Is Seniority-Based Pay used as a Motivational Device? Evidence from Plant Level Data*

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Abstract

In this paper we use data from industrial plants to find out whether seniority-based pay is used as a motivational device for production workers. Alternatively, seniority-based pay could simply be a wage setting rule independent of incentives. Unlike previous papers, we use a direct measure of seniority-based pay as well as measures of monitoring devices and explicit incentives. We find that those firms that base their wages partly on seniority are less likely to offer explicit incentives. They are also less likely to invest in monitoring devices. We also discover that these companies are more likely to engage in other human resource management policies, which result in long employment relationships. Overall these results suggest that seniority-based pay is indeed used as a motivational device.

JEL codes: M52, M12, J30.

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1 Introduction

The use of incentive schemes is an important instrument to motivate workers in the hands of firms. However, not all firms and not all types of production processes require the same kind of incentives to enhance motivation and, therefore, labor productivity.

There are two basic types of incentives that firms may offer in order to motivate workers: explicit and implicit incentives. Explicit incentives are a direct way to stimulate workers basing their pay on productivity, for instance through a contract that allows for piece-rates. This type of incentive is appropriate when the individual output is easy to observe and quantify. When this is not the case, implicit incentives not directly connected to productivity are an alternative way to motivate workers.

In this paper, we concentrate on implicit incentives. More specifically, we focus on a particular wage contract that can mostly serve as a deferred compensation scheme and, therefore, as a motivational device: the seniority-based pay contract. In a context in which workers can be fired for disciplinary reasons, workers who receive higher wages at higher seniority levels would be motivated to work harder in order to avoid getting fired and thus would obtain higher future wages.

In general, a seniority-based pay contract implies a contract in which, at some point in the worker's life-cycle, there is a discrepancy between the spot wage and the spot value of the worker's marginal product. Such contracts can act as motivators. The reason is that workers are paid below their productivity during the first few years of their contract, while their wage is above their productivity in the final stage of their career at the firm. If workers do not shirk, they will be allowed to stay at the firm and will be able to recuperate their initial losses. If they shirk, however, they run the risk of being caught and dismissed, and therefore, they jeopardize the chance to recover the wages that the firm owed to them, in the last years of their contract. According to Lazear (1979), workers and firms enter into these long-term implicit contracts to discourage shirking and malfeasance by shifting compensation to the end of the contract.

But seniority-based pay could be a wage rule completely independent of incentives. For instance it could be a practice due to cultural or social norms, or to the presence of unions, to induce self-selection of some type of workers in the firm or to insure risk-averse workers

who are uncertain about their productivity.[1]

According to Lazear, when seniority-based pay is used as a motivational device, seniority-based pay and explicit incentives should be negatively correlated. Similarly, since firms may undertake monitoring activities if input is easy to observe and quantify, when seniority-based pay is used as a motivational device, it should be negatively correlated with the use of monitoring devices.

However, when seniority-based pay is simply a wage rule, the existing theories are silent about its relationship with the provision of explicit incentives (or monitoring). That is, there is no theoretical reasoning that predicts any particular relationship between these two sets of practices. Therefore, in this case, we should not expect these two sets of policies to be related in any systematic way. Our empirical strategy is to identify whether firms that base wages on seniority do it for motivational reasons or not will be based on this prediction of the theory.

Additionally, we investigate the relationship between these practices and other firm practices. The reason is that, as we should expect, firms that use seniority-based pay for motivational reasons should be more likely to undertake practices that involve long-term employment relationships than firms that provide explicit incentives or use monitoring devices. Finally, we also analyze the relationship between seniority-based pay and training provided by the firm.

Incentive theories have been difficult to test empirically due to the lack of available data (see Lazear, 1979). This problem is perhaps even more serious with regard to implicit rather than explicit incentives.[2]

In the past, there have been several attempts to test the theory presented by Lazear (1979) with the available data sets (see, for example, Lazear and Moore, 1984; Hutchens, 1987; or Barth, 1997, among others).[3] Most of these studies tested the predictions of the theory in terms of worker's earnings and productivity, dismissals and tenure, or the incidence of mandatory retirement or workers' pensions. A common characteristic of the existing labor literature is that it uses survey data at the worker level, assuming the existence of a relationship between wages and seniority. However, to our knowledge, there is not yet a study that has used a direct measure of the existence of a seniority-based pay contract at the

[1]Section 2 reviews these theories in detail.

[2]A more recent test of explicit incentives is provided in Lazear (2000).

[3]The next section includes a review of the literature.

firm level. In this paper, we test empirically the theory of implicit incentives using new data which allows us to directly observe whether firms decide to set workers' wages according to seniority or not.[4]

We use a unique plant level data set that contains direct information on several firm's personnel practices for 734 industrial establishments in Spain. All surveyed establishments are involved in production processes within the manufacturing sector. Regarding personnel practices, the survey refers to the blue-collar workers in each plant (that is, workers involved directly in production). Overall, we obtain very homogeneous data for every surveyed plant. At the same time, a wide scope of different firms within the manufacturing sector is included in the survey.

The main feature of the data set is that it refers to firms rather than individuals and that it contains a considerable number of firms. This allows us to measure the presence of seniority-based pay from a different perspective than the one traditionally used in the empirical literature of tenure and wages, which concentrates on worker level data. Similarly, our data allows us to obtain direct measures of monitoring devices, as well as other measures of explicit incentives practices. Moreover, the use of plant level data allows us to get a better understanding of the role that firm and job characteristics play in the diffusion of deferred payment schemes. This is a question that has been scarcely addressed in the literature that uses data at the plant level.

Spain is an interesting case to analyze seniority-based pay because, in this country, retirement is mandatory for all workers once they reach the age of 65. Therefore, all establishments in our sample are subject to this mandate. According to Lazear (1979), jobs with delayed payment contracts should be characterized by mandatory retirement. The institution establishes a termination date after which the worker is not entitled to continue receiving a wage that is greater than her productivity. Moreover, production workers in Spanish manufacturing firms do not have absolute employment security. If they do not perform well in their job, they can be fired for disciplinary reasons (see Galdon-Sanchez and Güell, 2003). In this context, seniority-based pay can become an optimal contract.

[4]Bayo-Moriones and Huerta-Arribas (2002a and 2002b) have studied explicit incentives using the same data set that we use here. In Bayo-Moriones and Huerta-Arribas (2002a), the authors investigate the factors that influence the adoption of incentive schemes that link the blue-collar workers pay to the results achieved by the establishment that employ them, i.e. the so called organizational incentive plans. And in Bayo-Moriones and Huerta-Arribas (2002b), they identify the factors that determine the use of production incentives for manual workers in the Spanish manufacturing industry.

Our results provide empirical support for the theories that are behind the deferred wage schemes as motivational devices. We find that firms that offer seniority-based pay are less likely to offer explicit incentives. They are also less likely to invest in monitoring devices. We also find that firms that offer seniority-based pay rather than explicit incentives are more likely to engage in other personnel practices that imply long employment relationships. Finally, since seniority-based pay could be related to other personnel practices, specially training, we also analyze whether this is the case in our data set.

The rest of the paper is organized as follows. In the next section we review the related literature. Section three is devoted to the description of the survey from which we obtained the data used to perform our exercise. In section four we undertake our empirical analysis. We define all the variables used in our exercise and proceed to the descriptive analysis of such variables. The results appear in section five, which is followed by the conclusion.

2 Literature Review

In this section we review all the literature related to our study. First of all, we review the theory that considers the seniority-based pay contract as a motivational device, as well as the existing empirical evidence on this theory. Second, we review other theories that consider seniority-based pay contracts as independent of incentives. We also review some of the literature on the correlation of seniority and wages due to the provision of human capital.

2.1 Seniority pay as a motivator device

2.1.1 Theory

Lazear (1979, 1981) offers an explanation for seniority-based pay founded on motivational issues. Seniority-based pay can be used to align the interests of the worker with those of the company and, therefore, lead to greater levels of effort from employees.

If the firm offers a wage profile in which, at every moment in her career, the employee is paid just for her productivity, when the worker is close to retirement she will be likely to shirk. This will happen because, in that case, the worker has nothing to lose since she is not going to be employed anyway any more. The same would apply at any other moment

during her working life at the firm, as long as the costs of finding a new job at that moment are small.

However, this behavior would not take place if the worker had to face a penalty for not putting enough effort. For example, if the employee had to pay an up-front fee which would be returned at the moment of retirement from the firm. The fee would only be returned if the employee had not shirked during her career in the company. But, if she shirked, she would be fired, not ending her career at the firm and not getting back the up-front fee.

One way of generating this penalty is linking wages to seniority, paying the employee below her productivity at the beginning of her career and above her productivity at the end of it. This linkage implies a steeper association between wages and seniority than that between productivity and seniority. It also implies that seniority pay becomes a deferred compensation scheme. By allowing initial wages to be paid at the end of the employee's career, the firm discourages its workforce from engaging in any inappropriate behavior. This increases both the value that the employee can be expected to contribute to the firm and the total amount of wages that this worker receives throughout her career in the firm. This motivation mechanism can only work if it goes together with the threat of dismissal in case of poor job performance. If firing is not possible due to whatever reasons (legal constraints, etc.), seniority pay cannot act as a motivator device.[5]

There are several implications from the theory in Lazear (1979). The first one is that, if used as a motivational device, seniority-based pay is unnecessary when there are other mechanisms that prevent employees from shirking. If effort can be easily observed by the firm, for example because many resources are devoted to monitoring, the motivation role of seniority pay does not make any sense. The same applies when worker's output is easy to observe by the firm. In this case the firm can use explicit incentive mechanisms, such as payment by results, to encourage worker's effort. As a consequence, a negative relationship between the use of seniority pay and both the degree of monitoring and the existence of explicit incentives should be expected.

The second implication of Lazear's theory is that those jobs characterized by seniority-based pay should have higher wage growth rates than productivity growth rates. If seniority

[5] Notice that for such threat to be credible, some form of monitoring which allows firms to obtain at least a qualitative measure of worker's performance has to be feasible. While a necessary condition for firms to implement explicit incentives is that output is easy to observe and thus monitoring allows to quantify output and pay accordingly, a more imperfect form of monitoring is sufficient to implement seniority-based pay.

pay is used as a motivating device, it must be a deferred compensation scheme. For that reason, it is a long-term implicit incentive that involves a promise from the firm to the employee. The employee will accept this implicit contracting if she trusts that the firm will not renege on its promise. This will happen when the company has a solid and established reputation as employer, which is more likely to be associated with firm features such as size or age.

Other implications of this theory, which are not that relevant for the purpose of this paper, are the following ones: 1) pensions, which discourage shirking until the end of a labor relation, are more common in situations that include implicit incentives; 2) firms with jobs that included implicit incentives should implement mandatory retirement in order to fix a termination date, after which wages cannot grow beyond productivity; and 3) long-tenured workers are more likely to have jobs that offer mandatory retirement and pensions.

2.1.2 Empirical evidence

Empirical tests of Lazear's theory have been performed from very different perspectives. Since the implications that derive from this model are applicable to quite different research areas, it is possible to analyze its validity with different empirical approaches.

Some authors have concentrated their efforts on testing the prediction on worker's wage growth, i.e. that wages rise more rapidly than productivity. See, for example, Medoff and Abraham (1980), Lazear and Moore (1984), Spitz (1990) and Lazear (2000). Other authors have studied the implications of the theory with regard to mandatory retirement and earnings. Examples of these are the original paper by Lazear (1979) and the paper by Clark and Ogawa (1992), which tests the theory in Japan. Alternative approaches have studied the implications of the theory for dismissals and tenure (see, for example, Idson and Valetta, 1996).

There are also other empirical articles that, just like ours, focus more directly on the motivational nature of seniority pay. They test the hypothesis that seniority-based pay will be applied in circumstances of agency problems, provided that the link between wages and seniority is used as a means to motivate workers. This problem does not happen when workers are self-employed, that is, when they own the firm in which they work.

If seniority pay acts as a motivator to workers, the wage-seniority slopes found in self-owned companies ought to be less pronounced than those found in other types of firms.

Lazear and Moore (1984) find empirical evidence to support this argument since, in the case of self-employed workers, the present value of the lifetime income earned by an employee increases less with the slope of the age-earnings profile.

Hutchens (1987) focuses on the relationship between seniority pay and monitoring, which depends on how repetitive are tasks in a job. Then, the author analyzes jobs according to the predicted characteristics of Lazear's theory (long tenure, pensions, mandatory retirement, etc.) taking into account the degree of monitoring that workers are subject to.

Another paper that relates to our work is Barth (1997). Based on a sample of Norwegian workers, the author reports that employees paid on a piece-rate basis do not make any profit, in terms of wages, from staying with the same company over a long period of time. The author came to this conclusion by estimating a wage regression (controlling for worker seniority) and including a variable that captures the presence of piece-rates along with an interaction term between piece-rate and seniority.

A common characteristic of all these papers is that they use survey data at the worker level, inferring the existence of a relationship between wages and seniority from the analysis of worker's wage and tenure data. Our paper, however, measures the existence of seniority-based pay directly at the firm level. In addition, we evaluate both monitoring devices and explicit incentives as well. Finally, we also have information on other personnel practices that have important implications for the worker's tenure and thus should be related to seniority-based payments.

2.2 Other theories

Apart from Lazear's explanation, firms can offer seniority-based pay contracts for other reasons independent of incentives. One of these alternative explanations of upward sloping wage profiles is provided by the models of self-selection (see Salop and Salop, 1976). According to these models, this increasing wage path will attract those workers who intend to stay with the company throughout their professional careers. This has a positive impact on the firm due to the reduction in staff turnover costs.

Seniority pay also appears as a delayed payment scheme if it is used as a mechanism to reassure risk-averse workers who are insecure about their productivity (see Harris and Holmstrom, 1982). Social norms or cultural reasons could also explain the presence of such contracts. In these cases the origin of seniority-based pay could be the preference of

workers for rising earnings-seniority profiles over decreasing or flat profiles (Loewenstein and Sicherman, 1991; Frank and Hutchens, 1993) or the desire to keep status consistency inside the company (Baron and Kreps, 1999).

Another possible explanation for seniority-based pay has to do with the role of unions in the determination of working conditions (Freeman and Medoff, 1984). In those workplaces undergoing collective bargaining, unions will tend to favor the situation of their members with more power, who usually are those with more seniority in the firm.

Finally, others have explained the existence of a positive correlation between wages and tenure with different approaches. The most popular one is provided by the human capital theory (see Becker, 1964; Mincer, 1974; and Felli and Harris, 1996).[6] According to this theory, the existence of specific human capital increases worker productivity with tenure in the firm. Wages reflect such productivity gains and, as a consequence, seniority has a positive influence on wages through its effect on productivity. However, the existing empirical evidence is not unambiguously consistent with the specific human capital theory. While a part of the literature has found that wage increases due to seniority have their origin in productivity increases (see, for example, Brown, 1989; and Hellerstein and Neumark, 1995), other part of the literature provides empirical evidence that shows the seeds of doubt in relation to the validity of the predictions of the specific human capital theory and suggests the possible validity of the aforementioned explanations (see Medoff and Abraham, 1980; Kotlikoff and Gohkale, 1992; Levine, 1993; Flabbi and Ichino, 2001; among others).

As it is evident, the most distinguishing feature of Lazear's theory is that it connects seniority-based pay to other practices such as explicit incentives or monitoring. Nevertheless, these practices do not play any role in all these other theories or possible explanations for the existence of seniority-based pay contracts. Our empirical strategy will be exactly based on this feature.

3 Survey's Description and Data

In this paper, we use a unique data set that contains plant level information on several firm's policies. All surveyed establishments are involved in production processes within the

[6]Note that this explanation does not rely on the existence of a seniority-based pay contract. However, it relies on the presence of training at the firm, something we are able to analyze using our data.

manufacturing sector. Overall, we obtain very homogeneous data for every surveyed plant. At the same time, a wide scope of different firms within the manufacturing sector are included in the survey. Next, we describe the characteristics of the survey and concentrate on the variables that we are going to use in our analysis.

The data were carefully collected in 1998 in the context of a wider research project on human resource management and operations management in Spain's manufacturing industry. All answers to the questionnaires refer to 1997. The concept of manufacturing industry is clearly defined in the Spanish National Classification of Economic Activity (*Clasificacion Nacional de Actividades Economicas*, CNAE)[7] which includes all the manufacturing industries with the exception of oil refining industry and that of the treatment of nuclear fuel.

The manufacturing industry was so chosen as the research focus for several reasons. First of all, it is a sector in which heterogeneity is limited compared to, for example, other sectors such as services. Second, manufacturing is an industry with a considerable weight in the economy of Spain. This allows us to draw more general conclusions, which would be applicable to a wider range of firms. Finally, choosing a wide scope of activities within the manufacturing sector allows us to obtain fairly general conclusions, while we avoid the problems of data sets that are too general and heterogeneous (see Ichniowski and Shaw, 2003).

When designing the survey, we decided that information should be collected at the plant level. In the manufacturing sector the plant is the basic business unit, which has strategic importance for the implementation of the practices under study. These practices are adopted in the plant, and therefore, it is at this level that problems arise and where results must be analyzed. Moreover, the answers to the different questions raised are expected to be more reliable when taken at the plant level, since knowledge of these issues is greater at this level, even if it is only for reasons of greater proximity to the matters addressed in the survey.[8]

Another aspect of the research scope to be defined was the size of the establishments to analyzed. The industrial plants included in our sample employ fifty or more workers. Other similar studies established this same limit (see, for instance, Osterman, 1994), which, in our case, serves to cover a wide spectrum of the population employed in the Spanish industry. Moreover, it simplifies the fieldwork, since there are more reliable directories of

[7]This is equivalent to the ISIC rev. 3 activity classification.

[8]As Osterman (1994) states: "The great advantage of surveying establishments, as opposed to firms, is that the respondent in an establishment is likely to know the facts" (page 174).

firms population for this group.

In order to carry out the investigation, the members of the research group designed a questionnaire together with the firm in charge of the fieldwork, after a close examination of the international literature related to the project content. The preliminary survey was tested in nine plants. After the pilot test, the questionnaire was modified in several ways before arriving to its final version. The questionnaire was divided into the following parts: general characteristics of the establishment, technology and quality management, human resource management, work organization, relations with customers and suppliers, and information on the firm.

Regarding personnel practices, the survey refers to blue-collar workers in each plant, that is, workers directly involved in the production process. The fact that we refer to a specific group of workers could create problems, as far as generalization of results to other professions is concerned. However, limiting the occupation under study makes comparisons easier, since there are possibly several internal labor markets with substantial differences between them within a company.

The information was gathered by interviewing the plant manager or the operations or human resources manager in the plant. A personal interview was chosen as the method of collecting information because it gives a higher response rate.

The reference universe, that is, manufacturing plants with at least 50 workers[9], was formed by 6,013 units. The aim was to obtain a sample of one thousand units, stratified according to sector and size. The larger-size stratum was represented at 50 per cent in the sample design. For the two remaining size strata, a fixed number of 30 interviews was allocated to each sector; the rest of the interviews being allocated proportionally across sectors. The sample allocated to each of the strata within a sector was also distributed proportionally. A random selection of plants was taken from each stratum for interview. After making 3,246 telephone calls to make the necessary appointments, 965 valid interviews were conducted. The sample size corresponds to 16 % of the population. Table A in the Appendix displays the ratio sample to population by firm size and sector.

For the purpose of this paper we analyze a final sample of 734 plants, those for which none of the variables have missing values.[10] For this type of data, this is a rather large

[9]This refers to all types of workers in the firm.

[10]These correspond to 75 per cent of the original sample and thus sizeable selection problems should not be at work.

sample size.

4 Empirical Analysis

Our goal is to understand if there is an incentive motive when a firm offers seniority-based contracts to their employees. A crucial aspect to bear in mind is that production workers in Spanish manufacturing firms do not have absolute employment security. If they do not perform well in their job, they can be fired for disciplinary reasons (see Galdon-Sanchez and Güell, 2003).[11] In this context, seniority-based pay could become an optimal motivational contract.

In order to determine if seniority-based pay is used as a motivational device rather than a wage rule independent of incentives,[12] we proceed as follows. We first analyze the relationship between seniority-based pay, monitoring devices and explicit incentives. When seniority-based pay is used as a motivational device, then seniority-based pay and explicit incentives (or monitoring) should be negatively correlated (see Lazear 1979). On the other hand, when seniority-based pay is simply a wage rule, there is no theoretical reason (or any economic mechanism) that predicts any particular relationship between seniority-based pay and explicit incentives. In other words, in this case we should not expect these two policies to be related in any systematic way. More particularly, we should not observe any sizeable negative correlation.

Once we establish that seniority-based pay is negatively correlated with explicit incentives and monitoring, in a second step we analyze other practices that could be potentially important to the firm when deciding to choose seniority-based pay to motivate its workers. We consider specifically other personnel practices that favor long term employment relationships. These practices make the firm's commitment to pay high future wages credible and, therefore, are complementary measures to implicit incentives. They provide further evidence that seniority-based pay could be used as an incentive device.

As mentioned earlier, wages can be correlated with worker's tenure for reasons other

[11] Employment protection legislation in Spain is very similar to most European countries. Firms can fire workers for "economic reasons" (in which case the worker gets an indemnity) or for "disciplinary reasons" (in which case the worker has no right to an indemnity). Workers can always appeal the case if they disagree. If a dismissal case ends up in court, firms may have to pay larger indemnities to workers. Therefore, while dismissal is costly for the firm, it is still a possibility even for permanent workers.

[12] As explained in Section 2.

than those related to incentives. The most obvious alternative is the existence of training. Therefore, in a third step we will analyze the relationship between seniority-based pay and training policies.

Different personnel practices are usually chosen simultaneously by a firm, generating "systems" or "bundles" of practices. There are theoretical foundations that explain the complementarities of different policies (see for example, Holmstrom and Milgrom, 1994). We are aware of the possible endogeneity problems of including different personnel practices as independent regressors when estimating the probability that firms use seniority-based pay schemes. However, in the present context, and, more precisely, due to this multidimensional nature of the firm's practices, it is very difficult to find instruments. Therefore, we carefully interpret our results as bivariate relationships between different personnel practices.

In the next two subsections we first describe the variables used in our exercise (subsection 4.1) and, second, take on a descriptive analysis of those variables (subsection 4.2).

4.1 Variables

The survey contains information on the two most important factors that are taken into account when setting the fixed-part of blue-collar workers wages. The survey makes a clear distinction between the fixed-part and the variable- part of worker's remuneration. There are five possible factors that may determine the fixed-part of wages. These include seniority, worker characteristics (skills, efficiency, evaluation from a supervisor) and job characteristics. Using the information gathered from the survey, we construct two variables that will be the main dependent variables in our exercises. The first one, *Seniority-Based Pay (incidence)*, captures whether firms use seniority-based pay or not. Among firms that use seniority-based pay, there may be differences in the degree in which such practice is being used. The second variable, *Seniority-Based Pay (intensity)* captures the different degrees in which firms may use seniority-based pay.

More specifically, the variable *Seniority-Based Pay (incidence)* takes value one when firms base wages partly on seniority, that is, if seniority was mentioned either as the most important or second most important factor when setting wages, and zero otherwise. We also constructed *Seniority-Based Pay (intensity)*, which takes value two when seniority was said to be the most important factor to set wages, value one when it was mentioned as the second most important factor, and value zero in the remaining cases. These variables directly

capture the idea of seniority-based pay contracts. We find that a substantial fraction of firms followed this policy: around 30 per cent of firms pay partly according to seniority. Among these, 30 per cent say that seniority is the most important criteria used when setting wages, while for the remaining 70 per cent it is the second most important criteria. These figures are empirically relevant to conduct our exercise.[13]

In the survey, firms were asked whether they offer incentive payments to their blue-collar workers. These included payments that are based on productivity, quality, plant-level or firm's results. This type of incentives correspond to the explicit incentives mentioned earlier. Using this information, we construct two variables that capture explicit incentives in a similar way that the two seniority-based pay variables. The first one, *Explicit Incentives (incidence)*, captures whether firms use explicit incentives or not. The second variable, *Explicit Incentives (intensity)* captures the different degrees in which firms may use explicit incentives. In particular, we define the variable *Explicit Incentives (incidence)*, to which we assigned value one when firms answered affirmatively to this question and zero when the answer was negative. As table 1 shows, around 62 percent of firms offer some explicit incentives to their workers. We also create the variable *Explicit Incentives (intensity)*, which registers the percentage of worker's earnings that such incentives represent. On average, in our sample, this accounts for 10 percent of wages.

We repeat all our analysis using another measure of explicit incentives that focuses on firms that only offer *individual* explicit incentives, that is, using variables *Explicit Individual Incentives (incidence)* and *Explicit Individual Incentives (intensity)*, respectively (see table 1). As will be shown, the results of the paper are generally robust to these alternative measures of explicit incentives.

The survey also contains information on the degree of supervision and control under which manual workers perform their duties at the plant. The answers are in a scale of one to five, where one is equivalent to no supervision at all, and five is equivalent to close supervision. Using this information we construct the variable *Monitoring (incidence)*, to which value one is assigned when the degree of control is sufficiently high (i.e. values four and five as the answers to this question) and zero otherwise. In our sample, around 40 per cent of firms spend resources in supervising their workers according to this variable. Equally,

[13]We have not been able to find any other paper that studies this variable with a cross section of firms, so we can not establish any comparison.

we also define the variable *Monitoring (intensity)*, which takes values 1 to 5.

We then turn to look at factors other than incentives that could also be behind the determination of seniority-based pay schemes. In our empirical analysis, it is important to control for these factors.

• Sector

Our data set includes information on the sector to which the plant's activity belongs (at a three digit level). The sector indicators capture the nature of the production technology. This is crucial to determine the ease to monitor effort (see Hutchens, 1987). According to the information available, we can distinguish among 91 different sectors. Since it is very important to analyze the provision of incentives among plants that have similar difficulties in observing effort, we include sectorial dummies in all of our regressions.

• Region

The province in which the plants are located also appears in our data set. There are 50 different provinces within Spain which correspond to 17 different larger regions (Autonomous Communities). Although the labor legislation is exactly the same in all regions, part of the collective bargaining between unions and employers' representatives is done at a provincial/regional level (see Diaz-Moreno and Galdon-Sanchez, 2004). Therefore, it may still be important to control for possible region effects, given the existence of potential differences in the negotiation of some labor conditions between unions and employers.

• Age of the establishment

In the data set we also have information regarding the year in which the establishment was founded. We construct the variable *Old*, which takes value one if the establishment was founded before 1980 and zero otherwise. The year 1980 is particularly relevant in Spain since it is the year in which the Worker's Statute, the main law that regulates the different aspects of labor relations in the Spanish democratic era, was signed.

• Ownership

Different sources of information regarding the ownership structure of the firms are available in the data set. From this information we construct the following variables. We define the variable *StateShare*, which takes value one if the state owns a share of the firm and zero otherwise. Around three percent of firms in our sample have some of their shares owned by the state. Among these, on average, 65 per cent of their capital is state owned. Moreover, since the establishments specify if they belong (totally or partially) to a multinational

group, we can define the variable *Multinational*, which takes value one if the firm belongs to a multinational group and zero otherwise.

• Size

The size of the establishment is also available since the data set provides information regarding the number of workers employed at each establishment. We define the variable *Large* that takes value one if the firm has more than 500 workers. Otherwise, it takes value zero.

• Union

Information on the presence and influence of unions in the firm can also be obtained from the available data. In Spain, most large firms negotiate an agreement beyond the regional pact that applies solely to that firm. All workers, unionized or not, are subject to this agreement. A unionized worker has the right to enter in this negotiation process, since unionized workers have the right to choose their representatives in the negotiation with the firm, among themselves, through voting. The number of unionized workers at the firm can play an important role in determining the type of agreement reached since this number also gives an idea of the strength of unions in the firm (see Diaz-Moreno and Galdon-Sanchez, 2004). Therefore, we specify the variable *Union* that takes value one if the level of workers' unionization is higher than 60 per cent and zero in the remaining cases.

• Wage Level

Firms are asked to compare the wages that they pay to their workers with the wages of similar workers of similar firms in the same region. We construct the variable *WageLevelAbove*, which takes value one if firms say that their workers wages are above comparable workers wages and zero if it is the opposite.

• Foreign Product Markets

The data set has information regarding the distribution of firms' sales among Spain, Europe and the rest of the World. From this information, we designate the variable *InternationalSales* that takes value one if more than 50 per cent of the firm's sales are international and zero if it is not the case.

Once we establish that seniority-based pay is used as a motivational device, and in order to provide further evidence, we analyze different factors and personnel policies that could be more relevant to the use of seniority-based pay than to the use of explicit incentives. These are described below.

• Temporary (or Fixed-Term) Contracts[14]

The proportion of workers under fixed-term and permanent contracts is also available in the data set. This ranges from zero to 96 per cent and the average is around 21 per cent. The variable which registers the share of temporary workers is *TemporaryWorkers*.

• Firing policies

There is information regarding firing policies from those firms that have recently fired workers or that were in a staff cutback process at the time. However, the number of observations for these variables is reduced substantially since many firms in the sample were not undergoing a process such as this. In particular, firms were asked about the adoption of alternative policies to avoid firing workers with permanent contracts. These policies included ending temporary contracts, reducing production subcontracted to other firms, relocating multi-skilled workers, cutting back or cancelling overtime, distributing labor hours (reducing hours of affected workers) and offering early retirement to older workers. Firms were asked to select the two measures that were mostly used by them. We use the information provided for the firms that were involved in this process to define the variable *NoFireMeasures*, which makes reference to the number of measures taken to avoid firing permanent workers. These could be zero (that is, firm did not mention any measure), one (that is, firm only mentioned one measure) and two (that is, firm mentioned two different measures). This variable measures the degree of commitment of firms to keep a long-term relationship with their workers.

• Training

As we have previously mentioned, wages can be correlated with worker's tenure for reasons other than incentives. A noticeable alternative to this explanation is the existence of training. We collected information on whether blue-collar workers were offered training courses, which led us to the variable *Training*. This variable takes value one if training was offered by the establishment to blue-collar workers and zero if it was not.

Table B in the appendix summarizes how the main variables regarding human resource management practices were defined. Table 1 provides the definition of the variables and their basic summary statistics.

[14]In 1984 there was a reform of the Spanish Labor Law that allowed the use of fixed-term contracts for jobs whose nature was not necessarily temporary. These contracts involve much lower termination costs than permanent contracts (see, for instance, Güell, 2000; and Alonso-Borrego et al., 2005, for an analysis of their effect in the Spanish economy).

[TABLE 1 HERE]

4.2 Descriptive Analysis

The descriptive analysis of the variables used in our exercise can be found in table 2. This analysis is based on the variable *Seniority-Based Pay (incidence)*. The left hand panel of this table displays the summary statistics for the main variables used by those firms for which *Seniority-Based Pay (incidence)* is equal to one or, in other words, firms that set wages partly on seniority. The central panel displays the summary statistics for the main variables used by firms where seniority is never used as a criteria to set wages or where *Seniority-Based Pay (incidence)* is equal to zero. The right hand panel displays the p-values associated with the one-sided tests regarding the difference in variable means for firms that base wages partly on seniority and those that do not.

[TABLE 2 HERE]

The first important feature to notice is that the firms that base wages partly on seniority are less likely to provide explicit incentives than those that do not provide such wage scheme. This is true for both the incidence and the intensity measure of explicit incentives. These firms also tend to undertake less monitoring in terms of both our measures (incidence and intensity), although the difference is not significant in the case of the incidence measure. These factors provide some preliminary evidence that seniority-based pay and other incentive mechanisms can be considered substitutive devices. It is also worth noting that these firms tend to be older, partly or totally owned by the state, and larger. Firms that offer wages according to seniority tend to be more unionized, although the difference is not significant. Since the firm's characteristics could affect the way in which the firm sets its wages, it is important to control for these factors in our regression analysis. For example, state owned and/or large firms may have a preference for rules rather than discretion with regard to their pay schemes. Therefore it is important to see if the negative relationship between seniority-based pay and explicit incentives, which appears in the raw data, stays the same once these variables are included as controls in our analysis.

With regard to other personnel policies, firms that base wages partly on seniority have also a lower proportion of workers under fixed-term contracts. Also, on average, they reported a higher number of measures taken to avoid firing their core permanent workers, although

the difference is not significant. Regarding training and seniority-based pay, table 2 shows that there is no difference between firms that base wages partly on seniority and those that do not in terms of training.

5 Results

In this section we undertake the empirical analysis and explain the results obtained. We want to explore if a firm's predisposition to offer wages partly based on seniority is related to long-term incentives. That is, to find out if the negative correlation between seniority-based pay and other incentive devices (explicit incentives or monitoring devices) remains present after controlling for different firm characteristics as well as regional and sectorial controls.[15]

In particular, we estimate a probit model in which *Seniority-Based Pay (incidence)* is the dependent variable and include as regressors the incidence measures of explicit incentives and monitoring as regressors. Then we estimate an ordered probit model in which *Seniority-Based Pay (intensity)* is the dependent variable and include the intensity measures of explicit incentives and monitoring.[16] The results are displayed in tables 3a and 3b, respectively.

[TABLES 3a and 3b HERE]

We start with the most simple specification which includes *Explicit Incentives (incidence)* as an explanatory variable as well as the mentioned controls. As column (1) of table 3a indicates, firms that base wages partly on seniority are less likely to offer explicit incentives, even after controlling for different firm characteristics. This result confirms the findings of Barth (1997). Working with a sample of Norwegian workers, he found that piece-rate workers have a negligible return to seniority in terms of wages. Column (2) analyzes the relationship between seniority-based pay and monitoring. Again, a negative relationship remains after controlling for firm characteristics. This result is similar to the findings of Hutchens (1987). Using US data, he proved that monitoring difficulties correlate positively with the application of deferred payment schemes.

[15]The coefficients of the different controls are available upon request.

[16]Around 10 per cent of the observations in the sample show no variation in terms of the dependent variable within sectors or regions and are lost when estimating the probit model.

Jobs that offer piece-rate payments are lead to monitoring (see Lazear, 1979). As Hutchens (1987) clearly explains, in this case, monitoring essentially takes the form of counting the units produced so workers are paid accordingly. In column (3), we apply both *Explicit Incentives (incidence)* and *Monitoring (incidence)* as right-hand side variables. Moreover, we allow an interaction term between these two variables. The coefficient on these two variables remains negative in this specification. The coefficient of the interaction term is not statistically different from zero, suggesting that there is no additional effect coming from firms that invest in monitoring devices at the same time they provide incentives.

Table 3b reports the results when repeating the previous exercise but using intensity measures instead. According to the overall analysis, results are qualitatively the same.[17] All these results suggest that seniority-based pay and explicit incentives, as well as monitoring devices, act as substitutes. This suggests that seniority-based pay is used as a motivational device, in accordance with the main prediction of Lazear's theory. The intuition is simple: the more difficult a job is to supervise and the less resources devoted by the firm to control its workers, the more likely the firm relies on seniority-based pay.

As mentioned earlier, different personnel practices are chosen simultaneously by a firm. One possible way of solving this simultaneity problem is to estimate multivariate probits of the different incentive practices. In this case, the correlation coefficient between the different equations captures the relationship between the different practices. We estimate bivariate probit models in which *Seniority-Based Pay (incidence)* and *Explicit Incentives (incidence)*, and *Seniority-Based Pay (incidence)* and *Monitoring (incidence)*, respectively, are the dependent variables (columns (1) and (2) in table 4). We also estimate a trivariate probit model in which *Seniority-Based Pay (incidence)*, *Explicit Incentives (incidence)* and *Monitoring (incidence)* are the dependent variables (column (3) in table 4).[18] As it can be appreciated, the correlation coefficients between the variables *Seniority-Based Pay (incidence)* and *Explicit Incentives (incidence)*, and *Seniority-Based Pay (incidence)* and *Monitoring (incidence)* are negative and significant, providing further evidence that these are substitutive practices. The correlation coefficient between the variables *Explicit Incentives (incidence)* and *Monitoring (incidence)* is positive but not significant.

[17]The estimation of an ordered probit of *Seniority-Based Pay (intensity)* on incidence measures of explicit incentives and monitoring leads to the same findings. These results are available upon request.

[18]For estimation of this type of models see, for instance, Cappelari and Jenkins (2003).

[TABLE 4 HERE]

Once we established that seniority-based pay is a substitute for other motivational devices, we further analyze the relationship between this policy and other personnel practices. Economic theory suggests that firms that decide to use seniority-based pay as an incentive device, rather than using explicit incentives, should complement such policy with other personnel practices that give the firm the necessary credibility to commit to future wages. As Hutchens (1987) states, seniority-based pay contracts should be accompanied by long job tenure. However, this should not be the case for firms that offer explicit incentives. Next, we study the combination of different personnel practices. We start analyzing the use of short duration contracts or temporary contracts. Table 5a displays the estimates of a trivariate probit model in which *Seniority-Based Pay (incidence)*, *Explicit Incentives (incidence)* and *Monitoring (incidence)* are the dependent variables. We include the share of temporary contracts in the firm, *TemporaryWorkers*, as independent variable.

[TABLE 5a HERE]

Overall, the results in table 5a show that firms that opt for seniority-based pay are less likely to use short duration contracts.[19] This result indicates a commitment to long employment relations that can be explained in terms of the incentive role of seniority-based pay practices. On the other hand, as expected, the coefficient of the variable *TemporaryWorkers* is not generally significant in the equations in which the dependent variables are *Explicit Incentives (incidence)* or *Monitoring (incidence)*. The correlation coefficients between these variables are similar, although smaller, to those reported in table 4.

We next analyze different firing policies. As mentioned earlier, these variables have fewer observations because only the firms that had been recently under a process of restructuring had to answer the questions related to firing policies. For this reason, we are forced to estimate separate probit models (rather than a trivariate probit) in which *Seniority-Based Pay (incidence)*, *Explicit Incentives (incidence)* and *Monitoring (incidence)* are the dependent variables.[20] Table 5b displays these estimates.[21]

[19]Using incidence measures of temporary contracts, we obtain the same qualitative results. Also ordered probit estimates in which *Seniority-Based Pay (intensity)* is the dependent variable provide similar results. These results are available upon request.

[20]In these estimations, in order to maximize the number of observations, regional dummies correspond to the 17 Autonomous Communities instead of the 50 provinces.

[21]Between 32 and 44 per cent of the observations in the sample show no variation in terms of the dependent

[TABLE 5b HERE]

The first column of table 5b shows that firms that base wages partly on seniority are more likely to implement measures to avoid firing their permanent workers. The second column reveals that for firms that use *Explicit Incentives (incidence)*, the coefficient on *NoFireMeasures* is positive but not significant. Finally, the relationship between *Monitoring (incidence)* and *NoFireMeasures* is negative, although not significant. Overall these results suggest that firms that choose to base wages partly on seniority also choose other personnel practices that involve long employment relationships, which is consistent with the idea that seniority-based pay is used to provide long-term incentives.

As mentioned earlier, there are alternative theories that predict a positive relationship between wages and seniority for reasons other than the provision of incentives. In particular, this could be the case in the presence of training policies. We estimate a probit model in which the dependent variable is *Seniority-Based Pay (incidence)* and an ordered probit in which the dependent variable is *Seniority-Based Pay (intensity)*, as follows. In this model, we include the variable *Training* as an explanatory variable. Table 6 displays the results of this exercise.

[TABLE 6 HERE]

The main result in this exercise is that training and seniority-based pay are negatively related. This suggests that firms that base wages partly on seniority are not more likely to train their workers than firms that do not pay according to accumulated tenure. Several clarifications are worth noting. First, the variable *Training* is a general measure of training and not necessarily training on firm-specific skills. Second, this variable captures training activities from the previous year and not overall training activities or training required in the current job.[22]

Of course, our findings do not rule out training as a mechanism that generates a positive correlation between wages and seniority or the fact that trained workers may receive higher wages due to their tenure. Instead, our sample suggests -keeping these clarifications in mind- that there are reasons beyond training that explain the practice of seniority-based pay. In

variable within sectors or regions and are lost when estimating the probit model.

[22]Barth (1997) has information on the job's required level of on-the-job training. He finds that firm-specific training has a negative effect on the tenure wage profile.

this paper, we have argued that there is evidence that seniority-based pay is used as an incentive device.

6 Conclusions

In this paper, we have empirically tested the theory of long term implicit contracts using plant level data. In particular, we have analyzed the possible motivation role of seniority-based pay schemes. Unlike previous papers, we have used a direct measure of such firm practice.

Our main conclusion is that firms which base wages partly on seniority are less likely to offer explicit incentives. They are also less likely to invest in monitoring devices. This result remains stable after controlling for several firm characteristics. Another interesting result that arises from our exercise is that firms that base wages partly on seniority are more likely to engage in other personnel practices that involve long employment relationships. These practices make the firm's commitment to pay high future wages credible and therefore are complementary measures to implicit incentives. Overall, our plant level data provide empirical support to the implicit incentives theory proposed by Lazear (1979).

On the other hand, we think that, in order to properly test personnel economics theories, plant level data on firm's practices is required. Even though the data is costly to gather and has so far been scarce, it contains valuable information that can shed new light on testing personnel economic theories.

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Table 1. Variable Definitions and Descriptive Statistics

Variable	Definition[1]	Mean	Std. Dev.
HRM practices			
Incidence			
Seniority-Based Pay (incidence)	1 = wages partly based on seniority, 0 = otherwise	0.287	(0.452)
Explicit Incentives (incidence)	1 = explicit incentives provided, 0 = otherwise	0.619	(0.485)
Explicit Individual Incentives (incidence)	1= explicit individual incentives provided, 0=otherwise	0.519	(0.500)
Monitoring (incidence)	1 = workers subject to high supervision, 0 = otherwise	0.396	(0.488)
Intensity			
Seniority-Based Pay (intensity)	2 = seniority as most important factor in setting wages, 1 = seniority as second most important factor, 0 = otherwise	0.372	(0.636)
Explicit Incentives (intensity)	Percentage of earnings that correspond to incentive pay	10.17	(11.01)
Explicit Individual Incentives (intensity)	Percentage of earnings that correspond to individual incentive pay	9.158	(11.128)
Monitoring (intensity)	Level of supervision: 1 = no supervision at all, 2 = hardly any, 3 = moderate , 4 = high, 5 = very high	3.36	(0.7)
Firm characteristics			
Old	1 = plant founded before 1980, 0 = otherwise	0.738	(0.439)
StateShare	1 = state owns a share of the firm, 0 = otherwise	0.034	(0.181)
Multinational	1 = firm belongs to multinational group, 0 = otherwise	0.287	(0.452)
Large	1 = firm with more than 500 workers, 0 = otherwise	0.107	(0.309)
Union	1 = unionization of workers above 60 %, 0 = otherwise	0.318	(0.467)
WageLevelAbove	1 = wages above similar workers in similar sector & region, 0 = otherwise	0.419	(0.493)
InternationalSales	1 = more than 50 % of sales sold abroad, 0 = otherwise	0.241	(0.428)
Other HRM practices			
Training	1 = training provided, 0 = otherwise	0.792	(0.406)
TemporaryWorkers	Share of temporary workers	20.690	(21.220)
*No Fire Measures**	Number of measures mentioned to avoid firing permanent workers	1.915	(0.278)
Number of obs.		734	

Notes:

[1] See Table B in the Appendix for a detailed description of how variables have been constructed.

* For this variable, the number of observations is 178.

Table 2. Descriptive Statistics, by *Seniority-Based Pay (incidence)*

Variable	Definition	Seniority-Based Pay[1] Mean	Seniority-Based Pay[1] Std. Dev.	Non Seniority-Based Pay[2] Mean	Non Seniority-Based Pay[2] Std. Dev.	p-value
Explicit Incentives (incidence)	1 = explicit incentives provided, 0 = otherwise	0.578	(0.495)	0.636	(0.481)	0.069 *
Explicit Incentives (intensity)	Percentage of earnings that correspond to incentive pay	9.057	(10.386)	10.627	(11.243)	0.040 **
Explicit Individual Incentives (incidence)	1 = only explicit individual incentives provided, 0 = otherwise	0.493	(0.501)	0.530	(0.499)	0.183
Explicit Individual Incentives (intensity)	Percentage of earnings that correspond to individual incentive pay	8.019	(10.167)	9.618	(11.470)	0.039 **
Monitoring (incidence)	1 = workers subject to high supervision, 0 = otherwise	0.364	(0.482)	0.409	(0.492)	0.134
Monitoring (intensity)	Level of supervision (1 to 5)	3.331	(0.699)	3.377	(0.701)	0.071 *
Old	1 = plant founded before 1980, 0 = otherwise	0.819	(0.385)	0.705	(0.456)	0.000 ***
StateShare	1 = state owns a share of the firm, 0 = otherwise	0.061	(0.241)	0.022	(0.149)	0.004 **
Multinational	1 = firm belongs to multinational group, 0 = otherwise	0.289	(0.454)	0.284	(0.451)	0.454
Large	1 = firm with more than 500 workers, 0 = otherwise	0.156	(0.364)	0.087	(0.283)	0.003 **
Union	1 = unionization of workers above 60 %, 0 = otherwise	0.327	(0.470)	0.315	(0.465)	0.381
WageLevelAbove	1 = wages above similar workers in similar sector & region, 0 = otherwise	0.426	(0.495)	0.416	(0.493)	0.404
InternationalSales	1 = more than 50 % of sales sold abroad, 0 = otherwise	0.218	(0.413)	0.250	(0.433)	0.176
Training	1 = training provided, 0 = otherwise	0.767	(0.423)	0.801	(0.399)	0.157
TemporaryWorkers	Share of temporary workers	16.590	(19.100)	22.350	(21.816)	0.000 ***
No Fire Measures	Number of measures mentioned to avoid firing permanent workers	1.942	(0.235)	1.899	(0.303)	0.158
Number of obs.		211		523		

Notes:

[1]Seniority-Based Pay (incidence variable) =1

[2]Seniority-Based Pay (incidence variable) =0

*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 3a. Seniority-Based Pay, Explicit Incentives and Monitoring
Incidence measures. Probit Estimates

Dependent Variable: Seniority-Based Pay (incidence)	(1)	(2)	(3)	(4)	(5)
Explicit Incentives (incidence)	-0.296**		-0.412**		
	(0.127)		(0.162)		
Explicit Individual Incentives (incidence)				-0.199	-0.468***
				(0.123)	(0.160)
Monitoring (incidence)		-0.269**	-0.465**		-0.640***
		(0.124)	(0.208)		(0.187)
Explicit Incentives X Monitoring			0.318		
			(0.259)		
Explicit Individual Incentives X Monitoring					0.689**
					(0.252)
CONTROLS	Yes	Yes	Yes	Yes	Yes
SECTOR DUMMIES	Yes	Yes	Yes	Yes	Yes
REGION DUMMIES	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-347.895	-348.249	-344.934	-349.315	-343.26
Chi-squared	112.8	112.1	118.73	109.97	122.07
Number of obs.	654	654	654	654	654

Notes: Columns (4) and (5) are equivalent to colmuns (1) and (2) using the measure *Explicit Individual Incentives.*
Controls include *Old, StateShare, Multinational, Large, Union, WageLevelAbove, InternationalSales*.
Standard errors in parenthesis, *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 3b. Seniority-Based Pay, Explicit Incentives and Monitoring
Intensity measures. Ordered probit Estimates

Dependent Variable: Seniority-Based Pay (intensity)	(1)	(2)	(3)	(4)	(5)
Explicit Incentives (intensity)	-0.013**		-0.013**		
	(0.005)		(0.005)		
Explicit Individual Incentives (intensity)				-0.010*	-0.010*
				(0.005)	(0.005)
Monitoring (intensity)		-0.141*	-0.141*		-0.137*
		(0.081)	(0.082)		(0.081)
CONTROLS	Yes	Yes	Yes	Yes	Yes
SECTOR DUMMIES	Yes	Yes	Yes	Yes	Yes
REGION DUMMIES	Yes	Yes	Yes	Yes	Yes
Ancillary parameter 1	0.671	0.318	0.160	0.678	0.139
	(0.494)	(0.574)	(0.579)	(0.494)	(0.580)
Ancillary parameter 2	1.634	1.278	1.126	1.640	1.106
	(0.496)	(0.575)	(0.580)	(0.496)	(0.581)
Log Likelihood	-487.036	-488.235	-485.554	-487.895	-486.466
Chi-squared	162.08	159.68	165.04	160.36	163.22
Number of obs.	734	734	734	734	734

Notes: Columns (4) and (5) are equivalent to colmuns (1) and (2) using the measure *Explicit Individual Incentives.*
Controls include *Old, StateShare, Multinational, Large, Union, WageLevelAbove, InternationalSales*.
Standard errors in parenthesis, *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 4. Seniority-Based Pay, Explicit Incentives and Monitoring Incidence Measures. Bivariate & Trivariate Probit Estimates.

Dependent variables:	Seniority-Based Pay & Explicit Incentives (1)[1]	Seniority-Based Pay & Monitoring (2)[1]	Seniority-Based Pay, Explicit Incentives & Monitoring (3)[2]		Seniority-Based Pay & Explicit Individual Incentives (4)[1]	Seniority-Based Pay, Explicit Individual Incentives & Monitoring (5)[2]	
Correlation coefficients:							
	Seniority-Based Pay	*Seniority-Based Pay*	*Seniority-Based Pay*	*Monitoring*		*Seniority-Based Pay*	*Monitoring*
Explicit Incentives	-0.197**		-0.193**	0.089			
	(0.074)		(0.074)	(0.073)			
Explicit Individual Incentives					-0.128**	-0.124*	0.039
					(0.075)	(0.073)	(0.071)
Monitoring		-0.168**	-0.158**			-0.166**	
		(0.073)	(0.074)			(0.076)	
CONTROLS[3]	Yes	Yes	Yes		Yes	Yes	
SECTOR DUMMIES	Yes	Yes	Yes		Yes	Yes	
REGION DUMMIES	Yes	Yes	Yes		Yes	Yes	
Log Likelihood	-729.913	-759.300	-1138.631		-754.651	-1163.374	
Chi-squared	196.03	190.25	291.32		219.17	315.37	
Number of obs.	734	734	734		734	734	

Notes: Columns (4) and (5) are equivalent to colmuns (1) and (2) using the measure *Explicit Individual Incentives*.

[1]Bivariate Probit.

[2]Trivariate Probit. Simulated maximum-likelihood estimates using GHK smooth recursive simulator (100 random draws).

[3]As in Table 3a.

Standard errors in parenthesis, *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 5a. Seniority-Based Pay, Explicit Incentives, Monitoring & Temporary Contracts
Incidence Measures. Trivariate Probit Estimates[1]

	Panel A			Panel B		
Dependent variables:	Seniority-Based Pay, Explicit Incentives & Monitoring[2]			Seniority-Based Pay, Explicit Individual Incentives & Monitoring[2]		
Estimation coeficients:						
	Seniority-Based Pay	*Explicit Incentives*	*Monitoring*	*Seniority-Based Pay*	*Explicit Individual Incentives*	*Monitoring*
TemporaryWorkers	-0.009*	0.003	0.005*	-0.009*	0.003	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
CONTROLS[3]		Yes			Yes	
SECTOR DUMMIES		Yes			Yes	
REGION DUMMIES		Yes			Yes	
Correlation coefficients:						
	Seniority-Based Pay	*Monitoring*		*Seniority-Based Pay*	*Monitoring*	
Explicit Incentives	-0.192**	0.086				
	(0.075)	(0.073)				
Explicit Individual Incentives				-0.138*	0.042	
				(0.074)	(0.072)	
Monitoring	-0.146*			-0.155**		
	(0.075)			(0.075)		
Log Likelihood		-1138.957			-1157.958	
Chi-squared		297.34			322.09	
Number of obs.		734			734	

Notes: Panel B is equivalent to Panel A using the measure *Explicit Individual Incentives*.

[1] Simulated maximum-likelihood estimates using GHK smooth recursive simulator (100 random draws).

[2] Incidence Measures.

[3] As in Table 3a.

Standard errors in parenthesis, *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 5b. Seniority-Based Pay, Explicit Incentives, Monitoring & No Firing Measures Incidence Measures. Probit Estimates

Dependent variable:	Seniority-Based Pay	Explicit Incentives	Monitoring	Explicit Individual Incentives
	(1)	(2)	(3)	(4)
No Fire Measures	2.611**	0.785	-0.377	-0.173
	(1.191)	(0.809)	(0.627)	(0.682)
CONTROLS[1]	Yes	Yes	Yes	Yes
SECTOR DUMMIES	Yes	Yes	Yes	Yes
REGION DUMMIES	Yes	Yes	Yes	Yes
Log Likelihood	-42.743	-42.376	-66.137	-46.399
Chi-squared	65.12	50.74	30.03	42.89
Number of obs.	111	98	120	62

Notes: Column (4) is equivalent to colmun (2) using the measure *Explicit Individual Incentives.*

[1] As in Table 3a.

Standard errors in parenthesis, *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 6. Seniority-Based Pay and Training

Dependent variable:	Seniority-Based Pay (incidence) Probit	Seniority-Based Pay (intensity) Ordered Probit
	(1)	(2)
Training	-0.262*	-0.304**
	(0.157)	(0.146)
CONTROLS [1]	Yes	Yes
SECTOR DUMMIES	Yes	Yes
REGION DUMMIES	Yes	Yes
Log Likelihood	-349.221	-487.584
Chi-squared	110.15	160.98
Number of obs.	654	663

Notes:

[1] As in Table 3a.

Standard errors in parenthesis, *** p-value < 0.01,

** p-value < 0.05, * p-value < 0.1

Appendix

Table A. Ratio Sample to population, by firm size and sector

Sector / Firm size	50-199	200-499	500 or more	Total
Food, drinks and tobacco	12.53	16.67	28.85	14.09
Textiles, clothing, leather goods and footwear	13.94	19.48	54.55	15.05
Wood and cork	17.36	18.18	0.00	17.31
Paper, publishing and graphic arts	12.65	20.29	55.56	14.52
Chemical industry	14.75	10.17	22.86	14.23
Rubber and plastics	14.56	24.24	28.57	15.98
Non-metallic mineral products	13.27	11.76	40.00	13.61
Primary metal industries and fabricated metal products	15.88	13.13	48.28	16.83
Machinery and mechanical equipment	13.83	19.05	42.11	15.72
Electrical material and equipment, electronics and optics	13.67	19.59	39.39	17.16
Transport material	17.70	26.44	48.21	24.39
Miscellaneous manufacturing industries	20.33	28.57	66.67	21.69
Total	14.44	17.63	38.97	16.05

Note. Sector corresponds to the Spanish equivalent to ISIC (CNAE).

Table B. HRM practices: Variables Description		
Survey Questions (Q) & Answers (A)	**Variable Name**	**Variable Values**
Q1: On which of these factors does the fixed-part of the wage of manual workers at this plant most closely depend? Which comes in second? **A:** Type of job, skill level, seniority, efficiency of their work, personal assessment from supervisor.	*Seniority Based-Pay (incidence)*	1 = seniority mentioned either as the most important or the second most important factor when setting wages, 0 = otherwise.
	Seniority Based-Pay (intensity)	2 = seniority mentioned first, 1 = seniority mentioned second, 0 = otherwise.
Q2: Do the manual workers at this plant receive any type of incentive payment? **A:** Yes, No.	*Explicit Incentives (incidence)*	1 = Yes, 0 = otherwise.
Q3: What type of incentives? **A:** Based on productivity; on quality; on plant-level or firm's results; other types.	*Explicit Individual Incentives (incidence)*	1 = Yes on Q2 and based on productivity and/or quality on Q3, 0 = otherwise (this includes firms answering 'No' in Q2; also firms using both individual incentives (based on productivity and/or quality) as well as collective incentives (based on plant-level or firm's results and/or other types).
Q4: Among those manual workers who receive incentives, what percentage of their earnings (on average) represent such incentives? **A: %**	*Explicit Incentives (intensity)*	% number.
	Explicit Individual Incentives (intensity)	% number for firms which *Explicit Individual Incentives (incidence)* equals 1.
Q5: Which of the following phrases best describes the degree of supervision to which your employees are subject? **A:** 1. No supervision at all; 2. Hardly any supervision; 3. Moderate supervision; 4. Quite close supervision; 5. Close supervision.	*Monitoring (incidence)*	1 = high and very high supervision, 0 = otherwise
	Monitoring (intensity)	(1, 5).
Q6: On average, how many hours of training per worker were given last year? **A:** number of hours	*Training*	1 = number of hours is positive, 0 = otherwise.
Q7: How many permanent and temporary workers were employed at your plant at the end of last year? **A:** number of workers	*TemporaryWorkers*	Share of temporary workers (0,100)
Q8: When downsizing is in progress, measures are usually taken to avoid laying off permanent workers. Among the measures of this type that appear on this card, which are the main ones that have been adopted/are planned to be adopted in the downsizing of the workforce at this plant? (Please, select the two main ones and rank them in order of importance) **A**: 1. Ending temporary contracts; 2. Reducing production subcontracted to other firms; 3. Relocating multi-skilled workers; 4. Cutting back or cancelling overtime; 5. Distributing labour hours (reducing hours of affected workers); 6.Offering early retirement to older workers;	*NoFireMeasures*	Number of measures mentioned to avoid firing permanent workers (0, 2).