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ABSTRACT

Complements or Substitutes? Examining the Relationship between Teamwork and Selection Intensity

Teamwork has become widely embraced in recent decades; however, its adoption carries significant implications that require thorough understanding. In this paper, we study the relationship between teamwork and selection intensity. The use of teams may increase the value of investing in comprehensive selection, as it facilitates the identification of workers with complementary skills. However, teamwork may also substitute intensive selection if team members engage in mutual monitoring and peer reporting. Using data from a representative sample of Spanish manufacturing plants, we find a significant and negative association between selection intensity and teamwork that is aligned with the mutual monitoring hypothesis.

JEL Classification: M50, M51, M12

Keywords: teamwork, selection intensity, mutual monitoring, HRM complementarity

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Introduction

The incidence of teams has gained prominence over the years and is now used in a large variety of production activities. According to the European Company Survey, 70 percent of establishments in the European Union use teamwork (Eurofound and Cedefop, 2020). The adoption of teams is expected to impact not only job design and work organization but also extend its influence to human resource management (HRM) domains such as training, performance appraisal and pay systems.

The goal of this paper is to study the implications of the use of teams for one central HRM activity: employee selection. Specifically, we analyze the relationship between the use of teams and the intensity of the selection process in the hiring of new employees. We test two competing perspectives regarding the sign of this association. The arguments in favor of substitutability propose that teamwork will involve less intensive selection, whereas the complementarity approach predicts a relationship of the opposite sign.

The idea underlying a relationship of substitution is that the value of intensive selection diminishes if the company employs monitoring mechanisms that reduce shirking. One such mechanism is the organization of workers in teams, where peer pressure, mutual monitoring and peer reporting are in place (Mas and Moretti, 2009). In some settings, coworkers are the only ones that directly observe peer's effort (Carpenter et al., 2018). Additionally, workers in teams have incentives to monitor each other, since when an individual shirks, this decreases not only her own productivity but also the productivity of her teammates (Alchian and Demsetz, 1972). Therefore, when workers participate in teams, peer monitoring may render intensive selection less valuable as a control mechanism in the production process.

Alternatively, the organization of workers in teams could enhance the value of intensive selection. Previous work has considered teamwork and selection as complements in the design

of the HRM system (Huang and Cappelli, 2010). Teamwork requires hiring workers with specific abilities such as collaborative skills, the ability to communicate with others, or reciprocal behaviors (Hamilton et al., 2003). It also requires finding workers whose skills are complementary. To meet these requirements, intensive selection is needed. Furthermore, teamwork may increase monitoring costs due to interdependent production processes, making it challenging to gauge individual performance. An exhaustive selection process can mitigate the need for intensive monitoring, thus reducing monitoring costs in team-based environments (Huang and Cappelli, 2010).

Based on the arguments presented by these two theoretical approaches, in this paper we explore the teamwork-selection relationship puzzle. To that end, we use a data set that contains information on a representative sample of Spanish manufacturing plants. This data set is a unique source of information regarding selection intensity and teamwork in Spanish organizations. Data was collected at the plant level, as this is the unit where decisions regarding the implementation of the relevant practices are taken. Regarding selection, managers reported their use of the following instruments when selecting production workers: personal interviews, knowledge tests, personality tests, intelligence tests, and group exercises.

This research offers several contributions to the existing literature. First, it extends previous research on the complementarity and substitutability of HRM practices (Meuer, 2017) by examining the association between selection and teamwork, a topic not previously explored. Second, it contributes to the literature on mutual monitoring in work teams (Kandel and Lazear, 1992) by studying the contextual factors that might encourage this type of mutual monitoring as well as their implications particularly focusing on direct supervision, establishment size, and collective pay for performance. Third, our work contributes to the literature on the factors associated with the prevalence of intensive selection in hiring processes (Wilk and Cappelli, 2003).

Our empirical strategy proceeds as follows. We examine the association between teamwork and the number of selection instruments used in a plant, which is our measure of selection intensity. Our estimates indicate a predominance of the substitution effect, evidenced by a negative association between the percentage of workers participating in autonomous teams and the number of selection instruments used. Then, through the inclusion of interaction terms between teamwork and several variables related to supervision, we provide evidence supporting the mutual monitoring hypothesis as an explanation for this association. These complementary regressions, along with additional robustness checks, suggest that our results align with the idea that mutual monitoring within teams diminishes the value of intensive selection.

The remainder of our paper is structured as follows. The second and third sections present the theoretical arguments that explain the substitutive and complementary relationship between teamwork and selection intensity, respectively. In the fourth section, we describe the data set and the variables that will be used in the empirical analysis presented in the fifth section. The sixth section discusses the main findings. Finally, the seventh section concludes and offers implications of our results for the literature and practice.

The substitution effect: *mutual monitoring and peer pressure within teams*

One of the central issues in Economics is the alignment of employer and workers interests through the provision of incentives and the use of motivation and control mechanisms. In particular, the literature identifies alternative control choices available to employers to address the principal-agent problem (Prendergast, 1999). One such choice involves supervising the effort exerted by workers in the workplace (Alchian and Demsetz, 1972). Another widely studied alternative consists of controlling output by including it in the formula to pay employees (Holmstrom, 2017). A third option is to control the skills, beliefs and traits of employees as inputs to the production process in such a way that they meet the requirements that guarantee adequate performance (Abernethy et al., 2015). This process largely takes place prior to hiring

the employee and is carried out through selection. Selection helps to identify those workers who best fit the job requirements and the objectives of the company. This might reduce the likelihood of agency issues arising during the employment relationship.

The concept of alternative motivation or alternative control mechanisms suggests that, in the absence of conventional control mechanisms such as direct supervision or monetary incentives, the reliance on other forms of control, particularly selection processes, intensifies (Abernethy et al., 2015). Previous research has explored the substitutive relationship between selection and other control systems, focusing on performance pay (Abernethy et al., 2015; Jirjahn and Mohrenweiser, 2019). However, selection intensity can also be replaced by an organizational practice that, seemingly, may not share a direct connection with it: peer monitoring within teams.

A good starting point for analyzing the substitutive relationship between selection and teams is the Kandel and Lazear (1992) model on the impact of peer pressure in team settings. According to this model, the effect of peers on a worker's effort operates through two mechanisms related to motivation and monitoring. First, groups bargain over an effort norm that conditions the behavior of team members, since deviating from the norm implies disutility. This disutility may emerge from two possible reasons. In the case of action observability, deviation from effort involves feelings of shame and social punishment from peers (Mas and Moretti, 2009). Even if there is no observability, the mere presence of coworkers and the interaction with them may prevent shirking, since this awakens feelings of guilt. Second, workers tend to be organized in teams when their productivity is interdependent (Heywood et al., 2008). Workers organized in teams have incentives to monitor each other because any decrease in one member's productivity directly impacts the overall output of the team (Alchian and Demsetz, 1972). Descriptive evidence from Freeman et al. (2010) further supports this idea, as they show that workers are more likely to act against peers' shirking when they are organized in teams.

Organizations will choose between alternative motivation or control systems, such as selection and teams, based on their respective benefits and costs. Selection intensity allows a better identification of the characteristics of the worker across various dimensions including knowledge, skills, abilities, personality traits, and beliefs. This comprehensive identification enables a more accurate prediction of a candidate's future behavior. This is especially useful in screening out those candidates most prone to undesired behaviors such as shirking and to select those most likely to exhibit desired behaviors.

Compared to the advantages, the main drawback of intensive selection lies in its cost. High selection intensity implies the use of several selection tools, each of which can involve substantial expenses. Therefore, if the company manages to avoid unwanted behavior in another less costly way, it may reduce selection intensity. In the case of shirking, as we have explained, teams can avoid this behavior through mutual monitoring and social pressure, reducing the need for intensive selection to achieve this objective. All in all, the arguments presented suggest that organizations may substitute selection for teamwork as an alternative control mechanisms.

Moderating factors in the substitutability relationship

The existence of arguments that support a substitution between selection and teamwork does not imply that this negative relationship is present in any organization. Previous research has found that certain motivation or control mechanisms may either complement or substitute employee selection, contingent upon various organizational characteristics. For example, Jirjahn and Mohrenweiser (2019) show that multitasking moderates the association between applicant screening and performance pay, showing a positive relationship in establishments with increased multitasking but a negative one in those without it. Moreover, the sign of the association between these two practices is also dependent on the strategy of commitment to organizational learning and the level of external volatility (Abernethy et al., 2015). Similarly,

there are factors that might condition the role of teams as monitoring devices and, consequently, as substitutes for selection intensity. Specifically, we argue that effort supervision, establishment size, and collective performance pay could moderate this relationship.

Going back to the idea of alternative control systems, teams are more likely to be used as monitoring tools in the absence of other supervision strategies. The classical mechanism for avoiding employee misbehavior involves a supervisor observing worker's effort during the production process and rewards based on whether the observed effort matches the contracted effort (Alchian and Demsetz, 1972). The degree of supervision will be inversely related to the span of control, meaning it will rise as the ratio of supervisors to subordinates increases (Calvo and Wellisz, 1978). Thus, we hypothesize that the substitutability between selection intensity and teams will be low when the level of supervision is high due to a large number of supervisors per worker.

The number of employees may also serve as a moderating factor in the relationship between our variables of interest. As the size of a group increases, so do the costs and obstacles associated with observing employee effort within the firm. Hence, when the number of employees is large, the uncovering of shirking is more difficult (Oi, 1983). It is stated that coworkers' observation is frequently the only way to detect shirking (Carpenter et al., 2018). This argument has been supported by survey evidence, where workers claim to be able to detect peer's shirking (Freeman et al., 2010). Considering these arguments, the role of teams as monitoring devices should be more valuable in large organizations, where the costs of monitoring workers are higher. Consequently, the negative relationship between teams and selection intensity should be stronger in establishments with a large number of employees.

Despite the advantages of teams as supervision mechanisms, mutual monitoring and reporting also incur costs for the individuals involved, as it requires extra effort to observe coworkers'

behavior. Moreover, peer monitoring may damage social relations, particularly when instances of shirking are reported to a superior (Orr, 2001). In order to motivate mutual monitoring, a benefit must be reaped by workers from this action. Peer supervision and pressure are more likely to be exerted when there are elements that enhance their value for the individuals involved. For instance, previous literature has highlighted the effectiveness of collective monetary incentives, such as profit-sharing schemes, as mechanisms that increase the value of monitoring peers within team contexts (Kandel and Lazear, 1992; Knez and Simester, 2001; Carpenter et al., 2018). These payment systems make an individual's pay contingent upon the effort of peers, providing incentives to monitor, sanction or report instances of shirking, since this misbehavior has negative consequences in terms of lower pay. Therefore, collective incentives may moderate the relationship between teams and intensive selection. In particular, the substitution effect is expected to be stronger when teamwork is coupled with payment schemes such as profit-sharing.

The complementarity approach: *selection requirements in team settings*

Complementarity relationships might emerge between different HRM practices, so that the value of implementing them jointly is greater than the value of adopting each of them individually (Ichniowski, et al. 1997; Pfeffer, 1998). In the HRM literature this idea has been captured by concepts such as HRM bundles (MacDuffie, 1995) or internal fit (Meuer, 2017), which highlight the mutually reinforcing effects of multiple HRM practices on employee and firm performance. Prior research has pointed out a set of HR practices that might be complementary to the use of teams (Lazear and Shaw, 2007). One of them is selection, so that to reap its benefits, teamwork must be accompanied by a proper set of practices in this domain. Synergies between teams and intensive selection are expected to emerge for several reasons.

Team production and the interdependencies it generates imply the inclusion of additional tasks in jobs, which require specific skills to be properly executed. In particular, teamwork entails

frequent collaboration and communication with peers. Supporting these ideas, Ichniowski and Shaw (2005) found that employees working in mills and organized around teams display higher rates of communication with colleagues and superiors than those working in hierarchical structures. In the same line, Hamilton et al. (2003) observed a positive joint effect of teamwork and communication on firm performance.

To achieve effective communication in teams, selection processes oriented toward hiring candidates with strong interpersonal skills are of special value. This also makes certain personality traits particularly beneficial in team settings, leading to cooperative behaviors desirable in partnerships. The literature on social preferences has shown that traits such as reciprocal behavior impact the employment relationship (Englmaier and Leider, 2012). In particular, reciprocity contributes to the enforcement of contracts and triggers significant efficiency improvements (Fehr et al., 1997). According to Englmaier et al. (2016), for teamwork to be successful, workers must be reciprocal and subordinate their needs to the common good of the group. Therefore, the selection process should look for these specific personality traits, such as reciprocity, to find suitable workers for a team environment. This demands exhaustive selection processes to ensure that chosen candidates possess the necessary skills for team-oriented organizations (Wilk and Cappelli, 2003).

Besides seeking workers with the aforementioned characteristics, effective teamwork requires careful consideration of group composition. In team production, the skills of team members must be complementary, thereby increasing the marginal output of each worker through their interactions. This idea is supported by the findings of Hamilton et al. (2003), who found that team heterogeneity increased productivity compared to teams with members possessing similar skills. Ichniowski and Shaw (2003) also alluded to the benefits obtained by finding complementarities between workers with different skills or information. From a motivation perspective, differences in abilities facilitate the achievement of efficient effort levels in team

production (Kuhn, 2017). Consequently, to enhance team performance, it is important to identify complementarities among workers and define an appropriate team composition in advance. This requires an intensive selection process that ensures the team is composed of the precise mix of workers with different skills and personality traits. Altogether, these ideas point to a positive association between teams and intensive employee selection.

Data and Measures

To test the previously described theoretical arguments, we conduct an empirical analysis using a data base on different HRM practices in Spanish manufacturing plants with 50 employees or more. The information was obtained by means of a questionnaire addressed to the managers of the plants. The questionnaire was divided into several sections and inquired about the characteristics of the plant, as well as the HRM practices adopted. The data were gathered by specialists in computer-assisted telephone interviews. A total of 2933 plants were contacted, obtaining 1003 valid responses; as a result, the response rate was 34.2%. Because some of the responses did not provide full information on all the variables of interest, the final sample used in our empirical analysis is smaller (as indicated in the tables presented in the next section)[1].

There are several remarkable advantages of exploiting this unique data set for the purposes of the study. To the best of our knowledge, it is one of the few data sources that includes information on the use of different selection instruments, enabling us to explore the determinants of selection intensity based on the addition of instruments. It also accounts for the extent of teamwork at the plant, our explanatory variable of interest. Besides, the teamwork variable specifically refers to autonomous teams, that is, teams where members have the power to supervise and sanction their peers. Granting autonomy to teams is necessary for the peer pressure and mutual monitoring effects to be in place. This definition of the team variable is key for analyzing the substitutive relationship between selection and teamwork. We also have information on relevant organizational factors that may affect the selection-teamwork

relationship, such as the intensity of supervision, the size of the company and the use of collective monetary incentives. This allows us to explore the mechanisms underlying the association between the variables of interest. Finally, the database provides a comprehensive set of controls, so we can sort out the role of potential confounding factors affecting the intensity of selection.

Table 1 shows the definitions of all the variables considered in the analysis and their descriptive statistics. These variables will be described in the following subsections.

[INSERT TABLE 1 HERE]

Selection intensity

Questionnaire respondents were asked about the use of the following selection instruments for production workers (the core workers in manufacturing): personal interviews, knowledge tests, personality tests, intelligence tests and group exercises. Using this information, and following Koch and Hundley (1997), we define the variable *Selection Intensity* as the number of instruments used in the selection process. Each selection instrument provides specific information about candidates, from cognitive ability and personality characteristics to their collaborative skills, among others (Wilk and Cappelli, 2003). Therefore, as the number of instruments used increases, more information for candidate selection is obtained, resulting in a more accurate selection process.

By far, the most widespread instrument in our sample is the personal interview, which is used in almost 91 percent of cases. The second most frequently used instrument is knowledge tests (23.23 percent), followed closely by personality tests (19.80 percent). In addition, 10.61 percent of establishments use intelligence tests, whereas group exercises are only applied in 3.54 percent of plants in the sample. Regarding the number of selection instruments used in each establishment, a negligible number of cases do not use any (1.41 percent). Most establishments

(67.68 percent) use only one selection instrument, and 20.20 percent of the sample use two. Around ten percent of cases apply three or more of the selection instruments considered.

Teams

Our main explanatory variable*, Teams,* measures the percentage of production workers in the plant taking part in autonomous teams. The variable not only accounts for the use of teamwork, but also for the intensity of the practice. In our sample of plants, around 31 percent of workers participate, on average, in autonomous teams. It is worth noticing that 70 percent of establishments organize at least part of their production workers in teams, which is consistent with recent data on teamwork use in Europe (Eurofound and Cedefop, 2020), and 13 percent of plants have all of their production employees participating in teams.

Moderating variables

As explained in the previous sections, there are three variables expected to play a moderating role in the relationship between teams and selection intensity: *Supervision, Establishment Size* and *Collective Pay for Performance*. Supervision effort is measured by the number of supervisors per production worker in the plant. Regarding establishment size, it is measured by the logarithm of the number of workers in the plant. Finally, a binary variable captures the existence of compensation plans linking pay to collective performance.

Control variables

Our empirical analysis accounts for several control variables that may have an influence on selection intensity (Cappelli and Wilk, 1997). In particular, we control for establishment characteristics that may affect the costs and benefits of selection, factors related to job requirements, and the use of practices that might perform the same function as selection.

Regarding the establishment characteristics, an HRM department is essential to manage the selection processes (Cohen and Pfeffer, 1986), and provides the organization with specialists in selection that may facilitate the task and reduce its costs. An HRM department is also associated with a more sophisticated approach to HRM, including selection strategies. This idea is supported by Wolf and Jenkins (2006), who find that the presence of HRM specialists promotes a formalization of selection, increasing the number of instruments used. We also control for the age of the plant, since it may capture the organizational beliefs in relation with the best HRM practices. Empirical evidence shows that firm age has an impact on the HRM practices applied to the workforce (Wu et al., 2014). Foreign ownership may also influence the intensity of the selection process. In particular, subsidiaries of foreign companies may import HRM practices from the country of origin (Bayo-Moriones and Galdon-Sanchez, 2010).

The way employment conditions are determined and the existence of collective bargaining processes could also be related with selection intensity (Jirjahn and Mohrenweiser, 2019). For example, collective bargaining fosters the existence of long-term employment relations, thus making intensive selection more valuable. We also include a set of variables that capture if the strategy of the organization focuses on cost reduction, quality or innovation, or flexibility. The reason for controlling for these variables is that intensive selection impacts these aspects (for example, it is costly and takes time), so it will be conditioned by plant strategy. Finally, we include 12 industry dummies[2] and 17 regional dummies[3] to control for differences in skills across industries and regions (Wilk and Cappelli, 2003).

A second group of control variables refers to job-related factors for production workers (DeVaro, 2005). We expect that greater skill requirements will demand more intensive selection processes, particularly when the skills are difficult to measure. Job complexity, strongly linked to skill requirements, plays a significant role in this regard. As a job becomes more complex, the demand for skills increases, and the pool of suitable workers declines (Ben-Ner et al., 2023).

Therefore, when hiring for complex jobs, it is more important to select the right workers, demanding greater accuracy in the selection process. Consequently, intensive selection of candidates becomes more valuable.

We also account for job autonomy, which is a core characteristic in job design. Jobs in which workers are provided with discretion to make decisions are more complex than those in which their action is limited to follow the instructions of supervisors. Therefore, we expect selection to be more careful when workers are to enjoy significant job discretion (Morrison et al., 2005). Another job-related factor worth considering is technology, and its connection with selection can be explained by the skill-biased technical change literature (Card and DiNardo, 2002). The sign of the relationship with selection intensity is a priori undetermined because technological advances may increase routine or, on the contrary, demand higher skills depending on its nature. Another aspect with implications for selection intensity is the presence of participatory mechanisms aimed at improving work organization and conditions. It is plausible to argue that organizations that promote employee involvement show different selection requirements compared with non-participatory organizations. For example, Godard (2010) identifies participatory HRM with more sophisticated selection instruments such as values-based.

Concerning the third group of controls, intensive selection will be more valuable in the absence of substitutive practices that aid in attracting and hiring the right workers. One of these practices is individual pay for performance. In addition to motivational purposes (Lazear, 1986 and 2000, Curme and Stefanec, 2007; or Dohmen and Falk, 2011), individual pay for performance may induce the self-selection of workers with specific characteristics such as high ability (Dohmen and Falk, 2011; Kuhn, 2017). In the presence of these effects, intensive selection becomes less valuable to the firm. However, it must be considered that the provision of performance pay may distort sorting if only some dimensions of performance are measured, potentially attracting workers with low ability in unmeasured facets of the job (Jirjahn and Mohrenweiser, 2018).

Similarly, promotion opportunities may attract workers with the type of skills required to succeed in the organization, as they will have the opportunity to improve their earnings and working conditions within the firm. From this argument, internal promotion and intensive selection might be substitutes. However, there are also arguments in favor of a complementarity relationship. Those plants that adopt internal labor markets should devote more resources to the selection process since the worker is expected to stay longer in the company and, therefore, there is a greater need of ensuring that she meets job requirements (Baron and Kreps, 1999). Finally, the implementation of performance appraisal may also be related to selection, being a substitute for intensive screening of workers. Whereas performance appraisal involves control during and after the production process, intensive selection focuses on controlling the human input (Abernathy et al. 2015).

Results

Main results

Table 2 presents the results of the empirical analysis aimed at disentangling the relationship between teamwork and selection intensity. The table reports ordinary least squares estimates of selection intensity with robust standard errors. The results presented in Column 1 show that the variable of interest, *Teams*, is significantly and negatively related to the number of selection instruments. This result is consistent with the idea of a substitution between the organization of workers in teams and the intensity of selection. Concerning the control variables, the number of selection instruments used increases with establishment size, the use of collective pay for performance, job complexity, the degree of technological development and employee participation.

[INSERT TABLE 2 HERE]

Having identified a negative association between *Selection Intensity* and *Teams*, we test whether this substitutability relationship aligns with the mechanisms proposed in the theoretical

framework. In Columns 2, 3 and 4 of Table 2 we include interactions of the *Teams* variable with *Supervision*, *Establishment Size* and *Collective Pay for Performance*, respectively. Recall that the substitution effect may arise because autonomous teams act as a supervision mechanism, based on mutual monitoring and peer pressure, that reduces the need for intensive selection. However, the use of teams as monitoring tools, and consequently as substitutes for intensive selection, can be influenced by the presence of alternative supervision methods as well as the costs and benefits of supervision.

Column 2 in Table 2 presents estimates of our main regression including the interaction between the variables *Teams* and *Supervision*. The inclusion of this interaction term aims at capturing whether the association between teams and selection is dependent on the use of an alternative monitoring channel such as the direct supervision of workers by supervisors. The results show that, when including the interaction, the variable *Teams* maintains a negative (and highly significant) coefficient, whereas the interaction term itself shows a positive and statistically significant coefficient. The strength of the substitution relationship diminishes with the number of supervisors, giving way to complementary effects between teams and selection. In other words, teamwork replaces selection when supervision is not carried out using other -more conventional- channels (direct supervision by specialists), which suggests that the substitution effect may be driven by peer monitoring reasons.

Next, in Table 2 (Column 3) we look at the interaction between teamwork and the size of the establishment. As explained above, the number of employees may also be a factor that moderates the relationship between our variables of interest, since it affects the detection of shirking and the costs of supervision. The results show a negative and statistically significant coefficient for the interaction term. Therefore, as the number of workers increases, the use of autonomous teams is associated with a reduction in selection intensity. Given that the substitutive relationship seems to be stronger in establishments of larger size, that is, where

shirking detection is difficult, the mutual monitoring hypothesis seems to be a plausible explanation for our results.

Finally, in Column 4, we include an interaction term between *Teams* and *Collective Pay for Performance*. The mutual monitoring argument hypothesizes that the substitution between teams and intensive selection will be greater when there are mechanisms that reward employees for monitoring their peers. However, the coefficient of this interaction term does not emerge as a significant factor explaining the intensity of selection[4]. Overall, we find that the substitutive relationship between teamwork and selection intensity is mitigated as the number of supervisors per worker increases, and it is enhanced in large establishments. These results are consistent with the idea that the relationship between the use of teams and selection intensity is explained by mutual monitoring within groups.

Supplementary analysis and robustness checks

The estimate of the variable *Teams* coefficient by OLS will be biased if the variable is correlated with the error term of the model. In particular, our OLS estimations may be subject to an omitted variable bias, even though we have included an extensive set of control variables that account for general establishment characteristics, job-related variables and alternative supervision mechanisms[5]. In order to address endogeneity concerns, in Table 3, we instrument the variable *Teams* with the percentage of white-collar workers participating in autonomous teams. The organization of white-collar workers in teams may affect the use of teams for blue-collar workers as well due to the existence of returns to scale in the use of teams. Furthermore, from a horizontal fit perspective, companies should pursue the congruence in the adoption of HRM practices for different occupational groups (Kepes and Delery, 2007). Therefore, an alignment between the use of teams for blue-collar and white-collar workers is expected. The positive and highly significant correlation between team participation for production workers and for white-

collar workers provides preliminary evidence supporting this relationship and the choice of this instrumental variable (correlation = 0.316, p-value = 0.000).

For an instrument to be valid, it must meet the exogeneity requirement. That is, our instrument should not have a direct effect on the dependent variable, but an indirect effect through the variable *Teams*. The inclusion of the instrument in our main equation shows that teamwork for white-collar workers is not significantly associated with the intensity of selection for production workers (see Table 3, Column 1). Furthermore, results from the 2SLS-first stage regression (Column 2) show that the instrument (*Teams white-collar*) has a strong statistical significance, which suggests that it is correlated with the potentially endogenous variable (*Teams*), meeting the relevance requirement as pointed out by Angrist and Pischke (2009). To provide additional evidence on the instrument relevance, and following Stock et al. (2002), we compute the first-stage F-statistic to test whether it exceeds the threshold of 10. The result obtained confirms that this criterion is met (F statistic = 63.951, p-value = 0.000).

[INSERT TABLE 3 HERE]

The second stage estimates (Column 3) show that the variable *Teams* has a negative and statistically significant coefficient, which confirms the robustness of our baseline analysis (although the significance level is reduced, being the p-value=0.050). However, the endogeneity tests do not reject the hypothesis that the instrumented variable is exogenous in the analysis (Robust score χ^2= 1.216, p-value = 0.270; and Robust regression F-statistic = 1.149, p-value = 0.284). Therefore, we take the initial OLS estimation results as valid.

In our sample of firms, the personal interview is a selection instrument used by virtually all plants. Therefore, we could see the interview as the default or basic selection strategy used in Spanish manufacturing firms, and it may not be very informative about the actual intensity of selection. Considering this, we build a new measure of selection intensity that excludes personal interviews in order to avoid adding an instrument for which there is no variation in use across

organizations. Using this new definition of selection intensity, we focus on the use of less frequent selection instruments. These instruments will be used when additional candidate information is deemed necessary, deviating from the common standards or baseline patterns used in worker selection.

Table 4 replicates the estimations presented in Table 2, using the alternative measure of selection intensity as the dependent variable. Columns 1 to 4 show the baseline OLS estimations (Column 1) and the estimations including the interaction between *Teams* and *Supervision* (Column 2), *Establishment Size* (Column 3) and *Collective Pay for Performance* (Column 4). The pattern of results is basically unchanged, with the exception of the result obtained for the interaction between *Teams* and *Collective Pay for Performance*. The negative and significant coefficient of this term supports the hypothesis that the substitution effect is stronger when teamwork is complemented with such payment schemes.

[INSERT TABLE 4 HERE]

Finally, to test the sensitivity of our results to the estimation method, we replicate our empirical exercise using a count-data Poisson model. The results are shown in Table 5. As expected, the variable *Teams* shows a highly significant and negative association with the dependent variable in the model without interactions. Moreover, the combination of teamwork and supervision has a positive coefficient, whereas the interaction of the main explanatory variable with the number of employees has a negative one. Both interaction terms are statistically significant at conventional levels.

[INSERT TABLE 5 HERE]

Conclusions

There are theoretical arguments pointing out that intensive selection of workers and teamwork may show either a complementary relationship or, alternatively, may be substitutive practices. In this paper, we find a negative association between the two practices that is compatible with

the claim that mutual monitoring within teams might render intensive selection less valuable. We perform complementary analyses to provide additional evidence consistent with the idea that the substitution effect is related to mutual monitoring. These analyses reveal that the number of supervisors per worker mitigates the substitutive relationship between teamwork and selection intensity. In addition, the substitution effect increases with the size of the establishment and, using an alternative measure of selection intensity, with the use of collective pay for performance.

This paper contributes to several strands of the literature. First, our work can be placed within the literature on the complementary and substitutive effects between HRM practices within the best practices approach. Although literature in this area is abundant, to the best of our knowledge, the association between selection and teamwork has not been previously addressed in detail. Recently, a couple of papers have examined the relationship between selection and the provision of incentives, finding that this relationship is contingent on factors such as multitasking, firm strategy or external volatility (Abernethy et al., 2015; Jirjahn and Mohrenweiser, 2019). We extend this literature by focusing on the relationship between employee selection and a pivotal work organization practice: teams. Besides the empirical evidence provided in this paper, the association between the two practices finds support in well-established economic theories. Our results also show that the substitution relationship is not universal; on the contrary, certain organizational factors contribute to enhance it or turn it into a complementary one. Synergies between teams and selection may be present in organizations with high levels of supervision or small size. These results reinforce the argument that the existence of bundles between HRM practices is contingent on other organizational factors (Jirjahn and Mohrenweiser, 2019).

Our paper also contributes to the literature on mutual monitoring within work teams, the factors that encourage it, and their implications. Previous studies have examined the connection

between teamwork, mutual monitoring and compensation practices such as profit sharing, identifying teamwork as a mechanism to mitigate the free-riding problem that arises when providing collective incentives (Carpenter et al., 2018; Knez and Simester, 2001). We build on this literature and highlight the implications that mutual monitoring within teams may have for a central domain in HRM: the selection of workers. We also provide insights on the settings where mutual monitoring and peer pressure within teams are beneficial for organizations. The role of teams as substitutes for an intensive selection process emerges specially in the absence of alternative control mechanisms, such as intensive supervision, and when shirking is more problematic as it may occur in large organizations.

All in all, we think our results may offer valuable guidance for managers when designing their organizational policies and, consequently, make a significant contribution to practice. Depending on the organization's reliance on teamwork, managers may assess whether intensive selection processes are necessary or if the team dynamics themselves can serve as effective control or motivation mechanisms. To evaluate this, it is important for managers to recognize the potential impact of teams on peer pressure, mutual monitoring, and peer reporting. This can inform decisions about the level of intensity required in the selection process. Our results also suggest that the relationship between teamwork and selection intensity is context-dependent, and it is moderated by factors such as supervision intensity or establishment size. For example, larger organizations may find that teamwork serves as a more valuable monitoring device due to increased difficulties in supervision and shirking detection. Managers should, therefore, consider their organization's unique context when designing combinations of HRM practices.

Finally, our work contributes to the analysis of the determinants of worker selection (Barron et al., 1985 and 1997; Cohen and Pfeffer, 1986; Holzer, 1987 and 1988; Koch and Hundley, 1997; Wilk and Cappelli, 2003; Abernethy et al., 2015; Jirjahn and Mohrenweiser, 2019). Existent

literature has mainly considered the determinants of different selection instruments in isolation, whereas we focus on the determinants of selection intensity.

The cross-sectional nature of the data is a limitation of our analysis because the intensity of selection could be related to unobserved characteristics of firms. In order to mitigate this problem, we have tested for endogeneity using an instrumental variables approach. In any case, we do not claim for causality relations. In spite of these limitations, we consider the strengths of the analysis overshadow the potential concerns about it. Our analysis provides unique evidence on the relationship between selection intensity and teamwork. Furthermore, it contains information on a wide set of explanatory factors, precluding confounding effects on selection intensity.

Notes

1. More information about the data as well as the details of the questionnaire can be consulted in Bayo-Moriones et al. (2017).
2. Industries are: (1) Food, Beverages and Tobacco, (2) Textile Industry, Wearing Apparel, Leather and Footwear, (3) Wood and Cork, (4) Paper, Editing and Graphic Design, (5) Chemical Industry, (6) Rubber and Plastic Products, (7) Non-metallic Mineral Products, (8) Metallurgy and Fabricated Mechanical Products, (9) Machinery and Mechanical Equipment, (10) Electrical, Electronic and Optical Products and Equipment, (11) Transport Equipment and (12) Other Manufacturing Industries.
3. The Spanish Autonomous Communities, which correspond to the regional division of Spain according to the NUTS 2 classification of territorial units in the European Union and the UK.
4. When we exclude the instrument *Interview* from the selection intensity variable, the interaction between *Teamwork* and *Collective Pay for Performance* has a negative and statistically significant coefficient (see next section), supporting the hypothesis that collective pay for performance motivates team members to monitor their peers and makes intensive selection less necessary.
5. Endogeneity bias may also arise by the existence of reverse causality or measurement error. However, we do not consider reverse causality to be a source of endogeneity in our analysis. Worker selection is fundamentally a matter of finding the best workers given the characteristics of the organization (Oyer and Schaefer, 2010). Therefore, the features of the selection process will be contingent on work organization arrangements, such as teamwork. In contrast, we do not expect that whether workers are organized into teams will depend on the intensity of selection.

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Tables

Table 1: Variable Description

Variable name	*Description*	*Mean (% if binary)*	*S.D.*
Selection Intensity	Number of instruments used when selecting a production worker, from 0 to 5.	1.478	0.910
Teams	Percentage of production workers that work in autonomous teams.	30.843	36.562
Moderating variables			
Establishment size	Number of workers at the establishment (logarithm).	4.780	.787
Supervision	Number of supervisors per production worker in the plant.	0.093	0.090
Collective Pay for Performance	1 if a collective pay for performance scheme is used for production workers; 0 otherwise.	.305	.461
Establishment characteristics			
HRM Department	1 if there is a HRM department in the plant; 0 otherwise.	.712	.453
Establishment age	Age of the establishment (logarithm).	3.647	.548
Multinational	1 if the plant is part of a foreign multinational enterprise; 0 otherwise.	.213	.409
Sector Collective Agreement	1 if employment conditions for production workers are established by means of a collective agreement at the sector level; 0 otherwise.	.487	.500
Firm Collective Agreement	1 if employment conditions for production workers are established by means of a collective agreement at the firm or plant level; 0 otherwise.	.497	.500
Other Agreement	1 if employment conditions for production workers are established by a manner different than the collective agreement; 0 otherwise.	.016	.126
Cost	1 if cost is the most important factor in the management of the plant; 0 otherwise.	.232	.423
Quality	1 if quality is the most important factor in the management of the plant; 0 otherwise.	.509	.500
Innovation	1 if innovation is the most important factor in the management of the plant; 0 otherwise.	.121	.327
Flexibility	1 if flexibility is the most important factor in the management of the plant; 0 otherwise.	.137	.344
Industry	12 industry dummies		
Region	17 region dummies		
Job-related variables			
Job Complexity	Technical complexity of the jobs of production workers, measured on a 0 to 10 scale.	4.517	2.509
Job Autonomy	Degree of autonomy of production workers over their work. Mean of the following five items (measured on a 0 to 10 scale): (a) workers set up their machines, (b) do maintenance of their equipment, (c) analyze data resulting from their work, (d) plan and organize autonomously their work, (e) set their work pace.	4.610	2.099
Technology	Degree of technological development in the plant compared to the technology in the market, measured on a 0 to 5 scale.	3.695	.875
Participation	Percentage of production workers that participate in improvement meetings.	21.014	31.410
Alternative mechanisms			
Individual Pay for Performance	1 if an individual pay for performance scheme is used for production workers; 0 otherwise.	.348	.477
Promotion	Vacancies in supervisory and middle- management production jobs in the plant are filled with internal candidates, 1 (never) to 5 (always) scale.	4.291	.854
Performance Appraisal	1 if there is a formal performance appraisal scheme for production workers; 0 otherwise.	.448	.498
Teams White Collar	Percentage of white-collar workers that work in autonomous teams.	38.165	40.491

Table 2: Determinants of Selection Intensity

	(1)	(2)	(3)	(4)
Teams	-0.003***	-0.005***	0.013**	-0.002**
	(0.001)	(0.002)	(0.006)	(0.001)
Supervision	0.157	-0.348	0.190	0.173
	(0.279)	(0.320)	(0.278)	(0.279)
Establishment Size	0.237***	0.242***	0.338***	0.238***
	(0.057)	(0.057)	(0.076)	(0.057)
Collective Pay for Performance	0.167**	0.159***	0.169***	0.225**
	(0.074)	(0.074)	(0.076)	(0.100)
Teams x Supervision		0.027*		
		(0.015)		
Teams x Establishment Size			-0.003**	
			(0.001)	
Teams x Collective Pay for Performance				-0.002
				(0.002)
HRM Department	0.043	0.051	0.033	0.039
	(0.067)	(0.066)	(0.068)	(0.068)
Establishment Age	0.046	0.047	0.049	0.046
	(0.063)	(0.063)	(0.063)	(0.063)
Multinational	0.007	0.007	0.012	0.010
	(0.087)	(0.087)	(0.086)	(0.087)
Sector Collective Agreement	0.070	0.068	0.058	0.054
	(0.253)	(0.262)	(0.263)	(0.245)
Firm Collective Agreement	0.091	0.091	0.070	0.073
	(0.254)	(0.264)	(0.265)	(0.247)
Quality	0.104	0.100	0.097	0.100
	(0.077)	(0.077)	(0.077)	(0.077)
Flexibility	0.109	0.108	0.110	0.105
	(0.100)	(0.100)	(0.101)	(0.100)
Innovation	-0.017	-0.028	0.008	-0.016
	(0.104)	(0.105	(0.105)	(0.104)
Job Complexity	0.030**	0.029**	0.030**	0.030**
	(0.013)	(0.013)	(0.013)	(0.013)
Job Autonomy	0.011	0.012	0.013	0.012
	(0.015)	(0.015)	(0.015)	(0.015)
Technology	0.074**	0.078**	0.068**	0.072**
	(0.032)	(0.032)	(0.032)	(0.032)
Participation	0.004***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Individual Pay for Performance	0.069	0.073	0.054	0.067
	(0.067)	(0.067)	(0.067)	(0.068)
Promotion	-0.036	-0.034	-0.036	-0.036
	(0.036)	(0.036)	(0.036)	(0.036)
Performance Appraisal	-0.000	0.000	0.010	0.002
	(0.064)	(0.064)	(0.064)	(0.064)
Constant	-0.284	830	830	830
	(0.467)	0.164	0.169	0.160
N	830	830	830	830
R-squared	0.159	0.164	0.169	0.160

Notes: Industry and region dummies are included. Robust standard errors are in parenthesis.
**** p<0.01, ** p<0.05, * p<0.1*

Table 3: Endogeneity Tests and 2SLS-IV Estimations

	(1) OLS	(2) FIRST-STAGE Regression (Dependent variable: *Teams*)	(3) INSTRUMENTAL VARIABLES - 2SLS
Teams	-0.002***	-	-0.005*
	(0.001)		(0.003)
Teams White Collar	-0.001	0.281***	-
	(0.001)	(0.034)	
Supervision	0.172	-24.043**	0.101
	(0.278)	(10.636)	(0.279)
Establishment Size	0.247***	-1.820	0.242***
	(0.058)	(0.810)	(0.056)
Collective Pay for Performance	0.183**	-3.571	0.172**
	(0.075)	(2.687)	(0.073)
HRM Department	0.059	-0.567	0.057
	(0.067)	(3.009)	(0.066)
Establishment Age	0.035	4.150*	0.047
	(0.064)	(2.283)	(0.063)
Multinational	0.000	-1.437	-0.004
	(0.087)	(3.575)	(0.084)
Sector Collective Agreement	0.049	-14.370	0.007
	(0.258)	(11.441)	(0.244)
Firm Collective Agreement	0.072	-12.173	0.036
	(0.260)	(11.414)	(0.245)
Quality	0.102	1.754	0.108
	(0.077)	(2.998)	(0.076)
Flexibility	0.114	-4.450	0.101
	(0.101)	(4.078)	(0.100)
Innovation	-0.042	1.286	-0.039
	(0.105)	(4.354)	(0.102)
Job Complexity	0.030**	0.182	0.030**
	(0.013)	(0.567)	(0.013)
Job Autonomy	0.010	0.872	0.013
	(0.015)	(0.674)	(0.015)
Technology	0.073**	(0.522)	0.074**
	(0.032)	(1.442)	(0.031)
Participation	0.004***	0.209***	0.005***
	(0.001)	(0.046)	(0.001)
Individual Pay for Performance	0.064	2.444	0.071
	(0.068)	(2.638)	(0.066)
Promotion	-0.032	0.435	-0.030
	(0.036)	(1.502)	(0.035)
Performance Appraisal	0.005	3.531	0.016
	(0.065)	(2.669)	(0.065)
Constant	-0.260	16.889	-0.210
	(0.479)	(18.654)	(0.462)
N	814	814	814
R-squared	0.169	0.199	0.157

Notes: Industry and region dummies are included. Robust standard errors are in parenthesis.
**** p<0.01, ** p<0.05, * p<0.1*

Table 4: Determinants of Selection Intensity, Interview Excluded

	(1)	(2)	(3)	(4)
Teams	-0.002***	-0.005***	0.015**	-0.001
	(0.001)	(0.002)	(0.006)	(0.001)
Teams x Supervision	-	0.025*	-	-
		(0.015)		
Teams x Establishment Size	-	-	-0.004***	-
			(0.001)	
Teams x Collective Pay for Performance	-	-	-	-0.004*
				(0.002)
N	830	830	830	830
R-squared	0.147	0.152	0.160	0.151

Notes: Regressions include all the control variables. Robust standard errors are in parenthesis.
**** p<0.01, ** p<0.05, * p<0.1*

Table 5: Poisson models

	(1)	(2)	(3)	(4)
Teams	-.002***	-.003***	.007*	-.001**
	(.001)	(.001)	(.004)	(.001)
Teams x Supervision	-	.018*	-	-
		(.01)		
Teams x Establishment Size	-	-	-.002**	-
			(.001)	
Teams x Collective Pay for Performance	-	-	-	-.001
				(.001)
N	830	830	830	830
R-squared	.032	.033	.033	.032

Notes: Regressions include all the control variables. Robust standard errors are in parenthesis.
**** p<0.01, ** p<0.05, * p<0.1*