of pensioners vary significantly from those made in the Report as indicated in **Table-3** below. As far as the number of service pensioners is concerned, there is no difference in the two sets of estimates. The differences arise in family pensioners. As a consequence, the projected total number of pensioners (service + family) is significantly lower (by about 8%) in our estimate, which leads to a lower average growth rate of pensioners over the concerned period.

Table – 3 : Projections of Number of Pensioners

Years	Working Group Estimate			Revised Estimate			
	SP	FP	Total	Service	SOFP	FFP	Total
1999-2000	442600	140175	582775	442600	83872	56303	582775
2000-01	445970	158985	604955	445970	97615	59485	603070
2001-02	449172	177990	627162	449172	110152	61605	620929
2002-03	452213	197184	649397	452213	121595	63641	637449
2003-04	455103	216555	671658	455102	132046	65596	652744
2004-05	457848	236096	693944	457847	141597	67472	666916
2005-06	460456	255797	716253	460455	150329	69273	680057
2006-07	462933	266653	729586	462932	158319	71002	692253
2007-08	465286	277655	742941	465285	165634	72662	703581
2008-09	467522	297795	765317	467521	172335	74255	714111
2009-10	469646	318075	787721	469645	178477	75785	723908
CAGR	0.6%	8.5%	3.1%	0.6%	7.8%	3.0%	2.2%

The only deviation in the methodology followed in our estimation from that used by the Working Group is that differential rates of attrition are applied to the two distinct categories of family pensioners, which is both appropriate and reasonable. Application of a flat rate of attrition to all FPs would further reduce the projected number of FPs and not the reverse. Thus, there is no doubt at all that the projections of the number of pensioners in the Working Group report is simply overstated even with their own assumptions. Thus, if only this correction were to be made, the projected growth rate of pension liabilities would reduce even further; thereby accentuating the contradictions. It is necessary, therefore, to closely examine the structure of pension entitlements and how these would vary over time.

Estimation of Pension Liability

The total pension liability of the Government is a function of total number of pensioners, their category-wise break-up, category-wise annual addition to the pensioners and pension's structure. In the previous sub-section we have

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discussed the category-wise break-up of the total pensioners and annual addition to their numbers. In this sub-section, the pension structure has been discussed as it prevails at present. The total pension bill of the Government consists of the Basic Pension and Dearness Relief (DR), Death-Cum-Retirement Gratuity (DCRG), commutation of pension and Leave Encashment. Of these four components, DR, DCRG and Leave Encashment are indexed.

Basic Pension

As per prevailing pension rules, monthly basic pension of a normal service pensioner for full qualifying service of 33 years is 50 per cent of the average basic salary drawn by the employee during last 10 months of the service before retirement. A SOFP draws 30 per cent of the average basic salary as monthly pension. The basic pension of the FFP is 50 per cent of the average salary for the initial 7 years. Thereafter basic pension gets reduced to 30 per cent of the basic salary or 60 per cent of that of a service pensioner. All the three variants of basic pension are linked to one common denomination i.e. the average basic salary of the retiree or deceased, as the case may be. Thus, the first step in estimating the average basic pension of different category of pensioners is to estimate the average basic salary of the government employees.

It may be worth mentioning here that the Working Group Report estimated the average basic salary, particularly in case of central government employees of the civil department, as a simple average of the basic salary applied to all four categories of Government Employees (Class I, II, III and IV). A realistic estimate has to be based on a weighted average of the basic salary.

Our study estimates the average basic salary of government employees as the weighted average of the average basic salary of different groups of Central Government employees as described below.

$$B = \sum_{i=1}^{4} p_i b_i / \sum p_i \qquad\qquad (15)$$

where : B = average basic salary
b_i = average basic pay of the employees belonging to i^{th} class of Government service
  i = 1,2,3,4 (same as group A, B, C & D respectively)
p_i = number of new retirees belonging to i^{th} class of Government service

The average basic salary arrived at as per the above-mentioned formula has been used to estimate the basic pension of all pensioners. Thus, the implicit assumptions are that: (a) the ratio of different categories of total pensioners (Class I, Class II, Class III and Class IV) is same as that of new retirees; (b) the average pay of superannuation pensioner and deceased employee remains same; and (c) every pensioner has 33 years of qualifying service.

Dearness Relief (DR)

The DR paid to the pensioners on the basic pension is linked to inflation. DR was 37% of the basic pension in the year 1999-2000 and 43% in the year 2000-01. Our estimate incorporates the actual DR payable up to the financial year 2000-01. Thereafter, an annual increase of 6% has been applied to the Dearness Relief for our estimation purposes on the basis of the assumption of full neutralization of inflation over the basic pension as per the FCPC effect. For the service pensioners, who receive basic pension less commutation, DR has been calculated over full basic pension. It is not clear whether this feature of DR has been incorporated in the Working Group Report.

Commutation of Pension

As per prevailing pension rules for Central Government Employees, the pensioners can commute 40% of his/her pension after retirement in pursuance of the implementation of Central Fifth Pay Commission recommendations (FCPC). The average value of commutation per pensioner is as follows:

$$C = (0.4) * (0.5) B * 12 * f \qquad (16)$$

where:
C = average value of commutation per pensioner
B = average basic salary
f = commuted value factor (determined by age at next birthday)

The commuted value factor as prescribed in the commutation table would be about 10 years for a pensioner who submits the application for commutation within the first year of his/her retirement. For the purposes of estimation in this study, it is assumed that every retiree would apply for commutation within the first year of his/her retirement. Amount of pension bill on account of commutation of pension is thus estimated by multiplying the number of new retirees by the average value of commutation per pensioner.

Death-cum-Retirement Gratuity (DCRG)

At present, retirement gratuity admissible to a pensioner is 16.5 times of the last average emoluments drawn (basic average pay + DA) at the time of retirement if the retiree has 33 years of qualifying service to his credit. In our calculation, the estimate of retirement gratuity presumes every retiree to have completed 33 years of qualifying service. So far as the death gratuity is concerned, the pension rule has been more liberal in that the death gratuity is almost double of the retirement gratuity pro-rated with the number of years of service one has put in. Accordingly an average service period of 29 year has been presumed for the deceased Government employee.[27] This makes the

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[27] The mean age for in-service deaths has been estimated at 54 years.

death gratuity to be 29 times of the last average emoluments drawn by the deceased. The relevant formula, therefore, are :

$$RG = (B+DA) * 16.5 \qquad DG = (B+DA) * 29 \qquad (17)$$

Leave Encashment

The maximum number of days of earned leave that can be accumulated and encashed on retirement is 300 days or 10 months. Our estimate assumes every pensioner to have accumulated 300 days of leave. For a deceased employee, accumulated days of leave is taken to be 7.5 months. This component of retirement benefit has been clubbed with the sub-head DCRG in our estimation table.

Restoration of Commutation

Till April 1985, the reduction in the monthly pension on account of commutation was a lifetime commitment. As per a Supreme Court judgment, however, the commuted amount of pension was restored after 15 years period with effect from 1st April, 1985. Accordingly, restoration of commutation has been estimated separately for the service pensioners who are likely to survive after 15 years of their retirement. For computation of survivors, the same attrition rate of 5% p.a. has been assumed. This aspect of pension entitlements has been completely ignored in the Working Group Report.

Revised Projections

Before any projections are made, it is important to validate the methodology through in-sample forecasts. Unfortunately, it is not possible to do so with each item of pension entitlements since data is not maintained in this manner. All that is available are some broad aggregates. With the assumptions and the pension structure as explained above, an estimation has been made, at the first instance, of the total pension bill of the Central Government for the base year 1999-2000. The break-up of pensioners into the three categories is as per the revised estimates for the year given in Table-3 above. The base year figure of the total pension bill as per our method is estimated at Rs. 3248 crores, which is comparable to the actual pension bill of the central government amounting to Rs. 3285 crores. The gap at the margin, which is only about 1%, could be due to some left over arrear payment on account of FCPC effect. This provides at least some degree of validation of the methodology adopted in our study.

After establishing the validity of the methodology, the pension liability of the central government has been projected up to the year 2010 under a scenario of 6% annual inflation. These projections employ the projected time profile of the number of pensioners in each category computed by us as given in Table-3. The

additional assumptions undertaken for these projections are common with those made in the Working Group Report:

1. The existing pension structure would prevail throughout including full neutralisation of inflation over basic pension.
2. No other Pay Commission recommendation would be implemented for the pensioners.

Table-4 indicates the component-wise projection of pension bill of the central government over the 10-year period ending 2009-10. This projection yields an annual average increase of 7.5% in the total pension bill of the Central Government. A component-wise observation of the projected pension bill indicates that the Basic cum DR component is projected to grow at more than 8% for all the categories of pensioners. This is clearly driven by the inflation factor as well as rate of growth of pensioners. No growth in nominal terms has been estimated for the commutation head since this component is inflation-neutral and the number of annual retirees to whom commutation is applicable, remains constant throughout at 25,500. Retirement gratuity and Death gratuity are expected to grow at 7.6% and 3.2% respectively during the ten years period.

Table-4 : Projection of Pension Payment to Central Government Employees (Civil)
(At 6% annual inflation rate)

(Rs. Crores)

Basic pension+DR			Commutation of Pension	Retirement Gratuity	Death Gratuity	Restored Commutn	PENSION BILL
Years	Service	SOFP	FFP	Service	Service	FFP		TOTAL
1999-00	1546	248	223	312	472	174	275	3248
2000-01	1654	302	246	367	580	170	270	3588
2001-02	1811	361	268	367	615	149	269	3840
2002-03	1970	422	291	367	651	158	269	4129
2003-04	2130	486	316	367	691	168	268	4425
2004-05	2308	552	343	367	732	178	267	4747
2005-06	2503	621	370	367	776	189	266	5093
2006-07	2700	694	398	367	822	200	267	5448
2007-08	2931	769	427	367	872	212	270	5849
2008-09	3147	848	461	367	924	225	271	6244
2009-10	3415	931	497	367	980	238	271	6699
CAGR	8.3%	14.1%	8.3%		7.6%	3.2%		7.5%

The projected growth rate of pension liabilities of 7.5% per annum appears to accord reasonably well with our *a-priori* expectations. This projection is only 0.7 percentage point less than the sum of inflation rate and growth rate of pensioners. This gap is explained by the un-indexed component of pension bill, which pulled down the projection a little. Thus, the implicit elasticity of the pension bill to the inflation rate is 0.88, which is a clear indication of the extent to

which pensions have become indexed post FCPC. In stark contrast, the estimate of pension bill contained in the Working Group report projected an annual increase of 3.8% during the same period, with inflation assumed to be 6% and the annual increase in the number of pensioners projected to be 3.1%. The implicit elasticity in this case works out to a mere 0.12, which implies a very small degree of indexation. Even a cursory perusal of the FCPC recommendations will reveal the unrealistic nature of this level of indexation.

The difference in the two estimates of the growth rates of the pension bill cumulates to very sizeable discrepancies in absolute terms. In 2009-10, for instance, the Working Group has estimated a pension bill of Rs. 4,976 crore as compared to our estimate of Rs. 6,699 crore – i.e. an underestimation of 35%. An unreasonable estimate, with underestimation of such a magnitude, by the Working Group, if accepted, may lead to gross errors in budgeting and policy intervention.

Reassessment of the Growth Rate of Pensioners

We turn now to the problems arising from the assumptions relating to the attrition rates of the pensioners and the additions to each of the pension categories. Analogous to the case of retirements, the assumed attrition rates in the Working Group Report are based on the number of years a pensioner is expected to survive.[28] It should be clear from the theoretical model developed earlier that such rule of thumb assumptions are valid only in the limiting case where the number of pensioners in any given category has been constant for a particular period of time. The rapid rate of increase in the pension bill over the last three decades is a clear indication of the unrealism of such an assumption. The model also suggests that if the number of pensioners has grown steadily during the past, then the attrition rates will be significantly lower than the inverse of the number of years of survival. Thus there is *a-priori* reason to believe that the Working Group assumptions may lead to an underestimation of the future number of pensioners.

The model can be easily modified to estimate the attrition rates of pensioners as well, provided that the requisite data is available. Unfortunately, the data on the numbers of pensioners do not exist on a time-series basis. Indeed, there appears to be only a single point in time – namely 1999-2000 – for which there is such data. This information on the number of pension accounts was apparently specially collected for the Working Group. Given the paucity of data, the methodology for estimating the future accretion to the stock of pensioners in different categories has to be developed afresh.

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[28] Thus, the attrition rate of 5% per annum for service pensioners has been arrived at by applying the simple rule of thumb to the average life expectancy of male population at the age of 58. If the average life expectancy is 20 years at the age of retirement, then one twentieth or 5% of the retirees would die every year. Similar considerations underlie the attrition rates for family pensioners.

In developing the methodology, two considerations need to be borne in mind. First, the availability of data is limited to what is presented in Table-2. Second, the base data on the number of pensioners as on 1999-2000 is assumed to be accurate. The latter consideration is of some importance since there is reason to believe that this may not be the case.[29]

The starting point for this exercise is the net accretion to the number of service pensioners (SP) in any given year. Clearly, this would be determined by the number of retirees (R) during the year less the number of deaths among the existing service pensioners. Thus :

$$\Delta SP_t = R_t - DSP_t \tag{18}$$
where : DSP_t = number of deaths among service pensioners in year t

The projections on R_t may be obtained from the model developed earlier, i.e. equations (6), (7) or (11), but DSP_t needs to be specified. It is assumed for simplicity that the entire cohort of retirees in a given year dies simultaneously after $\gamma 1$ years, where $\gamma 1$ refers to the average years of survival after retirement. Therefore :

$$DSP_t = R_{t-\gamma 1} \tag{19}$$

Combining equations (18) and (19) yields :

$$\Delta SP_t = R_t - R_{t-\gamma 1} \tag{20}$$

Since switch-over family pensioners (SOFP) are linked to the death of service pensioners, the change in the number of SOFPs should be determined by the following relationship :

$$\Delta SOFP_t = (1 - \delta_1).DSP_t - DSOFP_t \tag{21}$$
where : δ_1 = percentage of service pensioners with no dependents
$DSOFP_t$ = number of deaths among SOFPs in year t

As earlier, it is assumed that the cohort of dependents who receive family pensions on the death of the pensioner in a given year die simultaneously $\gamma 2$ years later. Thus :

$$DSOFP_t = (1 - \delta_1)DSPt_{-\gamma 2} \tag{22}$$

Substituting from equations (19) and (22) into equation (21) yields the annual accretion to the number of switch-over family pensioners as :

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[29] The problems with the estimates of the number of pension accounts in the base year are addressed elsewhere by the authors.

$$\Delta SOFP_t = (1 - \delta_1)(R_{t-\gamma 1} - R_{t-\gamma 1-\gamma 2}) \tag{23}$$

Finally, as far as fresh family pensions (FFP) are concerned, these are linked to in-service deaths of government employees.   Thus :

$$\Delta FFP_t = (1 - \delta_2)D_t - DFFP_t \tag{24}$$
where : δ_2 = percentage of government employees dying in service without dependants

As in the other cases, death among fresh family pensioners is assumed to be on a cohort basis :

$$DFFP_t = (1 - \delta_2)D_{t-\gamma 3} \tag{25}$$

Substituting from equations (2) and (25) into equation (24) yields the final expression for annual net accretion to the number of fresh family pensioners:

$$\Delta FFP_t = \delta.(1 - \delta_2)(N_{t-1} - N_{t-1-\gamma 3}) \tag{26}$$

Equations (20), (23) and (26) therefore represent the annual net accretions to the number of SPs, SOFPs and FFPs respectively. It can be seen that most of the data required to make future projections is available in Table-3, and therefore recourse does not have to be taken either to *ad hoc* assumptions or to the rule of thumb. Before entering into projections, however, it is necessary to provide estimates for the parameters represented by the various δs and γs. Starting with δ, the average in-service death rate among government employees, the estimate of 0.32% used earlier continues to remain valid. As far as δ_1 and δ_2 are concerned, it is assumed that all government employees and pensioners have some dependants at their time of death, so that both these parameters can be taken to be zero. This is of course a somewhat extreme assumption, but it is probably not too far off the mark, at least as far as δ_2 is concerned.[30] Nevertheless, the possibility exists that the rate of accretion may be marginally over-stated.

The γ parameters are clearly determined by the assumed longevity of the different categories of pensioners. In these cases it would be possible to use the assumptions made in the Working Group Report. However, it is believed that the Working Group assumptions are not justified by the existing demographic characteristics of the pensioners. In reality (i) the death rate of the pensioners are not evenly distributed across all age groups; (ii) the age structure of new retirees

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[30] In the case of service pensioners, however, there is certainly a fair possibility that there may be no dependants at the time of death, since the probability of pre-decease of the spouse during the relevant age of the government employee, ranging between 23 to 76 years, is quite signifcant. In addition, at the age of death of 76 years, there may be not be any dependant children.

and existing pensioners vary, and (iii) some proportion of the retirees could be female having life expectancy higher than 20 years at the time of retirement.[31] Similar limitation applies to the attrition rate adopted for family pensioners. Therefore, it would be desirable to clearly state the assumptions made in our analysis.

According to the life tables, the average life expectancy of a male at the retirement age of 58 years is 18 years, i.e. up to 76 years. The female life expectancy is 3 years longer, but with women representing only 11% of government employees, it makes only a marginal difference. Therefore, $\gamma 1$ has been taken to be 18 years as against 20 years assumed by the Working Group. In the case of SOFPs, it is assumed that all government employees are male and that the average difference in the age at marriage between men and women is 5 years. This, coupled with a 3 years longer life expectancy of women, yields a value of $\gamma 2$ of 8 years as compared to the Working Group assumption of 10 years. The largest discrepancy, however, occurs in the case of fresh family pensioners (FFPs). As mentioned earlier, the average age for in-service deaths in government is 54 years, which, taken with the difference in the age at marriage, implies that the average age of a fresh family pensioner would be 49 years. Since the average life expectancy of women in that age group is 79 years, it implies that a FFP lasts for at least 30 years and not 25 years assumed by the Working Group.

On the basis of the above assumptions, the implicit attrition rates as on 1999-2000 can be estimated from the data given in Table-2. As it turns out, the attrition rates are 3.5%, 15.5% and 2.9% for SPs, SOFPs and FFPs respectively as against the Working Group assumptions of 5%, 10% and 4%. It is evident, therefore, that the rule of thumb method of assessing attrition rates is most misleading in these cases too.

Finally, it needs to be mentioned that some of the projections depend upon the assumption made about the future time path of the number of government employees. For simplicity it has been assumed that the number of government employees will be held constant at the base year level for the nest ten years. The projections are no doubt sensitive to this assumption, and alternative paths can be generated on the basis of different assumptions.

On the basis of the above assumptions and parameter estimates, category-wise projections have been made for the period up to 2009-10, and these are presented in **Table-5** below. In the table, Projection-I refers to the revised estimates made by us on the basis of the Working Group assumptions and shown in Table-3 above; while Projection-II reflects the results of the methodology developed us. It is evident that there are significant differences

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[31] As per the latest census on central government employees, the proportion of female employees as percentage of total civil department employees was more than 11% in the year 1991.

between the two sets of projections. In the aggregate, Projection-II yields a lower rate of growth of the number of pensioners, but the category-wise differences are of greater significance. As far as service pensioners are concerned, we estimate the growth rate to be significantly higher despite the fact that the number of retirees each year is taken to be 24,000 as against the Working Group estimate of 25,500. The difference arises entirely from the lower attrition rate that is justified by past data.

Table-5 : A Comparison Between Projected Number of Pensioners Under Two Scenarios

	Number of Pensioners Projection-I				Number of Pensioners Projection-II			
	Service	SOFP	FFP	Total	Service	SOFP	FFP	Total
1999-2000*	442600	83872	56303	582775	442600	83872	56303	582775
2000-01	445970	97615	59485	603070	452161	86372	58729	597262
2001-02	449172	110152	61605	620929	461445	88920	61082	611447
2002-03	452213	121595	63641	637449	470446	91518	63365	625329
2003-04	455102	132046	65596	652744	479159	94166	65579	638904
2004-05	457847	141597	67472	666916	487578	96865	67726	652169
2005-06	460455	150329	69273	680057	495698	99616	69809	665123
2006-07	462932	158319	71002	692253	503513	102419	71830	677762
2007-08	465285	165634	72662	703581	511018	105275	73790	690083
2008-09	467521	172335	74255	714111	518206	108187	75692	702085
2009-10	469645	178477	75785	723908	525071	111155	77536	713762
CAGR	0.6%	7.8%	3.0%	2.2%	1.7%	2.9%	3.3%	2.0%

The lower attrition rate of service pensioners gets reflected in the growth rate of switch-over family pensioners, since it affects the gross accretion to SOFPs. As a consequence, the estimated growth rate of SOFPs turns out to be significantly lower, and indeed this decline dominates the total figures. The estimates of the number of FFPs are slightly higher, which are driven by a somewhat lower gross annual accretion – of 4,100 as against 4,500 – and a lower rate of attrition.

It is worth noting that our estimates (Projection-II) imply that the growth rates of the two categories of pensioners which involve higher pension liabilities – i.e. Service and Fresh Family pensioners – will be higher despite the growth of total pensioners being lower. It is important, therefore, to assess how these inter-category variations will affect the projections of the over-all pension liabilities of the government in the future. This exercise has been carried out on the basis of the methodology for pension calculations described earlier, and the results are presented in **Table-6** below.

Table-6 : Projection of Pension Payment to Central Government Employees (Civil)
(at 6% annual rate of inflation)

(Rs.Crores)

Years	Basic pension+DR			Commutation of Pension	Retirement Gratuity	Death Gratuity	Restored Commtn	PENSION BILL
	Service	SOFP	FFP					
1999-2000*	1546	248	225	312	472	174	275	3250
2000-01	1677	267	242	346	546	129	283	3488
2001-02	1861	291	264	346	578	137	290	3767
2002-03	2049	318	287	346	613	145	298	4056
2003-04	2242	346	311	346	650	153	306	4355
2004-05	2457	378	339	346	689	163	313	4684
2005-06	2695	412	366	346	730	172	320	5041
2006-07	2936	449	393	346	774	183	328	5409
2007-08	3219	489	426	346	821	194	339	5833
2008-09	3489	533	461	346	870	205	346	6249
2009-10	3818	580	499	346	922	218	352	6734
CAGR	9.5%	8.9%	8.3%		6.9%	2.3%	2.5%	7.6%

As can be seen from a comparison of Tables 4 and 6, the significant changes in the numbers and structure of pensioners shown in Table 5 has little impact on the projected pension bill. Apparently the decline in the total number of pensioners is more or less compensated by the higher liability per pensioner arising from the change in structure. Nevertheless, the elasticity of the pension bill to inflation goes up to 93.3% as compared to 88% assessed earlier. The important point, however, is that the projected growth rate of the pension bill is double of that assessed by the Working Group and there is thus no cause for complacency.

Conclusion

The principal objective of this study was to provide an appropriate methodology for projecting the future behaviour of government employment and pension liabilities so that there is some basis on which informed decisions can be taken regarding manpower planning in government. In doing so, it turns out that many of the commonly held beliefs are not rooted in reality. In particular, the view that the government can be down-sized relatively painlessly is erroneous. This may not be a matter of much import, since the data suggests that the fiscal strain arising out of the salary bill of the Central Government is not large enough to cause concern. The problems are elsewhere. Nevertheless, there may yet be a case for down-sizing on the grounds of efficiency. In such a situation, careful consideration needs to be given to the method by which such a reduction is accomplished. The choice between extended attrition and VRS is not obvious.

As far as pension liabilities are concerned, the only existing set of projections has been shown to be widely off the mark. Even so, the estimated growth rate of pension payments of 7.6% per annum at an assumed inflation rate of 6% should be considerably lower than the growth rate of nominal GDP in the foreseeable future.[32] Therefore, if the theory is correct, the pension bill as a percentage of GDP is likely to decline without any further measures. The main problem in this context is the appalling state of the data available. While there is complete information on the number of new pensioners added each year, there is no measure of the annual attritions, the switch-overs or even of the total number of pension accounts in existence. In such a situation, it is difficult to visualise how any kind of control can be exercised by the pension offices. The lack of data also hampers the validation of our projections, which could otherwise have been used as a cross-check on the actual demands raised for pension disbursement. This is an issue which has to be taken up for further research.

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[32] A fairly safe projection of real GDP growth for the next ten years would be around 6% per annum, which, taken with an inflation rate of 6%, yields a growth rate of nominal GDP of 12.4%.