The Innovative Behavior of Spanish Enterprises and Its Impact on Salaries

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ABSTRACT. Our aim was to analyze the effects of firms' innovative behavior on their employees' salaries in the Spanish manufacturing industry. We found a premium in the wage paid by innovative firms, regardless of size. However, when taking company size into account, we found that the effect of innovations was greater in small-medium enterprises (SME), contrary to what was expected. The inferences of the models estimated suggest that the higher the market concentration the weaker the appropriability regime, especially for SMEs. However, at the same time, a firm's innovations reduce the impact of market concentration on wages, making innovating firms more autonomous than non-innovating ones. Even more, to be able to innovate, firms have to isolate their employees' salaries from the product market. These results hold regardless of firm's size, but have a greater impact on the small-medium group of firms. Finally, our analysis backs the assumption that salaries in both large and small-medium firms are generated by two distinct economic regimes, supporting the proposition that an SME is not simply a scaled-down large firm.

Final version accepted on September 16, 1999

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1. The determinants of wage premiums

Several studies have addressed the issue of wage determinants. Their results suggest that salaries paid by SMEs follow a differentiated pattern in comparison to large firms. Nickel et al. (1994) found that (1) workers in large firms are better placed to extract quasi-rents stemming from a firm's competitive strength in the product market, but this has nothing to do with unions, and (2) while internal factors play a role in determining wages, there appears to be no marked differences in their importance between SME's and large firms. Later, however, Lever and Werkhooven (1996) also found that a firm's competitive strengths have a positive impact on wages, but, contrary to the inferences of Nickel et al. (1994), the weight of internal factors in SMEs was substantially lower. Furthermore, they found that market concentration increases the impact of a large firm's internal factors on wages.

These contradictory and surprising findings warrant further research on the determinants of wages in SMEs in comparison to large firms. In this piece of work we address this issue as well as analyze the innovative behavior of Spanish firms and its impact on wages paid by SMEs and large firms. The Spanish economy contains a high percentage of SMEs and is currently experiencing significant changes in the business climate, making it an exciting subject for study concerning the firm's role in the process of wealth generation and effective political measures to promote company growth. A recent initiative of the Spanish Ministry of Industry and Energy – hereafter MINER – to construct panel data with company-level data on more than 2,000 manufacturing firms allows us to test theory in order to gain insight

and, thereby, design effective policies that foster economic growth.

In general, Spanish industry has not engaged in much innovative activity. However, since Spain joined the European Economic Community (EEC) in 1986, firms have been led to change their strategic behavior in many cases. In fact, by 1992 45 per cent of the firms had introduced some kind of innovation compared with figures of around 15 per cent in 1986, as indicated by the Central de Balances survey conducted by the Bank of Spain (Labeaga and MartÌnez-Ros, 1994). Traditionally, Spanish industry has primarily been composed of small-medium firms with a low percentage of innovative activity. However, during the 1980's companies developed some technical changes (mainly in process innovation, according to data) which possibly affected the composition of their labor force as well as their internal capacity to compete. Entry into the EEC may be considered to have changed the competitive business environment, a new situation that required that companies to devise innovative strategies to be more competitive and gain market share in both domestic and foreign markets.

We had six aims in our work. First we were interested in checking the existence of a differential wage stemming from quasi-rents in innovating firms. Next we looked at the question of the existence of a confounding variable (Anderson et al., 1980): firm size. Third we assessed the impact of firms' innovation by type: product only, process only and both simultaneously. Fourth we analyzed if the wage premium paid by innovative firms depends on the firm's competitive strength on the market and its structure. Fifth, we checked whether the human resources of innovative firms were more firm-specific than those of non-innovative firms, and, therefore, whether the wage premium went to them. Lastly, on the basis of the above differences between large firms and SMEs we needed to look at whether the salaries paid by both groups were rooted in different economic regimes.

This paper is organized as follows. In the following section we present the neoclassical model and elaborate our theoretical framework linking the former to contemporary research on innovation, firms' competitive heterogeneity and Small Business theories. In the third section we discuss the development of our research design in order to find answers to our inquiries. In the fourth section we present our findings and proceed to discuss their implications in the fifth section. Lastly, we present our main conclusions.

2. Theoretical framework

Wages' main determinants when alike firms compete in homogeneous markets

As Lever and Werkhooven (1996) did, we start from the wage determinants equation proposed by Nickel and Wadhwani (1990), Holmlund and Zetterberg (1991) and Nickell et al. (1994). This model presumes that wages are determined through negotiation between firms and the existing work force at the beginning of the period – it is a static model – and that the employment level is set by the firm. In addition, there is imperfect competition in the product market – an oligopolistic market structure is supposed offering identical products. Output demand is subject to exogenous shocks, which are unknown at the stage of bargaining. The firm sets the output price and the employment level after the wage negotiations and after the size of the shock is identified, so that profits are maximized. Finally, it is presumed that the trade union maximizes the expected income for their members, who are the existing employees.

The bargaining model results in the following wage determinants (see Nickel et al., 1994 for details):

$$w_i = w_i(\text{InternalFactors}_i, \text{ExternalFactors}_i, \text{MarketFactors}_i, \text{BPower}_i)$$

Where w_i is the firm wage rate per employee and its determinants can be grouped into four classes: firm's internal factors, external factors, market factors, and employees bargaining power, respectively. *Firm's internal factors* are composed by p_j, the market price, ϕ_i, the level of production efficiency, k_i, capital stock, and n_i, the level of employment. Those internal factors, ϕ_i, k_i, and n_i, are nothing more than the marginal revenue product per employee, and p_j the value of one unit produced and sold. Consequently we can aggregate them and use the value of labor productivity or value added per employee as its empirical

construct. Hence, a significant impact of internal factors (value of labor productivity, pt_i) on wages implies that they adapt to firm's performance ($\partial w_i/\partial pt_i > 0$). As Lever and Werkhooven point out, this produces stable employment as well as change in relative wages rates (1996, p. 94).

Firm's external factors are composed of: um_i, the union membership, w, the aggregate wage, u, the aggregate unemployment rate, b, the unemployment subsidies relative to the average wage, and z, any factor representing the reducing competition for jobs among the unemployed. We use these external factors as controls in the estimation process so we only include the aggregate unemployment rate with a negative expected sign over salaries ($\partial w_i/\partial u_j > 0$). Contrary to the impact of internal factors on wages, a high impact of external factors implies that wages adapt to the overall performance of the economy. Comparing both effects on wages, a higher impact from the internal factors is considered favorable over external ones.

Firm-market factors are ms_i, its market share in physical terms, $ms_i = q_i/\sum_{\forall j} q_j$, and μ_i, the conjectural variations. Both variables, ms_i and μ_i, measure the degree of competition in the market: the higher the firm's market share, the less rivalry it has in the market ($\partial w_i/\partial ms_i > 0$), and if firms do not take into account rivals' reactions to their competitive moves, competition will be greater, and the other way round ($\partial w_i/\partial \mu_i = (?)$). The final factor is employees' bargaining power, β_i, measured as the union power ($\partial w_i/\partial \beta_i > 0$).

Although the firm constitutes the unit of analysis in microeconomics, the level of interest has typically been the industry. In neoclassical theory firms in the same industry are assumed to have equal access to the most efficient techniques as changes occurs in relative prices as well as alike access to the market, so that they are interested in explaining differences among industries, not among firms in the same industry. Below we introduce heterogeneity among firms in any market and see how it could affect wages.

Wages and firm's innovations

Since we are interested in analyzing the effect of firm's innovations – an internal factor – on wages, we must introduce them in the model with care, because it is expected that innovations affect salaries in some ways: the level of production efficiency, ϕ_i, firm i market j price, p_{ij}, and firm competitive position. We focus our interest on innovations rather than Research and Development (R&D) because the former is the result of later conceptualization in which SMEs are less likely to answer in a questionnaire, producing, as a result, a bias in the measurement of R&D (Kleinknecht, 1989; Scheirer, 1991). Hence we introduce innovations in the basic model as a treatment assuming that innovations make a shift in the slope of the innovative-firm's wages equation relative to the non-innovative one. Thus we expect that wages will be positively affected by innovation, $\partial w_i/\partial I > 0$, so that wages in innovative firms will be greater than in non-innovative firms, $w_I > w_N$.

Firm size manifests different possibilities concerning access to resources. Consequently, the effect of innovations on wages will be different, depending upon the capacity of the firm to appropriate the rents stemming from innovation. In short, the difference between large innovative and non-innovative large firms will be greater than between SMEs, $(w_I^L - w_N^L) > (w_I^S - w_N^S)$. That is, innovations are a necessary but not sufficient condition to earn rents from the product market: firms need resources to transform innovations into rents as well as competitive strength that will possibly vary with firm's size.

Wages, innovations, and different firms competing in an heterogeneous market

In the strategic management literature, the resource-based view of the firm (hereafter RBV) suggests that firms increase their competitive advantage by improving production efficiency through intangible resources, company assets and capabilities (Wernerfelt, 1984; Barney, 1991). As in the case of the neoclassical approach, the RBV of the firm suggests that product market rents stem from imperfect competition, but rather than being based on identical firms marketing the very same products, it is rooted on different firms marketing imperfect substitutes. Firms are not identical because there is no strategic factor market where the necessary resources can be bought (assets as well as both individual and organizational skills)

to duplicate a winning market strategy, although in several cases there might be strategic substitutes (Dierickx and Cool, 1989). Hence, resources can be imitated only imperfectly, and since firms have access to different sets of resources, their market strategies will also be different.

In this framework, market share, $ms_i = q_i/\sum_{\forall j} q_j$, is no longer an external factor but the result of the firm's strategic decisions: its achieved level of product differentiation, cost position and other marketing variables, as well as their interaction with those of its competitors in the same market. In addition, the effect of the firm's strategic decisions is mediated by some market parameters: marketing variable elasticities, industry elasticity of price, and the effect of cross-elasticities between firms in the same industry (Karnani, 1984, p. 370). As a result, firms with a comparative superior cost position, differentiation, or both, will enjoy a larger market share, which, in turn, leads to higher profitability. (In fact, in theory, market share and profitability are a simultaneous result.) In this case, firm's market share depends positively on its competitive strength (positively on its level of absolute demand and negatively on its absolute cost position, both aspects closely related to the quality of firm-specific resources), given some industry parameters, and negatively on its rivals' strength. As Karnani points out, "a higher level of absolute demand can be achieved in several different ways, such as better product quality, more convenient distribution, and better customer service" (1983, p. 79; 1984, p. 370).

As a result, the distribution of firms between Large and SMEs is an endogenous solution that depends on some industry-specific parameters: market elasticities on marketing variables, price cross-elasticities between products of different firms in the same market, and the economies-of-scale effect and industry price-elasticity. Hence, in the wage determinants formulation, a *firm's market factors* should be modified to take into account heterogeneity in the firm's offer, so that *salaries will be a positive function of the relative level of absolute differentiation position and a negative function of its relative absolute cost position*, a combination that is both valued by customers and superior to that of its competitors – a firm's relative share – *sharel* – being its empirical construct, ($\delta w_i/\delta \text{sharel}_i > 0$ (Acs and Audretsch, 1988). Nevertheless, this effect will be mediated by some industry parameters.

Firm's competitive position, market concentration, and the ease of innovation

Mediating factors are those variables that make a firm's competitive strength and innovations more or less influencing. By *appropriability* (Teece, 1986) we mean the innovators' ability to protect their innovations from imitation and, consequently, to reap profits stemming from their innovative strategy and, thereby, appropriate the rents stemming from their innovations. This ability will be associated with a firm's access to the market, a good position in market channels and, a high value of its trademarks. *Opportunity conditions* refer to the ease of innovation by would-be innovators, and are related to the innovation potential of each technology and, thus, are industry-specific. Appropriability conditions are more important in markets with comparatively more opportunities of innovating.

As Levin et al. (1985) demonstrated, concentration measures are proxies of both theoretical constructs and the effects of the respective sector are proxies of opportunity. By using a measure of market concentration – average markup, *avgmbe*, will be its empirical construct – along with the sector's effects – captured by industry dummy variables – we were able to split the effect of the appropriability and opportunity conditions. *We expect that market appropriability theoretical construct will have a positive effect on the wage premium earned by employees and interact with firm's internal factors*. In other words, innovating firms will not be able to reap the benefits stemming from their innovative activity if they compete in regimes of weak appropriability (Teece, 1986), whereas firms competing in settings where innovating activity is easier will attempt innovation more frequently, and, consequently, the wages paid to their employees will be higher. Furthermore, we expect that the greater the market concentration, the larger the average markup and the less interested both types of firms will be in innovating, a negative interaction that Schumpeter (1942) suggested.

Heterogeneity in firms' innovative behavior

Firm's size is the result of managerial decisions intended to develop and accumulate company capabilities and focused on finding new ways in which they can be used (Penrose, 1959). As firms get larger, however, their learning and adaptation costs increase, and, consequently, Cyert and Kumar's model predicts that firms will change their marketing and organizational strategies over the product life-cycle from strategies emphasizing entrepreneurial and marketing function – product innovation – early in the company's life-cycle over those focused on cost reduction and process innovation (1996a).

As firms become larger due to implementation of successful competitive strategies, they earn quasi-rents stemming from imperfection in the product and/or input markets that result in imperfection in their internal labor markets as employees share the organizational quasi-rents. Nevertheless, as they get larger, their learning and adaptation costs also increase, thus causing a change in the way they compete. As firms grow they tend to employ product-innovation strategies, IP, but when they actually become large, they shift toward the implementation of cost reduction strategies, IC. In short, we expect employee wages of innovative firms to be higher than those of non-innovative firms, even though the determinants of the wage premium in small firms are different than those in large ones. To be precise we expect that the impact of product-innovation on wages will be greater on small-medium firms than in the large ones, $\partial w_i^S/\partial IP > \partial w_i^L/\partial IP$, and the reverse effect will be found when it comes to process-innovation, $\partial w_i^S/\partial IC < \partial w_i^L/\partial IC$. On the other hand, we expect that simultaneously performing product and process innovation, due to its complexity, has a greater impact on larger firms' wages than in the SMEs group, $\partial w_i^L/\partial(IC \,\&\, IP) > \partial w_i^S/\partial(IC \,\&\, IP)$.

Firm-specific resources and the wages paid by Large and SMEs

Whereas strategic marketing decisions aim to maintain and improve the value of firm-specific resources, the company's actual capabilities and assets make it possible to implement its marketing decisions. Thus, an innovative firm's strategy must be based on an accumulated set of firm-specific resources and on developing new ones to fill the gap between the level of the firm's resources and those needed to implement the strategies (Abernathy and Clark, 1985). Cyert and Kumar (1996b) showed that a firm's marketing strategy ("product market", in their words) and organizational designs are closely related when it comes to seeking a competitive advantage.

As Doeringer and Piore (1971) and Aoki (1984) have shown, for a firm's employees to develop firm-specific skills they must carry out long-term idiosyncratic investments. In order to encourage employees to invest in firm-specific skills, the internal labor market must be isolated from the external labor market and, therefore, from current company performance. *Thus, we expect that a firm's internal-factors will have a greater positive impact on the wage premium earned by employees working for small firms than on the wage of employees working for the large ones*. This would suggest that SMEs specialize in volatile environments not because of any lack of intellectual ability to select and memorize administrative procedures, but because they are unable to devise innovative strategies based on, and intended to develop, new, idiosyncratic firm's capabilities.

Wages in Large and SMEs are set by different economic regimens

The above arguments suggest that there are reasons for SMEs being something more than a miniature large company. Casson (1995, p. 124) put forward the following hypothesis: "the link between a general theory of the firm and small firm economics comes from identifying small firms as the firms that specialize in operating in volatile environments." Even though we agree with Casson's answer, we disagree with his causality chain because he appears to consider SME capabilities to be static – in Casson's model, volatility comes from the difficulty to foresee demand conditions – although, in reality, volatility is partially controlled by a firm's innovative strategies (Piore and Sabel, 1984; Cyert and Kumar, 1996). According to the latter, "economizing requires not only adaptation in the passive sense of the firm taking as given the random arrival of the 'shocks' but that the firm also consciously

generates these shocks in a pro-active way." (1996a, p. 220).

Along the same lines as Penrose (1959), Aoki (1984), Piore and Sabel (1984), Teece (1986), Casson (1995) and Cyert and Kumar (1996), we suggest that large firms become large because they develop decision-making procedures, firm-specific resources and capabilities embedded into routines. Small firms remain small because they are unable to develop these intangible and firm-specific resources. This proposition differs from Casson's only in that we have not taken the intellectual qualities of a firm's management team as a given – we could interpret these intellectual qualities as a measure of those routines developed inside the firm – but as a dynamic learning and adaptation process led by innovative managerial strategies. SMEs do not specialize in volatile environments because they lack the intellectual qualities required to select and memorize administrative procedures but rather because they are unable to devise innovative strategies based on (and intended to develop) new company capabilities, a fact that frequently keeps them small – these are precisely the intellectual qualities mentioned in Casson's model.

As a consequence we shall propose that the determinants of wage premium must be different in small and large enterprises since as they grow, they change their cumulative set of capabilities and hence, the costs of learning from their environment and adapting to this new information. To the extent to which wages in small and large firms stem from different technological regimes, a difference in the determinants' parameters that affect wages in small- and large-firm would offer support for Winter's (1986) and Casson's (1995) hypotheses. The model of this two-regime case can be written as:

Large firms regime: $w_i^L = w_i^L(X_L: \beta)$

SMEs regime: $w_i^S = w_i^S(X_S: \alpha)$

3. Research design

Research questions

First question: Is there any wage premium or differential salary stemming from quasi-rents in innovating firms, $w_I > w_N$?

Second question: If the answer to the previous inquiry is affirmative, is the wage differential affected by firm's size? Is the latter a confounding variable? Does firm's size affect the impact of innovations on the wage premium, $(w_I^S - w_N^S) < (w_I^L - w_N^L)$?

Third Question: Do large and small-medium firms differ in their innovative behavior? We expect that large enterprises carry out more process innovations and more simultaneous process and product innovations, and that the impact of this type of innovations is greater than in the small-medium group ($\partial w_i^S/\partial IC < \partial w_i^L/\partial IC$, $\partial w_i^L/\partial(IC \,\&\, IP) > \partial w_i^S/\partial(IC \,\&\, IP)$). The reverse is expected for product innovation ($\partial w_i^S/\partial IP > \partial w_i^L/\partial IP$).

Fourth question: Is there any interaction between a firm's internal factors and market factors? Is the effect of innovation affected by the market structure? Is it affected by the firm's competitive strength?

Fifth question: Are the human resources of innovative firms more firm-specific than the ones in non-innovative firms? If the answer were affirmative, then we would have to find that the salaries of the formers are less affected by the firm's current performance than those of the employees working for non-innovative firms; this should be confirmed, in both SMEs and large firms.

Sixth and last question: On the basis of the above differences between large firms and SMEs, we needed to look at whether the salaries paid by both groups were rooted in different economic regimes. If the answer were yes, then a statistically significant difference in the parameters for the small- and large-firm regressions would offer support for Winter's (1986) and Casson's (1995) hypotheses.

Sample and variables

The database used for this study contained company-level information for the Spanish manufacturing industry obtained from the Business Strategic Survey (hereafter ESEE, the Spanish acronym). These data covered the period 1990–1994 although we use another source for calculating the aggregate unemployment rate, namely, the annual survey of employed people,

Encuesta de Población Activa (EPA). The ESEE survey consists of a panel with a different number of firms each year. However, we considered only the 2,188 firms that submitted data for each year. Samples were selected by excluding observations with missing values due to problems of data consistency, specifically we excluded any firm reporting zero sales and/or zero employment. Observations for firms that did not report information in any of the five years were also deleted. This gave a final sample consisting of a balanced panel with 1,306 observations available for each period. The representative sample of the manufacturing industry was justified by comparing descriptive statistics of the main variables from the complete sample (2,188 firms) with the reduced one (1,306 firms). We confirmed the existence of two broad groups of firms: approximately 65 percent are small and medium-firms (less than 200 workers) and 35 percent are large firms (more than 200 workers). In the following table, we present the definition of variables.

Table II lists descriptive statistics for the main variables according to size, allowing us to roughly observe several behavioral differences between the two groups of companies. As expected, we observed that wages were higher in large firms than in smaller ones. The standard deviation also showed greater variance in remuneration within small companies. The descriptive statistics indi-

TABLE I
Definition of variables

Variable	Description
Dependent variable	
LNWAGE	Average firm wage expressed in logarithms.
Firm's internal factors	
Innovation activity	
INNOVA	Dummy variable takes 1 if firm innovates, 0 otherwise.
PRODUCT	Dummy variable takes 1 if firm *only* innovates in product, 0 otherwise.
PROCESS	Dummy variable takes 1 if firm *only* innovates in process, 0 otherwise.
BOTHINOV	Dummy variable takes 1 if firm innovates in process and product *at the same time*, 0 otherwise.
Labor productivity	
PT	Quotient between firm added value and the average number of employees: added value per employee.
Labour structure	
SKILLED	Proportion of engineers and employees in the firm with degree.
SEMI-SKILLED	Proportion of semi-skilled employees in the firm.
Situational factors	
SMALL	Dummy variable equal to 1 when firm has less than or equal to 200 workers.
LARGE	Dummy variable equal to 1 when firm has more than 200 workers.
Firm's external factors	
TAXA	Sector's average unemployment ratio.
Firm's market factors	
SHAREL	Quotient between production of firm and the production of largest firm of the sector.
AVGMBE	Average margin of the sector.
Interactions between firm's internal and external factors	
AVGMBEIN	Product of AVGMBE and INNOVA
AVGMBEPT	Product of AVGMBE and PT

TABLE II
Descriptive statistics

Variables	Small-Medium (No. observ.: 3705)		Large (No. observ.: 2105)	
	Mean	Std. dev.	Mean	Std. dev.
LNWAGE	0.893	0.416	1.355	0.348
SHAREL	0.016	0.034	0.206	0.255
PT	4.116	2.846	6.267	4.179
TAXA	0.149	0.056	0.139	0.055
AVGMBE	0.103	0.034	0.102	0.038
AVGMBEIN	0.033	0.050	0.057	0.057
AVGMBEPT	0.004	0.004	0.007	0.006
INNOVA	0.334		0.582	
PRODUCT	0.096		0.088	
PROCESS	0.138		0.215	
BOTHINOV	0.100		0.280	
SKILLED	0.023		0.048	
SEMI-SKILLED	0.037		0.054	
NON-DEGREED	0.940		0.898	
CHEM.	0.286		0.302	
ELECTRICAL	0.088		0.138	
MACHIN.	0.078		0.183	
FOOD	0.154		0.150	
LEATHER	0.394		0.228	

cated that large firms showed a greater tendency to be engaged in innovation activities. Process and simultaneous innovation rates were higher for large companies whereas product innovation appeared to be similar in both groups. It is also worth noting that there was a higher percentage of highly skilled workers in large firms.

On the other hand, relative market share figures were interesting because they showed that large firms were better positioned market-wise, although there was considerable heterogeneity in this group with respect to the standard deviation. We also observe that the unemployment ratio is larger for SME indicating that external factors could discipline the wage determination. Interestingly, the value of the variable reflecting firm productivity was higher in large companies, as expected, although the mean productivity of SMEs was not significant.

The empirical model

Our study focused on the importance of a firm's capabilities in wage premiums by taking into account the varying structures of companies. Hence, the dynamic specification can be formulated as follows:

$$W_{it} = \alpha W_{it-1} + \phi' I_{it} + \delta' E_{it} + \beta' M_{it} + \gamma' X_{it} + \varepsilon_{it} \quad (1)$$

Where W_{it} is the average wage of firm i in period t (in natural logs); I is the firm's internal factors matrix containing the innovation technological variables, labor productivity, as well as the skill composition of the labor force within the firm at the beginning of the period (unfortunately, we do not have information on skill composition for the entire sample period, hence, we must assume either that there were no changes in skills over time or that current skills are a function of past knowledge. Regardless of which assumption is chosen, we can safely assume that an employee's initial abilities are a good approximation of his/her skills); E represents a firm's external factors, as unemployment ratio; M is a matrix of the firm's market factors as relative market share, and aggregate margin – our empirical construct of market concentration – and, X relates to interaction variables among firm's internal and market factors. ε_{it} is a random term composed of hetero-

geneity effects μ_i and a standard mixed error term, v_{it}. Finally, the introduction of lagged wages controls the dynamics in the process of wage determination and provides some assessment of how they affect current labor negotiations. In all estimations, we introduce industry dummies.

It is important to notice that we assumed that unions have no bargaining power concerning overall employment figures in the economy but only in firms, since this was where our specific interest laid. In Spain, this is possible because unions do not represent most workers, only those who are members; in fact, union members are insiders who have bargaining power within the firm.

In order to test the existence of two regimes, one for large firms and the other for SMEs, we split the sample in these two categories. The estimation process revealed that both types of firms determined the wage in a different manner. While SME firms follow the traditional equation of wage, large firms present a novelty. They use past wage to determine current wage, which implies that the coefficient of W_{t-1} is 1. Such evidence leads us to reformulate the wage equation for large firms, passing the lagged wage to the left-hand side and regressing the growth of wage on the explanatory variables.

Working with panel data has an advantage over cross-sectional analysis because unobserved heterogeneous effects (called "fixed effects" in the panel data) can be controlled, for example, the ability of a manager to achieve good company performance throughout the period. The fixed effect parameter, μ_i, measures such ability and introduces a correlation with the lagged variable under the assumption that μ_i is unobservable. The result of the correlation is that Ordinary Least Squares (OLS) or Within Group (WG) estimation methods are inconsistent and hence, the need to overcome the correlation problem using alternative procedures. The estimation process finally proposed consisted of applying an alternative Instrumental Variable (IV) developed by Arellano and Bover (1995) and Blundell and Bond (1995). In this method the correlation between fixed effects and lagged wage is controlled using ΔW_{it-2}, as an instrument for lagged wage; this variable does not contain the fixed effects. This approach consisted of using the initial information conditions for deriving optimal estimators in dynamic panel data models.

4. Findings

A descriptive analysis for the entire period, 1990–1994, yields a significant feature: on the average, 16.5 per cent of firms carry out both product and process innovation, 9.3 per cent innovate only in new products and 16.6 per cent only in new processes. However, the evolution of these types of activities has been different. Product innovation has experienced an increase during the period, reaching 10 per cent in the final year studied. This contrasts with a slight decline (from 20 to 19%) in process innovation during the same year after a huge increase in 1991. A possible explanation for this is that the economic recession in Spain had a greater influence on process innovation than product innovation. This is to be expected if we assume that the process view has permanent effects on company profitability

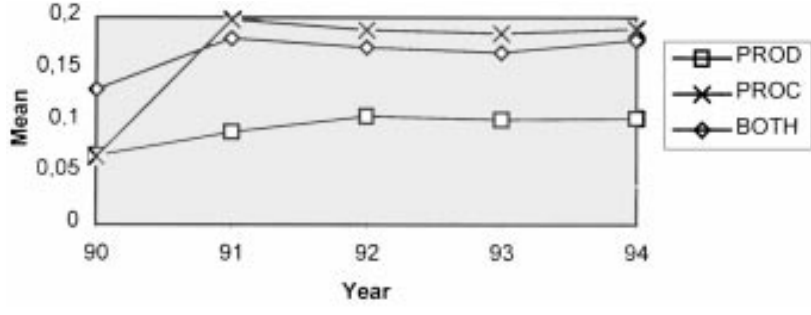

Figure 1. Innovations by type.

TABLE III
Mean of wage by Innovation and Size. (Number of firms conducting innovating activities)

	Innovating	Non-Innovating	Total
Small	0.964 (1237)	0.857 (2468)	0.893 (3705)
Large	1.364 (1228)	1.344 (877)	1.355 (2105)
Total	1.163 (2465)	0.985 (3345)	1.061 (5810)

whereas the product view has only temporary effects if other firms find it easier to replicate product rather than process innovation.

In order to assess the effect of innovative activities on the wages paid by Spanish firms, we analyzed employee wages for firms undertaking some kind of innovation. Table III contains the results of a cross-tabulation of average wage (in natural logs) that distinguishes between innovating versus non-innovating firms and large versus small firms.

Results clearly show that, on the average, innovating firms pay higher wages than those who do not carry out this activity, and that this difference is statistically significant at 1 per cent. When looking at the wage differential according to firm size, we observe that large firms pay workers more than small ones, and that this is also statistically significant. Table III also shows the number of firms that performed innovative activities during the period 1990–94, broken down according to company size. Although the number of companies in the sample carrying out innovative activities was similar in small and large companies, the proportion differed as can be seen when considering the total number of firms in each group. A Chi square test rejects the hypothesis that the number of innovating firms is independent of their size ($\chi^2 = 342.1$). Consequently, we may state that in the Spanish industrial sector, large firms exhibit more innovative activity than small firms, although this does not necessarily result in higher wages if company size is not associated with the existence of a competitive advantage due to greater efficiency achieved from firm-specific resources.

Surprisingly, we found that the salary difference was greater between large firms and small ones than between innovating and non-innovating firms. To determine if these salary differences were random, we performed a variance analysis by studying the effect of innovations on the salary paid by firms, controlling firm size. If we could reject the null hypothesis proposing that the relationship between innovation and size is insignificant, then we should separately analyze the impact of innovations on the wage paid by both groups of firms, since firm's size will be a situational factor or proxy of other factors moderating the impact of innovation on salaries.

Figure 2 shows a linear-ordinal relationship pattern. The differential effect of moving from non-innovating to innovating on the salary premium earned by employees depends on the firm's size. The incremental effect is of the same order (positive) although less pronounced for large

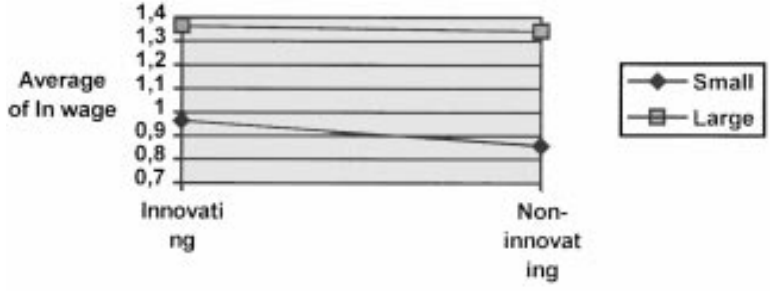

Figure 2. Mean wage (in natural logs) by size.

firms. This can be seen by looking at the departures from parallelism observed in each line. Actually, according to the F ratios of the variance analysis, the interaction between a firm's size and its innovating activity was quite significant (with an alpha level of less than 0.001).

The main findings of both wage determination processes are summarized in Table IV. A different wage determination is found between small-medium and large firms. Although the wage process differed between small-medium companies and large ones, interesting conclusions may be reached concerning the influence of innovations on salaries. In general, innovations produced large wages in SMEs (model I) but if we distinguish by types of innovations (model II), we observe that only process innovations in SMEs led to higher salaries: If a small-medium firm improve its technological process of manufacturing, its employees' salary increases by 0.052 units. As far as large firms are concerned, their average salary increase only seems to be affected by an enlargement in the sector's average unemployment ratio (model I′ and II′); neither innovations nor firm's market factors were found to move the average salary paid.

The opposite pattern is found in the SME group where market position as well market concentration affected salaries positively: one point increase in firm's competitive strength augmented the salary paid by 2 units, and increased market concentration by 1.57. The latter seems to indicate that employees' salaries in SMEs are highly affected by the firm's competitive strength and the competition encountered in the market. The higher the market position, the higher the salaries; the less competition in the product market, the higher the wages. The unemployment ratio is the only significant variable in both types of firms, but with an unexpected sign in both types of firms: theory suggests that the threat of high levels of unemployment could discipline the labor market, however we found the opposite result. This suggests that Spanish salaries do not adapt well to the overall performance of the economy.

When we took into account the possible existence of an interaction between firm's innovative activity and market factors (models III and III′), we found that the impact of innovations on wages depends on a firm's product market structure, and the other way around: the moderator impact of market structure on wages depends on the firm's innovative activity. Hence, the short-term impact of process innovations on the wage of the small-medium group of firms is 0.133 minus 0.95 times

TABLE IV
Wage determination according to firm size[a, b]

Explanatory variables	Small-Medium No. observations: 1482			Large No. observations: 1684		
	Dependent variable					
	lnwage			Δlnwage		
	Model I	Model II	Model III	Model I′	Model II′	Model III′
$LNWAGE_{t-1}$	0.274 (0.95)	0.272 (0.94)	0.281 (0.99)	n.a.	n.a.	n.a.
INNOVA	0.025 (1.68)			0.011 (1.21)		
PRODUCT		0.001 (0.06)	0.076 (1.38)		0.006 (0.39)	0.061 (2.03)
PROCESS		0.052 (2.31)	0.133 (1.99)		0.010 (0.94)	0.065 (2.34)
BOTHINOV		0.004 (0.19)	0.082 (1.40)		0.136 (1.17)	0.067 (2.38)
SKILLED	1.446 (2.79)	1.452 (2.78)	1.440 (2.80)	–0.012 (0.16)	–0.920 (0.15)	–0.014 (0.18)
SEMI-SKILLED	0.322 (1.50)	0.341 (1.55)	0.336 (1.55)	0.043 (0.45)	0.044 (0.46)	0.040 (0.43)
SHAREL	1.973 (2.73)	2.002 (2.73)	1.966 (2.75)	0.002 (0.13)	0.001 (0.09)	–0.001 (0.02)
AVGMBE	1.604 (2.13)	1.572 (2.11)	1.851 (2.13)	0.145 (1.28)	0.146 (1.28)	0.410 (2.14)
TAXA	1.684 (2.73)	1.699 (2.72)	1.579 (2.72)	0.156 (2.51)	0.156 (2.50)	0.053 (0.60)
AVGMBEIN			–0.955 (1.44)			–0.598 (2.26)

[a] All results are robust to heteroskedasticity.
[b] T-ratios in brackets.

the average of AVGMBEIN, that is 0.102 (0.045 for product, and 0.114 for simultaneous product and process innovations). To find the long-term impact, we must divide the short-term impact by (1 – 0.281); this results in 0.141 (0.062 for product, and 0.158 for simultaneous product and process innovations). For the large firms' group we found that the wage increase was impacted by 0.064 minus 0.598 times their average of AVGMBEIN, that is 0.03 (0.027 for product, and 0.033 for simultaneous product and process innovations).

The data show that market structure negatively affects the impact of innovations on wages. The same innovation in a more concentrated market produces a reduced premium on wages and this result holds for large as well as for small-medium firms. Nevertheless, the impact is greater for small-medium firms than for large enterprises. In a concentrated market small firms are poorly positioned to appropriate the quasi-rents stemming from their innovations; in contrast, large firms have more adequate resources to appropriate these quasi-rents. On the other hand, the moderation effect of market concentration is affected by a firm's innovative behavior. For the same level of market concentration, innovative firms find their impact moderated by their innovations. The results also show that the impact of innovations on salaries was moderated by technological opportunity conditions to a greater extent in all sectors than in the reference sector (Leather).

To test the hypothesis that firms grow developing firm-specific resources (human resources in this case), we need to know if employees' salaries are influenced by firm's current performance – labor productivity is its empirical construct. To develop individual and organizational skills specifics to the firm, the entrepreneur must isolate the firm's internal labor market from the product market. To check this proposition we have to split the original two groups of firms into four – small-medium innovating firms, small-medium non-innovating firms, large innovating firms, and large non-innovating firms – since innovation variables may be correlated with labor productivity. Table V reports the results.

We see that the average wage of large innovating firms is almost not influenced by labor productivity – the value of its parameter is reduced and statistically insignificant – but is positively moved by the sector's average unemployment ratio. In large non-innovating firms, however, wages are affected by firm's current performance. In the small innovating and non-innovating groups we observed the same pattern: while the parameter estimated for both types of small firms are statistically significant in the edge (the value of alpha is slightly greater than 0.10), the wages in the non-innovating group are more affected by firm's current performance. In fact, when comparing large with small-medium innovating firms we found that the wages paid by large innovating firms were less moved by labor productivity, the same pattern that we detected between large and small-medium non-innovating firms. Hence, we can hold the alternative hypothesis that firms grow by developing firm-specific resources and that innovating firms must have more specific resources than non-innovating firms, and this last result holds regardless of firm size.

Finally, we checked the existence of different regimes in the wage determination strategy using the Chow test and the specification in levels for the joined estimation. Clearly, we rejected the null hypothesis that β estimates in both regressions were equal. This suggests that salaries in both large and small-medium enterprises were generated by two distinct economic regimes (large firms' regime : $w_i^L = w_i^L(X_L; \beta)$; small-medium firms' regime : $w_i^S = w_i^S(X_S; \alpha)$), as Winter (1986) and Casson (1995) argued.

5. Discussion and implications

Spanish firms have changed their innovative behavior since Spain became an EC member in 1986. In fact, the number of firms carrying out some kind of innovation process was threefold by late 1992. By that time, one out of ten Spanish firms were involved in product innovation, almost one and a half out of ten Spanish firms were committed to implementing process innovation, and more than 15% were conducting both kinds of innovation. When crossing innovative behavior and firm size, we found interesting figures: in terms of product innovation only, SMEs innovated more than large firms, although the difference was not impressive; however, when firms engaged *only* in process innovation or in *both* types of innova-

TABLE V

Explanatory variables	Small-Medium No. observations: 1482		Large No. observations: 1684	
	Dependent variable			
	lnwage		Δlnwage	
	Innovating firms firms	Non-innovating firms	Innovating firms firms	Non-innovating firms
Specificity of resources[a, b]				
$LNWAGE_{t-1}$	0.653 (2.66)	–0.429 (–0.48)	n.a.	n.a.
SKILLED	0.611 (1.80)	1.352 (1.51)	–0.056 (–0.56)	–0.007 (–0.05)
SEMI-SKILLED	–0.106 (–0.80)	0.376 (0.89)	0.066 (0.49)	–0.012 (–0.10)
SHAREL	0.413 (1.22)	2.004 (1.68)	–0.014 (–0.69)	0.024 (0.74)
AVGMBE	0.390 (0.95)	2.094 (1.36)	0.103 (0.82)	0.171 (0.74)
TAXA	0.947 (1.60)	2.453 (1.64)	0.168 (2.31)	0.128 (1.22)
PT	1.393 (1.42)	10.29 (1.68)	0.109 (0.76)	0.281 (2.07)
Specificity of resources (model with interactions)				
$LNWAGE_{t-1}$	0.666 (2.81)	–0.385 (–0.47)	n.a.	n.a.
SKILLED	0.585 (1.75)	1.568 (1.68)	–0.056 (–0.57)	–0.019 (–0.14)
SEMI-SKILLED	–0.092 (–0.70)	0.328 (0.89)	0.061 (0.46)	–0.034 (–0.30)
SHAREL	0.345 (1.12)	1.861 (1.76)	–0.014 (–0.69)	0.024 (0.78)
AVGMBE	2.213 (2.07)	7.735 (1.58)	0.226 (1.16)	0.581 (1.35)
TAXA	0.249 (0.61)	0.386 (0.64)	0.113 (1.12)	–0.055 (–0.29)
PT	4.901 (2.33)	24.497 (1.68)	0.432 (1.20)	1.334 (1.93)
AVGMBETP	–39.541 (–2.21)	–163.25 (–1.58)	–3.144 (–1.00)	–9.977 (–1.64)

[a] All results are robust to heteroskedasticity.
[b] T-ratios in brakets.

tion, large firms innovated considerably more than small-medium ones.

How has this innovative process affected salaries paid by Spanish manufacturing firms? In particular, we were interested in knowing if salaries paid by innovative firms were higher. Results showed that innovating firms paid higher wages on average than those offered by non-innovating firms, and that the same pattern was found in both groups of firms (SMEs and large firms). Thus, if firms can grow as the result of their capacity to develop organizational capabilities, then theory predicts that the salary difference among innovating firms will be greater in large firms than in SMEs.

A variance analysis showed that there was actually a linear relationship between innovation and size, suggesting the need to study the effect of innovations on salaries paid in each size group separately. Although the relationship favored salaries paid by innovative SMEs instead of innovating large firms as theory predicted, the regression model used to estimate the determinants of salary levels in both groups of companies showed that in large firms, the firms' innovating activity only affected salary variations and not the levels.

This result showed the difficulties that large Spanish firms are experiencing in adapting to a significant change in the competitive environment: the incorporation of Spanish industry into the single European market and growing global competition they face from the remaining European countries as well as other industrialized (recent GATT agreements) and developing nations (multifibre agreements, etc.). As Henderson and Mitchell (1997, p. 7) pointed out, "firms that develop extensive organizational capabilities find it more difficult to adapt to major changes in an industry's environment than firms that rely on the capabilities of individuals." This further demonstrates the need to regress the wage level on its

determinants to form the econometric model for SMEs and the wage increase for the group of large firms. Recent articles in the Spanish press indicated that there are sometimes up to three labor agreements in a firm that define different wage scales for the same job and showed that salaries paid to the oldest employees included organizational rents from competitive advantages that the company had lost. Since salaries successfully resist being reduced, new employees must compensate for the competitive advantage lost.

When analyzing the effects of innovative activity conducted by Spanish manufacturing firms, we found that the effect on salaries paid differed according to company size. In general, *only process* innovations were important for small-medium firms, even though they were more engaged in product innovations than the large ones. These results do not support the hypothesis of Cyert and Kumart (1996) that proposes that small-medium firms are more interested in product innovation than the large ones, whereas the reverse is true as far process innovations are concerned. Probably this result is due to the fact that Cyert and Kumart's model assume that firms are competing in the same final market, whereas the majority of small-medium Spanish firms possibly compete as suppliers of large firms. This is a conjecture that requires further work.

When we analyzed appropriability conditions, we found that as far as large firms were concerned, their salary increase was not influenced by firm's market factors, indicating that large firms have the necessary resources to appropriate the profits derived from their innovative activities. The opposite pattern is found in the small-medium firms group where the market position as well as the market concentration affected the salaries positively. However, these results changed when we took into account the expected interaction between firm's internal and market factors. We found that the impact of innovations on wages depends on firm's market structure, and the other way around, the moderator impact of market structure on wages depends on the firm's innovative activity.

The data shows that market structure negatively affects the impact of innovations on wages. The same innovation in a more concentrated market produces a reduced premium on wages and this result holds for large as well as for small-medium firms. Nevertheless, the impact is greater for the latter group than for large enterprises. In a concentrated market small firms are poorly positioned to appropriate the quasi-rents stemming from their innovations; in contrast, large firms have more adequate resources to appropriate this quasi-rents. On the other hand, the moderation effect of market concentration is affected by firm's innovative behavior. For the same level of market concentration, innovative firms find its impact moderated by their innovations: the greater the firm's innovations, the less the impact of market concentration on wages and the more wages are affected by innovations.

We found support for the alternative hypothesis that suggests that firms grow by developing firm-specific resources and that innovating firms must have resources more specific than non-innovating firms, and this holds regardless of firm's size. The entrepreneur must isolate the firm's internal labor market from the external market, the result of its business strategy in order to develop individual and organizational skills specific to the firm. This finding suggests that the weight of internal factors in small-medium and large firms depends on the innovating behavior of the firm, suggest a way to solve the contradictory inferences of Nickel et al. (1994) and Lever and Werkhooven (1996).

Finally, Chow's test rejects the null hypothesis that states that there are no significant differences between the process that generates the salaries in both groups of firms. Apart from the difficulties faced by large Spanish manufacturing firms to adapt to major changes in their competitive environment, there are remarkable differences between the behavior of both large and small-medium manufacturing enterprises. Not only do their innovative strategies differ, but also the opportunity conditions they face, the appropriability conditions of the economic income stemming from their innovative activity, and the firm-specific resources to which they have access. This result – along with that found by Acs and Audretsch (1988) when studying the determinants of small-medium and large firms' innovations – lends support to the hypothesis that small-medium enterprises are not simply scaled-down large firms.

6. Conclusions

In this paper we have addressed the issue of wages determinants as well as analyzed the innovative behavior of Spanish firms and its impact on wages paid by SMEs and large firms. We found that innovative firms paid a wage premium to their employees, and that this wage premium was greater in small-medium firms than in large ones, contrary to what was expected. This unexpected positive interaction is apparently due to the fact that large Spanish firms are experiencing difficulties adapting themselves to the new competitive environment.

Small-medium firms' wages were primarily influenced by process innovations, contrary to what was predicted, whereas wages in large firms were receptive to all kinds of innovations, process, product and both simultaneously. These influences were moderated by firm's competitive strength in the small-medium firms group, but not in the large one.

Even more interesting, the moderator impact of market factors on wages was seen to depend negatively on a firm's innovative activity, and the impact of this innovative activity was found to depend negatively on a firm's market structure. The inferences of the models estimated suggest that the higher the market concentration the weaker the appropriability regime, especially for small-medium firms. However, at the same time, a firm's innovations reduce the impact of market concentration on wages, making innovating firms more autonomous than the non-innovating ones. In fact, in order to be able to innovate, firms must isolate their employees' salaries from the product market, results which hold regardless of firm size, but have a greater impact on the small-medium group of firms.

This finding suggests that the weight of internal factors on wages in small-medium and large firms depends on the innovating behavior of the firm, suggesting a way to solve the contradictory inferences found recently. Finally, there are remarkable differences between the behavior of both large and small-medium manufacturing enterprises, and the data lend support to the proposition that small-medium enterprises are not simply scaled-down large firms.

Acknowledgements

The authors would like to express their appreciation for the insightful comments made by two anonymous reviewers as well as Dr. Vicente Salas (University of Zaragoza, Spain) concerning improvements of their work. They also gratefully acknowledge funding from Spanish Research Grants DGICYES #PB95-0616 and DGES #PB97-0186-C03-01.

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