

Self-selection between Payment Methods based on Quantitative and Subjective Performance Measures

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Abstract

Payment methods based on quantitative performance measures make it harder for employers' prejudice and stereotypes to be translated into differential earnings and easier for external authorities to judge if this has occurred. Thus, workers who perceive that they are discriminated against in the labor market will be more likely to seek this type of compensation rather than payment based on subjective performance measures than workers who do not have that perception. The present study explores this prediction using the European Working Conditions Survey and interpreting (respectively) foreign-born and native-born employees as workers who perceive and who do not perceive discrimination. I found that foreign-born workers are more likely than native-born workers to be paid based on quantitative performance measures compared to payments based on subjective performance measures and fixed wages.

JEL Classification: J33, J71, M52.

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1. Introduction

Economists have repeatedly investigated the prediction that the discriminatory wage gap should be lower among workers paid according to their output than those paid according to subjective methods. This prediction is based on the idea that output-based pay is less susceptible to employers' prejudice and/or negative stereotypes and more transparent to external authorities, and

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has generally found support in the data. For example, Gunderson (1975) and Jirjahn and Stephan (2004) provide evidence on this hypothesis in the context of sex, whereas Belman and Heywood (1988), Heywood and O'Halloran (2005), and Fang and Heywood (2006, 2010) confirm the prediction in the context of race. However, with a few exceptions, they have overlooked a direct implication of their results: Employees who perceive that they are discriminated against in the labor market (EPD) will be more likely than employees who do not perceive such discrimination (ENPD) to seek compensation methods based on output (such as piece rates or productivity payments) rather than subjective compensation methods (such as discretionary bonuses or fixed wages).

To my knowledge, only two papers have investigated this implication. Fang and Heywood (2006) provided unfavorable evidence using a sample of Canadian employees. When they compared output-based pay with fixed wages, they found that ethnic minorities are less likely (although slightly) than European Canadians to receive output-based pay, thus contradicting the expected result¹. Moreover, when output-based pay was compared with a compound measure including fixed wages and productivity bonuses, they found no differences between the classification patterns of these two types of workers. On the other hand, Jirjahn and Stephan (2004) provide favorable evidence. Using a sample of German workers, they found that women are more likely than men to be on piece rates compared to fixed wages. These studies have provided us with valuable information on the way that EPD and ENPD are classified across output-based pay and payment schemes involving subjectivity. However, they are limited by the precision of their compensation measures.

First, they do not use a measure for output-based pay that convincingly reduces the risk of discrimination. Fang and Heywood's (2006) measure includes piece rates, tips, and commissions. Piece rates are based on objective individual pieces. Therefore, they make it harder for supervisors' prejudice and stereotypes to be translated into differential earnings (Heywood and O'Halloran, 2005). Tips and commissions do not depend on supervisors' decisions, thus negating the influence of such prejudice and stereotypes. However, they do nothing to prevent leakage of the prejudice and stereotypes from customers, who are also potential discriminators in labor markets (Becker,

¹These authors suggest that this result could be a consequence that employers who pay based on output may be more reluctant to hire ethnic minorities.

1971). Consequently, workers who perceive that they are discriminated against in the labor market will be willing to self-select into piece rates but not into tips or commissions. Jirjahn and Stephan (2004), for their part, use a measure that does not distinguish between piece rates based on individual and group performance. As the latter are typically based on the evaluator's judgment (Baker, Jensen, and Murphy, 1988), we might also expect that EPD will tend to avoid rather than seek out those payment methods. Second, both studies use fixed wages as a proxy for subjective compensation methods, so their results might confuse discrimination and productivity effects. As long recognized in the personnel economics literature (Lazear, 1986, 2000), workers self-select between output-based pay and fixed salaries based on their ability. Therefore, if we compare these compensation methods, we cannot tell if workers prefer one or another because of the discriminatory characteristics of those methods or their beliefs about their ability.

This paper seeks to overcome these limitations by using the sixth wave of the European Working Conditions Survey (EWCS). This wave has two advantages. First, it includes a question asking workers if they are paid (individual) piece rates or productivity payments. This question allows me to create a measure that closely captures the concept of output-based pay (OBP) discussed in the theory and that is not tainted by compensation schemes that generate doubts on their ability to reduce the risk of discrimination. Second, this wave also contains a question asking workers whether they receive payments based on their individual performance. As individual performance is typically constructed with supervisors' assessments, this question allows me to create a measure for payment methods based on subjective performance measures (PSP). Because OBS and PSP are both pay-for-performance methods, comparing them eliminates the possibility that workers self-select in one or the other according to their ability. However, as they differ in terms of the objectivity/subjectivity of their performance measures, comparing them allows me to test whether workers self-select based on the discriminatory properties of those methods.

The EWCS also reports whether interviewed workers are foreign or native born; I use these classifications as proxies for workers who perceive and workers who do not perceive discrimination in the labor market, respectively. This survey therefore allows me to test whether the foreign-born workers are more likely than the native-born workers to be compensated with output-based pay (in relation to PSP). The results, based on an instrumental variables strategy that exploits geographic variation in the concentration of immigrants, show that (as expected) foreign-

born employees are more likely than native-born employees to receive output-based pay. This pattern persists even when I use alternative measures for subjective compensation methods such as group pay and fixed wages.

These results are important for several reasons. First, as has been documented in several EU countries², immigrants generally suffer from higher unemployment rates. My results provide policy makers with a tool that could be used improve immigrants' participation in the labor force. This implication is particularly relevant in the current context of the Russo-Ukrainian war, which has caused the displacement of millions of Ukrainian citizens to various European countries. Second, as a mirror image, my results provide managers with an HR policy that they can exploit to attract highly productive immigrants. One of the attributes of compensation methods based on performance measures is that they attract the most productive workers and keep the less productive ones away (Lazear, 1986, 2000). My study suggests that in the case of immigrants, this property is more effective when output rather than subjective performance measures are used. This second implication is important for management since it is likely, as some literature (Chiswick, 1978, 1999) and causal empiricism suggest, that a substantial proportion of people from immigrant communities are highly able and motivated.

The paper proceeds as follows. In section two, I lay out my theoretical argument and state the hypothesis to be tested. Section three discusses the suitability of foreign- versus native-born workers as a potential case study and describes the data and the measures to be used in the estimations. Section four presents the empirical results as well as robustness checks and additional analyses, and section five draws conclusions.

2. Theory and Hypothesis

Prejudices, stereotypes, and labor market discrimination

Prejudice and stereotypes are the two most prominent explanations for labor market discrimination in the economics literature (Bertrand and Mullainathan, 2004). Prejudice is at the core of the taste-base models first analyzed by Becker (1971). In the employer version³ of these models, there is a

² See Drinkwater, S. (2017).

³ The other two versions are the customer and co-workers discrimination models.

disamenity value for employers to interact with workers of a particular group (e.g., Black people, immigrants, or women). So, to hire them, employers will charge those workers a “price” in the form of a lower wage. This hypothesis has been criticized by Arrow (1973), who argues that since prejudiced employers sacrifice profits by discriminating, they will not survive in the long-run competitive equilibrium. However, scholars (including Arrow himself or Heckman 1998) also assert that under the more realistic setup of imperfect competition, prejudiced employers will not necessarily be driven from the market in the long run, thus suggesting that prejudice may indeed be one of the driving forces behind labor market discrimination. Consistent with this prediction, Charles and Guryan (2008) found that relative wages paid to Black people vary negatively with the racial prejudice of White people.

Stereotypes (when they are negative) are the main alternative to prejudice for explaining the existence of labor market discrimination in economics. This concept lies at the core of one class of statistical discrimination models (Phelps, 1972; Arrow, 1973; Aigner and Cain, 1977), which states that employers cannot assess worker productivity perfectly and thus use stereotypes based on easily observed characteristics (e.g., race or gender) to estimate that missing information (Bertrand and Mullainathan, 2004). Consequently, employers will offer a lower wage to those workers belonging to groups whose productive characteristics are negatively stereotyped. Mobius and Rosenblat (2006), who found that less physically attractive people earn less because their employers believe that they are less productive and not because they really are, provide convincing evidence for this argument in the context of beauty.

Type of compensation and susceptibility to prejudice and stereotypes

In this subsection, I compare performance pay based on quantitative and subjective performance measures in terms of their capacity to mitigate the impact of prejudice and stereotypes on workers’ compensation and thus to reduce discrimination. I have chosen to contrast only these payment methods and exclude fixed wages from the analysis to rule out any possibility of confusing discrimination with productivity. The argument developed (in more detail) below suggests that employees who perceive that they are discriminated against in the labor market will self-select into methods of compensation based on quantitative performance measures because they mitigate the possibility of discrimination. Moreover, the personnel economics literature suggests that

performance-related pay methods (whether they are based on quantitative or subjective performance measures) are more likely than fixed wages to attract high-ability workers (Lazear, 1986, 2000). Therefore, if I compare compensation systems based on quantitative performance measures with fixed wages, it might be that employees self-select into the former because they are more able and not because they feel less discriminated. That said, in the *Robustness checks and additional analyses* section of the paper I include fixed wages in the analysis.

Payment methods based on subjective performance measures depend on the evaluators' judgment of the workers' effort, whereas those ones based on quantitative measures consider outcomes such as number of products produced. The former methods are more susceptible to wage discrimination because the judgment of evaluators can be easily biased by their prejudices and/or stereotypes. For example, employers could claim (in the case of prejudice) or believe (in the case of negative stereotypes) that a prejudiced/stereotyped individual has produced less than he or she actually did and pay less accordingly. Quantitative performance measures, on the other hand, are more resistant to such distortions for at least two reasons (Heywood and O'Halloran, 2005; Fang and Heywood, 2006). First, they reduce the possibility that supervisors' sentiments or beliefs influence the preparation of these measures. Second, they increase the probability that acts of discrimination will be detected and punished thus increasing the costs of such acts. The argument that quantitative performance measures are less affected by employer's bias than subjective performance measures has received empirical support in the context of racial (McKay, Avery, and Morris 2008) and age (Waldman and Avolio 1986) discrimination⁴.

Self-selection decisions across pay methods

I now analyze the self-selection decisions between payment methods based on subjective and quantitative performance measures of workers who perceive and workers who do not perceive that they are discriminated against in the labor market and derive the hypothesis to be tested. To conduct this analysis, I develop a simple argument based on Agency Theory.

⁴Gunderson (1975) notes that it is possible for the bonus of the compensation formula to be less for discriminated than for non-discriminated employees, even for the same quantitative performance measure. However, I am skeptical about this possibility because it would be very difficult for the discriminating employer to justify this policy before the legal authorities.

First, I adapt the standard definition of labor market discrimination⁵ to the performance pay context. Therefore, I define discrimination as a lower performance measure for an identical level of effort. Second, I assume an environment free of risk, distortions, or any other factor typically considered in the economics and management literatures that may compromise the adoption of an optimal pay-for-performance scheme.⁶ This assumption is made to ensure that discrimination will be the only factor that could prevent firms from paying workers the performance measure associated with their level of effort. So, in the absence of discrimination, firms will offer workers a compensation scheme that sets a negative salary but that lets them keep all the performance measure corresponding to their efforts. Workers will exert the optimal level of effort and generate a performance measure that is enough to meet their participation constraint (see, for example, Lazear and Oyer, 2010). However, if there is discrimination, firms will fail to pay the performance measure associated with the workers' level of effort and workers will not be able to generate the performance measure that allows them to meet their participation constraint with any level of effort. Note that since in the absence of discrimination firms always pay workers the performance measure associated with their level of effort, this discussion implies that discriminated workers will receive a lower performance measure than the one associated with their level of effort. Third, I remark that what is important for my analysis is not the existence of discrimination but the perception of workers as to whether (or not) they are discriminated against, be discrimination real or assumed. Thus, the analysis will be carried out from the perspective of the worker.

Let's analyze first the case of workers who do not perceive that they are discriminated against in the labor market. In this case, the type of compensation does not modify the workers' self-selection decisions. Since in both systems workers expect to receive the performance measure corresponding to their level of effort and thus meet their participation constraint (by exerting the optimal level of effort), they will accept to work under either compensation method. However, the self-selection decisions of workers who do have the perception of discrimination will depend on the type of compensation. Since subjective performance measures are susceptible to discrimination, with pay methods including these performance measures, workers will expect to receive a performance measure lower than that associated with their level of effort. Hence, they

⁵ Less favorable treatment for identical productivity (Heckman, 1998)

⁶See Baron and Kreps (1999, pp. 250-277) for an excellent discussion on these factors.

will not be able to meet their participation constraint and not self-select into payment methods based on subjective performance measures. On the other hand, as quantitative measures are less susceptible to discrimination, with compensation methods considering these performance measures, workers will expect to receive the full value of the performance measure associated with their level of effort. So, they will exert the optimal level of effort and generate a performance measure that ensures compliance with their participation constraint and, consequently, their self-selection into compensation methods based on quantitative performance measures.

By comparing the self-selection patterns of these two types of workers, I arrive at the hypothesis to be tested in this study. Workers who perceive that they are discriminated against in the labor market prefer compensation methods based on quantitative performance measures and avoid those methods based on subjective performance measures. However, workers who perceive no discrimination are indifferent between these two types of payment. Therefore, the former group are more likely than the latter to be compensated with performance pay based on quantitative performance measures as opposed to payment methods based on subjective performance measures.

3. Empirical analysis

Foreign-born workers in Europe: a potential case study

To test this hypothesis, I need a group of workers that perceive that they are discriminated against in the labor market because of prejudice or negative stereotypes and a reference group that does not feel discriminated against. I propose that foreign-born and native-born employees in Europe can be used, respectively, as proxies for these groups. Note that I am not suggesting that all foreign-born employees in Europe develop such a perception and that all native-born workers are exempt from this feeling. What I suggest is that the former are more likely than the latter to be subject to prejudice and negatively stereotyped and thus develop such a perception, and that I can exploit this difference to test my hypothesis.

A substantial proportion of foreign-born employees in Europe has socio-demographic characteristics such as ethnicity (Avery, Volpone, and Holmes, 2018), religion (Ghumman and Ryan, 2018), or culture (Bradley-Geist and Schmidtke 2018) that might be subject to prejudice and negative stereotypes. Moreover, as I noted earlier, there is solid evidence that discrimination

responds to prejudice (Charles and Guryan, 2008) and stereotypes (Mobius and Rosenblat, 2006). Therefore, it is reasonable to expect that many of those workers—for example through the stories about specific cases of discrimination in the news or by word of mouth—develop the perception that they will face discrimination in employment settings because of prejudices and/or negative stereotypes. Consistent with this argument, several studies (Dion, 1989; Dion and Kawakami, 1996; Mor Barak et al., 1998; Deitch et al., 2003) have documented that, indeed, non-White workers perceive more discrimination than their White counterparts.

Obviously, some foreign-born workers in Europe might not be exposed to prejudice. For example, there is no guarantee that a German-born employee in Spain will be disliked by their employer because of their socio-demographic characteristics. Yet, there is scope for discrimination against this worker through the presence of negative stereotypes. For example, the Spanish employer might think the German worker's command of Spanish is deficient or that they lack knowledge about the institutional context, which might impair their performance⁷. Therefore, as in the former case, it makes sense to assume that the German worker will develop the perception that they will be discriminated against because of the preconceived beliefs about the group they belong to.

I acknowledge that some native-born employees may also develop the perception that they are discriminated against in the labor market because of prejudices and/or stereotypes. In fact, there are many of these workers with ethnicities, religions, or cultures that might be subject to prejudice and negative stereotypes. However, it is also arguable that the proportion of native-born employees developing such perceptions will be much lower than the corresponding proportion of foreign-born workers. Hence, native-born workers can act as proxies for workers who do not perceive that they are discriminated against in the labor market, whereas foreign-born workers can represent workers who perceive such discrimination.

Data and variables

⁷Language deficiencies and unfamiliarity with social and economic institutions have been highlighted in the economics of immigration literature (Bodvarsson and Van den Berg, 2013) as two of the main limiters of immigrants' success in the labor market.

The main data are taken from the European Working Conditions Survey (EWCS), which is conducted by the European Union (EU) to provide comparable and reliable information on employees' working conditions across Europe⁸. The EWCS is based on face-to-face interviews with workers aged over 15, and employed at the time of the interview, in almost all the economic sectors of the NACE classification.⁹ Six cross-sectional waves of the EWCS have been conducted so far but I focus on the sixth, carried out in 2015, because it is the only one that includes the information needed to conduct my study. This wave reports on 35 countries¹⁰ and was conducted with 43 850 individuals; however, the incompleteness of some questionnaires yields smaller samples (as specified in each estimation) for purposes of analysis. This wave is unique because it allows us to identify compensation methods closely matching the compensation methods discussed in the theoretical section. Below, I describe the variables used in the estimations; the survey items that represent these variables are reproduced in the Appendix.

The survey contains two questions about the compensation schemes relevant to constructing my dependent variable. The first question asks interviewees whether they receive piece rate or productivity payments (PR) and is intended to capture payment based on a pre-defined rate per item produced/task performed. The second question asks workers whether their earnings include payments based on their individual performance (IP) and is aimed at capturing incentives that depend on the review of their individual performance by their supervisors, which is typically a subjective process. I admit that if these questions were presented alone, it would be hard to unambiguously associate them with compensation methods based on quantitative or subjective performance measures. However, the fact that they are presented together in the list of choices (see the first panel in the Appendix) maximizes chances that interviewees associate PR with payment methods based on quantitative performance measures and IP with those based on subjective performance measures.

Based on these constructs, I create the dependent variable PRvsIP, which equals one when the employee is compensated under the first methods discussed in the previous paragraph (PR) and

⁸See the online technical report for details about the construction of the survey.

https://www.eurofound.europa.eu/sites/default/files/ef_survey/field_ef_documents/6th_ewcs__technical_report.pdf

⁹ Sectors excluded from the sample are agriculture, household labor, and extraterritorial organizations.

¹⁰The EU-28 along with Albania, Kosovo, Macedonia, Montenegro, Norway, Turkey, and Serbia.

zero when he or she is compensated under the second (IP). The survey also asks employees if they are compensated with basic fixed salary/wage (FW). With this information I create another dependent variable, *PRvsFW*, which allows me to conduct robustness checks. This variable takes the value of one when the worker is paid piece rate or productivity payment (PR) and zero when he or she is paid fixed salary/wage (FW). I note that at the time of the interview workers were allowed to simultaneously choose several alternatives, so the compensation methods found in the original database are not mutually exclusive. For example, a worker might receive PR plus IP. Therefore, to define the binary variables needed for my study, I eliminate from the database all the observations including simultaneously the two payment methods being compared. This procedure implies a high loss of observations but guarantees a meaningful definition on my dependent variables.

For the construction of my independent variable, I rely on two questions from the questionnaire. The first one asks whether both the respondent and their parents were born (or not) in the country where the survey took place. If the answer is negative, the survey provides a follow-up question asking whether the respondent was born in that country or not. From this information, I create the binary variable *Foreign*, which takes the value 1 for workers who were born in a foreign country or 0 otherwise. Note that this variable, as is well known, may be subject to endogeneity concerns. Therefore, in my empirical analysis I instrument *Foreign* with the geographic variation in the concentration of immigrants (Past settlement) taken from the International Migration Report 2015 of the United Nations. More details on the potential endogeneity of *Foreign* and the instrumental variable validity can be found in the Results section.

The survey offers information to control for several characteristics of the job position (*Autonomy, Rotation, Teams, Training, Full-time*), workers (*Education, Unions, Gender, Age, Tenure*) and firms (*Size, Private, Multilocation*) that might affect the type of compensation the worker receives. For the variables *Autonomy* and *Training*, I use the primary factor from a factor analysis of a series of items related (respectively) to the autonomy of the worker and to the type of training received. The information on education provided by the EWCS is based on the ISCED-2011 classification, which contains nine categories. In this case, I group together the first four (value of 0) and second five (value of 1) categories and create the indicator variable *Education*. The indicator variable *Size* is created by pooling together the first two (value of 0) and second two

(value of 1) categories provided by the survey, while the indicator variable *Private* is formed by setting equal to 1 the employees who work in the private sector and 0 otherwise. The other variables come from the survey in continuous (*Age* and *Tenure*) or in a dichotomized way (*Rotation*, *Teams*, *Full-time*, *Unions*, *Gender* and *Multilocation*). Finally, the survey also allows me to control for potential fixed unobserved differences across workers' occupation (*Occupation*), industry (*Industry*) and country (*Country*).

Table 1 presents the description, means and standard deviations of the variables employed in the analyses, as well as the scales with which they are included. The indicator variable *PRvsIP* is relatively balanced, with a mean of 42 percent. However, the variable *PRvsFW* is (as expected) very unbalanced in favor of workers receiving fixed wages, with a mean of 3.4 percent. Regarding the variable of interest, *Foreign*, the percentage of workers born in a foreign country is 8.5 percent. The data also shows that a considerable percentage of employees work in modern (with rotation and teamwork) and full-time job positions, large firms, the private sector, and firms with several plants. In addition, 49 and 47 percent of the sample are (respectively) female and unionized workers. Finally, the average worker is 43 years old and has 10 years of tenure.

[[INSERT **Table 1** about Here]]

Base results

The theoretical discussion suggests that workers who perceive that they are discriminated against in the labor market, such as foreign-born workers, are more likely than workers who don't have that perception, such as native-born ones, to be paid PR with respect to IP. For this reason, I propose the following econometric model:

$$(1) PRvsIP_i^* = \alpha + \beta Foreign_i^* + X_i' \lambda + n_c + n_s + n_o + \varepsilon_i,$$

where $PRvsIP_i^*$ is a latent variable. Thus, for worker i , the variable *PRvsIP* will equal one when the employee has an associated positive value ($PRvsIP_i^* > 0$) and zero otherwise (that is, when $PRvsIP_i^* = 0$). The independent variables (described in the previous section) are *Foreign* and a set of X controls that might affect the employee's compensation method. I want to note that to rule

out the effect of fixed wages on the employers' capability to discriminate X also includes this type of compensation method. Parameters n_c, n_s and n_o are fixed effects that absorb (respectively) any permanent country, industrial sector, and occupation differences, and ε_{ij} is an error term. My hypothesis predicts $\beta > 0$; for the control variables, I make no predictions.

Table 2 presents the baseline results of a series of probit estimations whose specifications vary across columns and with standard errors calculated using the White-Hubert procedure. In all the cases, the Wald chi-square test rejects at the 1 percent level the null hypothesis that the parameter estimates of the explanatory variables are all zero. Column [1] shows the estimations including only country, industry, and occupation dummies—a naïve analysis but a useful benchmark for comparison. My estimate for *Foreign* is positive (0.149) and statistically significant at the 5 percent level, which hints that the hypothesis might be valid. Then, I progressively include other sets of controls, such as the characteristics of the job position, workers and firms, and other pay methods¹¹. The coefficients in columns [2]–[5] are again positive and significant at the 5 percent level and the marginal effects of *Foreign* related to these specifications are only slightly higher than the marginal effect related to the specification of Column [1]. These results suggest that X (even if it includes the observables that, in my view, are the leading determinants of the compensation method) has a small influence on the association between *PRvsIP* and *Foreign*.

[[INSERT **Table 2** about Here]]

Instrumental variables estimates

The estimations presented in Table 2 control for a rich set of variables; however, there is a possibility that I left out some unobservable variables that are related to both *PRvsIP* and *Foreign*, which may lead to omitted variable bias. There could also be a reverse causality problem. My econometric specification assumes that a worker enters the labor market and chooses between compensation methods according to their susceptibility to discrimination. In other words, the econometric specification is defined by a hypothetical *ceteris paribus* conceptual experiment in

¹¹ In this item, I have included only Fixed wages because it is the only compensation method considered in the literature that may have effects on the employers ability to discriminate. That said, I have also estimated especifications including other compensation mehods (such as group pay and profit sharing) and the results are maintained. These results are available upon request.

which I vary country of origin but keep all else constant. However, an alternative scenario could be imagined in which the employer first changes the PR-IP distribution (i.e., chooses the compensation method) to attract/keep away foreign born-workers and then workers adapt to it. If this second effect is important, my estimations will be biased due to reverse causality¹². Finally, there is the issue of measurement error typically found in surveys.

To deal with endogeneity in the light of the cross-sectional nature of my data, Equation (1) will have to be estimated using instrumental variables (IV) methods. A common approach in the literature is to exploit the geographic variation in the concentration of immigrants to identify immigrants' labor supply shocks on a range of outcomes (Altonji and Card, 1991, Jaeger, Ruist, and Stuhler, 2018). I argue that this variation (which is known as the *Past settlement* instrument) satisfies the requirements for a valid instrument outlined in Imbens and Angrist (1994) in the context of the present paper. First, since one can argue that the proportion of foreign-born workers is related to the proportion of foreign-born individuals in a country, it is probable that that this instrument fulfills the relevance requirement (i.e., that it is correlated with the endogenous variable). Second, as foreign-born employees form the only sector of the immigrant population who are in contact with the payment structure, any potential association between immigrants' past settlement and the dependent variable is entirely captured by the endogenous regressor. Hence, the *Past settlement* instrument is also likely to meet the independence requirement (i.e., that it is uncorrelated with the error term of the equation for the dependent variable). Thus, I instrument *Foreign* with the distribution of immigrants across countries (*Past settlement*).

Panel A of Table 3 presents the bivariate probit estimates for the same set of specifications estimated in Table 2, with standard errors also calculated using the White-Hubert approach. Panel B shows the endogeneity tests for *Foreign* and relevance analysis for the *Past settlement* instrument. The correlation coefficients (ρ) between the error terms of Equation (1) and the instrumental equation are statistically significant, thus suggesting that *Foreign* is endogenous in

¹² I believe that the specification in Equation (1) is more sensible than an alternative specification that considers *Foreign* in the left-hand part of the equation. This alternative specification requires that employees observe the type of compensation from their country of origin and then decide whether to immigrate or not—only in that way can the type of compensation determine the origin of the worker. This setup, however, ignores the fact that some foreign-born employees are already in their host country when they search for a job. Hence, in these cases, the type of compensation is unlikely to determine the origin of the worker.

all the specifications. To check for relevance, I obtain the coefficients of the instrument in the first stage of the estimation as well as the Wald chi-square of the reduced-form probit¹³ of the dependent variable on the instrument¹⁴. The *Past settlement* coefficients are positive and statistically significantly different from zero in all the specifications, whereas the Wald chi-square test rejects at the 1 percent level the null hypothesis that the parameter estimates of all explanatory variables are zero. These results support my intuition that *Past settlement* complies with the relevance requirement. Regarding the independence requirement, unfortunately, data limitations (i.e., the lack of additional instruments) dictate that I cannot use the over identification test to obtain insights into it. However, despite this limitation, I believe that the results of the endogeneity tests and the relevance analysis suggest that the bivariate probit model is more appropriate than the probit model to estimate Equation 1.

Turning to the coefficients of *Foreign* in Panel A, we can see that they are positive and statistically significant in all the cases. For example, in Column 5, my most controlled specification, the coefficient of this variable is 0.777 and it is significant at the 1 percent level. These outcomes suggest that foreign-born workers are more likely than their native-born counterparts to be compensated with PR as opposed to IP, thus providing support for the hypothesis of this study. More specifically, the marginal effects show that foreign-born workers are around 14 percent more likely to be on PR. Note also that the fact that these marginal effects are lower than those of the univariate specification suggests that endogeneity was indeed biasing the latter upward and this effect was absorbed by the instrument. Moreover, in line with what one would expect, the use of piece rates or productivity payments (as opposed to individual performance payments) is associated with workers with less autonomy, education, and tenure. Finally, the use of piece rates is also less prevalent in workers with less training.

[[INSERT **Table 3** about Here]]

Robustness checks and additional analyses

¹³Results of these estimations are available upon request.

¹⁴In using this procedure, I follow the recommendations of Angrist and Pischke (2009: 2012-2013).

To explore the robustness of my findings, I repeat my analysis of Column [5] of Table 3 (my main specification) dropping one by one each country, economic sector and occupation included in the sample. Overall, the patterns established in Tables 2 and 3 do not change. Some point estimates change, albeit in a few cases, but the coefficients of *Foreign* are positive and statistically significant at conventional levels of significance in all cases. Fixed effects saturate. These results are not presented in the paper for reasons of space but available upon request from the author.

Fixed wages have frequently been used as a proxy for compensation methods based on subjective assessments (see, for example, Gunderson, 1975; Jirjahn and Stephan, 2004; Belman and Heywood, 1988; Heywood and O'Halloran, 2005; Fang and Heywood, 2006, 2010). As in the IP case, fixed wages also rely on the employers' judgment of the level of workers' effort. The difference is the timing of the effort assessment. Whereas in fixed wages it occurs at the beginning of the contract (Lazear, 1986), in the IP case it occurs at the end. To explore the robustness of my findings, I re-estimate the specification of Column (5) of Table 3 using this alternative compensation method. This measure is included in the base of the dependent variable PRvsFW, which was described in the Data and Variables sub section. The results of the probit and bivariate probit estimations are shown in Table 4. In this case, as the correlation coefficient ρ obtained from the bivariate model is not statistically significant (see Column (2) of Panel B), I comment on the results of the univariate specification. The coefficient of *Foreign* is positive (0.144) and statistically significant at the 5 percent level, and its marginal effect is 7 percent (see Column [2] Table 4).

[[INSERT **Table 4** about Here]]

Fang and Heywood (2010) find that women from ethnic minorities in Canada suffer little or no discrimination in either the time rate or output pay sectors, but that their male counterparts earn significantly less than non-minorities in the time rate sector. This result may suggest that my findings are generated exclusively by male workers. To explore this possibility, I divided the sample into men and women and run separate estimations for the specification of Column [5] of Table 3. The results of this exercise, presented in Table 5, seem to suggest that the results are led by women. The coefficient of *Foreign* in the female subsample (Column [1]) is positive and statistically significant at the 1 percent level whereas in the male subsample¹⁵ (Columns [2]) is

¹⁵ This estimation relies on a probit model because *Foreign* did not turn out to be endogenous.

positive but insignificant at conventional levels of significance. Note, however, that this analysis is conducted with small samples, so their results must be interpreted with caution. I believe it is important to learn why women and men differ in their self-selection patterns when different compensation methods are compared. I leave this analysis for future work, however.

4. Conclusions

This article found that foreign-born European workers are more likely than their native-born counterparts to be on piece rates or productivity payments as opposed to payments based on individual performance, group pay, or fixed wages. These results support the idea that output-based pay reduces the risk of wage discrimination by increasing cognitive barriers and external transparency. Thus, workers who perceive that they are discriminated against in the labor market will be more likely than workers without that perception to avoid compensation methods based on subjective performance measures and, instead, search for those based on output. To my knowledge, only two previous studies have explored this prediction. I advance this literature by improving the precision of the compensation method measures and using an instrumental variables strategy that allows me to identify my results.

My study has several limitations. First, foreign- and native-born employees are imperfect proxies for workers who perceive and workers who do not perceive that they are discriminated against in the labor market. Although it is safe to argue that the proportion of foreign-born workers who develop such a perception is much higher than the proportion of native-born workers who do, I recognize that using those proxies may result in many false positives and negatives. Second, consistent with Fang and Heywood's (2006) arguments, my results may also follow from the fact that employers who use output pay hire more foreign-born workers and not from the self-selection argument discussed in this paper. Unfortunately, the EWCS does not have information that allows me to disentangle these effects. Note that my IV strategy is likely to reduce the measurement error and reverse causality bias associated with these limitations. However, it would be interesting to corroborate my results with better proxies for the types of workers analyzed in this study and with data that allow us to identify if the results are led by workers' or employers' decisions.

Finally, while comparing output-based pay with fixed wages—as I do in the *Robustness checks and additional analyses* subsection—can reinforce the results of my main finding, this exercise

needs to be interpreted with caution as it could confound the perception of discrimination and productivity. Future research that has access to more disaggregated data may be better able to address this concern. Disentangling these effects would be indeed an interesting exercise since finding evidence of such confound would allow us to assert on an empirical basis (and not only a theoretical basis, as I do in this paper) the need to place payment methods based on subjective performance measures rather than fixed wages on the base of comparison.

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Tables

Table 1
Descriptive statistics and variable descriptions

Variable	Description	Mean	Sd.	Scale
PRvsIP	Piece rates vs. Individual performance	0.423	0,494	PR = 1 IP = 0
PRvsFW	Piece rates vs. Fixed wages	0.034	0.181	PR = 1 FW = 0
Foreign	Worker and parents born in a foreign country	0.085	0,280	Foreign = 1 Native = 0
<i>Past settlement (instrument)</i>	Country percentage of immigrants	0.113	0.074	Continuous
Autonomy	Autonomy in activity's order, method, and speed	-	-	Factor
Rotation	Rotating between yourself and colleagues	0.445	0,497	Yes = 1 No = 0
Teams	Working in a team	0.531	0,499	Yes = 1 NO = 0
Training	Training paid by employers and on-the-job training	-	-	Factor
Full-time	Full-time vs. part-time contract	0.806	0.395	Full time = 1 Part time = 0
Education	Education level (ISCED)	0.397	0.489	High = 1 Low = 1
Unions	Trade union, works council or a similar committee representing employees	0.470	0,499	Yes = 1 No = 0
Gender	Gender of the employee	0.496	0,499	Male = 1 Female = 0
Age	Age of the employee (years)	43	12.748	Continuous
Tenure	Years in the company or organization	10	10.31	Continuous
Size	Employees in your company or organization	0,628	0,483	10-250 = 1 1-9 = 0
Private	Working in the private sector	0.692	0,462	Private sector = 1 Otherwise = 0
Multilocation	Operating on one site or more	0.420	0.494	One site = 1 Otherwise = 0
<i>Occupation</i>	2-digit ISCO-88 occupations	-	-	10 indicators
<i>Industry</i>	1-digit NACE industries	-	-	21 indicators
<i>Country</i>	Country dummies	-	-	35 indicators

Table 2
Probit Estimates of Equation (1)

		[1]		[2]		[3]		[4]		[5]	
		Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Independent variable: Foreign		0.149** (0.072)	0.044	0.186** (0.075)	0.053	0.199** (0.079)		0.182** (0.081)	0.051	0.166** (0.082)	0.045
Job position characteristics	Autonomy			-0.148*** (0.02)	-0.042	-0.132*** (0.021)	-0.037	-0.139*** (0.022)	-0.039	-0.142*** (0.022)	-0.038
	Rotation			0.063 (0.042)	0.010	0.039 (0.043)	0.011	0.044 (0.044)	0.012	0.041 (0.045)	0.011
	Teams			-0.064 (0.043)	-0.018	-0.043 (0.045)	-0.012	-0.018 (0.046)	-0.005	-0.002 (0.046)	-0.001
	Training			-.143*** (0.020)	-0.041	-0.132*** (0.020)	-0.037	-0.126*** (0.021)	-0.035	-0.123*** (0.021)	-0.033
	Full-time			-0.253*** (0.055)	-0.072	-0.230*** (0.058)	-0.065	-0.211*** (0.060)	-0.059	-0.079 (0.063)	-0.021
	Education					-0.197*** (0.049)	-0.056	-0.188*** (0.050)	-0.053	-0.167*** (0.051)	-0.045
	Unions					-0.066 (0.045)	-0.019	-0.034 (0.049)	-0.010	0.005 (0.050)	0.001
	Gender x 10					0.002 (0.439)	0.0004	-0.026 (0.450)	-0.007	0.019 (0.046)	0.005
Worker characteristics	Age x 10					-0.079 (0.021)	-0.002	-0.006 (0.021)	-0.002	-0.014 (0.022)	-0.004
	Tenure x 10					-0.075*** (0.026)	-0.021	-0.065*** (0.026)	-0.018	-0.057** (0.027)	-0.002
Other pay methods	Fixed wage									-0.868*** (0.074)	-0.236
	Size							-0.12** (0.061)	-0.034	-0.077 (0.062)	-0.021
Firm characteristics	Private							0.048** (0.063)	0.013	0.017 (0.064)	0.005
	Multilocation							-0.144 (0.045)	-0.021	-0.062 (0.046)	-0.017
Fixed effects	Industry	YES		YES		YES		YES		YES	
	Occupation	YES		YES		YES		YES		YES	
	Country	YES		YES		YES		YES		YES	
	Constant	0.750*** (0.221)		0.994*** (0.246)		1.290*** (0.277)		1.262*** (0.300)		1.799*** (0.307)	
N		6,556		5,999		5,677		5,438		5,431	
χ^2		1625.04		1602.70		1502.71		1448.62		1460.18	

p-value	0.000	0.000	0.000	0.000	0.000
R ²	0.225	0.253	0.257	0.259	0.282

***, ** and * stand for significance at the 1, 5 and 10 % level, respectively. Standard errors are in parentheses.

Table 3
Bivariate Probit Estimates of Equation (1)

Panel A. Second stage estimates											
		[1]		[2]		[3]		[4]		[5]	
		Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Independent variable: Foreign		0.699** (0.269)	0.013	0.900*** (0.284)	0.015	0.939*** (0.281)	0.015	0.938*** (0.296)	0.015	0.777*** (0.245)	0.013
Job position characteristics	Autonomy			-0.146*** (0.020)	-0.002	-0.131*** (0.021)	-0.002	-0.137*** (0.022)	-0.002	-0.140*** (0.022)	-0.002
	Rotation			0.061 (0.041)	0.001	0.038 (0.042)	0.001	0.043 (0.044)	0.001	0.041 (0.044)	0.001
	Teams			-0.063 (0.043)	-0.001	-0.042 (0.044)	-0.001	-0.017 (0.045)	-0.0003	-0.002 (0.046)	-0.00003
	Training			-0.140*** (0.019)	-0.002	-0.130*** (0.020)	-0.002	-0.124*** (0.021)	-0.002	-0.121*** (0.021)	-0.002
	Full-time			-0.247*** (0.054)	-0.004	-0.224*** (0.058)	-0.004	-0.206*** (0.059)	-0.003	-0.076 (0.062)	-0.001
	Education					-0.193*** (0.048)	-0.003	-0.184*** (0.049)	-0.003	-0.165*** (0.051)	-0.003
	Unions					-0.062 (0.045)	-0.001	-0.031 (0.048)	-0.001	0.007 (0.049)	0.0001
Worker characteristics	Gender x 10					-0.019 (0.431)	-0.0003	-0.049 (0.443)	-0.001	0.004 (0.451)	0.000
	Age x 10					-0.008 (0.020)	-0.0001	-0.006 (0.021)	0.000	-0.014 (0.021)	-0.0002
	Tenure x 10					-.074*** (0.026)	-0.001	-0.064** (0.026)	-0.001	-0.056** (0.027)	-0.001
Other pay methods	Fixed wage									-0.856*** (0.074)	-0.014
	Size							-0.118** (0.059)	-0.002	-0.078 (0.061)	-0.001
Firm characteristics	Private							0.048 (0.062)	0.001	0.017 (0.063)	0.0003
	Multilocation							-0.073 (0.044)	-0.001	-0.062 (0.045)	-0.001
Fixed effects	Industry	YES		YES		YES		YES		YES	
	Occupation	YES		YES		YES		YES		YES	
	Country	YES		YES		YES		YES		YES	
	Constant	0.733*** (0.003)		0.965*** (0.243)		- 1.255*** (0.274)		-1.225*** (0.297)		1.764136 .3049065	
	N	6,556		6,000		5,678		5,439		5,432	
	χ^2	2131.42		3021.73		3109.17		2793.34		2822.75	
	p-value	0.000		0.000		0.000		0.000		0.000	

Panel B. Endogeneity tests and relevance analysis

Endogeneity test (ρ coefficient)	-0.276**	-0.359**	-0.371**	-0.378**	-0.305***
Relevance analysis					

Instrument coefficient	0.056***	0.058***	0.058***	0.057***	0.057***
χ^2 test of the reduced form	2786.66***	2786.66***	2786.66***	2786.66***	2786.66***

***, ** and * stand for significance at the 1, 5 and 10 % level, respectively. Standard errors are in parentheses.

Table 4
Probit and Bivariate Probit Estimates of Equation (1) Using PRvsFW as Dependent Variable

Estimation method		[1]		[2]	
		Probit		Bivariate Probit	
		Coefficient	Marginal effect	Coefficient	Marginal effect
Independent variable: Foreign		0.144** (0.069)	0.007	0.858* 0.487	0.001
Job position characteristics	Autonomy	0.013 (0.019)	0.001	0.013 (0.019)	0.00002
	Rotation	0.018 (0.042)	0.001	0.017 0.042	0.00002
	Teams	-0.022 (0.043)	-0.001	-0.021 0.043	-0.00003
	Training	0.007 (0.023)	0.0003	.007254 .0227567	0.000
	Full-time	-0.472*** (0.050)	-0.023	-0.467*** 0.050	-0.001
	Education	-0.065 (0.052)	-0.003	-0.064 (0.051)	-0.0001
Worker characteristics	Unions	-0.148*** (0.051)	-0.007	-0.146*** (0.050)	-0.0002
	Gender x 10	-0.570 (0.460)	-0.030	-0.580 (0.460)	-0.001
	Age x 10	-0.010 (0.020)	-0.001	-0.010 (0.020)	-0.000
	Tenure x 10	-0.060** (0.030)	-0.003	-0.060** (0.030)	-0.000
Other pay methods	IP	0.597*** (0.051)	0.029	0.593*** (0.050)	0.001
Firm characteristics	Size	-0.111** (0.049)	-0.005	-0.109** (0.049)	-0.0001
	Private	0.272*** (0.068)	0.013	0.268*** (0.068)	0.0004
	Multilocation	-0.014 (0.047)	-0.001	-0.014 (0.047)	-0.00002
Fixed effects	Industry	YES		YES	
	Occupation	YES		YES	
	Country	YES		YES	
	Constant	-1.246*** (0.243)		-1.259*** (0.241)	
	N	25,913		26,051	
	χ^2	988.47		6115.70	
	p-value	0.000		0.000	
Panel B. Endogeneity tests and relevance analysis					
Endogeneity test (ρ coefficient)				-0.329	
Relevance analysis					
Instrument coefficient				0.046***	

χ^2 test of the reduced form

2786.66***

***, ** and * stand for significance at the 1, 5 and 10 % level, respectively. Standard errors are in parentheses.

Table 5
Estimates of Equation (1) by Gender

Estimation method		[1] Bivariate Probit		[2] Probit	
Gender		Female		Male	
		Coefficient	Marginal effect	Coefficient	Marginal effect
Independent variable: Foreign		1.419*** (0.370)	0.016	0.054 (0.106)	0.015
Job position characteristics	Autonomy	-0.159*** (0.035)	-0.002	-0.131*** (0.029)	-0.036
	Rotation	0.147** (0.071)	0.005	-0.011 (0.059)	-0.003
	Teams	-0.047 (0.073)	-0.001	0.030 (0.062)	0.008
	Training	-0.083** (0.034)	-0.001	-.1465*** (0.028)	-0.041
	Full-time	-0.086 (0.082)	-0.001	-0.059 (0.104)	-0.017
	Education	-0.108 (0.079)	-0.001	-0.202*** (0.069)	-0.056
Worker characteristics	Unions	-0.146* (0.078)	-0.002	0.077 (0.066)	0.022
	Age x 10	-0.010 (0.030)	-0.0001	-0.030 (0.030)	-0.007
	Tenure x 10	-0.050 (0.004)	-0.001	-0.040 (0.040)	-0.009
Other pay methods	Fixed wages	-1.016*** (0.124)	-0.011	-0.777*** (0.097)	-0.217
	IP				
Firm characteristics	Size	0.059 (0.097)	0.001	-0.183** (0.082)	-0.051
	Private	-0.008 (0.102)	-0.0001	0.027 (0.084)	0.008
	Multilocation	-0.036 (0.071)	-0.0004	-0.073 (0.061)	-0.020
Fixed effects	Industry	YES		YES	
	Occupation	YES		YES	
	Country	YES		YES	
	Constant	1.976*** (0.484)		1.772*** (0.444)	
	N	2,413		3,015	
	χ^2	1094.30		858.04	
	p-value	0.000		0.000	

Panel B. Endogeneity tests and relevance analysis

Endogeneity test (ρ coefficient) -0.493**

Relevance analysis

Instrument coefficient

0.065***

χ^2 test of the reduced form

***, ** and * stand for significance at the 1, 5 and 10 % level, respectively. Standard errors are in parentheses.

Appendix: Survey Items

Pay Scheme	Thinking about your earnings from your main job, what do they include? A - Basic fixed salary/wage B - Piece rate or productivity payments F - Payments based on your individual performance
Foreign	Were you and both of your parents born in this country? Yes = 1 No = 2 (recoded Yes = 1, No = 0)
	Were you born in this country? Yes = 1 No = 2 (recoded Yes = 1, No = 0)
Autonomy	Are you able to choose or change... A – your order of tasks B – your methods of work C – your speed or rate of work
Rotation	Does your job involve rotating tasks between yourself and colleagues? Yes = 1 No = 2 (recoded Yes = 1, No = 0)
Teams	Do you work in a group or team that has common tasks and can plan its work? Yes = 1 No = 2 (recoded Yes = 1, No = 0)
Training	Over the past 12 months, have you undergone any of the following types of training to improve your skills? A - Training paid for or provided by your employer B - Training paid by yourself C - On-the-job training (co-workers, supervisors) D - Other training
Full-time	... do you work part time or full time? Part time = 1 Full time = 2

Education	What is the highest level of education or training that you have successfully completed? 01 - Early childhood education (ISCED 0) 02 - Primary education (ISCED 1) 03 - Lower secondary education (ISCED 2) 04 - Upper secondary education (ISCED 3) 05 - Post-secondary non-tertiary education (ISCED 4) 06 - Short-cycle tertiary education (ISCED 5) 07 - Bachelor or equivalent (ISCED 5) 08 - Master or equivalent (ISCED 5) 09 - Doctorate or equivalent (ISCED 6)
Unions	Does the following exist at your company or organization...? A- Trade union, works council or a similar committee representing employees? Yes = 1 No = 2 (recoded Yes = 1, No = 0)
Gender	Coded by interviewer
Age	How old are you?
Tenure	How many years have you been in your company or organization?
Size	How many employees in total work in your company or organization? 01 – 1 (interviewee works alone) 02 – 2-9 03 – 10-249 04 – 250+
Private	Are you working in...? 1 – the private sector 2 – the public sector 3 – a joint private-public organization or company 4 – the not-for-profit sector or an NGO 5 – other (complete:)
Multilocation	Does the company or organization you work for operate from one site or more? 1 – One site only 2 – More than one site
Industry	1-digit NACE industries, 21 dummy variables
Occupation	2-digit ISCO-88 occupations, 10 dummy variables
Country	Country dummies, 36 dummy variables
