

# THEORIES OF THE SENIORITY-BASED WAGE SYSTEM

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## I. *Introduction*

The seniority-based wage system in Japan is now occupying the attention of economists both here and abroad mainly for two reasons. The first is that the recent low rate of economic growth and increasing proportion of older workers are allegedly making most firms have difficulty in maintaining the system as it used to be. The second is that it is an important element of the rather unique Japanese employment practices (the other elements are lifetime employment and enterprise unions). It is interesting to note that the first reason is given to predict the possibility of collapse of the system and the second to support it because it has several advantages. So it must be worth-while to study exactly what functions the system has. This is the purpose of this paper.

The seniority-based wage system is by no means a simple employment practice to analyze. It has several characteristics when it is actually applied to workers in Japan, so its functions must be related to those characteristics. As Sano (1976) points out, it is applicable mainly to male workers, more educated workers, full-time regular workers and those of large firms, and it is not so applicable to female workers, less educated workers, temporary or subcontracted workers and those in small firms. Moreover, wages are determined in consideration both of ages and of lengths of service of workers. Thus a worker who got employed by a firm in his mid-career receives wages lower than those for workers of the same age but with longer lengths of service in the firm. However, his wages are usually higher than those for younger workers with the same length of service in the firm. Though precise international comparisons in each point of the system are not yet performed, it is well-known that the seniority-based wage system is applied in Japan to a larger degree and that the Japanese workers receive peak wages at slightly older ages. The system is also closely related to the growth rates of the population and the GNP and to the social consumption pattern of workers. A good theory of the seniority-based wage system must be able to explain all of these characteristics, but there is no such a theory today. Each theory can explain only a part of them. Though this might imply that we do not have a good theory at this present stage, it must be more appropriate to insist that the seniority-based wage system has several qualitatively different aspects or functions which can be analyzed by corresponding different approaches.

Our basic idea in most part of this paper is that the seniority-based wage system can be regarded as a form of implicit labor contracts. The concept of implicit labor contracts was first introduced by Baily (1974) and Azariadis (1975) to explain relatively sticky wages when firms face uncertain prices for their outputs. Their explanation is based on the differ-

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ence in attitudes toward risk of firms and workers, i.e., in their analysis firms are assumed to be risk-neutral and maximize expected profits, while workers are assumed to be risk averse and maximize expected utility. As Riddell (1981) showed, when two parties differ in their attitudes toward risk, they can always make themselves better off in an expectational sense by reaching an agreement prior to the state being realized. In our present discussion difference in attitudes toward risk is not the major reason for labor contracts of seniority-based wages. The main reason is that when there are such contracts the parties' behavior will be different from when there are not such contracts and the existence of contracts makes both parties better off or at least one party better off without hurting the other.

The outline of the following sections is this. We first discuss a simple human capital approach, because it is a pioneering theory in this field. Then we see the theory of internal labor markets developed in the early 1970s by institutionalists. We next consider models which explicitly describe the firm's dismissal behavior and the worker's quit behavior. These three approaches are closely related in that they use the concept of specific human capital, and the relation between the first and the third approaches is especially strong because the latter is a direct application of the former. As the fourth theory we consider the model which analyzes inter-generational transfers within firms in the determination of wage structures. Finally, the theory which models workers' cheating is discussed. Concluding remarks appear in the last section.

## II. *The Simple Human Capital Approach*

It is the theory of human capital developed by Mincer (1958), Oi (1962), Schultz (1963) and Becker (1964) that provided first a nice theory of the relationship between ages and wages. At the start this theory was very simple, but during the past decade more sophisticated models with precise dismissal and quit behavior were developed. Though the latter approach uses basically the same idea (especially the concept of specific human capital), we would like to distinguish them, because the more sophisticated models have some qualitatively different aspects.

The most important concepts in the human capital approach are those of general human capital and specific human capital. Both general and specific human capital can be accumulated through training or experience. Though general human capital is useful in many firms, specific human capital is useful only in specific firms. According to the human capital approach wages increase as workers get older, because they get training and experience through their careers. If a worker's capital is purely general, his wage is equal to his value-productivity and increases as the latter increases through training or experience. In this case the employer has no incentive to bear the training costs. On the other hand, if a worker's capital is purely specific, his wage is not necessarily equal to his value-productivity, because wages above the market rate can reduce his incentive to quit. The employer chooses the worker's wage levels so as to prevent him from quitting and to capture the returns to the specific training whose costs must now be borne by the employer. The difference between the value-productivity and the wage at each period is the periodic rent according to Oi (1962). In the real labor markets most workers' human capital has properties both of generality and specificity. According to the above theory, an age-wage profile is steeper, as Sano (1980)

notes, the more general the corresponding human capital.

The theory of human capital was directly applied by Sano (1971) to the seniority-based wage system. But theories similar to this were developed by Ujihara (1966) and Koike (1966). Ujihara emphasizes on-the-job training and specificity of capital in the developing Japanese economy, while Koike emphasizes mobility of workers within a firm from easy tasks to difficult ones. There are also similarities between Koike's view and the theory of internal labor markets, which will be discussed in the next section.

If workers accumulate purely general human capital through training or experience, lengths of service in particular firms are not important in wage determination. But as the reality shows that there exist wage differences at the same age due to differences in length of service, the theory of human capital can be interpreted to insist that older workers receive wages higher than those for younger workers with the same length of service in their firm because the older workers have more general capital. On the other hand, wage differences due to differences in length of service in a firm can be explained by differences in the amount of specific capital, that is, workers with longer lengths of service have larger amount of specific capital than workers at the same age with shorter lengths of service. Though this argument is very rough, it shows that the theory of human capital has a possibility of explaining important characteristics of the seniority-based wage system.

How about other characteristics mentioned in Section I? The human capital approach has some hope for explaining differences in degree of the seniority system. As noted in the previous section the system is more applicable to workers in large corporations than to those in small firms. If the jobs in large corporations require more specific capital than those in small firms do, then it is reasonable for them to have more distinct seniority-based wage systems. Since large corporations are complex organizations today, workers must be required to have large amount of specific capital to participate fully in production. The requirement includes not only the knowledge or skills related to machines, customers, or forms to be filled in, but also the knowledge of a whole organization and even good human relations with co-workers. This is quite appealing in the light of the fact that most large Japanese corporations regard the first few years of new employees (most of whom are young) as their training periods. I believe that general capital also plays an important role. Generally speaking, large corporations employ more workers with higher education, and promotion within firms is based, in part, on general knowledge such as law or accounting. This implies both specific and general capital enhances the degree of the seniority system in large corporations.

It seems to me that we cannot get very strong explanations of the other characteristics mentioned in Section I from this simple human capital approach. But the fact that the seniority-based wage system is more applicable to educated workers must be partly related to profitability of investment in on-the-job training and the fact that it is more applicable to male workers and full-time regular workers must be partly related to their quit behavior.

### III. *The Theory of Internal Labor Markets*

In this section we examine the theory of internal labor markets developed by Doeringer and Piore (1971) to gain insight into the seniority-based wage system. Though the theory

was constructed by observing the American economy, it seems to apply to the Japanese economy surprisingly well. It will be clear that the theory of human capital has considerable influence on the theory of internal labor markets.

Doeringer and Piore argue that because of enterprise-specific skills, on-the-job training, and custom there is formed a very stable employment structure which is beneficial both to workers and to the employer. In each internal labor market a compromise is made between managements' concern with efficiency and workers' interests in enhancing job security and advancement opportunity. Internal mobility, which depends on seniority and ability in varying ways, is designed to capture natural on-the-job training sequences and to reduce turnover costs. Because of the job specificity and the stability of employment in the internal labor market, wages are not necessarily equated to marginal productivity.

The theory of internal labor markets outlined above seems to answer many questions posed by Japanese economists about the seniority-based wage system. Umemura (1967) gives a critical review to the traditional theories (see Ujihara (1966) and Koike (1966)) about the unique ways of development of skills in Japan. One of his questions is that a similar process of acquisition of skills can be found in other countries. In the light of the theory of internal labor markets, which emphasizes the existence of enterprise-specific skills and on-the-job training, we can give an affirmative answer to the above question. His other question is that the traditional theory does not explain how skills are acquired in small firms, where seniority systems are not so salient. If skills are acquired in small firms as in large firms, why do not we observe seniority systems in small firms? It is obvious that the theory of internal labor markets does not apply so well to very small firms. But it does not seem to explain so clearly the difference in acquisition of skills in firms of different sizes, though the same discussion of specific human capital can be repeated here again.

Koshiro (1961) is critical about arguments which emphasize similarities between the labor markets in Japan and those in other countries. He asserts that though there are positive correlations between ages and wages in other countries, social factors behind them must be investigated. As the social factors which support the positive correlations in other countries he cites high rates of job turnover among the youth, large working hours of older workers and so on. Though there may be these factors working behind statistical correlations (I personally think that the factors must be explained as endogenous variables), it is obvious from the study by Doeringer and Piore that seniority cannot be ignored in the United States as a determinant of wages.

Sumiya (1974) considers the seniority-based wage system in Japan from the viewpoint of the internal labor market theory. He argues that the correlation between seniority and wage rate observed in the United States does not substantially differ from the Japanese wage system. He further asserts that since internal labor markets are developed at the highly developed industrial stage where specific jobs are specialized at large industrial plants, it is fundamentally wrong to associate the seniority-based wage system with premodernism. Because of the benefits discussed above of this system to both employers and employees, it is not, he predicts, destined to be phased out by innovations. From a point of view slightly broader than that of this paper, Ono (1981) doubts Sumiya's argument. He insists that the differences in mobility (quit) rates between the Japanese and the U.S. external labor markets, which condition internal markets, imply differences in the structure and function of internal labor markets of the two countries. Though more empirical and theoretical dis-

cussions might help us know differences between the two countries, the internal labor market theory provides some insight into the seniority-based wage systems in both countries.

Can we say more about the seniority-based wage system in the light of the internal labor market theory? One point we can discuss here is about skill specificity as a major factor generating internal labor markets. As Doeringer and Piore note, performance in some production and most managerial jobs involves a team element, and a critical skill is the ability to operate effectively with the given members of the team. This is the matter of human relations in work places and this skill can be developed gradually as a worker's length of service increases. Thus a productivity of a worker depends partly on his length of service in a given firm, and the longer he stays in it, the larger his productivity is. Since skills necessary to work on one team are never quite the same as those required on another, those who are hired in their mid-career are likely to have lower productivities and get lower wages.

This kind of productivity based on the interaction of the personalities of a team is quite important but seems to have been ignored in the literature of the seniority-based wage system. It is especially important when we take into account the fact that each Japanese firm has and tries to have a unique atmosphere in its work place. The workers in the same work place tend to share the same values and expectations, and the sociological explanation of the seniority system which emphasizes loyalty, commitment, and paternalism in enterprises could be reduced to the argument of this kind of productivity.

Another point worth mentioning in the light of the theory of internal labor markets is the wage structure constrained by the administrative rules for allocation of labor in an internal market. According to Doeringer and Piore the wage on every job must be high enough relative to the jobs from which it is supposed to draw its labor and low enough relative to the jobs to which it is supposed to supply labor to induce the desired pattern of internal mobility. Because sequences of job assignments are rarely reversible, wages tend to increase as a worker's length of service increases. This observation is quite similar to that by Koike (1966) mentioned in the previous section.

A similar argument holds about the role of wage rate as an indicator of social status. Jobs which involve the direction and management of others require wages higher than the subordinates'. A matter closely related to this is that for the on-the-job training process to operate effectively the wage determination process must protect the status of incumbents by giving considerable weight to seniority, since otherwise workers responsible for training feel their status threatened by the trainees and the effectiveness of the training process cannot be achieved. These arguments show that high wages due to long service are not necessarily directly related to high productivities.

The theory of internal labor markets has an advantage of analyzing employment problems from a viewpoint broader than that of the orthodox economic theory, but it has a disadvantage of roughness in its analysis. Though it provides an explanation more vivid than that of the simple human capital approach, as far as the seniority-based wage system is concerned it cannot give explanations of the characteristics in Section I especially stronger than those of the human capital approach.

#### IV. *Models of Labor Turnover*

This section is a study of the recent approach to employment problems which explicitly models workers' quit behavior and employers' dismissal behavior. Most of the models with this approach use the ideas developed in the human capital approach, so they can be regarded as applications of the latter. But the reason why we have a separate section here is that the simple human capital approach does not have rigorous explanations of turnover behavior based on individual rationality. By contrast, the recent approach tries to introduce such behavior and some new models have results qualitatively different from those obtained in the simple human capital approach.

Since we would like to aim at a relatively rigorous argument in this section, it might be better to see the Arrow-Debreu model (see e.g. Debreu (1959)) for the comparison with the models of this section. In the Arrow-Debreu model (with many periods and states of nature) quit or dismissal is not an important economic problem, because even if a worker does not continue to work in a given firm, the firm can costlessly employ another worker with the same ability for the same certain wage rate in each period, and because even if a worker is dismissed he can costlessly find a similar job which pays the same certain wage rate in each period. But in the real economy, which does not have perfectly competitive markets for all imaginable commodities with dates and states of nature probably because of large costs for organizing them, quit and dismissal are quite important, since workers and firms have to bear employment-related risks, search for alternative jobs or employees, and pay searching or hiring costs, which are usually called transaction costs in economic theory. Moreover, the Arrow-Debreu model does not have the concept of specific human capital nor that of producing it. In the real economy specificity is an important matter in employment problems, and the existence of it together with the transaction costs mentioned above brings about external diseconomies to parties of employment matches when they are broken. When workers quit, the firms cannot capture the potential returns to their costly investment in specific training, and even if explicit investment was not made, they face loss since newly hired workers do not have sufficient knowledge of the firms. On the other hand if workers are dismissed, they also incur loss, because they have to search for new jobs, pay moving costs, and adjust themselves to new environments. Furthermore, if they have paid for a part of the training costs, they cannot capture all returns.

In the following discussion I would like to refer mainly to Arai (1981), but there are several other papers with models of labor turnover related to the purpose of this section (see Parsons (1972), Mortensen (1978), Hashimoto (1979), and Hashimoto and Yu (1980)) and all of these use the concept of specific human capital either explicitly or implicitly.

The worker's quit decision in these models is made to maximize his expected future gains (wages or utility net of the transaction costs related to the decision) by considering both the wages he can receive if he stays with his current employer and wage offers from other firms. Thus he is more likely to quit, the higher the wage offer from the outside relative to the wage he will receive if he does not quit. Wage offers from other firms are usually obtained through search effort, so search costs also affect quit behavior and if they are high, he is less likely to quit.

On the other hand, the firm's dismissal decision is made to maximize expected future profits by considering both the (expected) value-productivity of the worker and the wage the firm has to pay him. Thus the firm is less likely to dismiss the worker, the higher the (expected) value-productivity relative to the wage. In the Mortensen model there is perfect symmetry as to the behavior of the two parties, that is, the firm is assumed to dismiss or replace a worker if and only if a better worker is found by search. But I believe that most employers' dismissal or layoff decisions in the real economy are based on fluctuations in demand for their products, so his model of employer search is quite unrealistic. I think the reason why few firms try to search for workers with better ability to replace their current employees is that the latter have already specific human capital and it is hard to find new workers whose ability surpasses that of the current employees with specific capital. This is especially true when screening was precise at the time of hiring.

The above discussion implies that the future wages the worker can receive in a given firm have important effects on his behavior. If they are too low, then he is very likely to search for a better wage offer outside the firm and he might quit. If they are too high, then he will probably search again, because very high wages imply very high probability of dismissal according to the firm's behavior above, and if he searches, there is some probability that he gets a better wage offer and therefore quits. The firm has to maximize (expected) profits by taking account of such behavior of the worker. But actually the firm has another strategy that affects the worker's quit behavior. It is to guarantee the worker's job security, that is, to promise that the firm will never dismiss him. If the firm adopts this strategy of lifetime employment, the worker's quit behavior will surely be different from that discussed above. We can show that the worker is less likely to search and therefore to quit under lifetime employment. In particular, he does not search in this case if his future wages are sufficiently high.

We see in the following that the seniority-based wage system is a wage strategy very closely related to the lifetime employment practice. This is a very reasonable result, because the two are usually jointly observed in Japanese firms. To see it consider the current match of a firm and a worker. Suppose the two parties play a game, in which the firm can choose as strategies the wage level and either lifetime employment or non-lifetime employment, while the worker can choose either to search or not to search. If the firm adopts lifetime employment, it will never dismiss the worker. But if it adopts non-lifetime employment, it will dismiss him in case the value-productivity is expected to be lower than the wage it sets. If the worker chooses to search for a wage offer, he has to pay search costs and can receive an offer as a process of random sampling. If he does not choose to search, he does not have to pay search costs, but he cannot receive any wage offer from other firms.

Suppose the two parties choose their own strategies as so to maximize their own payoffs in a non-cooperative situation. Then it is obvious that the firm chooses the non-lifetime employment strategy for any given strategy of the worker, because it is always more profitable for the firm to be able to dismiss the worker in case the value-productivity is expected to be lower than the wage. On the other hand, the worker is very likely to search regardless of the firm's employment strategy (either lifetime or non-lifetime) if his search cost is very small, because in this case the firm has to set unprofitably high wages in order to prevent him from searching. This consideration implies that the resulting payoffs of the two parties are very likely to those corresponding to the firm's non-lifetime employment strategy and

the worker's search strategy. If the value of the specific capital of the current match is large, it is probable that each of the above pair of payoffs is smaller than that corresponding to the firm's lifetime employment strategy and the worker's strategy of no search. This is a kind of the prisoner's dilemma.

The non-cooperative behavior in the above context does not bring about Pareto optimality. When there is formed specific human capital in the match of a firm and a worker, the former has to give relatively high wages and guarantee job security to the latter to prevent losing the capital. But such strategies of the firm tend to reduce its expected profits and do not meet its individual rationality. Of course, if they promise to adopt the strategies corresponding to a Pareto optimal payoff combination and it is never broken, then this kind of inefficiency does not occur. But each party has strong incentive to adopt the individually more beneficial strategy, and the one who sticks with the promise will be taken advantage of.

If transaction costs related to quitting such as search, moving, and adjustment costs of the worker are pretty high, then he is not likely to quit and the above-mentioned dilemma might be eliminated (see Arai (1981) for more detail). But it seems that the development of modern societies has lowered these costs. Thus the above is an example in which low costs are not necessarily desirable! Incidentally, a similar problem occurs in economics of marriage (see Becker (1973, 1974), and Becker, Landes, and Michael (1977) for economics of marriage). The institution in which matches are broken so easily or at low costs as in Sweden is not necessarily efficient.

Now how can the dilemma be prevented even when transaction costs are low? Usually there are multiple (a continuum of) Pareto optimal strategy combinations, and it may be hard to conceive of a significant single combination to be chosen. But suppose the two parties choose the one that maximizes their joint wealth. Then it is a Pareto optimal combination. The joint-wealth maximizing combination must have a nice property if redistribution of the wealth is possible. I submit that in our framework not only joint-wealth maximization but also redistribution of the wealth is possible. We can show that the joint-wealth maximizing strategy combination is very likely to involve job security or lifetime employment. After these observations we have the answer to the first sentence of this paragraph: the firm and the worker choose the joint-wealth maximizing strategies and each receives the resulting payoff, but for the redistribution of the wealth the firm can adjust the wages at the beginning or when specific human capital is being accumulated. If the value of specific capital is expected to be high, the firm has to guarantee job security and promise to give high wages when specific capital has already been accumulated. Then the worker is very unlikely to search or quit. But in return the firm sets relatively low wages at the beginning for the redistribution of the maximized joint wealth. In this case the firm would not lose much if the worker should quit. This is exactly the function of the seniority-based wage system in our framework.

The above consideration does not show how much of the joint wealth the two parties can redistribute, that is, how low the wages at the beginning can be. The answer to this question depends on how much information workers have before employment about their age-wage profiles if they work in firms. Suppose this information is perfect when they get employed for the first time, in the sense that they know the wage streams, employment policies (either lifetime or non-lifetime), and the distribution of value-productivities of all the

firms, and the distributions of wage offers they will face if they search to quit in the future. This may appear rather restrictive, but if the career guidance at the time of graduation is good, it is not so unrealistic. But note that we still assume that information is not perfect when they search in their mid-careers. Suppose further that all workers have the same ability. Then each firm has to guarantee the same expected present value of its wage profile to attract workers. Incidentally, this expected present value is computed by considering the benefits workers will get by searching in the future. Now, in this situation a firm which adopts lifetime employment and gives high wages after specific capital is accumulated can set relatively low wages at the beginning, because this wage profile and employment strategy can bring about the above expected present value.

The discussion of this section has implied that the seniority-based wage system is closely related to lifetime employment and that the firms with these two practices are those which can enjoy large value-productivities. Because our argument here has been mainly theoretical and has not involved especially Japanese aspects, it is possible that the results apply to other economies. In this sense, it is interesting to note that our results agree pretty well with Ouchi's (1981) and Ono's (1981) observations. The former shows that the firms with high productivities in the United States have employment practices similar to those of large Japanese corporations. The latter reveals that the quit rate of the workers in large corporations in Japan is smaller than that in small firms. Since most large Japanese corporations adopt lifetime employment and their productivities of specific capital seem to be relatively high, this confirms our results.

### V. *The Model with Inter-Generational Transfers*

Though I guess it is unique to the Japanese economic ideas, there has been a hypothesis that the seniority-based wage system should be explained by the costs of living of workers (see e.g. Funabashi (1961, 1967)). According to this hypothesis older workers receive higher wages, because their costs of living are higher. I think it was formed under the influence of Marxian economics. Though this idea appears to be very strange to modern economists, there is undeniable evidence for it in Japan. Koike (1966) shows that age-wage profiles in Japan look very like profiles of ages and living costs of the model households. Ono (1973) insists that the wages of many jobs increase as workers get older even if their skills cease improving. A part of these facts may be explained by the theory of internal labor markets. But most Japanese firms actually take into account of the living costs of workers in wage determination (see e.g. Shimada (1980)). Many Japanese firms have adopted this wage determination rule since the last war partly because of the high inflation rates.

A naive question to the above cost-of-living approach is why firms employ old workers for high wages when they can employ young workers for low wages. Since this traditional approach does not consider explicitly the effect of competition in labor markets, it cannot answer this question so well. The following discussion based on Arai (1982) will show that the wage contract which allows for costs of living at different ages dominates that which guarantees wages corresponding to productivities. The basic idea of our model is that the wages at different ages are not equal to productivities because there are inter-generational transfers within firms when wages are determined. This is an application of the exact con-

sumption-loan model by Samuelson (1958). Thus the wage contract specifies the wage levels at different ages of a worker or the ratios of wages of young and old workers.

The model is rather simplified to show only the essence and to avoid complication. Each worker participates in production for two periods, during the former of which he is young and during the latter of which he is old. Since we consider continuous generations, there are both young and old workers in each period. All workers are assumed to be identical with respect to ability and preferences (workers' ability may be assumed to increase at a constant rate each period). The worker's utility function over his consumption plan is strictly quasi-concave as well as increasing in each variable. Further, it is assumed to be homothetic to avoid the complication that different generations strike qualitatively different wage contracts. This assumption of homotheticity implies that the worker's consumption pattern is invariant with respect to the change in his lifetime income. I think this is less unnatural than the same assumption for other ordinary goods.

We add more assumptions to the utility function. We assume that the worker tends to put higher valuation to the consumption in his second period. We call this assumption 1. One reason for this is that a unit of consumption in his second period, when he has a spouse and children to support, gives him higher satisfaction than that in his first period, when he is single or his family is small. Another reason is that a unit of consumption in his second period is more valuable when he sees whether or not his life is a comfortable one or a success. Next we assume that the substitutability between the worker's consumption in his first period and that in his second period is relatively small. We call this assumption 2. The meaning of this is that the worker tends to secure certain standards of living in both periods subject to his lifetime budget constraint, and therefore very large consumption in his first period and very small consumption in his second period, for instance, do not give him very large satisfaction. In the following discussion we use either or both of these two assumptions.

In the discussion of intertemporal consumption the interest rate plays an important role, but we assume that the interest rate the worker can make use of in safety is relatively low. A reason for this is a high rate of inflation. In fact, the real interest rate of savings accounts can be negative when the inflation rate is high. Other reasons are that the worker has more difficult access to capital markets because he lacks financial expertise, that he is relatively risk averse, and that his transaction cost per unit of money he invests is large for profitable projects since his income is relatively low. Finally, we assume that all firms have identical technology and that there is no uncertainty either in production or in the product market. This implies that workers have no incentive to quit and the firms have no incentive to dismiss them.

In this framework we can see that wages are not equal to workers' productivities because of inter-generational transfers from young to old workers within firms and that such contracts dominate the contracts that wages are equal to productivities in each period. To show this we suppose that both periods and generations continue from minus infinity to plus infinity and that both the productivity and population of workers grow at constant rates. Then we can see that if there are inter-generational transfers within each firm in wage determination, the slope of each worker's budget constraint without borrowing is equal to the product of one plus the productivity growth rate and one plus the population growth rate. If the real interest rate is relatively low, this product is larger than one plus the interest

rate. If the assumptions above are satisfied, it can be easily shown that the wage contracts with inter-generational transfers dominate the contracts without transfers.

This implies that workers prefer to receive wages lower than their productivities when they are young and those higher than their productivities when they are old. We define the degree of the seniority-based wage system as the ratio of the wage the old worker receives to that the young worker receives in a given period. Then we can show that under the above assumptions this degree is larger, (a) the higher the valuation the worker puts on the consumption in his second period, (b) the larger the growth rate of population, (c) the smaller the growth rate of productivity, and (d) the larger the measure of costs of living (see Arai (1982) for the definition) in his second period. (a), (b) and (d) seem very natural. The reason for (c) is that if the rate of productivity growth is large, the worker does not have to transfer much to consume much in his second period.

Of the above results, (b) and (c) are especially interesting. Ono (1973, p. 125) shows that the degree of the seniority-based wage system in Japan generally increased until about 1958 and has been decreasing since then. He also shows that the degree increased rapidly during the depression in the 1930s. The general increase up to about 1958 can be explained mainly by (b). Since the growth rate of productivity is roughly equal to the growth rate of GNP per capita, the general decline since about 1958 is mainly due to (c). The increase during the depression is also due to (c). (d) provides an insight into the effects of social security, costs of formal education and so forth on the degree of the seniority-based wage system.

The distinct merit of the model in this section is that it enables us to know explicitly the effects of population growth, productivity growth, and the social pattern of consumption on the seniority-based wage system. The previous three approaches cannot explain these effects explicitly. But it is these points that are important today when we are facing a low rate of economic growth and a low birth rate. The model has demerit, too. Since it is highly simplified, more specifically, since all workers and firms are assumed to be identical, it cannot explain other important characteristics of the seniority system mentioned in Section I. We might be able to build a more sophisticated model similar to that in this section by introducing uncertainty, especially by introducing the worker's quit behavior and the firm's dismissal behavior. Then we could explain more of the characteristics of the seniority system.

## VI. *The Incentives Model*

In this section we discuss briefly the theory posed by Lazear (1979, 1981). He insists that wages are lower than productivities when workers are young and get larger than productivities when they become older, because this kind of age-wage profile induces young workers to perform at the optimal level of effort and eventually makes the workers better off. His theory is based on the idea of workers' cheating, malfeasance, or shirking discussed by Alchian and Demsetz (1972), Stiglitz (1975) and so forth, and is an application of the theory of the optimal law enforcement by Becker and Stigler (1974).

His argument is as follows. The worker has an incentive to shirk or reduce his effort on the job. If he does shirk, he will get some gains but will be fired. The employer, of course, loses. The worker, however, does not lose anything if he can find a similar job with

the same wage level in the labor market. The situation changes if he receives wages lower than productivities when he is young and wages higher than his productivities when he is old. If he faces such an age-wage profile, he will lose much in case he is dismissed. Thus the seniority-based wage system like this tends to prevent workers from shirking or reducing efforts, and brings about larger total output. If the wage contract is to give him the wage stream whose present value is equal to the present value of the stream of his marginal products under such a profile, then the contract with this age-wage profile dominates the one that gives him wages equal to his marginal products at each time.

Lazear points out that large firms have steeper age-wage profiles than those of small firms, because monitoring costs are larger in the former, though I personally do not believe so much that the difference in monitoring costs can explain the difference in the slope of age-wage profiles. This model can give a reason for another characteristic mentioned in Section I. It is straightforward to understand in view of the model why the worker who got employed by a firm in his mid-career receives wages lower than those for workers of the same age but with longer lengths of service in the firm. However, I do not think that it can explain the other characteristics so well.

## VII. *Concluding Remarks*

This paper has examined major theories of the seniority-based wage system. Its goal has been achieved, if we have understood that the system is by no means a simple employment practice explained by one or two models. It has a lot of characteristics and several different functions. From the discussion of this paper it must be clear that different models can explain only a few different characteristics and even if they can explain the same characteristics the explanations are mostly different.

At this stage I would like to point out a few characteristics of the seniority-based wage system that need comment. First, no model above gives explicit explanation of why female workers have relatively flat age-wage profiles, but I do not think that this is a difficult matter to explain. Women have relatively flat profiles, because their quit behavior is different from men's. Since many female workers quit when they get married or when their husbands get transferred, firms' investment in the on-the-job training of women is extremely risky, and therefore they do not have large human capital. Moreover, long-term contracts, which are assumed in the above models, are not advantageous to women, most of whom work in the same firms only a few years. Of course, there are women who would like to and actually do continue to work in the same firms until they get quite old. But they have an undesirable index (see Spence (1973)), and the employers are not sure who will actually stay long with them, so they do not invest much in the training of them. Thus my idea is completely different from Sano's (1976), which insists that the seniority-based wage system is a scheme of exploitation which can function at the sacrifice of workers placed outside the system.

The question of the effect of academic careers on the degrees of the seniority-based wage system is not so easy to answer. This matter is especially important in Europe and in the United States, where the age-wage profiles for highly educated workers are much steeper than those for uneducated workers. As we noted in Section II, returns to investment in highly educated workers might be larger. The internal labor market theory might suggest

that the degree of promotion of highly educated workers is larger. Another reason might be that workers with more education tend to work in large corporations, where, as we have seen before, not only general but also specific capital seem more valuable than in small firms. Though we can think of these reasons, we need more analysis for more precise explanations especially of the situations in Europe and in the United States.

In almost all models discussed in the previous sections, the contract of the seniority-based wage system is of long-term nature, and the basic and common idea is that the worker considers his lifetime wage stream when he makes a contract. So it is quite natural that the system is applicable mainly to full-time regular workers and not to temporary or sub-contracted workers. Though not all models have explicit explanations, it is not so difficult to conjecture that the system applies differently to workers with different future lengths of service in a given firm. Thus a worker who gets employed in his mid-career has a contract different from that for those who have just graduated from schools. Smaller amount of investment in specific capital and smaller amount of inter-generational transfers can explain a less steep age-wage profile for such a worker. Thus the two characteristics mentioned in Section I concerning the worker who has changed his employers in his midcareer seem to be quite natural.

Finally, we want to discuss the important question about the future of the seniority-based wage system. There are some people who insist that the system is vanishing. Magota (1978) asserts that it is on its way out because of the change in the age structure of Japanese workers. This means simply that the number of workers who are expected to have high positions according to the traditional criteria is getting larger than the number of positions available to them. Sano (1976) shows that the wage differentials by age have been narrowing in Japan. But she notes that if bonuses are included, the wage differentials by age are still large. And we have already seen that the degree of the system has been decreasing since about 1958.

Of all the models in the previous sections only the one with inter-generational transfers can explain explicitly the recent trend of the narrowing wage differentials by age. We noted that growing proportion of old workers, a high rate of economic growth, and richer social security tend to decrease the degree of the seniority-based wage system. I conjecture that the last two factors worked to decrease the degree during the period of rapid growth. The first and the third factors seem to be working to decrease the degree now. But since the rate of economic growth fell dramatically in the past several years, this factor must now work to increase the degree. Empirical studies are necessary to know the recent trend, but since the system has several functions and beneficial aspects as the models we have seen show, we cannot expect that it will vanish in the future.

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