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Matching Severance Payments with Worker Losses in the Egyptian Public Sector

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Severance pay programs can reduce political opposition and minimize the social costs of labor redundancies. In Egypt, only voluntary programs are feasible because legal limitations preclude layoffs and strong organized labor groups oppose any weakening of job security protections. A common problem with voluntary severance programs, however, is that they tend to overpay workers relative to the welfare losses they experience from displacement.

This article estimates the losses that public sector workers would incur if they were displaced from their jobs and simulates several voluntary severance schemes to determine how well the schemes match compensation payments to these estimated losses. It provides a fairly strong argument for looking at the structure of opportunity costs and wage profiles when designing severance programs. It shows that significant overpayment can be avoided by matching compensation payments to the expected losses of workers. It also provides a method for estimating these losses from standard labor force surveys that are available in most countries.

Public sector restructuring and privatization have caused substantial labor retrenchment in many countries, and displaced workers often suffer important welfare losses. Governments have used a variety of mechanisms to address the political and social costs of large-scale displacements, including employment guarantees, retraining programs, job search assistance for displaced workers, and severance pay. A recent survey has shown that severance pay programs are one of the most effective methods for reducing political opposition and minimizing the social costs of labor redundancies (Kikeri 1996). In some cases, like the case of Egypt examined here, only voluntary programs are feasible because legal limitations preclude layoffs and strong organized labor groups oppose any weakening of job security protections.

A common problem with voluntary severance programs, however, is that they tend to overpay workers relative to the welfare losses the workers experience from displacement. Therefore the programs can be quite expensive (Rama in this issue). Some overpayment is inevitable in voluntary programs because per-

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fect matching of compensation to the unobserved worker-specific losses is impossible and undercompensation would result in insufficient exits. Public authorities can reduce the extent of overpayment by using observable worker characteristics to match the compensation amount to individual-specific losses. This article compares the earnings of workers in and out of the public enterprise sector, while taking account of differences in nonwage benefits and nonrandom sector selection. It relates worker losses to observable characteristics such as seniority, age, years of overall labor market experience, educational attainment, and gender. It assesses how well alternative redundancy pay formulas typically used in severance programs match compensation payments to these estimated losses. I calibrate the parameters for several formulas to achieve a given rate of exit at a minimum cost per exiting worker. Finally, I analyze the effect of the choice of formula on the composition of exiters and stayers.

Minimizing compensation payments to workers is not the only desirable feature of voluntary severance programs. Severance programs also may need to achieve a certain mix of qualifications and occupations among workers who remain in the public sector so as to minimize the need to rehire workers. Severance programs that simply achieve a given exit rate at minimum cost generally do not yield the desired mix. For instance, in the Egyptian case, workers with less than secondary education have significantly lower displacement costs than workers with secondary or university education. The lowest-cost program would therefore aim to exit all the less-educated workers first. This is unlikely to be desirable from the point of view of labor force composition. A well-designed program would need to set separate target rates for the redundancy of workers in different educational or occupational categories and to achieve these rates by offering different compensation packages to workers in each category.

Determining the rate of redundancy for specific categories of workers in Egyptian state-owned enterprises (SOEs) is beyond the scope of this study. I simply assume a 30 percent rate that applies equally to workers in three broad educational categories. Within each category, workers who opt to accept the severance package will self-select based on their relative prospects in the private sector.

This article estimates the welfare losses to displaced workers in the government and in SOEs in Egypt. It then uses these individual-specific estimates to assess how well standard severance pay formulas minimize the overpayment to workers. Standard formulas typically index payments on seniority, the worker's wage at separation, years of denied service, and in some cases age (see Nunberg 1994 and Kikeri 1996). To get quantitative estimates of the extent of overpayment, I perform simulations on the SOE workers in the October 1988 labor force sample survey. The simulations attempt to achieve a given exit rate at the lowest fiscal cost by attempting to exit the workers with the lowest welfare losses first. A worker is assumed to exit voluntarily if the payment offered exceeds the worker's displacement losses. The parameters of the standard severance pay formulas are optimized to achieve the desired exit rate at the lowest possible fiscal cost using each formula. The analysis then compares the performance of the different formulas in minimizing costs. The simulations also generate the composition of exiters and stayers in terms of observable characteristics.

The goal of exiting first the workers with the lowest welfare losses from displacement, the main measure of performance here, may in fact worsen the adverse selection problem. Workers who have the best reemployment prospects in the private sector tend to be the first to accept the severance package. They also are likely to be the most motivated and productive in the public sector. There are ways to reduce such adverse selection, but all of them involve some increase in the cost of the program. For instance, the severance payment can be raised to achieve more voluntary exits than required. The right to accept the severance package can then be rationed to prevent the exit of some workers. This can be done either by vetoing the exit of workers whose performance exceeds a certain standard or, if this is deemed unfair, through some sort of randomization process. The random allocation would not prevent all high-quality workers from exiting, but it would make sure that some of them remain (Diwan 1993a, 1993b). Other mechanisms to make workers reveal private information about themselves have been proposed, such as sealed auctions and menus (Levy and McLean 1997; Rama in this issue). Here I focus on the overpayment problem and abstract from the issue of adverse selection.

Other important issues not addressed in this article relate to the design of voluntary severance schemes. These include the form that compensation should take, whether it should be a lump-sum payment, an annuity, or an in-kind payment such as retraining assistance, or whether workers should be able to choose from a menu of options. I also do not deal with issues relating to the timing and speed of the retrenchment program, the need for reforms in public sector pay and management after retrenchment takes place, or ways to reduce deadweight losses from the fact that some workers would leave anyway. Such deadweight losses are likely to be small in Egypt because historically the public sector has had a very low rate of turnover. Most workers who wish to work in the private sector simply engage in moonlighting while remaining on the public sector payroll. The value that tolerance for moonlighting adds to public sector employment is implicitly taken into account in my estimate of the nonwage benefits of public employment.

Section I outlines the estimation strategy pursued in this article. Section II develops and implements the methodology for estimating worker-specific displacement losses. Section III runs simulations of the alternative severance pay schemes to see how well they match compensation payments to the estimated worker losses.

I. An Opportunity Cost Approach to Estimating the Losses of Displaced Workers

The literature has proposed several empirical strategies to relate the losses of displaced workers to individual-specific characteristics. These approaches generally involve a comparison of workers' earnings before and after displacement (Alderman, Canagarajah, and Younger 1996; Younger 1996; Tansel 1997; and Rama and MacIsaac in this issue) or a comparison of the characteristics of stayers and leavers after retrenchment has taken place (Robbins 1997). Both of these approaches must be done ex post and therefore require previous experience with public sector retrenchment for the country in question. The approach pursued in this article produces estimates of anticipated losses from displacement by comparing the earnings of public sector workers with the opportunity cost of their labor in the private sector. For some female workers, the appropriate comparison may be between their public sector wages and their reservation wage for market work, which may be higher than their private sector wage. Estimates of welfare losses based on wage comparisons across the two sectors may thus overstate the losses of female workers.

In making comparisons, I take into account the nonrandom selection of workers into the public sector and the potential difference in the nonwage attributes of public and private sector jobs. The advantage of this approach is that it relies on data from standard labor force surveys that are commonly available in many countries. I use data from the October 1988 Egyptian Labor Force Sample Survey to estimate the potential welfare losses for workers who could be displaced by privatization.

Welfare losses due to displacement can be classified into three parts: loss of earnings due to transitional unemployment while searching for a private sector job, permanent loss of earnings associated with moving to lower-paying jobs in the private sector, and loss of nonwage benefits associated with a public sector job, including intangible benefits like greater job security and lower levels of effort (Rama in this issue). In voluntary severance programs, where workers are given some flexibility in choosing the timing of exit within a fairly broad window, it is safe to assume that most job search occurs while workers are still in public sector jobs. Under such circumstances, transition costs would be fairly small compared with permanent losses. For simplicity, this analysis neglects transition costs.

The analysis estimates the permanent loss of earnings due to displacement by comparing the expected earnings of workers in the public sector with those of similar workers in the private sector. I estimate selectivity-corrected earnings equations for workers in and out of the public sector. I then calculate differences in discounted streams of earnings from the time of displacement until retirement as a function of observed worker characteristics such as seniority, overall labor market experience, education, and gender.

In theory, there could be downward shifts in the private sector wage schedule as a result of supply shocks from large-scale exits from the public sector. I neglect such supply effects because exits are likely to take place over a fairly long period of time, so that the impact on total labor supply is limited. The total number of public enterprise workers to be retrenched under the 30 percent redundancy assumption (about 400,000), if spread out over several years, is fairly small compared with the annual increment to the labor force in Egypt (about half a million workers). In addition, any wage impact on the private sector is likely to be short-lived.

Some of the permanent losses from displacement result from the higher expected unemployment and greater job instability in the private sector that the worker will experience over the long run. In fact, a sizable fraction (34 percent) of workers in the private sector sample are employed only intermittently, whereas none of the public sector workers are. Earnings equation estimates (not shown here) indicate that workers employed intermittently earn 50 percent less per year than private sector workers employed regularly. I assume that displaced public sector workers are as likely to end up in intermittent employment as are similar workers currently in the private sector. Subject to this assumption, earnings equation estimates that include intermittent workers in the private sector sample but do not correct for such a status automatically incorporate potential earnings losses due to employment instability.

Workers considering whether to accept a compensation package would look at differences in both the pecuniary and nonpecuniary attributes of jobs in the public and private sectors. To estimate the value that workers would place on such differences, I make four assumptions. First, I assume that workers would not enter the public sector unless their anticipated lifetime compensation in that sector, including these nonpecuniary rewards, was at least as high as what they could get in the private sector. Because relative wages in the public and private sectors could have shifted since some workers made their decisions to join the public sector, I limit this part of the analysis to relatively young public sector workers (age 35 and under). Second, I assume that public sector workers face a uniform discount rate of 5 percent.

Third, because queuing for public sector jobs is ubiquitous, I assume that most public sector workers receive higher lifetime compensations in that sector than the opportunity cost of their labor in the private sector. However, for at least a marginal group of workers, these rents are close to zero. To identify the marginal group of workers who receive no rents, I classify the sample of public sector workers into 12 groups based on observable characteristics—gender, education, and whether they work in SOEs or the government. I then compare the ratio of private to public discounted lifetime monetary earnings for each of the groups. The group with the highest ratio in favor of the private sector is assumed to be the marginal group that dissipates its rents first. By equating total lifetime compensation in the public and private sector career paths for this marginal group, I obtain an estimate of the ratio of total compensation to monetary compensation.

In calculating the earnings stream in each career path, I take into account the time spent in the public sector job queue. The employment guarantee for graduates that has been in effect in Egypt since 1964 entitles graduates of vocational secondary schools, technical institutes (equivalent to two-year colleges), and universities to a government job after a certain waiting period (see Assaad 1997). As of 1988, the last cohort of graduates to be offered government appointments under the employment guarantee was the 1982 cohort for university graduates and the 1981 cohort for secondary and technical institute graduates. An assumption that queuing is costly does not mean that applicants have to remain unemployed while queuing, but it does mean that they earn less than workers who are not queuing. Because workers with less than secondary education are not guaranteed public sector jobs, I assume that they do not engage in costly queuing for such jobs. (See Assaad 1997 for a more detailed discussion of the workings of the public sector queue.)

Fourth, I assume that nonwage benefits in the public sector are proportional to monetary earnings and that the constant of proportionality is invariant to worker characteristics and is equal across government and SOE employment. The assumption that the value of the nonwage attributes of public sector jobs is proportional to monetary earnings can be justified as follows. The most important nonwage aspects of public sector jobs are the higher probability of receiving a retirement pension and paid vacations and the lower effort required relative to private sector jobs. The benefits derived from these nonwage job attributes are therefore either directly related to monetary remuneration or depend on the value of a worker's time, which relates them indirectly to wages. Because some nonwage benefits, such as health insurance, are clearly independent of wages, in a sensitivity analysis, I consider the assumption that the value of the nonwage aspects of public sector jobs over a worker's lifetime is a constant absolute amount for all workers rather than a constant multiple of monetary compensation.

Because the estimation of the ratio of nonwage benefits to earnings depends on several assumed parameters, including the length and cost of queuing, the discount rate, and the age cutoff used to identify new entrants, I conduct extensive analyses of the sensitivity of the estimates to changes in these parameters. The need to rely on the observed heterogeneity in the sample to identify the marginal group of workers, however, makes it impossible to test the assumption that the ratio is invariant to worker characteristics. I do entertain the possibility that nonwage benefits are constant across workers and see the extent to which such a pattern of benefits across workers alters the simulation results conducted in section III.

II. Estimation of Displacement Losses

This section uses estimates of selectivity-corrected earnings equations to obtain the expected earnings profiles of workers in the government, SOEs, and the private sector. It estimates nonwage benefits in the public sector and individual-specific displacement losses. It then analyzes the sensitivity of the loss estimates to the estimate of nonwage benefits.

Expected Wages

The earnings equation estimates used to predict wages are reduced-form equations based on a standard Mincerian model. I correct for selectivity using a standard Heckman-type two-stage model with a multinomial logit selection rule that predicts the probability of selection into the government, SOEs, and the private sector.[1] Appendix table A-1 shows the selection equation estimates. The selection equation includes several variables on the worker's parental background and marital status for all workers, as well as the number of children and employment characteristics of male family members for female workers. The exclusion of these variables from the earnings equations helps identify these equations in the second stage. Assaad (1997) provides a more detailed discussion of the identification issue in a similar context.

The earnings equations include a tenure variable to account for seniority-based wage-setting rules in the government and SOEs. Tenure is calculated as the time since joining the public sector for government and SOE workers and the time since the last job change for private sector workers. This definition takes into account the fact that public sector workers can transport their seniority level across public sector jobs. Experience is calculated as the time since entry into the labor market and may therefore include a period of unemployment at entry. Because of the way in which data are collected, education is specified as the attainment of specific educational credentials rather than years of schooling. In the subsequent analysis, level-one workers have less than secondary education, level-two workers are graduates of general and vocational secondary schools and technical institutes, and level-three workers are university graduates.

Occupation is not taken into account explicitly, but a rough division between blue-collar and white-collar employment is implied by the education variables. In Egypt, individuals educated up to and including the preparatory level can be assumed to be engaged in blue-collar occupations. Those educated at the technical institute, university, and general secondary levels can be assumed to be white-collar workers. Because vocational secondary education can lead to either blue- or white-collar occupations, I use information on occupation to classify vocational school graduates into blue- and white-collar workers. Finally, regional dummy variables take into account regional differences in the cost of living and institutional wage-setting rules.

The data are obtained from the October 1988 round of the Egyptian Labor Force Sample Survey, which was a special round designed to collect much more detailed information than the standard survey. In particular, it included a special module on earnings, which is the source of the earnings data used here. The earnings module gathered data on earnings net of payroll taxes and deductions in the reference year. An attempt was made to get data on earnings in kind, but the quality of that data seems quite poor. The annual earnings of intermittent workers were estimated by asking about the number of months worked in each

1. The standard errors of the wage equations are adjusted for the inclusion of the predicted sample selection terms. See Lee (1983) for more details on the multinomial logit selection model.

of four quarters, the number of days worked per month in each quarter, and the daily wage rate.[2]

While the overall survey was administered to a stratified random sample of 10,000 households, parental background information comes from a module that was administered to a randomly selected subsample of 5,000 households. The data used here are limited to that subsample. The earnings equation estimates are also limited to nonagricultural wage workers between the ages of 18 and 59, the age group that is likely to have regular employment in the government and SOEs. Table 1 provides descriptive statistics on the variables used in the earnings equations.

Table 2 shows the earnings equation estimates for males and females in the government, SOEs, and the private sector. While the earnings-experience profile has the usual concave shape in all three sectors, the profile has significantly more curvature in the private sector. Tenure (or seniority) is a significant determinant of earnings in all three areas. The returns to education are similar in the government and SOEs and are significantly higher than they are in the private sector (see Assaad 1997). While wages are roughly equal for males and females in the public sector, there is a large gender wage gap in the private sector. Therefore, female public sector workers are likely to have significantly higher displacement losses than their male counterparts.

An examination of the selection terms reveals negative selection into government employment for both males and females. This is consistent with the operation of the queue, which results in adverse selection into the government. By contrast, there is positive selection into the private sector, consistent with the operation of a more competitive labor market. There is no significant selectivity into SOEs.

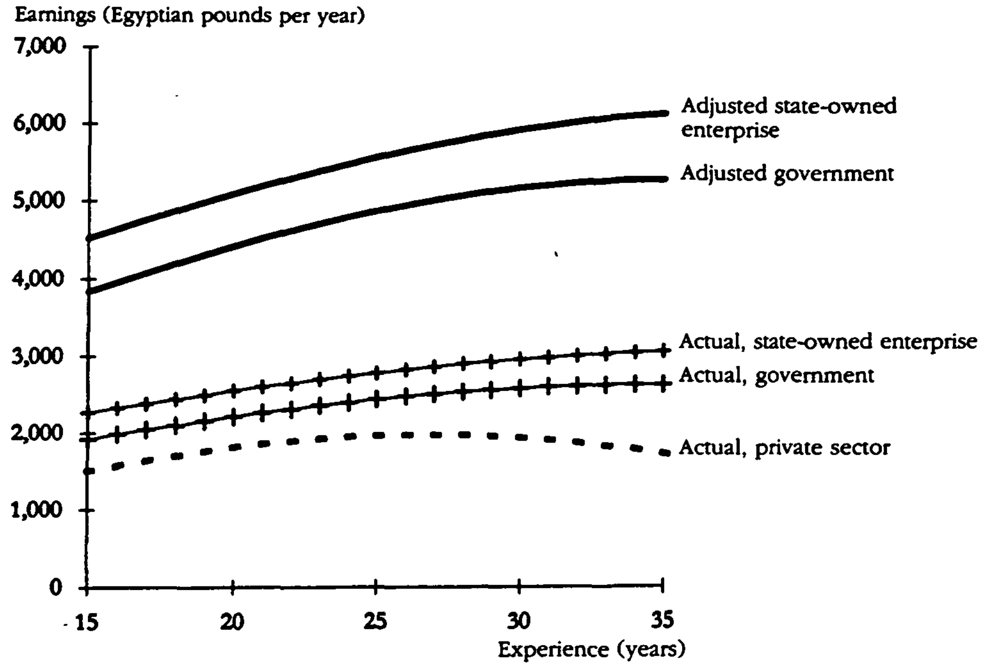
Figure 1 shows the expected earnings profile of a male worker in a white-collar occupation displaced from the government or an SOE after 15 years of tenure. The figure is based on actual parameter estimates from the earnings equations. In drawing an earnings profile, I assume that general labor market experience is transferable to the private sector but returns to seniority are not. However, the worker is assumed to begin accumulating seniority once the move to the private sector takes place. The adjusted government and SOE profiles shown in the figure include an estimate of the value of nonwage job attributes. The permanent losses experienced by workers displaced from the government or an SOE are therefore equal to the area between the relevant adjusted public sector curve and the private sector curve after taking discounting into account.

Nonwage Benefits in the Public Sector

As described in section I and the appendix, nonwage benefits are estimated indirectly by calculating the ratio of total compensation to monetary compensa-

2. The earnings module was designed by Mohaya Zaytoun, professor of economics at El-Azhar University, Cairo, Egypt. Overall technical direction for the special round of the Labor Force Sample Survey was provided by Nader Fergany, managing director of the Al-mishkat Center for Research and Training, Cairo, Egypt.

Figure 1. *Estimated Earnings Profiles for a Worker in a State-Owned Enterprise in Egypt*



Note: These estimated earnings profiles are for a male white-collar worker with secondary education who is displaced after 15 years of experience in the public sector. The adjusted profiles for government and state-owned enterprises include an estimate of the value of nonwage job attributes.
Source: Author's calculations.

tion (η) that sets lifetime rents to zero for a marginal group of public sector workers but yields positive rents for all other workers. Lifetime rents are defined here as the excess public sector compensation the worker obtains over a lifetime above his or her opportunity cost in the private sector. To find the estimated ratio of total compensation to monetary compensation, η, I first calculate a parameter η_j for a 12-cell classification of public sector workers who are recent entrants to the labor market. The parameter η_j is the multiple of the discounted lifetime earnings in the public sector career path that equates these earnings with the earnings the worker could have obtained in a private sector career path.[3] The group with the highest mean η_j is the marginal group, and its η_j is equated to η. The 12 cells are obtained by classifying workers by gender, educational level, and government or SOE affiliation. I could have used a finer classification that also classifies workers by region or urban-rural status, but that would have given cells with a very sparse number of observations for which estimates would be unreliable.

The base scenario has five assumptions. First, the discount rate is constant ($\rho = 0.05$). Second, the length of the queuing process (τ_u) is seven years for level-

3. In calculating the discounted lifetime earnings in the public sector path, I include a queuing period for level two and level three, when a worker obtains a specified fraction p of the private sector earnings.

Table 1. *Means and Standard Deviations for Variables in the Earnings Equations for Nonagricultural Wage Workers in Egypt, 1988*

	Males				*Females*			
Variable	*Government*	*State-owned enterprises*	*Private sector*	*All*	*Government*	*State-owned enterprises*	*Private sector*	*All*
Log annual earnings	7.09	7.41	6.89	7.08	6.81	7.00	6.32	6.73
	(0.675)	(0.592)	(1.005)	(0.828)	(0.722)	(0.954)	(1.149)	(0.895)
Experience (years)	18.9	20.6	13.7	17.2	9.89	11.9	6.88	9.48
	(11.6)	(11.0)	(10.2)	(11.3)	(8.31)	(8.74)	(8.21)	(8.48)
Tenure (years)	13.8	14.7	4.80	10.5	9.17	11.0	3.64	8.17
	(10.7)	(10.3)	(7.39)	(10.5)	(8.18)	(8.38)	(7.01)	(8.33)
Educational attainment								
Illiterate (reference category)	0.124	0.185	0.302	0.206	0.031	0.075	0.308	0.099
	(0.330)	(0.388)	(0.459)	(0.404)	(0.172)	(0.263)	(0.462)	(0.298)
Read and write	0.146	0.236	0.195	0.184	0.010	0.037	0.055	0.023
	(0.353)	(0.425)	(0.397)	(0.388)	(0.097)	(0.191)	(0.229)	(0.151)
Primary	0.064	0.092	0.084	0.078	0.006	0.075	0.049	0.025
	(0.245)	(0.289)	(0.277)	(0.268)	(0.076)	(0.264)	(0.217)	(0.155)
Preparatory	0.040	0.074	0.101	0.071	0.017	0.047	0.077	0.035
	(0.197)	(0.262)	(0.301)	(0.257)	(0.130)	(0.212)	(0.267)	(0.183)
General secondary	0.033	0.028	0.048	0.038	0.017	0.056	0.038	0.027
	(0.179)	(0.166)	(0.213)	(0.190)	(0.130)	(0.231)	(0.193)	(0.163)
Vocational secondary, all	0.232	0.197	0.170	0.201	0.469	0.467	0.264	0.423
	(0.422)	(0.398)	(0.376)	(0.401)	(0.499)	(0.499)	(0.441)	(0.494)
Vocational secondary, blue collar	0.016	0.062	0.113	0.063	0.004	0.093	0.077	0.032
	(0.124)	(0.241)	(0.317)	(0.243)	(0.062)	(0.292)	(0.267)	(0.176)
Vocational secondary, white collar	0.217	0.136	0.057	0.138	0.466	0.374	0.187	0.391
	(0.412)	(0.343)	(0.232)	(0.345)	(0.499)	(0.486)	(0.391)	(0.488)
Technical institute	0.077	0.030	0.024	0.047	0.134	0.037	0.033	0.099
	(0.267)	(0.171)	(0.153)	(0.211)	(0.341)	(0.191)	(0.179)	(0.298)
University and above	0.283	0.158	0.076	0.177	0.316	0.206	0.176	0.270
	(0.451)	(0.365)	(0.265)	(0.381)	(0.465)	(0.406)	(0.382)	(0.444)

Region of residence								
Greater Cairo (reference category)	0.231	0.387	0.376	0.320	0.307	0.533	0.544	0.390
	(0.422)	(0.487)	(0.484)	(0.467)	(0.461)	(0.499)	(0.498)	(0.488)
Alexandria and Suez Canal	0.085	0.197	0.125	0.124	0.151	0.215	0.159	0.162
	(0.280)	(0.398)	(0.331)	(0.330)	(0.359)	(0.413)	(0.367)	(0.368)
Urban Lower Egypt	0.145	0.137	0.148	0.144	0.224	0.150	0.110	0.189
	(0.352)	(0.344)	(0.355)	(0.352)	(0.417)	(0.358)	(0.314)	(0.391)
Urban Upper Egypt	0.171	0.046	0.086	0.112	0.151	0.019	0.049	0.111
	(0.377)	(0.209)	(0.280)	(0.315)	(0.359)	(0.136)	(0.217)	(0.314)
Rural Lower Egypt	0.216	0.165	0.176	0.190	0.138	0.047	0.099	0.117
	(0.412)	(0.372)	(0.381)	(0.392)	(0.345)	(0.212)	(0.299)	(0.322)
Rural Upper Egypt	0.152	0.067	0.090	0.110	0.029	0.037	0.038	0.032
	(0.359)	(0.250)	(0.286)	(0.313)	(0.167)	(0.191)	(0.193)	(0.176)
Job-related variables								
Intermittent employment			0.373				0.148	
			(0.484)				(0.356)	
Work outside establishments			0.386				0.187	
			(0.487)				(0.391)	
Selection term (λ)	0.701	1.231	0.670	0.800	0.389	1.382	0.839	0.621
	(0.420)	(0.334)	(0.481)	(0.484)	(0.335)	(0.422)	(0.576)	(0.540)
Number in sample	1,089	568	1,050	2,707	522	107	182	811
Number in population (thousands)	1,897	1,018	1,904	4,820	866	193	366	1,395

Note: All variables except log annual earnings, experience, tenure, and the selection term are dummy variables. Standard deviations are in parentheses.
Source: Author's calculations based on survey data.

Table 2. *Selectivity-Corrected Earnings Equation Estimates for Nonagricultural Wage Workers in Egypt, 1988*

	Males			*Females*		
Variable	*Government*	*State-owned enterprises*	*Private sector*	*Government*	*State-owned enterprises*	*Private sector*
Constant	6.447***	6.528***	6.116***	6.079***	5.713***	5.706***
	(38.48)	(37.11)	(52.22)	(26.12)	(10.08)	(26.80)
Experience	0.047***	0.039***	0.084***	0.039***	0.131***	0.075***
	(8.83)	(5.28)	(8.19)	(2.99)	(3.25)	(2.78)
Experience² / 100	–0.081***	–0.057***	–0.199***	–0.116***	–0.232**	–0.279***
	(–7.79)	(–3.91)	(–9.26)	(–3.91)	(–2.41)	(–3.12)
Tenure	0.021***	0.013***	0.023***	0.043***	–0.001	0.045***
	(8.77)	(4.47)	(5.55)	(4.22)	(–0.03)	(2.55)
Educational attainment[a]						
Read and write	0.072	0.165***	0.024	0.414	–0.339	0.309
	(1.24)	(2.69)	(0.31)	(1.58)	(–0.75)	(0.89)
Primary	0.084	0.168**	0.086	0.128	–0.041	0.215
	(1.10)	(2.16)	(0.77)	(0.40)	(–0.10)	(0.58)
Preparatory	0.222**	0.284***	–0.217	0.110	0.492	–0.467
	(2.52)	(3.29)	(–0.20)	(0.51)	(1.16)	(–1.49)
General secondary	0.215**	0.671***	–0.460***	0.432**	0.849**	0.075
	(2.15)	(5.47)	(–3.19)	(2.01)	(2.09)	(0.18)
Vocational secondary, blue collar	0.536***	0.631***	0.056	–0.799*	0.963***	–0.074
	(3.94)	(6.64)	(0.42)	(–1.89)	(2.64)	(–0.21)
Vocational secondary, white collar	0.324***	0.532***	0.148	0.262	0.693**	–0.331
	(4.33)	(7.13)	(0.95)	(1.63)	(2.30)	(–1.02)
Technical institute	0.298***	0.615***	–0.114	0.133	0.081	–0.530
	(3.00)	(5.05)	(–0.52)	(0.73)	(0.19)	(–1.05)
University and above	0.586***	1.062***	0.578***	0.591***	0.720**	0.785**
	(6.50)	(14.73)	(3.44)	(3.56)	(2.34)	(2.57)

Region of residence[b]						
Alexandria and Suez Canal	–0.071	–0.201***	0.005	0.027	0.094	–0.092
	(–1.18)	(–3.68)	(0.06)	(0.37)	(0.53)	(–0.45)
Urban Lower Egypt	–0.278***	–0.149**	–0.292***	–0.085	0.041	–0.619***
	(–5.13)	(–2.43)	(–3.49)	(–1.14)	(0.20)	(–2.53)
Urban Upper Egypt	–0.332***	–0.072	–0.584***	–0.051	–0.315	–0.392
	(–5.13)	(–0.65)	(–5.51)	(–0.53)	(–0.53)	(–1.08)
Rural Lower Egypt	–0.434***	–0.140**	–0.218***	–0.241***	0.012	0.060
	(–7.61)	(–2.27)	(–2.69)	(–2.65)	(0.03)	(0.23)
Rural Upper Egypt	–0.454***	0.075	–0.293***	–0.195	–0.175	–0.671*
	(–6.59)	(0.84)	(–2.80)	(–1.34)	(–0.48)	(–1.72)
Selection term (λ)	–0.227***	–0.087	0.348***	–0.342***	–0.234	0.397
	(–3.06)	(–0.92)	(3.32)	(–2.82)	(–0.91)	(2.05)
R^2	0.471	0.439	0.290	0.457	0.502	0.305
Sample size	1,089	568	1,050	522	107	182

* Significant at 10 percent.

** Significant at 5 percent.

*** Significant at 1 percent.

Note: The dependent variable is the log of annual earnings. Standard errors are adjusted for the inclusion of the predicted selection term. *t*-ratios are in parentheses.

a. Illiterate is the reference category.

b. Greater Cairo is the reference category.

Source: Author's calculations based on survey data.

Table 3. *Selected Measured and Estimated Variables for Public Sector Workers by Educational Level in Egypt, 1988*

	Government				*State-owned enterprises*			
Variable	*Level one*	*Level two*	*Level three*	*All*	*Level one*	*Level two*	*Level three*	*All*
Males								
Percentage of public sector workforce	18.6	16.0	13.1	47.7	14.6	6.5	4.5	25.6
Average tenure (years)	17	12	12	14	17	12	12	15
Average monthly salary (Egyptian pounds)	94	102	148	111	120	154	249	151
Ratio of private to public discounted lifetime earnings	1.51	1.21	1.41	1.38	1.28	1.11	1.25	1.23
η_i[a]	1.93	1.22	1.41	1.41	1.42	1.07	1.17	1.24
Average displacement losses (Egyptian pounds)	4,978	14,251	17,160	11,430	7,625	21,430	29,957	15,056
Average losses in monthly salaries (months)	53	140	116	103	64	139	120	100
Number of observations	408	373	308	1,089	333	145	90	568
Females								
Percentage of public sector workforce	1.4	13.5	6.9	21.8	1.0	2.8	1.0	4.9
Average tenure (years)	13	9	8	9	12	10	13	11
Average monthly salary (Egyptian pounds)	63	85	111	92	81	129	193	133
Ratio of private to public discounted lifetime earnings	1.17	0.54	1.14	0.77	1.20	0.64	2.03	1.05
η_i[a]	1.40	0.57	1.17	0.79	1.51	0.68	2.33	1.07
Average displacement losses (Egyptian pounds)	7,878	21,519	25,163	21,810	11,817	32,702	15,234	24,658
Average losses in monthly salaries (months)	125	253	228	238	147	254	79	186
Number of observations	33	324	165	522	25	60	22	107
All								
Percentage of public sector workforce	20.0	29.6	20.0	69.5	15.6	9.3	5.6	30.5
Average tenure (years)	17	11	10	12	16	11	12	14
Average monthly salary (Egyptian pounds)	92	94	135	105	117	146	238	148
Ratio of private to public discounted lifetime earnings	1.48	0.90	1.32	1.19	1.27	0.97	1.40	1.20
η_i[a]	1.89	0.92	1.33	1.13	1.42	0.95	1.39	1.20
Average displacement losses (Egyptian pounds)	5,177	17,579	19,918	14,683	7,893	24,850	27,200	16,588
Average losses in monthly salaries (months)	56	187	147	140	67	170	114	112
Number of observations	441	697	473	1,611	358	205	112	675

Note: Level one refers to workers with less than a secondary school certificate. Level two refers to workers with a secondary or technical institute certificate. Level three refers to workers with a university or graduate certificate.

a. η_i is the ratio of private to public discounted lifetime earnings limited to workers who are 35 or younger.

Source: Author's calculations based on survey data.

two workers and six years for level-three workers. Third, queuing involves a total loss of private sector earnings (p) for females and the loss of half of potential earnings for males ($p = 0.5$ for males and $p = 0$ for females). Fergany (1991) attributes the higher proportion of new entrants among unemployed females to the fact that males are more likely to engage in marginal or occasional economic activities while waiting for government employment. Fourth, nonwage benefits are proportional to wages. And fifth, an age cutoff of 35 is used to identify recent entrants to the public sector. To the extent possible, I assess the consequences of these assumptions on the estimates obtained.

The ratio of the discounted stream of monetary earnings in the private and public sectors and the parameter η_j, which is closely related to it, are shown in table 3 for each of the 12 cells and for all workers. The group with the highest ratio (and the highest η_j) consists of female SOE workers with level-three (university) education ($\eta_j = 2.33$), followed by male government workers with level-one (less than secondary) education ($\eta_j = 1.93$). Among workers 35 and under, there are only 8 observations in the sample in the first group and 84 observations in the second group. The first group engages in costly queuing, but the second does not. All other groups have much smaller ratios than these two groups. Government wages and benefits are therefore just sufficient to attract these two categories of workers to public sector employment. Given the relative imprecision of these estimates and the sparse number of observations in the first group, I use $\eta = 2$ as the baseline ratio of total compensation to monetary compensation in the public sector.

Because the ratio of nonwage benefits is an important parameter in the subsequent analysis, it is worth doing a sensitivity analysis to determine its robustness to the various assumptions made. First, I test the extent to which the rankings of the various groups and the estimate of η change when the age cutoff is increased or decreased. At an age cutoff of 30, the same two groups of workers emerge as the lowest-lifetime-rent workers, with $\eta_j = 2.28$ for male government workers with level-one education (38 observations) and $\eta_j = 2.52$ for female SOE workers with level-three education (5 observations). At an age cutoff of 40, the ranking remains the same, with $\eta_j = 1.75$ for male government workers with level-one education (164 observations) and $\eta_j = 2.18$ for female SOE workers with level-three education (14 observations). Thus the estimate of η ranges from 1.8 to 2.5, depending on the choice of age cutoff. Younger age cutoffs yield very sparse cells and therefore increasingly unreliable estimates. Older age cutoffs may include workers who entered the public sector facing significantly different wage schedules.

Second, I test for robustness to the assumptions relating to the length of queuing (τ_u) and the cost of queuing (p). Shorter queuing time and less costly queuing raise the lifetime rents of level-two and level-three workers but do not affect the rent of level-one workers, who are assumed not to queue. Shorter and less costly queuing may increase the rents of female level-three workers to the point where they are no longer the lowest-rent workers but does not displace male level-one government workers from their position among the lowest-rent workers. Thus the robustness of the estimate needs to be tested only for longer and more costly queuing. To increase the cost of queuing to a maximum, I set the fraction of private sector earnings that can be earned while queuing (p) to zero and the length of the queuing period (τ_u) to 10 years for level-two workers and 9 years for level-three workers. Despite these changes, the two groups with the lowest lifetime rents (highest η_i) remain the same. Increasing the queuing time to 9 and 10 years raises the η_i of female SOE workers with level-three education only marginally, to 2.56 at an age cutoff of 35.

Sensitivity analysis on the discount rate shows that the marginal groups of workers remain the same for a range of discount rates from 0.03 to 0.07 and that η stays well within the range of 1.8 to 2.5. Finally, the assumption that the ratio of nonwage benefits is invariant across the two segments of the public sector is not important because a group of marginal workers is identified in each of the two subsectors and both give roughly similar estimates for η.

These sensitivity tests suggest that the identification of a marginal group of workers and the estimate of η are fairly robust to changes in the assumptions. I use $\eta = 2.0$ as the baseline estimate but also discuss results for a low estimate of $\eta = 1.8$ and a high estimate of $\eta = 2.5$.

Displacement Losses

Once the ratios of total compensation to monetary compensation (η) are obtained, the estimation of worker-specific displacement losses is fairly straightforward using equation A-7 in the appendix. Table 3 shows the average estimated displacement losses for the 12-cell classification and for all workers. The average losses of SOE workers are about £E16,600 (the equivalent of 112 months of salary), compared with £E14,680 (140 months of salary) for government workers. (The Egyptian pound, £E, was worth US$0.30 in 1988.) In general, displacement losses for female workers in both the government and SOE sectors are significantly higher than those of their male counterparts, with the exception of level-three female workers in SOEs.

Displacement losses tend to be significantly higher for workers with secondary and postsecondary education than for workers with lower levels of education but do not increase much between the secondary and university levels. Losses of level-two SOE workers are more than three times as high as those of level-one workers, whereas those of level-three workers are only 9 percent higher than those of level-two workers. Among women, level-two SOE workers have the highest displacement losses, £E32,700 (254 months of salary). These patterns reflect the differential premiums placed on various levels of education in the private and public sectors. While public sector workers receive significant returns to secondary education, the private sector places little value on it, resulting in high displacement losses for workers at that level of education (see table 3). At the tertiary level, the returns to education continue to be higher in the public sector but are nonetheless significant in the private sector, especially for women (see

Assaad 1997 for a more extensive discussion of the returns to education in the private and public sectors in Egypt).

The significant difference in displacement losses between workers at different levels of education has important implications for the design of severance pay programs. If the same package of benefits is offered to all workers to achieve a certain rate of exit, the likely outcome is that all level-one workers, who tend to have lower losses, will exit first, leading to a highly distorted occupational structure. Some control can be achieved over the composition of the exiting workers by setting up separate programs for each level of education. This is the approach pursued below.

The losses of SOE workers at each level of education are significantly higher than those of government workers, with the exception of level-three female workers. This reflects the sharper erosion in real wages experienced by government workers compared with SOE workers in recent years, making the compensation of government workers more comparable to what they can get in the private sector. Because of compositional differences, however, the losses of the average worker in the government and SOEs are comparable. Level-one workers, who have relatively low losses, make up more than half of the SOE workforce but only a quarter of government employment.

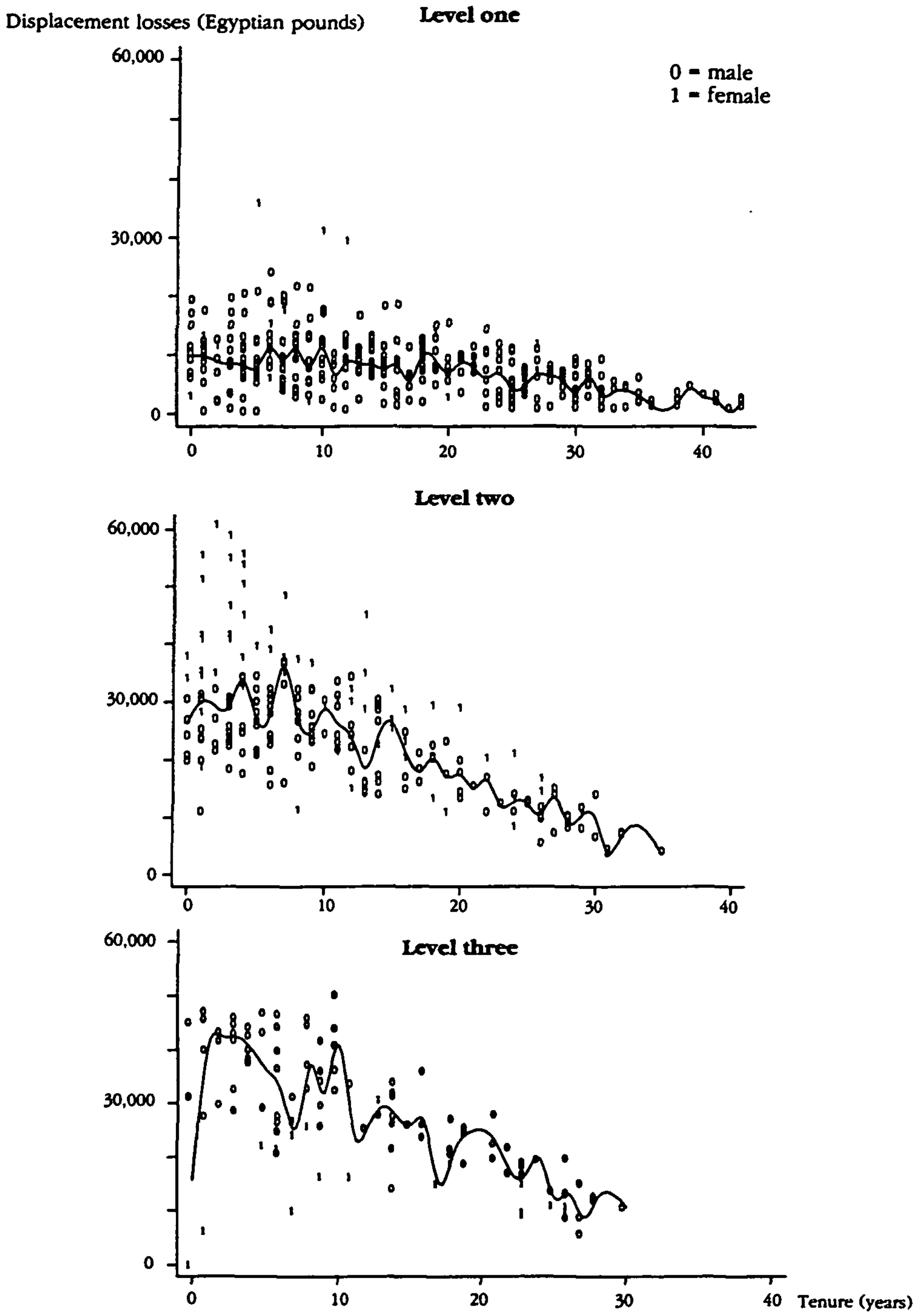
Figure 2 plots the estimated displacement losses against tenure in the public sector for SOE workers at different levels of education using base case assumptions. The solid line is a cubic spline that connects the median losses at each level of tenure. Because displacement losses are equal to the area between the public and private sector earning profiles up to retirement age, they must fall to zero as the worker approaches retirement, as shown on the figure. Moreover, because discounting reduces losses experienced far into the future, losses may first increase as workers gain seniority and then begin falling as the years of denied service decline. In all panels except for that of level-three SOE workers, females have higher losses, as indicated by the higher density of "1s" above the median line than below it.

These profiles reveal that severance schemes that positively index payments on tenure, such as those that pay a given number of monthly wages per year of tenure, are fiscally costly because they pay the highest compensation to the workers with the lowest losses. Schemes that index on years of denied service do a better job of tracing these estimated loss profiles and therefore may be more cost-effective. Section III evaluates various severance pay schemes on the basis of how well they match compensation payments to worker losses.

Sensitivity of the Loss Estimates

Here I analyze the sensitivity of the loss estimates to the estimate of nonwage benefits. Varying η over a range from 1.8 to 2.5 while keeping it constant across workers will change the magnitude of displacement losses, but will it change the rankings of various groups of workers within the 12-cell classification and affect the shape of the loss-tenure profiles shown in figure 2? As expected, the magni-

Figure 2. *Estimated Displacement Losses and Job Tenure by Educational Level for Workers in State-Owned Enterprises in Egypt, Base Case*



Note: The solid line is a cubic spline that connects the median losses at each level of tenure.
Source: Author's calculations.

tude of displacement losses varies significantly for the average SOE worker as η goes from 1.8 to 2.5. Losses change from £E13,925 to £E23,285 as compared with £E16,588 in the base case ($\eta = 2$). However, the ordinal ranking of losses in the 12-cell classification of workers by gender, education, and subsector changes very little. Furthermore, other than a change in scale, the shape of the loss-tenure profile shown in figure 2 for the base case changes very little as η is altered.[4]

Do the estimates of worker losses differ under the assumption that nonwage benefits are a constant amount per year for all workers? I use a methodology similar to that described in section II to calculate the constant amount. Rather than finding the maximum multiple of monetary earnings that equates lifetime compensation in the public and private sectors, I find the maximum additive shift that does so. The same two groups—female level-three SOE workers and male level-one government workers—show up as marginal. Under the other baseline assumptions, the size of lifetime nonwage benefits turns out to be £E13,370 for level-one male government workers and £E28,890 for level-three female SOE workers. On the basis of these estimates, I use an additive shift of £E28,900 on lifetime earnings to calculate an alternative set of displacement losses. This additive shift is prorated by the amount of time each worker has left in the public sector.

Although the assumption that nonwage benefits are constant for all workers is somewhat unrealistic, it gives a sufficiently different pattern of nonwage benefits across workers compared with the base case of benefits proportional to earnings. Some of the consequences of this change in assumptions are obvious: the losses of low-wage workers increase and those of high-wage workers decrease. In fact, the losses of male level-three SOE workers, the highest-paid category of worker, fall 47 percent and those of male level-one government workers increase 21 percent. Less expected is the fact that female losses change significantly less than male losses. Losses decline 9 percent for females compared with 25 percent for males. This is due to the fact that female workers in the sample are generally younger and therefore tend to have a longer period of constant nonwage benefits per year to look forward to in the public sector than males.

Because of the compression of the loss profile across educational levels and the increasing gender gap, the ordinal rankings of losses change. The highest-loss group continues to be females with level-two education in the SOE sector. However, they are now followed in second place by female level-two workers in the government rather than male level-three SOE workers. With this way of estimating nonwage benefits, level-two workers have higher losses than level-three workers for both males and females. An examination of the loss-tenure profiles shows that with the exception of a change in scale and some minor variations in pattern, they are essentially similar to those obtained using the base case as-

4. The results for different values of η are available from the author.

sumptions. Because most severance pay schemes tend to index on tenure, years of denied service, or age, the invariance of these profiles to the way nonwage benefits are estimated is what really matters.

III. Simulation of Severance Pay Schemes Based on Alternative Indexation Formulas

In the presence of heterogeneous workers, appropriate indexation of the severance payment to observed differences in worker attributes should in theory reduce the cost of the program for a given desired rate of exit. A uniform compensation package will be fiscally costly because it must be set at a level that compensates the worker with the largest losses among those who exit. As a result, it would end up overcompensating most workers who accept the package. However, compensation schemes that index on the wrong variables or that set the wrong parameters for the severance pay formulas could cost even more than a uniform payment scheme. For instance, a scheme that indexes on tenure rather than years of denied service costs more than a uniform payment scheme because the tenure scheme pays the most to workers who are close to retirement.

Furthermore, the loss-tenure profiles indicate that losses include a fixed component as well as a variable (or indexed) component. Payment schemes that set compensations on a purely variable basis may perform worse than schemes that have both a fixed and a variable component. Finally, compensation plans that separate out workers who are close to retirement and give them the option of early retirement are likely to perform better than ones that apply the same indexation rule to all workers.

In the subsequent analysis, the uniform payment scheme, which is the simplest scheme to implement, will serve as a benchmark for comparison of the various formulas. For another useful benchmark—the perfect indexation benchmark—the payment is set at the estimated losses obtained in section II. The analysis consists of several simulations that optimize the parameters of alternative severance pay formulas to achieve the desired rate of voluntary exits in each of three educational groups at the lowest possible cost. The average cost per retrenched worker and the total cost of the program under each of these alternatives are then compared with the two benchmarks. The effect of each program on the composition of the exiting and remaining workforces is also investigated. Although it is possible in practice to set different exit rates for each educational level or for that matter for various other categories of workers, for the purposes of this analysis the target exit rate is set at 30 percent for each of the three levels.

I start with severance pay schemes that apply to all workers within each of the three educational categories and then consider schemes that offer an early retirement option for workers 50 years and older and a regular severance package for workers below that age. In all cases, the payment amount is calculated as if it were a lump-sum payment, but this does not preclude various payment methods, including annuities, combinations of annuities and lump sums, and pension payments.

A worker is assumed to exit if the compensation the worker receives under any of the programs equals or exceeds the estimated loss from displacement. For any given level of the fixed payment C_j, the coefficient c_j is set at the minimum level that achieves the desired exit rate, namely 30 percent of the workers at each educational level. The value of the fixed payment C_j is optimized by selecting the value that minimizes the average cost of severance per retrenched worker under the *j*th formula. Because different programs are implemented at each level of education, different parameters are computed at each level for each severance pay formula.[5]

Schemes without Provisions for Early Retirement

Here I discuss the uniform payment scheme and five severance pay schemes. First, under a uniform payment scheme, there is no indexation. The scheme (formula 1) is characterized by $C = C_1$. This is the simplest possible scheme and serves as the high-cost benchmark. The analysis considers separate programs at the three levels of education so that the payment is indexed only on education. Any program that results in a higher cost per retrenched worker is probably not worth considering. The uniform payment is set at a level that would just compensate workers whose losses are equal to the 30th percentile of the loss distribution at each level of education.

Formula 2 has a fixed payment plus a given amount per year of denied service, so that $C = C_2 + c_2 (60 - Age)$. In this scheme, the amount of compensation declines with tenure and thus captures some of the negatively sloped portion of the loss profiles shown in figure 2.

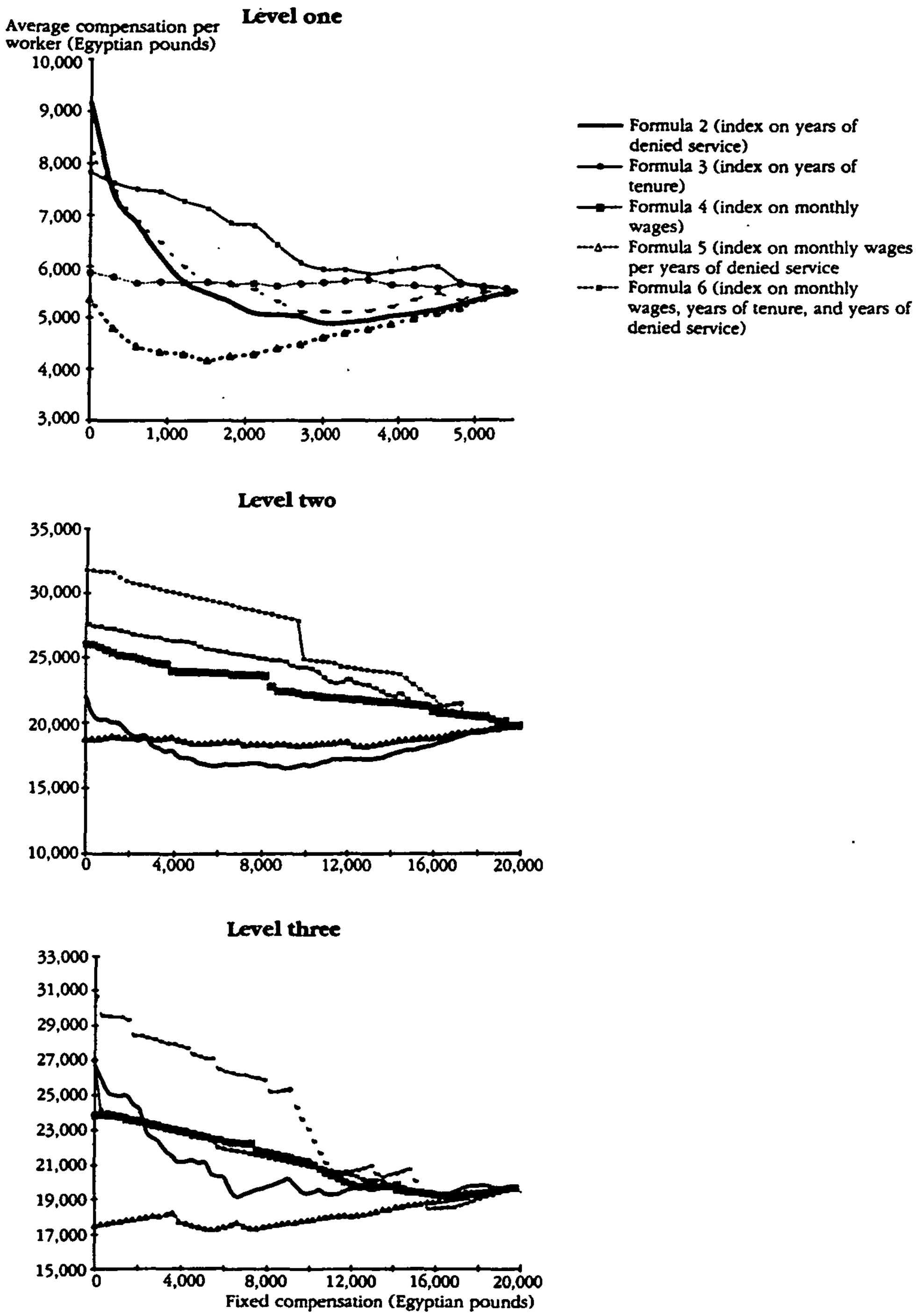
Formula 3 has a fixed payment plus a given amount per year of tenure. That is, $C = C_3 + c_3N$, where N is years of tenure. Positive indexation by tenure is a common feature of severance programs. This is the simplest such scheme. It may capture the loss profile of younger workers fairly well, but it does a poor job of matching the declining losses with the tenure of older workers. It therefore overcompensates those workers. A more common variant of this formula is to index on wage and tenure by paying a certain number of monthly wages per year of tenure. An example of such a program is the Leather Corporation package in Sri Lanka discussed in Fiszbein (1992). I tried this variant, but it produced results that were clearly inferior to the basic scheme from a cost point of view.

Formula 4 has a fixed payment plus a given number of monthly wages. $C = C_4 + c_4\hat{W}_G$, where $\hat{W}_G$ is the estimated monthly government wage. Linking compensation payments to monthly wages is quite common. This formula explores that linkage independent of the role of tenure or years of denied service. Here again, the most senior workers receive the highest compensation, even though they have the lowest losses.

Formula 5 has a fixed payment plus a given number of monthly wages per year of denied service, so that $C = C_5 + c_5\hat{W}_G(60 - Age)$. This scheme attempts to

5. The parameter values are available from the author.

Figure 3. *Average Compensation per Retrenched Worker and the Fixed Component of Severance Pay by Educational Level in Egypt, Base Case*



Note: See text and table 4 for more details on the severance pay formulas.
Source: Author's calculations.

mimic the curvature in the loss profile by linking compensation positively to wages, which are an increasing function of tenure, and to years of denied service, which are a decreasing function of tenure.

Formula 6 has a fixed payment plus a multiple of the monthly wage times years of tenure times years of denied service. That is, $C = C_6 + c_6 \hat{W}_{GN}(60 - Age)$. This is the most complicated of the severance pay formulas considered. A variant of this formula was used in the Bulmulla package in Sri Lanka (see Fiszbein 1992).

As mentioned above, the simulation exercise consists of optimizing the parameters of each severance pay formula to achieve the target exit rate through voluntary exits at the lowest cost. Figure 3 shows the average cost per retrenched worker and the fixed component of the severance payment (C_j) for the various severance pay formulas being considered. Each point on any given curve is the result of an optimization process that sets the multiple of the relevant index (c_j) to the minimum required for achieving the exit target. The point at the extreme right side of each chart where all the lines meet is the point for which the entire compensation is fixed. This is therefore the payment level under formula 1, the uniform payment benchmark. The extreme left of each chart represents a purely variable compensation in which the fixed component is set to zero.

The results summarized in figure 3 show that some commonly used severance pay formulas are always more costly than the fixed payment benchmark. These include formulas 3 and 4, which index on tenure or monthly wage. The results from a formula that indexes on both monthly wages and tenure are not shown but behave in very much the same way. Adding years of denied service to the index (formula 6) reduces the costs somewhat for level-one workers but performs worse than the uniform payment benchmark for level-two and level-three workers. Purely variable compensation payments, which are commonly used in severance programs, generally perform poorly as well. Under most formulas, compensation costs rise as the fixed payment approaches zero.

As expected from examining the shape of the loss-tenure profile, the best-performing formulas are those that index either on years of denied service alone or on years of denied service and monthly wage (formulas 2 and 5). Formula 5 performs best for level-one and level-three workers, and formula 2 performs best for level-two workers, but formula 5 is a close second. The best combination of fixed and variable payments appears to have a fixed component that makes up from one-third to half of the total payment.

Table 4 shows the average cost per worker and the total cost of the program at the optimum (lowest-cost) point for the various severance pay formulas, the full indexation benchmark, and the fixed payment benchmark. Next to the full indexation benchmark (formula 0), the lowest-cost scheme is the one based on formula 5. This can achieve the 30 percent exit target at a cost of £E10,876 per worker or a total cost of £E3.98 billion to exit 370,000 workers. The cost per worker under this formula ranges from £E4,159 for level-one workers to more than £E17,000 for level-two and level-three workers. Indexation with formula 5 can thus achieve savings of about 13 percent over the uniform payment bench-

Table 4. *Cost of Compensation Programs under Alternative Severance Pay Formulas*
(Egyptian pounds)

	Cost per retrenched worker				*Total cost of program (millions)*			
Formula number and description	*Level one*	*Level two*	*Level three*	*All*	*Level one*	*Level two*	*Level three*	*All*
0 Full indexation	2,735	12,301	12,966	7,555	500	1,310	853	2,663
1 Fixed payment	5,518	19,808	19,696	12,513	1,039	2,231	1,354	4,624
2 Fixed payment and multiple of years of denied service	4,889	16,463	19,137	11,068	917	1,832	1,280	4,029
3 Fixed payment and multiple of years of tenure	5,567	19,783	19,243	12,446	1,041	2,212	1,291	4,544
4 Fixed payment and multiple of monthly wages	5,569	19,761	19,114	12,416	1,048	2,210	1,282	4,540
5 Fixed payment and multiple of monthly wages times years of denied service	4,159	18,187	17,276	10,876	775	2,029	1,178	3,982
6 Fixed payment and multiple of monthly wages, years of tenure, and years of denied service	5,103	19,771	18,451	12,058	970	2,211	1,238	4,419
Number of exiters (thousands)	188	113	69	369	188	113	69	369

Note: The calculations are based on a 30 percent exit target. Level one refers to workers with less than a secondary school certificate. Level two refers to workers with a secondary or technical institute certificate. Level three refers to workers with a university or graduate degree. The optimal parameters C_j and c_j for each alternative j are available from the author.

Source: Author's calculations based on survey data.

mark, with the greatest savings being obtained for level-one workers. Formula 2 is a close second at £E11,068 per worker and £E4.03 billion overall. A slightly better performance (£E10,351 per worker and £E3.79 billion overall) can be achieved by combining formula 5 for level-one and level-three workers with formula 2 for level-two workers. It should be kept in mind, however, that even if the same formula is used for all three levels of education, the optimal parameters would be significantly different. For instance, the optimal parameters for formula 5 are £E1,500 plus 2.25 monthly salaries per year of denied service for level-one workers, £E12,600 plus 1.83 monthly salaries per year of denied service for level-two workers, and £E5,400 plus 3.15 monthly salaries per year of denied service for level-three workers.

As indicated in figure 3, formulas 3, 4, and 6 perform no better than a fixed payment in most cases. Moreover, all of the severance pay schemes fall well short of the savings that are possible with full indexation. The best-performing formula among these commonly used schemes (formula 5) exceeds the full indexation benchmark by nearly 45 percent.

I conducted a sensitivity analysis to test the robustness of these results to different estimates of nonwage benefits. The level of compensation changes depending on the size of η and on whether nonwage benefits are proportional to wages or simply constant. However, the interesting issue is whether the relative performance of the various formulas changes. Varying η from 1.8 to 2.5 produces charts virtually identical to those shown in figure 3, except for a change in scale.[6] Assuming that nonwage benefits are constant rather than proportional to wages produces slightly different shapes, but the ranking of the performance of each of the five severance pay formulas remains the same. Thus, although the magnitude of the estimates of compensation costs varies depending on how nonwage benefits are estimated, the conclusions on the relative performance of each formula are robust to different estimation methods.

Schemes with Early Retirement Provisions

The early retirement schemes offer separate severance packages for workers age 50 and above and for those below age 50 to take advantage of the declining losses of workers approaching retirement. Under Egyptian social security regulations, workers who are 50 or above can still receive a retirement pension if they retire early. However, their pensions are reduced significantly compared with what they would receive if they retired at age 60. The amount of reduction is determined by a complicated formula that distinguishes between basic and variable components of the wage. The rules are described in some detail in Assaad (1996). Based on a detailed analysis of workers in the Delta Spinning and Weaving Company, the loss of benefits amounts to 66 percent of full benefits at age 50, 57 percent at age 53, and 40 percent at age 57 (Integrated Development Consultants 1994: table B.5).

6. The figures are not shown here but are available from the author.

Table 5. *Cost of Compensation Programs with an Early Retirement Option*
(Egyptian pounds unless otherwise noted)

Retirement scheme	*Exit rate (percent)*	*Average cost per retrenched worker* Level one[a]	Level two[b]	Level three[c]	All	*Total cost of program (millions)* Level one[a]	Level two[b]	Level three[c]	All
Target 70 percent for early retirement									
Workers age 50 and over[d]	72	2,594	6,014	12,336	6,205	273	117	212	601
Workers under age 50	22[e]	6,240	18,441	19,069	9,470	513	1,736	979	3,228
All	30	4,194	16,316	17,379	8,217	786	1,853	1,191	3,829
Target 80 percent for early retirement									
Workers age 50 and over[d]	82	2,918	6,526	12,939	6,846	349	143	257	749
Workers under age 50	21[e]	5,813	18,220	18,300	9,035	397	1,671	893	2,961
All	31	3,969	15,964	16,749	8,080	746	1,814	1,150	3,710
Target 90 percent for early retirement									
Workers age 50 and over[d]	91	3,473	6,854	13,291	7,485	468	156	282	906
Workers under age 50	19[e]	5,209	17,998	18,322	8,399	277	1,629	854	2,760
All	30	3,965	15,753	16,748	7,956	745	1,785	1,136	3,667
Target 100 percent for early retirement									
Workers age 50 and over[d]	100	4,080	7,269	13,456	8,220	607	182	298	1,087
Workers under age 50	17[e]	4,450	17,790	17,775	7,657	170	1,535	799	2,503
All	30	4,156	15,428	16,368	7,958	777	1,717	1,097	3,590
Number of workers (thousands)									
Age 50 and over		149	25	22	196	149	25	22	196
Under age 50		472	344	199	1,016	472	344	199	1,016
All		621	369	221	1,212	621	369	221	1,212

Note: Level one refers to workers with less than a secondary school certificate. Level two refers to workers with a secondary or technical institute certificate. Level three refers to workers with a university or graduate degree. The optimal parameters C_j and c_j for each alternative j are available from the author. For severance pay formulas, see the text and table 4.

a. Indexation formula 4 was optimal for level-one workers under age 50.
b. Indexation formula 2 was optimal for level-two workers under age 50.
c. Indexation formula 5 was optimal for level-three workers under age 50.
d. Indexation formula 7 (defined in the text) was used for workers age 50 and above.
e. Based on the All category for the three levels.

Source: Author's calculations based on survey data.

Assuming that workers 50 and older would voluntarily retire early if they were offered full retirement benefits, one approach would be to offer them a compensation package equal to the present value of the lost benefits they and their survivors would incur for as long as they receive pension benefits. Integrated Development Consultants (1994) pursues this approach but does not take into account the losses incurred due to lost benefits after retirement. However, for some workers, retirement, even with full benefits, may not be more desirable than continuing to work. Indeed, retirement at age 60 is mandatory rather than voluntary. Moreover, it may be very difficult to calculate the value of lost benefits. The calculation would require detailed actuarial information on the expected life span of the retirees and their spouses to calculate the duration over which losses are incurred.

Rather than rely on an approach that compensates workers for lost benefits, I use an opportunity-cost approach that implies matching the compensation to the individual-specific losses as estimated in section II. The main difference in the early retirement plan is that it uses a severance pay formula that pays workers 50 and above a lump-sum payment plus a multiple of their monthly wage until retirement according to the formula: $C = C_7 + c_7 I$, where I is the present value of the current annual earnings until retirement (formula 7).[7] Both the lump sum (C_7) and the multiple of the monthly wage (c_7) are optimized to achieve a given exit target of people 50 and older at the lowest cost. Because workers 50 and older typically have lower losses, cost minimization might mean that the exit target for that group should be close to 100 percent. This may be impractical for operational reasons; therefore, I examine alternative scenarios in which the early retirement exit target for that age group ranges from 70 to 100 percent.

Workers under age 50 are offered a separate severance package based on one of the severance pay formulas. The parameters of that formula and the choice of the formula itself are optimized to achieve the exit of the balance of people necessary to reach the overall 30 percent exit target at the lowest possible cost. Workers younger than 50 are offered the plan that exits the balance needed to reach the 30 percent overall target at minimum cost.

Table 5 summarizes the results for the various early retirement schemes under consideration. The plan with the lowest average cost per worker is the one that exits 90 percent of workers 50 and over, with the plans exiting 80 and 100 percent very close behind. Because it is difficult to fix the percentage of exiting workers exactly at 90 or 80 percent, these plans in fact exit 91 and 82 percent of workers age 50 and over. All the early retirement plans offer significant savings over the plans without early retirement. The plan that exits 90 percent of workers age 50 and over and 19 percent of workers under age 50 costs £E7,956 per

7. $I = \int_{\tau}^{\tau_r} \hat{E}_G(\tau) e^{-\rho t} dt = 12 \hat{W}_G(\tau) \left(\frac{e^{-\rho t} - e^{-\rho \tau_r}}{\rho} \right)$

where $\hat{W}_G$ is the current monthly wage in the public sector.

exiting worker, which represents a 36 percent saving over the uniform payment benchmark and a 27 percent saving over the best-performing plan without early retirement. In fact, it is only 5 percent above the full indexation benchmark (the first row in table 4).

Now that the older workers are offered an early retirement plan, the optimal formula for level-one workers who are under age 50 changes from formula 5 to formula 4. Formulas 2 and 5 remain the optimal formulas for level-two and level-three workers, respectively.

Because the compensation is based on individual-specific losses, including nonwage benefits, the multiple of the current wage paid to early retirees until the mandatory age of retirement may actually be larger than 1. In fact, under the 90 percent exit scenario for workers age 50 and over, the optimum multiple is 1.64 for level-one workers, 1.71 for level-two workers, and 1.62 for level-three workers. It may seem strange that these workers will be told not to report to work and will receive more in monetary compensation every month than they are currently receiving in wages. It should be kept in mind, however, that out of these payments they have to make both the employer and employee contributions to the social security fund if they wish to receive full benefits when they reach the age of 60. These contributions amount to approximately 40 percent of the monthly wage.

Despite the fact that early retirees would be paid more than their current monthly wage, the early retirement plans cost less than the plans with no early retirement provisions because they allow for better matching between severance payments and worker rents. The simulations indicate that the cheapest workers to compensate for leaving the public sector are level-one workers who are age 50 and over. Severance costs for older level-two workers are also significantly lower than those for their younger counterparts. It may therefore be optimal to exit 100 percent of workers 50 and older with low and intermediate levels of education and limit the exit of older workers with university education, who require relatively high compensation. This may also be desirable from an operational point of view because it may retain managerial talent in the public sector. As a general rule, it makes sense from a fiscal perspective to maximize the exit rate among workers with low levels of education until managerial and operational considerations preclude any further reductions.

Simulation Results on Workforce Composition

The main compositional variable over which I have attempted to maintain some control is the proportion of exiters in each of three broad educational categories, which is kept at 30 percent. In the early retirement plans, I also fix the target exit rate for workers age 50 and older. In practice, it may be necessary to control the composition of the remaining labor force on several other dimensions, such as the proportion of managerial or production workers or the proportion of males and females. This can be done by offering each of these categories a separate severance program, as is done here with the three educational categories.

Because exit rates are not set ex ante for specific age, gender, regional, or occupational categories, it is interesting to see what they turn out to be ex post under the various severance pay formulas that prove cost-effective. Table 6 shows these ex post exit rates as produced by the simulations for different categories of workers. The full indexation plan is not shown because it exits exactly the same people as the fixed payment plan. I also do not show the exit rate by educational category because it is set at the 30 percent target.

In terms of age composition, most of the options without special provisions for early retirement exit workers age 50 and older at a rate of somewhere between 88 and 94 percent, close to optimum rates found in the early retirement schemes. Workers under age 35 exit at very low rates, ranging from 9 to 18 percent. The highest exit rates for that group are obtained for the severance pay formula that indexes only on years of denied service (formula 2), thus paying these young workers relatively high compensation. Workers in the middle age group exit at rates close to the target rate.

As expected, females exit at lower rates than males because they have higher losses. However, the difference between males and females is not very large. The Alexandria and Suez Canal region and to a lesser extent the Rural Lower Egypt region have disproportionately high exit rates. Conversely, Upper Egypt, a region with poor private sector prospects, has disproportionately low exit rates.

In terms of occupation, the most noteworthy result is the very high exit rate among workers in managerial occupations, who exit at a rate of close to 80 percent under most scenarios. This is probably because managers are more likely to be represented among the group over age 50 that exits at a high rate. The option that has the lowest exit rate for managers is formula 2, which also has the highest proportion of young people exiting. The disproportionate departure of managers may be welcome if the new owners of privatized SOEs prefer to hire their own managerial staff. However, if the retention of existing managers is deemed necessary, they could be offered a separate severance package that sets their target exit rates to lower levels ex ante. The other occupational group that exits disproportionately is service workers. These workers, who are mostly made up of janitors, guards, and messengers, are generally considered fairly unproductive in the Egyptian context. Again, if that exit rate is deemed insufficient, they could be offered a more generous severance package that would induce more of them to exit.

IV. Concluding Remarks

This article had two major objectives: to estimate the losses that public sector workers would incur if they were displaced from their jobs and to simulate various voluntary severance schemes to determine how well they match compensation payments to these estimated losses. It measured the displacement loss as the difference between what the worker can expect in terms of full compensation by staying in the public sector relative to the opportunity cost of working in the private sector. A

Table 6. *Simulated Exit Rates for Various Categories of Workers under Selected Severance Pay Formulas*
(percent)

Category of worker	Fixed payment	Severance formula[a] 2	3	4	5	6	Early retirement target (percentage of workers age 50 and older) 70	80	90	100
Age										
Below 35	9	18	9	9	11	8	12	12	11	10
Between 35 and 49	27	20	26	27	26	28	32	28	25	23
50 and older	94	88	94	94	88	93	73	82	91	100
Gender										
Male	31	30	31	31	31	31	31	31	31	31
Female	27	32	27	27	28	28	29	27	25	23
Region of residence										
Greater Cairo	30	27	29	29	29	29	26	28	29	30
Alexandria and Suez Canal	43	47	43	43	42	44	45	44	43	41
Urban Lower Egypt	29	26	29	29	28	31	29	29	30	28
Rural Lower Egpyt	39	31	39	39	31	39	38	35	35	35
Urban Upper Egypt	27	31	26	27	27	26	34	32	29	27
Rural Upper Egypt	17	17	17	17	19	19	18	18	16	16
Occupation										
Professional/technical	23	28	23	23	25	23	27	25	24	23
Managerial	79	62	77	77	81	77	75	78	80	81
Production	27	28	27	27	27	28	27	27	27	26
Clerical	30	26	30	30	26	30	28	29	29	28
Services	37	40	34	37	37	31	31	32	33	37

a. Refer to table 4 and the text.
Source: Author's calculations based on survey data.

good indicator of the size of displacement losses is the ratio of total compensation in the public and private sectors disaggregated by various worker characteristics. Another good indicator is the number of years of public sector employment that the worker will be denied by displacement. I also found that women, who tend to face strong barriers to entry into wage jobs in the private sector and thus have poorer earnings prospects there, have significantly higher losses than men. Therefore severance programs that do not distinguish along gender lines are likely to result in a feminization of the public sector labor force.

The most challenging aspect of estimating displacement losses was to come up with a reliable estimate for the value to workers of the nonwage aspects of public sector jobs. The method pursued in doing this relied on several assumptions, including the assumption that a marginal group of workers that receives no lifetime rents in the public sector can be identified by worker attributes observed in the data. Another assumption was that the ratio of nonwage benefits to monetary earnings is invariant to worker characteristics. These are fairly strong assumptions, and I attempted to carry out several sensitivity analyses to test the robustness of my results to their possible violation.

The main result of the simulations was that the severance programs that provide higher payments to long-tenure workers are likely to overpay many workers in order to achieve their desired exit targets because losses tend to decline as workers approach retirement. Schemes that base payment on years of denied service are likely to suffer less from overpayment because they offer lower compensation to these longer-tenure workers. Moreover, early retirement schemes that target older workers with separate plans are also likely to be cheaper than plans that apply to the entire workforce. I also showed that, in the Egyptian context, the losses of workers with secondary education and above are significantly higher than those of workers with lower levels of education. Thus if a balance is to be maintained in the educational composition of the remaining labor force, separate schemes, each with its own exit target, must be offered to workers at various educational levels. However, to the extent that operational requirements allow it, it is cheaper to retrench a higher proportion of unskilled workers. Moreover, most standard severance pay schemes are more expensive than a simple uniform payment to all workers that would achieve the same number of exits. The exceptions are schemes based on years of denied service, either alone or in combination with the wage. Another important finding was that the optimal programs generally have compensation payments that combine a fixed component with a variable component that varies across workers. The optimum size of the fixed component is generally anywhere from one-third to half of the total payment. Programs with a purely variable payment, such as those that pay a given number of months of wages per year of tenure or per year of denied service, tend to be more costly than even the uniform payment benchmark.

The plans that seem to approximate the estimated displacement losses most closely are early retirement plans that offer workers who are age 50 and older a multiple of their current monthly wage until retirement such that 80 to 90 percent of these workers voluntarily exit the public sector. The balance of the necessary retrenchment is achieved by offering younger workers one of the severance programs described above. In the base case, such a scheme turned out to cost only 5 percent more than the full indexation benchmark that pays workers the exact amount of their estimated losses.

Besides producing estimates of the relative costs of various programs, the simulations also produced the composition of exiters and stayers in terms of various observable characteristics, such as age, gender, region of residence, and occupation. The most noteworthy result was that the various severance programs tend to exit workers in managerial occupations in disproportionate numbers, with nearly 80 percent of them exiting under some schemes. This results from the fact that managers are typically older and that older workers tend to have smaller losses.

Several limitations of the analysis should be mentioned. First, by assuming that the returns to tenure in the public sector do not transfer to the private sector but that returns to general labor market experience do, I assumed that private employers value such experience. If that is not the case, reemployment wages will be lower than predicted, and losses will be underestimated. This would be more of an issue for workers with long tenure who would lose more of their specific human capital as they move to the private sector. The loss-tenure profiles I estimated may therefore underestimate the losses of older workers.

Second, some women and possibly older men who leave the public sector will probably prefer to stay home rather than join the private sector. In effect, this means that their reservation wage is below public sector compensation but higher than what they would get in the private sector. In that case, the opportunity cost of their labor should be the reservation wage, not the private sector wage, and the losses of these workers would be overestimated.

Third, I assumed that the worker would time the exit in a fairly broad window so as to minimize transitional unemployment. However, some exiters might reduce their labor supply after separation in the face of large reductions in the wage rate and in response to the income effect of a severance payment. As a result, they may not immediately take up a private sector job. If these temporary withdrawals from the labor force are voluntary, however, they do not really qualify as transitional unemployment. They simply mean that the reservation wage of these workers is temporarily higher than their private sector wage.

Finally, the strong assumptions needed to calculate nonwage benefits are clearly a limitation. The sensitivity analysis indicated, however, that the main results on the shape of the loss profiles and the relative performance of different severance pay formulas appear to be quite robust to changes in both the magnitude of nonwage benefits and their structure across workers. If workers at different points in their careers place a significantly different value on the nonwage aspects of their jobs, then the loss profiles would change. Short of that, the profiles and the evaluation of the different severance pay schemes that depend on them are fairly robust to the violation of assumptions on the structure of nonwage benefits.

Despite these limitations, this article provided a fairly strong argument for looking at the structure of opportunity costs and wage profiles when designing severance programs. It showed that significant overpayment can be avoided by matching compensation payments to the expected losses of workers. It also provided a method for estimating these losses from standard labor force surveys that are available in most countries.

Appendix. The Model Used to Estimate the Value of Nonwage Job Attributes and Worker Losses

For any experience level T and public sector tenure N_G, the predicted log earnings of a government (or SOE) worker are given by:

$$\text{(A-1)} \qquad \ln \hat{E}_{iG}(T) = \hat{\beta}'_G X_i + \hat{\alpha}_{1G} T - \hat{\alpha}_{2G} T^2 + \hat{\alpha}_{3G} N_G + \hat{\theta}_G \hat{\lambda}_{iG}$$

where X_i is a vector of observed characteristics, $\hat{\lambda}_{iG}$ is the inverse Mill's ratio from the multinomial logit selection model into the government, SOE, and private sectors, and $\hat{\beta}_G, \hat{\alpha}_G = [\hat{\alpha}_{1G}, \hat{\alpha}_{2G}, \hat{\alpha}_{3G}]$, and $\hat{\theta}_G$ are the parameter estimates of the selectivity-corrected earnings equation in the government or SOEs. (In equation A-1 the subscript G refers to government, but the same equations would also apply to SOE workers.) Accounting for the fact that the returns to public sector tenure are not transferable to the private sector but that the worker begins accumulating tenure in the private sector after displacement, the same worker's predicted log earnings in the private sector are given by:

$$\text{(A-2)} \qquad \ln \hat{E}_{iR}(T) = \hat{\beta}'_R X_i + \hat{\alpha}_{1R} T - \hat{\alpha}_{2R} T^2 + \hat{\alpha}_{3R}(T - \tau) + \hat{\theta}_R \hat{\lambda}_{iG}$$

where subscript R refers to the private sector, τ is the time of displacement, and $\hat{\beta}_R, \hat{\alpha}_R = [\hat{\alpha}_{1R}, \hat{\alpha}_{2R}, \hat{\alpha}_{3R}]$, and $\hat{\theta}_R$ are the equivalent parameter estimates from the private sector earnings equation.

To estimate the value of nonwage benefits, I need an expression for lifetime rents, which are given by the difference in discounted earnings streams in the two career paths at entry. The net present values of the discounted estimated earnings over the life of the contract in the public and private sector paths, L_{iG} and L_{iR}, respectively, are given by:

$$\text{(A-3)} \qquad L_{iG} = \int_0^{\tau_u} E_{iu} \exp(-\rho T) dT + \int_{\tau_r}^{\tau_r} \bar{E}_{iG} \exp(-\rho T) dT$$

$$\text{(A-4)} \qquad L_{iR} = \int_0^{\tau_r} \hat{E}_{iR} \exp(-\rho T) dT$$

where ρ is the discount rate, and τ_u, τ_r are the time in the queue and the time of retirement, respectively, both measured from the date of entry into the labor market. E_{iu} represents the worker's earnings while waiting in the public sector queue and is given by $E_{iu}(T) = p\hat{E}_{iR}(T)$, where $0 \leq p < 1$. $\tilde{E}_{iG}$ is the total annual compensation in the public sector, which is assumed to be some multiple η of public sector earnings as follows: $\tilde{E}_{iG}(T) = \eta\hat{E}_{iG}(T)$, where $\eta > 1$.

The marginal group of workers, indexed by m, has zero lifetime rents, implying that the present values of total lifetime compensation in the two career paths are equal: $L_{mG} = L_{mR}$. All other workers are assumed to have positive rents.

Let η_j be the ratio of total compensation to monetary compensation that will equalize lifetime compensations in the two career paths for workers in group j:

$$\text{(A-5)} \qquad \eta_j = \frac{L_{jR} - \int_0^{\tau_{uj}} E_{ju}\exp(-\rho T)dT}{\int_{\tau_{uj}}^{\tau_r} \hat{E}_{jG}\exp(-\rho T)dT}.$$

Thus η_m, the ratio that equalizes the compensation streams for the marginal group of workers, is given by:

$$\text{(A-6)} \qquad \eta_m = \max(\eta_j).$$

Assuming that the ratio of total compensation to monetary compensation is independent of worker characteristics, $\eta = \eta_m$ for all public sector workers. The displacement losses R_{iG} of a public sector worker with experience τ are therefore given by:

$$\text{(A-7)} \qquad R_{iG} = \eta\int_{\tau}^{\tau_r} \hat{E}_{iG}\exp(-\rho T)dT - \int_{\tau}^{\tau_r} \hat{E}_{iR}\exp(-\rho T)dT.$$

The closed-form expression for the integrals as a function of the earnings equation parameters is:

$$\int_{\tau}^{\tau_r} \hat{E}_{iG}\exp(-\rho T)dT = \hat{E}_{iG}^{0}\sqrt{\frac{\pi}{\hat{\alpha}_{2G}}}\exp\left[\frac{(\rho - \hat{\alpha}_{1G} - \hat{\alpha}_{3G})^2}{4\hat{\alpha}_{2G}}\right] \times\left[\Phi\left(\frac{[\rho - \hat{\alpha}_{1G} - \hat{\alpha}_{3G}] + 2\hat{\alpha}_{2G}\tau_r}{\sqrt{2\hat{\alpha}_{2G}}}\right) - \Phi\left(\frac{[\rho - \hat{\alpha}_{1G} - \hat{\alpha}_{3G}] + 2\hat{\alpha}_{2G}\tau}{\sqrt{2\hat{\alpha}_{2G}}}\right)\right]$$

$$\int_{\tau}^{\tau_r} \hat{E}_{iR}\exp(-\rho T)dT = \hat{E}_{iR}^{0}\sqrt{\frac{\pi}{\hat{\alpha}_{2R}}}\exp[-\hat{\alpha}_{3R}\tau]\exp\left[\frac{(\rho - \hat{\alpha}_{1R} - \hat{\alpha}_{3R})^2}{4\hat{\alpha}_{2R}}\right] \times\left[\Phi\left(\frac{[\rho - \hat{\alpha}_{1R} - \hat{\alpha}_{3R}] + 2\hat{\alpha}_{2R}\tau_r}{\sqrt{2\hat{\alpha}_{2R}}}\right) - \Phi\left(\frac{[\rho - \hat{\alpha}_{1R} - \hat{\alpha}_{3R}] + 2\hat{\alpha}_{2R}\tau}{\sqrt{2\hat{\alpha}_{2R}}}\right)\right]$$

where Φ is the cumulative normal distribution function.

Table A-1. *Parameter Estimates for a Multinomial Logit Equation for Selection into Employment in the Government, State-Owned Enterprises, and the Private Sector, Egypt, 1988*

	Males		*Females*	
Variable	*State-owned enterprises*	*Private sector*	*State-owned enterprises*	*Private sector*
Constant	1.824**	10.89***	4.347**	11.330***
	(1.94)	(12.87)	(2.19)	(6.05)
Age	–0.041	–0.350***	–0.215*	–0.454***
	(–0.81)	(–7.61)	(–1.88)	(–4.19)
Age^2 / 100	0.024	0.306***	0.253	0.500***
	(0.40)	(5.38)	(1.62)	(3.35)
Educational attainment[a]				
Read and write	–0.078	–0.683***	0.455	–1.084
	(–0.42)	(–3.93)	(0.51)	(–1.40)
Primary	–0.451*	–1.390***	0.847	–1.258
	(–1.89)	(–5.84)	(1.00)	(–1.49)
Preparatory	–0.115	–1.290***	–0.230	–1.238*
	(–0.43)	(–4.91)	(–0.29)	(–1.79)
General secondary	–0.709**	–1.539***	0.002	–1.331*
	(–2.05)	(–4.62)	(0.00)	(–1.83)
Vocational secondary	–0.880***	–2.678***	–1.459***	–3.900***
	(–4.51)	(–14.00)	(–2.71)	(–8.48)
Technical institute	–1.935***	–3.546***	–2.697***	–4.739***
	(–6.03)	(–11.67)	(–3.71)	(–7.44)
University or above	–2.164***	–4.027***	–2.792***	–3.794***
	(–8.58)	(–14.35)	(–4.22)	(–7.40)
Bachelor of engineering	1.553***	1.791***	2.308***	0.446
	(4.14)	(4.24)	(2.59)	(0.38)
Bachelor of science	1.724***	1.075*		
	(3.03)	(1.68)		
Bachelor of commerce	1.222***	1.533***	1.846***	0.699
	(4.02)	(4.48)	(3.45)	(1.34)
Region of residence[b]				
Alexandria and Suez Canal	0.301*	–0.219	–0.169	–0.527*
	(1.68)	(–1.12)	(–0.55)	(–1.60)
Urban Lower Egypt	–0.619***	–0.732***	–1.012***	–1.359***
	(–3.50)	(–4.07)	(–2.96)	(–3.89)
Urban Upper Egypt	–1.934***	–1.454***	–2.531***	–1.870***
	(–8.17)	(–7.34)	(–3.34)	(–3.71)
Rural Lower Egypt	–1.000***	–1.131***	–1.382***	–0.917**
	(–5.75)	(–6.54)	(–2.56)	(–1.98)
Rural Upper Egypt	–1.572***	–1.554***	–0.296	–0.046
	(–7.19)	(–7.60)	(–0.44)	(–0.07)
Parents' characteristics				
Father farmer or agricultural worker	–0.255*	–0.604***	–0.668	0.284
	(–1.87)	(–4.40)	(–1.32)	(0.71)
Father educated	0.209	0.083	0.573**	0.922***
	(1.21)	(0.46)	(2.05)	(3.06)
Mother educated	–0.645**	–0.134	–0.613	0.154
	(–1.98)	(–0.47)	(–1.43)	(0.42)

(Table continues on the following page.)

Table A-1 *(continued)*

	Males		*Females*	
Variable	*State-owned enterprises*	*Private sector*	*State-owned enterprises*	*Private sector*
Household-level variable				
Currently married	0.125	–0.331*	0.216	–0.487
	(0.64)	(–1.90)	(0.66)	(–1.59)
Number of children fewer than 2			–0.474*	–0.529**
			(–1.91)	(–2.11)
Number of children 3 to 6			–0.064	0.028
			(–0.37)	(0.15)
Number of children 7 to 11			0.303*	0.321**
			(1.94)	(2.00)
Other private nonagricultural wage workers			–0.171	0.443*
			(–0.52)	(1.65)
Other public wage workers			–0.079	–0.471***
			(–0.47)	(–2.77)
Log-likelihood	-2,171.7		-501.8	
Number of observations	2,707		811	

* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.

Note: The dependent variable is the worker's sector of employment: $y = 0$ for government, $y = 1$ for state-owned enterprises, and $y = 2$ for the private sector. The parameters of the government equation are normalized to zero. t-ratios are in parentheses.

a. Illiterate is the reference category.

b. Greater Cairo is the reference category.

Source: Author's calculations based on survey data.

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