# Do workers care about Corporate Social Responsibility? Compensating differentials and sorting implications of firm sustainability ratings

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**Abstract**

This study aims to assess the effects of CSR (Corporate Social Responsibility) on the labor market. CSR encompasses policies aimed at reducing environmental impact, creating an inclusive workplace, and improving the firm's internal decision-making processes. Associated with the term ESG (environmental, social, governance), CSR is increasingly becoming a key criterion for job seekers, especially for the young generations, who specifically look for companies that are environmentally friendly, transparent, and inclusive. Adopting these practices can then be a way for companies to attract and retain talent. This study builds a model of the labour market that allows to estimate employee preferences towards CSR practices and the impact of these preferences on sorting patterns across firms. Using matched employer-employee data from France and ESG scores from LSEG (formerly Refinitiv) for the period 2002-2021, preliminary reduced-form results show that the relationship between corporate sustainability and firm fixed effects from an AKM-type wage regression has become increasingly negative over time. This suggests that the importance of CSR in employment decisions has grown steadily during the period considered, in the sense that, conditional on switching jobs, in later years workers have accepted lower compensating differentials for the same increase in firm sustainability.

# 1 Introduction

Corporate Social Responsibility (CSR) designs any type of corporate initiative which aims at improving a firm's environmental impact, fostering a safe, inclusive and diverse workplace environment and making internal decision-making processes fair and transparent. All these actions are associated with implementation costs that the firm willingly uptakes to increase social welfare rather than profit. For this reason, the diffusion of CSR has fuelled the discussion around the objectives of the firm and especially about whether firms should pursue goals other than shareholder value (Hart and Zingales, 2017). At the same time, it has drawn considerable attention in the finance industry, where socially responsible investment (SRI) and Environment Social and Governance (ESG) performance are taking increasingly more space. SRI are investments designed to have both a financial return and a social impact, while ESG criteria and scores are designed to reflect a company's performance with regard to environmental and social issues. For the purpose of our discussion, these concepts – CSR, ESG and SRI – are all very similar, so the three terms will be used interchangeably.

Corporate Social Responsibility gathered considerable momentum over the recent years. In a recent study of shareholder letters, Rajan, Ramella, and Zingales (2023) show that since 1980 the percentage of companies mentioning environmental and diversity related objectives has risen from 20% to 90% in 2020. Similarly, firms referring to non-shareholder stakeholders grew from 60% to 90%. Also, investors worldwide are becoming attentive to ESG criteria when making their financial decisions. According to Bloomberg, total ESG assets worldwide reached $30 trillion in 2022 are are projected to surpass $40 trillion by 2030, which would represent about 25% of total assets under management. It is thus no wonder that firms' social responsibility, whether labeled as CSR or ESG, is drawing considerable academic attention. Why do companies engage in these activities if they are

costly? Or are these initiatives just greenwashing?

A possible explanation behind the adoption of CSR practices could be that investors or consumers care about social welfare in general. Many contributions explored these possibilities, some focusing on investors' motivations (Broccardo, Hart, and Zingales, 2022; Gollier and Pouget, 2022), while others try to gauge the importance of consumer activism. Companies may care to keep a reputation of being "good" simply because their customers and investors might turn to competitors in case they did not.

However, less attention has been given to another important mechanism that could explain the rise of ESG in the corporate world, namely workers' preferences and their impact on employment decisions. Indeed, one may not only want to buy green products and invest in ESG assets, but also work for a socially responsible company. Job-seekers might preferentially look for green companies and potentially even accept a lower salary to work in a firm that is deemed more sustainable. In other words, corporate sustainability, as measured by ESG scores, might be perceived as a workplace amenity. Workers would be willing to pay a compensating differential, that is a wage reduction, to obtain such an amenity. If this is the case, whenever it is investing in a socially responsible way, the firm would also augment its attractiveness with respect to workers that are sensitive to ESG. Therefore, improving the company's social and environmental impact would also become a way to attract and retain talent.

A survey from Climate Vault Solutions (2023) seems to suggest that this is the case. As shown in Figure 1, the majority of respondents declare considering the firm environmental footprint when choosing where to work. Interestingly, this concern grows larger for younger cohorts. The share of people stating that environmental performance is of great importance to them also becomes larger the younger the cohort. For Generation Z respondents 24% of respondents declared environmental impact very important for their workplace choice.

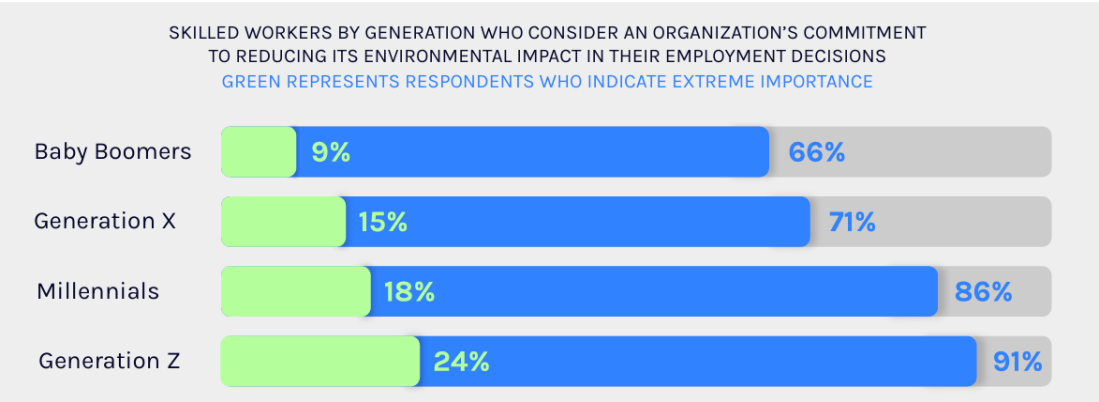



Figure 1: Survey results from Climate Vault Solutions (2023).

If at least some workers care about the firm's social responsibility, then a few interesting questions arise. First, one might wonder about the magnitude of the compensating differential, whether it is economically significant and whether it is trending in time. Second, workers preferences will matter for their choice of where to work. It is usual in labor markets with heterogeneous workers and firms to expect some degree of complementarity between the two and thus some positive assortative matching: high-skill workers to high-productivity firms. Will the preference for greenness enhance or dampens positive assortative matching in the labour market? What are the welfare consequences? Finally, increased talent attraction reduces the cost to the firm of making investments in environmental and social projects. It would be interesting to compare this value to other possible benefits of increased CSR performance, including reduced cost of capital which arises if investors are also sensitive to ESG, or increased revenue, supposing consumers are willing to pay a premium for green products. In order to answer these questions, this paper aims to develop a model that accounts for the effect of ESG on workers' employment decisions and to estimate the intensity of worker preferences from observed matched employer-employee data from France.

Concerning the first question, it is important to determine how relevant is firm social responsibil-

ity for employment decisions. Although the concept of compensating differential is quite simple and intuitive, formally characterizing equalizing wage differences across jobs with observational data has proven to be quite challenging. Theoretical models have been long been available (Roy, 1951) before Rosen (1974) seminal paper provided an influential framework for the study of compensating differentials in equilibrium settings that could guide interpretation of regression results. Rosen's model of hedonic prices allows to study a labour market where workers have heterogeneous preferences for job amenities but are otherwise identical. However, it is likely that workers differ in other dimensions, such as skill. In this case, the main source of difficulty in the empirical estimation of compensating differential is that the econometrician does not observe how the set of available job offers vary across worker types (Lavetti, 2023). In particular, workers of different skill might not have access to the same positions. In our setting, skill is not observed but assumptions on the labour market structure, namely imperfect competition, will allow to characterize different worker types' willingness to pay for workplace corporate sustainability.

The second research question relates to the fact that exactly as workers differ in skill, firms are also likely to be heterogeneous in productivity. When workers have varying levels of skill and firms differ by their productivity, sorting becomes a relevant aspect of the labour market. If skill and productivity are complements, one may expect some positive assortative matching. High-skill workers will choose to work preferentially for productive firms. But if workers are heterogeneous in their preference for ESG, one also expects more engaged workers to work preferentially for more responsible firms. How do these two aspects interact? In our model, imperfect competition prevents perfect assortative matching and answering this question is non-trivial. It is possible to show that high-productivity firms have a higher incentive in raising ESG, because that allows them to increase production and cut the wage bill relatively more.

Therefore, the distribution of preferences for ESG across different worker types matters. If the high-skill care more about ESG, then matching based on corporate responsibility enhances assortative matching on productivity and increases aggregate output. The skill wage gap might however be larger than if workers did not value ESG. Vice versa, if the low-skill care more about ESG, sustainability matching dampens assortative matching and might even decrease aggregate output, but the skill wage gap decreases. Assessing the social benefit of ESG scores is not easy, but in this case it would become paramount to understand the impact of the firms' social responsibility. Focusing on the E component, and especially carbon emissions for which social cost measures are readily available, could provide insights on the trade-off between aggregate output and environmental benefits.

Finally, with regard to impact of workers' employment preferences on the firm side, if workers are willing to give up some of their wage to working a more responsible firm, then firms that raise their ESG level will simultaneously increase production and reduce their total wage bill. Even if they do not care about sustainability *per se*, corporations will then have an incentive to invest in a socially responsible way to attract talent at lower cost. This result is symmetric to reduced cost of capital due to investor activism. If shareholders value the environmental and social impact of their assets, they might be willing to accept lower returns from more sustainable firms. The case of consumer activism is also similar. If consumers are engaged in protecting the environment and fostering inclusion, they might pay a premium for green or ethically produced products.

All of these mechanisms might explain the rise of ESG initiatives even in corporate environments that are fully profit-driven. It is insightful to compare their relative importance. Moreover, for each of them as well as for their joint effect, it is theoretically possible to compute a level of tax on the externality produced by the firm that could generate the same outcome (Pedersen, 2023). This variable could help to gauge how much worker, investor and consumer preferences are contributing

to corporate green transitions. In order to perform such calculations, however, it would be necessary that reliable valuations of the externality were readily available, which is the case only for some components of the E pillar, such as greenhouse gas emissions.

## 2 Literature

This study relates to many contributions in the economics and finance literature. First and foremost, there exist a young strand of literature that makes the link between social responsibility and labour market outcomes, such as Colonnelli et al. (2024), Krueger, Metzger, and Wu (2023) and Bond and Levit (2023). More specifically, as mentioned in the previous section, a goal of this paper is to recover workers' ESG preferences and the corresponding compensating differentials from observed employer-employee matches. Colonnelli et al. (2024) instead elicits preferences for social responsibility of firms directly through an experiment performed on a job-matching platform. They find strong compensating differential evidence. Job seekers are willing to give up 10% of their average monthly salary to work for a firm that mentions CSR initiatives in their posting. At the same time, this article aims to study the consequences of worker preferences on sorting across firms when ESG levels are chosen endogeneously by the firm and are costly. Colonnelli et al. (2024) also develops a similar model, but they keep ESG exogeneous and in their counterfactual they simply assume that high-productivity firms will adopt ESG practices at no cost.

Our study also puts an emphasis on firm productivity. In our model, firms might have different productivity levels even within the same industry. Since we will not be able to rely on good measures of workers' skill and firm productivity, these will be inferred from wages. Krueger, Metzger, and Wu (2023) explores the relationship between ESG and wages under the assumption that firms have

comparable productivity within the same industry. Unlike our setting, they also have measures of employee skill and argue that they are accurate. When skill is observed and firms are homogeneous, results from a Mincer type regression of wages on ESG levels, controlling for skill, can indeed be interpreted directly as evidence of compensating differentials. Provided these assumptions hold, the evidence from Krueger, Metzger, and Wu (2023) suggests that workers care about ESG, especially so if they are more skilled.

It is also important to mention that the definition of social responsibility matters. In this study, we define CSR as the set of practices that improve the firm's environmental and social performance, as measured by its ESG score. These practices come at a cost but do not produce direct consequences on output. A source of difficulty and confusion when studying CSR is that responsibility can take several meanings. For example, in Bond and Levit (2023), responsibility is interpreted as a commitment to provide a minimum wage that the shareholders impose on management.

More generally, our work relates to many contributions on ESG and CSR, especially to some studies that compare green finance with carbon pricing (Pedersen, 2023). We contribute also to a strand of the literature that studies the impact of employment decisions and the labour market in general on firm profitability and stock returns (Edmans, 2012; Edmans et al., 2024).

Finally, our work draws on the huge literature on compensating differentials and sorting in the labour market. Concerning compensating differentials, a mentioned before, a seminal work in this field is Rosen (1974), while more recent literature focused on structural approaches, such as Gronberg and Reed (1994), Burdett and Mortensen (1998), Dey and Flinn (2005), Bonhomme and Jolivet (2009) and Jarosch (2023). With regard to sorting, a separate stream of the literature has focused either on two-way fixed effect approaches, in the spirit of Abowd, Kramarz, and Margolis (1999), or on structural models of the labour market (Bagger and Lentz, 2019; Bonhomme et al., 2023). Bridging the two,

Bonhomme, Lamadon, and Manresa (2019) shows how fixed effect specifications can encompass a large class of models. Still, these works ignore compensating differentials, as adding non-wage amenities when workers are heterogeneous leads to the aforementioned problem of unobservability of the offer set (Lavetti, 2023). To overcome this issue, previous contributions have either exploited quasi-random variation in amenities (Lavetti, 2020), or relied on assumptions on the labour market. For example, Lavetti and Schmutte (2018) assumes search, while Lamadon, Mogstad, and Setzler (2022) assumes imperfect competition. If instead a good measure of skill or a skill proxy is available, such is in Bell (2022) or Maideu-Morera (2024), then it is possible to make assumptions linking job offers directly to worker ability. However, this will not be the case with the data used in this paper.

# 3 Model

In our model, we revisit a setting of imperfect competition in the labour market, such as in Lamadon, Mogstad, and Setzler (2022) and Colonnelli et al. (2024), but we allow corporate sustainability levels to be costly and endogeneously chosen by the firm. Our goal is to study the size of compensating differentials and their impact on the firm wage bill, as well as to analyze sorting patterns across firms. In this section, we show the fundamental assumptions of the model and we characterize its equilibrium. In the next section, we discuss how this framework allows to address our objectives and thus begin to answer the questions raised in Section 1. This analysis will also allow us to identify the key features that drive the results of the model.

We consider a labour market with $I$ workers, indexed by $i$, and $J$ firms, indexed by $j$. Each worker has a type $s$ from a finite, discrete set of types $\{\varsigma_1, \varsigma_2, ..., \varsigma_S\}$, and corresponding productivity $A(s)$. Firms have productivity $A_j$ that we also consider to take values from a finite, discrete set of firm

productivity levels.

**Workers.** Worker $i$ derives the following utility from working at firm $j$:

$$u_{ij}(w_j, E_j, B_j) = \log w_j + \log G(s_i, E_j) + \log B_j(s_i) + \frac{1}{\tau}\varepsilon_{ij} \tag{1}$$

where $w_j$ is the wage offered by firm $j$, $s_i$ is the type of worker $i$, $B_j$ are the non-wage amenities at firm $j$, $\tau$ is a parameter and $\varepsilon_{ij}$ is an idiosyncratic component which is specific to the worker-firm match. The term $G$ encapsulates the "green" amenity, i.e. how much utility a worker of type $s_i$ derives from the social responsibility level of firm $j$, $E_j$. There are many possible justifications for this term. For example, workers that care about environmental or social issues might benefit from the fact of working with like-minded people. The presence of this type of network effects would lead "green" workers to care about the ESG dimension of the firm because it would mean that they are more likely to find other "green" employees at that firm. Also, workers might value adhering to their own moral standards. Suppose for example that a job-seeker cares a lot about recycling. Then working in a company that does differentiate waste and promotes recycling could enable her to keep her habit on the workplace and it might be valuable *per se*.

Notice that both the valuation of the sustainability amenity and other non-wage amenities depend on worker type, because we want to allow for heterogeneous preferences for ESG initiatives. Indeed, it is hard to believe that all workers would care equally for corporate sustainability. Still, our assumption implies that workers of the same type cannot have different valuations of corporate sustainability. Up to this point, we have been agnostic on the content of the type, but since each type $s$ maps to a specific productivity $A(s)$, this is equivalent to say that equally productive workers have the same valuation of social responsibility. This is true if there exist some link between components of type, such as skill,

and preferences. For example, high-skill workers are usually more educated and individuals that are more educated are also more likely to be informed about climate and social issues. That could be one reason why high-skill workers might care relatively more for the environment. This assumption can however be limiting and we plan to relax it in a more general version of our model.

In the remaining part of this and the next section (Section 4), we will focus on CSR amenities and thus disregard the $B_j(s)$ term for all worker types.

**Firms.** Firms face the following production function:

$$Y_j = A_j \left( \sum_s A(s) L_j(s) \right)^{1-\alpha} \tag{2}$$

where $Y_j$ is output of firm $j$, $A(s)$ is the productivity of workers with skill $s$, $A_j$ is the productivity of the firm, $L_j(s)$ is the number of employed workers of type $s$ and $\alpha$ is a parameter governing returns to scale. We will assume $0 < \alpha < 1$. The chosen shape of the production function implies that workers of different skills as substitutes, while firm productivity and worker productivity are complementary. As a consequence, any firm will hire all types of workers. It is important to keep these assumptions in mind when considering the results that will follow.

Firms face monopsonistic competition on the labour market. They have some market power, but they are small relative to the market, so they anticipate the effect of their choices on their own labour supply but they do not internalize the consequences on other firms, i.e. they do not behave strategically with respect to their competitors. Formally, firms choose demand by posting wages for each worker type and corporate social responsibility levels so that profit is maximized subject to the

constraint that demand must not exceed supply. The problem of the firm is then:

$$\max_{w_j(s),E_j} A_j \left( \sum_s A(s) L_j(s) \right)^{1-\alpha} - \sum_s w_j(s) L_j(s) - C_j(E_j) \quad \text{s.t.} \quad L_j(s) = S_j(s, w_j, E_j) \tag{3}$$

where $C_j$ is the cost of picking CSR level $E_j$ and is assumed to be non-decreasing in $E_j$, i.e. $C'(E_j) \geq 0$ for all $j$. We will indicate the profit of the firm $\Pi_j$ as a function of labour demand for each type wages for each type $\{L_j(s)\}_{s=1}^S$, wages for each type $\{w_j(s)\}_{s=1}^S$ and social responsibility level $E_j$.

**Equilibrium.** An equilibrium in this setting is a set of worker choices $j(i)$ for each $i$, offered wages $w_j(s)$ for each firm $j$ and each worker type $s$ and CSR level $E_j$ for each firm $j$ such that:

- workers choose the firm that maximizes their utility, i.e. for each $i$:

$$j(i) = \arg\max_j \log w_j + \log G(s_i, E_j) + \frac{1}{\tau} \varepsilon_{ij} \tag{4}$$

- firms choose offered wages $\{w_j(s)\}_{s=1}^S$ and ESG level $E_j$ to maximize profits:

$$\begin{aligned} \{w_j(s)\}_{s=1}^S, E_j = \arg\max_j \Pi_j \left( \{L_j(s)\}_{s=1}^S, \{w_j(s)\}_{s=1}^S, E_j \right) \\ \text{s.t.} \quad L_j(s) = S_j(s, w_j, E_j) \; \forall s \end{aligned} \tag{5}$$

Concerning workers' employment decisions, under the assumption that $\varepsilon_{ij}$ follows a Type-1 generalized extreme value distribution, if all workers choose optimally, the share of workers of of type $s$ that pick firm $j$ given the set of offered wages $W(s) = (w_j(s))_{j=1}^J$ is

$$\mathbb{P}[j(i) = j | s_i = s, W(s)] = \frac{[w_j(s) G(s, E_j)]^\tau}{\sum_{j'} [w_{j'}(s) G(s, E_{j'})]^\tau} \tag{6}$$

Suppose further that there are $N(s)$ workers of type $s$ so that $\sum_{s'} N(s') = I$. Then supply of workers of type $s$ to firm $j$ is simply:

$$S_j(s, w_j, E_j) = N(s)\mathbb{P}[j(i) = j | s_i = s, W] \tag{7}$$

Labour supply for a firm $j$ is therefore increasing in wages offered by $j$ and in the level of corporate sustainability $E_j$ as long as no worker type dislikes ESG, i.e. $G'(s, E_j) \geq 0$ for all $s$. Notice that since firms are small relative to the size of the market, the elasticity of labour supply for a given worker type $\eta_{js}$ is constant across firms and types and approximately equal to $\eta_{js} \approx \tau$.

For any firm $j$, first order conditions with respect to wages give the following expression for any worker type $s$:

$$w_j(s) = \underbrace{\frac{\tau}{1+\tau}}_{\text{markdown}} \underbrace{A_j(1-\alpha)\left(\sum_{s'} A(s')L_j(s')\right)^{-\alpha} A(s)}_{\text{marginal product of labour}} \tag{8}$$

In words, firms equate wages to marked-down marginal product of labour. Market power indeed allows firms to lower wages below marginal product and still attract workers. The wedge between marginal product of labour and wages defines a markdown that directly depends on the labour supply elasticity and thus on the intensity of worker utility idiosyncratic preference shocks.

As for ESG levels, substituting the constraint directly into the objective allows to find the first order condition with respect to corporate sustainability $E_j$:

$$\frac{\partial C_j(E_j)}{\partial E_j} = \sum_{s'} \frac{w_j(s')}{\tau} \frac{\partial S_j(s', w_j, E_j)}{\partial E_j} \tag{9}$$

This equation has a straightforward interpretation. Each firm will raise its level of responsibility until

the marginal cost of raising it further equates the marginal net benefit of increasing production and reducing total wage bill across worker types. This is supposing that the net benefit is positive. If some workers dislike $E_j$ strongly enough, it might be that the RHS of equation (9) is negative for any $E_j > 0$. In this case, the only solution would be for firms to pick $E_j = 0$. However, if $E_j$ is indeed an amenity and the RHS is positive, than any firm would have an incentive to set $E_j > 0$. Firm incentives in setting sustainability levels and their implications will be discussed at length in the next section.

# 4 Theoretical Analysis

Given the equilibrium of the model, it is possible to conduct some analyses to start answering our research questions. Specifically, we can obtain an expression for the compensating wage differential and check whether it is differentiated across types. With a measure of the compensating differential for different types, it is immediate to obtain the impact of ESG level choice on the total wage bill. This in turn allows to characterize the different incentives faced by firms with different levels of productivity. Finally, we can characterize the labour market sorting implications of corporate sustainability practices.

**Compensating differentials.** The optimal choice of wages depends on the level of ESG chosen by the firm. Implicit differentiation of the first order condition in (8) allows to recover an expression for the variation of the wage offered by firm $j$ to a worker of type $s$ when the level of corporate responsibility varies:

$$\frac{\partial w_j^*(s, E_j)}{\partial E_j} = (-\alpha)\Lambda_j^{-1}(E_j) w_j^*(s, E_j) \sum_{s'} \frac{\partial S(s', w_j^*(E_j), E_j)}{\partial E_j} A(s') \tag{10}$$

where $\Lambda_j(E_j) = \sum_s A(s)S(s, w_j^*(s, E_j), E_j)$. The term $\frac{\partial S(s', w_j^*(E_j), E_j)}{\partial E_j}$ represents the total derivative of supply with respect to the ESG level of firm $j$. Since the optimal $w_j^*$ depends on $E_j$, it can be expressed as the sum of a direct effect of corporate sustainability on supply and an indirect effect of ESG levels on wages, which in turn influence supply. Clearly the sign and magnitude of these effects depend on the preferences of workers for ESG and are thus an empirical question. However, suppose simply that no type of worker dislikes corporate social responsibility and some strictly do. Formally:

**Assumption 1.** *Corporate social responsibility is an amenity, i.e. no worker type dislikes it and at least one type strictly likes it. Mathematically,* $G'(s, E_j) \geq 0, \forall s$ *and for at least one* $s'$*, the inequality holds strictly* $G'(s', E_j) > 0$.

It is interesting to see that Assumption 1 is sufficient to obtain that the compensating differential will be negative for all types of workers.

**Proposition 1.** *Under Assumption 1, the compensating differential* $\frac{\partial w_j^*(s, E_j)}{\partial E_j}$ *is negative for any firm* $j$ *and any worker type* $s$.

*Proof.* See Appendix A.1. □

However, labour supply increases only for the workers who care about corporate sustainability (see derivations). Indeed, the direct effect of increased attractiveness due to greater corporate social responsibility compensates the indirect effect of decreased attractiveness due to lower wages. For the workers that are instead insensitive to ESG practices, only the indirect effect survives. Thus, labour supply of indifferent workers would decrease. For a firm the direct effect means that a raise in its corporate environmental and social performance makes sensitive workers relatively cheaper and as a consequence provides an incentive to substitute towards workers that care about sustainability. This

substitution takes place by reducing wages for all workers. While workers that are indifferent decide to quit, those who are sensitive to corporate sustainability stay and the company is even able to attract more of this type of workers.

**Corporate Social Responsibility choice.** Under Assumption 1, all workers are either indifferent or enjoy corporate social responsibility practices. Therefore, if they have not yet invested in environmental and social performance, companies face a marginal benefit of increasing their ESG level, because this would allow them to make at least one type of labor cheaper. Substituting towards that type or those types leads to increased production and lower wage bill. The RHS in the first order conditions of the problem of the firm with respect to $E_j$ (equation 9) is always positive. As a consequence, all firms would set $E_j > 0$.

Firms will however choose different levels of $E_j$ depending on their productivity $A_j$. In order to see that, consider that the optimal wage choice is a function of the productivity parameter $A_j$ and the choice variable $E_j$. Thus, it is possible to rewrite the profit of any firm as a function of $A_j$ and $E_j$ only. Proceeding by monotone comparative statics, it can be shown that high $A_j$ firms will choose high $E_j$ in equilibrium when Assumption 1 holds.

**Proposition 2.** *Under Assumption 1, in equilibrium, high-productivity firms will choose high levels of corporate social responsibility.*

*Proof.* See Appendix A.2. □

Formally, this is due to the fact that the cross derivative of profit with respect to $A_j$ and $E_j$ is positive. The intuition is that, if wages are chosen optimally by the firms, substitution towards workers that are sensitive to corporate social responsibility leads to greater wage cuts and bigger production increases for firms that are more productive. Therefore high-productivity firms will have

larger incentives to raise $E_j$.

**Sorting.** Notice that if we take equation (8) and divide it for the same firm $j$ and two types $s$ and $s'$, we obtain:

$$\frac{w_j(s)}{w_j(s')} = \frac{A(s)}{A(s')} \tag{11}$$

Equation (11) implies that, within the same firm, more productive workers are better paid, i.e. if $A(s) > A(s')$ then $w_j(s) > w_j(s')$. Analogously, if we divide equation (10) for the same firm and two worker types $s$ and $s'$, we get:

$$\frac{\frac{\partial w_j^*(s',E)}{\partial E}}{\frac{\partial w_j^*(s,E)}{\partial E}} = \frac{w^*(s',E)}{w^*(s,E)} \tag{12}$$

Therefore, within the same firm, the compensating differential will be greater for workers that are more productive, as the evidence from Krueger, Metzger, and Wu (2023) seems to suggest. Keep in mind, however, that this conclusion is only valid *within firm* and it abstracts from considerations about how the worker's employment decision interacts with firm productivity, which is also likely to matter.

Indeed, if we are interested in characterizing the skill wage gap *across firms*, for example comparing the average $\frac{1}{J}\sum_j w_j(s)$ across types $s$, then the proportion of workers deciding to work at firms of differing levels of productivity becomes important. It is useful here to think in terms of an ideal experiment comparing two scenarios. In scenario A, Assumption 1 does not hold and all workers are indifferent to firms' corporate sustainability ratings. In Scenario B, Assumption 1 holds and some workers enjoy the green amenity. In A, no firm engages in CSR and all $E_j$ will be null. When switching from A to B, all firms raise $E_j$ and choose a positive level according to first order condition (9). However, higher $A_j$ firms choose higher levels of $E_j$, in accordance with Proposition 2. Hence,

the more productive a firm is, the more it raises its production and the more the share of workers that like ESG raises at that firm.

Now, it becomes crucial which type of workers enjoys corporate social responsibility. Suppose for example that workers that are more productive care more about ESG initiatives. Then this type of worker will be more likely to work for a high-productivity firm in B than in A. In other words, assortative matching on CSR preferences increases assortative matching on productivity. Under this assumption, the introduction of ESG ratings leads to higher aggregate output. Nevertheless, the change in across-firms average skill wage gap is ambiguous. On one hand, the more productive workers are willing to give up more of their wage for CSR on the workplace, because their preferences are stronger. On the other hand, the share of high-productivity workers matched to high-productivity firms is higher, so their average wage is higher as well. Depending on which effect prevails, the most skilled workers might earn on average more or less in B than in A. Another way to see this mechanism, is that the introduction of ESG creates correlation between $A_j$ and $E_j$. When high-skill workers like $E_j$, the attractiveness of ESG levels is more likely to compensate the utility impact of idiosyncratic shock realizations $\varepsilon_{ij}$. Thus, corporate social responsibility tends to "correct" the distortion due to horizontal differentiation. This way, endogeneous firm choice of corporate social responsibility would justify the results from the counterfactual of Colonnelli et al. (2024).

It is important to keep in mind that the opposite situation is possible if instead the workers that are less productive care more about CSR practices. In this case, the low-skilled workers would be the ones that are more attracted to high $A_j$ firms when going from scenario A to scenario B. Consequently, assortative matching based on firm sustainability would counter positive assortative matching based on productivity. In other words, the indifference to ESG would lead the most productive workers away from the most productive firms and thus exacerbate the distortion due to differentiation.

**Welfare.** The fact that allowing for ESG could lead to increased production under the assumption that the most skilled care the most about sustainability leads to the question of general impact of corporate sustainability ratings on total welfare. Clearly, increased CSR standards should lead to a positive externality (think of social inclusion programs) or a reduction of the negative externality imposed by the firm (think of pollution for example). But if firms increase production and the externality is proportional to production, then the total externality might increase. Indeed, even if the externality per unit is reduced, the number of units increases. If the latter effect is strong enough, the externality will be bigger with corporate sustainability scores than without.

The main complication when studying the welfare impacts of CSR is however measuring the externality. As ESG scores aggregate multiple different dimensions, they are hard to translate in monetary terms, not to mention the fact that for some categories even the magnitude of the externality is difficult to ascertain (for ex.: how much to value the hiring of individuals from disadvantaged communities?). One way to address this problem is to focus on a subset of categories from the ESG score that have good measures of the corresponding externality. For example, for carbon emissions, estimates of the social cost of carbon are available for many countries.

# 5 Empirical Analysis

Even though the theoretical analysis provided many insights on how workers' preferences for CSR could influence labour market outcomes, it is evident that empirical work is needed. Indeed, the magnitude and sign of the effects crucially depend on the shape of the workers' preferences, i.e. the function $G$, as well as on how these vary across different workers types. Another dimension that is critically relevant is heterogeneity in productivity both on the firms and workers' side. Our

objective then becomes to characterize the $G$ function, along with the distribution of firm and employee productivity, from observed labour market data. Other than being object of interest on their own, these elements will allow to determine the magnitude of implied compensating differentials associated to corporate social responsibility in our sample, the impact of the introduction of CSR on corporate profitability, the interplay between sorting based on corporate sustainability and sorting based on productivity and its consequences for aggregate production.

As it is common in labour market settings, a structural approach is helpful because exogeneous variation of corporate sustainability levels is difficult to find. We will then rely on the structure of the data and on motivated assumptions in order to uncover the preference primitives and distributions for heterogeneity in productivity. Our focus will be to identify which mechanisms are at play and to illustrate their importance by performing counterfactual analysis, by showing what would be the outcome of the labour market if workers were not sensitive to corporate sustainability ratings.

## 5.1 Data

**ESG Scores.** Data on ESG Scores comes from the London Stock Exchange (LSEG) Workplace platform (formerly known as Refinitiv). ESG Scores are computed both from corporate communications and third party information, such as statistics made available from NGOs and media companies. The score is yearly and for the current year it is updated weekly. It includes a wealth of variables, which are divided in pillars, categories and subcategories. The Environment pillar includes indicators on emissions ($CO_2$, waste, biodiversity, environment management systems), innovation (green products, green R&D) and resource use (water, energy, packaging, green supply chain). The Social pillar is calculated aggregating information on care for the consumer community (anti-competitive disputes, business ethics, etc.), respect of human rights (controversies on human rights), firm responsibility (re-

sponsible marketing, quality and data privacy) and attention to the workforce (health, safety, working conditions, inclusion). The Governance pillar includes corporate social responsibility (CSR strategy, transparency), management treatment (structure of the firm governing body, CEO compensation) and care towards shareholders (shareholder rights, defenses against takeovers).

A couple of remarks are in place. First, the fact that care towards the workforce is part of the Social pillar needs to be taken into account when designing the empirical strategy because it might introduce correlation between the ESG ratings and other workplace amenities. This is in principle a threat for the separate identification of $G$ ad $B$ function. Second, the definition of corporate social responsibility as part of the Governance pillar is stricter than the definition used in this paper. In fact, it includes only indicators of whether a company provides information on its CSR strategy and whether the firm is transparent with regard to company policies and practices. In order to avoid confusion, it is important to keep in mind that our definition is broader and includes also environmental and social initiatives.

In our sample we restrict attention to French firms. France, a total of 378 public and private companies have received ESG Scores at some point in the time period that goes from 2001 to 2024. The set of firms receiving a score varies overtime, in part due to exit, mergers and acquisitions and in part due to information availability. On average, a firm is scored for a span of 12 years in our sample. The summary statistics for last year (2024) are shown in Table 1.

A separate source of concern concerning the ESG score data is that LSEG (and Refinitiv before) reserve the right to make changes to already published scores up to 5 years prior the most recent observation.

**Matched employer-employee data.** We have access to matched employer-employee data from the "Base Tous Salariés" (BTS) dataset produced by the French "Institut National de la Statistique

Table 1: Summary Statistics for last observation of ESG Scores (2024)

| | ESG Score | ESG Combined | Environmental | Social | Governance |
|---|---|---|---|---|---|
| Average | 58.8 | 55.1 | 60.2 | 64.0 | 50.4 |
| Std. Dev. | 20.5 | 19.1 | 25.8 | 22.4 | 24.4 |
| Min. | 3.1 | 3.1 | 0.0 | 0.7 | 3.4 |
| $q_{25}$ | 44.6 | 41.8 | 42.7 | 50.2 | 30.8 |
| $q_{50}$ | 62.2 | 57.2 | 66.8 | 67.6 | 54.6 |
| $q_{75}$ | 75.7 | 70.7 | 79.1 | 81.7 | 68.7 |
| Max. | 92.9 | 89.5 | 98.0 | 97.2 | 96.6 |
| $N$ | 221 | 221 | 221 | 221 | 221 |

et des Études Économiques" (INSEE). It covers the universe of firms in the country and about 8% of the workforce for each firm in the period from 1976 to 2022. It contains detailed data on firm and worker matches, including wages, hours of work, working location and several demographic variables (year of birth, residence, etc.).

## 5.2 Empirical Research Design

Given the model described in the previous Section 4 and the data available, we discuss next our empirical strategy. We start by explaining and motivating the theoretical underpinning of our empirical approach. Then we derive the structural equations that will constitute the basis for identification and estimation of our model. Finally, we illustrate how we can use different specifications based on these equations to estimate different parts of the model with varying degrees of structure, starting from a simple two-way fixed effect approach, up to a full-fledged structural estimation. Indeed, the structural equations, together with additional a few additional assumptions, allow to estimate some parameters of the model already with an interactive regression specification *à la* Abowd, Kramarz,

and Margolis (1999). With the method proposed by Bonhomme, Lamadon, and Manresa (2019) it is possible instead to relax some of these assumptions, exploiting the full structure of wages and moves across firms. Finally, additional moments related to value added (as in Lamadon, Mogstad, and Setzler, 2022) and to ESG investment decisions will enable us to avoid other functional form specifications, in particular those related to CSR preferences.

**Theoretical Underpinning.** In order to see how the theoretical assumptions of the model are crucial for the empirical analysis, keep in mind that our framework can be seen as a specific case of a more general one where workers observe characteristics $x$ and wage $w$ of each offered job and decide which one to pick based on their own type $s$, taste for characteristics $\theta$ and possibly their past choices. This is a standard compensating differential setting which is discussed at length in Lavetti (2023). The main difficulty is that the econometrician does not observe neither all the characteristics of the jobs (components of the $x$) nor all the individuals characteristics (which are part of the $s$). Thus, the econometrician does not know which is the set of offers that each type of worker has access to. In particular we do not observe how the offer set varies with the productivity of the worker.

As mentioned in Section 2, multiple different strategies are available to address the difficulties of estimating compensating differentials. Since we do not have a good direct measure of worker skill available, trying to tie the offer set to observable ability is not feasible. We rely instead on model assumptions about worker and firm behaviour to characterize offered wages. Since dynamic considerations seem of second order importance, our pick is to assume imperfect competition through both vertical and horizontal differentiation, which is also consistent with evidence of labour market power (Lamadon, Mogstad, and Setzler, 2022).

Notice that the vertical differentiation component appears through preference for ESG and non-ESG amenities, $G$ and $B$ respectively. The horizontal component is instead embedded in the idiosyn-

cratic component of utility $\varepsilon$. Both $B$ and $\varepsilon$, in a way, allows to justify why any type of workers can end up accepting an offer from any type of firm. Without $B$ or $\varepsilon$, in a Rosen (1974) type model, workers of any type will strictly prefer working for high productivity firms, all else being equal, including ESg amenities $G$, because a productive firm will always be able to offer a higher wage. If instead the utility includes $\varepsilon$, once this is realized it defines an offered utility set that varies across workers, even if they are of the same type. The $\varepsilon$, together with taste for exogeneous non-ESG amenities $B$, will then be the reason why a worker might still accept a job at a lower productivity firm, for a lower wage. Coincidentally, it can be seen as the transportation cost of a horizontal differentiation model.

At the same time, with our assumptions on the production process, firms have an interest in offering any type of worker a job, because different types are imperfect substitutes. So all types of workers receive and accept offers from all types of firms. This might seem a bit of a stretch, but it is justified by empirical evidence, that shows that even the most productive firms still employ some lower productivity workers, although they might do so less intensively than low productivity firms Bonhomme, Lamadon, and Manresa (2019). It is also reasonable if we assume that firms, as workers, belong to a finite set of types, which we can refer to as "classes" so as to distinguish from worker types.

**Structural Equations.** Solving the theoretical model leads to the following system of equations:

$$Y_j = A_j \left( \sum_s A(s) S_j(s) \right)^{1-\alpha} \tag{13}$$

$$w_j(s) = \frac{\tau}{(1+\tau)} (1-\alpha) A_j \left( \sum_{s'} A(s') S_j(s') \right)^{-\alpha} A(s) \tag{14}$$

$$S_j(s) = N(s) \frac{[w_j(s) G(s, E_j) B_j(s)]^\tau}{\sum_{j'} [w_{j'}(s) G(s, E_{j'}) B_{j'}(s)]^\tau} \tag{15}$$

$$C'_j(E_j) = \sum_s \frac{w_j(s)}{\tau} \frac{\partial S_j(s)}{\partial E_j} \tag{16}$$

It is immediate to see that equations (13), (14) and (15) can be combined to obtain a fixed point equation, similarly to Lamadon, Mogstad, and Setzler (2022). A convenient way to reformulate the problem is to define $H_j$ so that:

$$H_j = \sum_s \frac{A(s)N(s)}{\sum_{j'}[w_{j'}(s)G(s,E_{j'})B_{j'}(s)]^\tau} \left[\frac{\tau(1-\alpha)}{(1+\tau)} A(s)G(s,E_j)B_j(s)\right]^\tau \tag{17}$$

Then it is possible to express the fixed point relationship in terms of $H_j$ only (see details in Appendix A.3).

This definition leads then to the following structural equations:

$$Y_j = A_j^{\frac{2-\alpha(1-\tau)}{1+\tau\alpha}} H_j^{\frac{1-\alpha}{1+\tau\alpha}} \tag{18}$$

$$w_j(s) = \frac{\tau}{(1+\tau)}(1-\alpha) A_j^{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}} H_j^{\frac{-\alpha}{1+\tau\alpha}} A(s) \tag{19}$$

$$\mathbb{P}[j|s] = \frac{\left[A_j^{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}} H_j^{\frac{-\alpha}{1+\tau\alpha}} G_j(s)B_j(s)\right]^\tau}{\sum_{j'}\left[A_{j'}^{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}} H_{j'}^{\frac{-\alpha}{1+\tau\alpha}} G_{j'}(s)B_{j'}(s)\right]^\tau} \tag{20}$$

where $\mathbb{P}[j|s]$ is the probability that a worker $i$ chooses firm $j$ conditional on her type being $s$.

**Empirical Strategy.** Our empirical strategy proceeds in three steps. First, we exploit structural equation (19) to perform a reduced-form regression analysis of a two-way fixed effect specification in the spirit of AKM (Abowd, Kramarz, and Margolis, 1999). Under specific assumptions, including a functional form for ESG preferences, this approach recovers compensating differentials across firms. In a second step, we leverage the method of BLM (Bonhomme, Lamadon, and Manresa, 2019) to

calculate type proportions across firms. Equation (20) can then be used to estimate compensating differentials relaxing some of the assumptions, but a functional form of employees preferences for CSR would still be needed to distinguish the relative importance of ESG and non-ESG amenities. Finally, in a third and final step, we estimate the full-fledged model, including moments derived from equation (18) and the choice of ESG investment by the firm.

The first approach is inspired by Abowd, Kramarz, and Margolis (1999) and subsequent literature and will thus be referred to as AKM specification in the rest of the paper. The motivation for an AKM-type regression in our setting comes from (19). Notice indeed that taking natural logarithms of this expression leads to:

$$\log w_j(s) = \underbrace{\log \frac{\tau}{(1+\tau)}(1-\alpha)}_{\text{intercept } a} + \underbrace{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}\log A_j - \frac{\alpha}{1+\tau\alpha}\log H_j}_{\text{firm effect } \psi_j} + \underbrace{\log A(s)}_{\text{worker effect } \theta_s} \tag{21}$$

The logarithm of wages can then be decomposed in two effects: a firm fixed effect $\psi_j$ and a type fixed effect $\theta_s$. In practice, we can estimate this equation by assuming that wages are observed with a measurement error, and that there are as many types as individuals. Then both sets of fixed effects can be recovered by regressing log-wages on firm and individual dummies, exactly as in the seminal paper by Abowd, Kramarz, and Margolis (1999). The effect of CSR on wages will be incorporated in the $\psi_j$ term directly through $H_j$ and indirectly through technology $A_j$. Indeed, Proposition 2 suggests that firms with high productivity will on average invest more on ESG. Therefore, ESG preferences will be fundamentally indistinguishable from the pure effect of technology $A_j$. Still, we can naively regress $\psi_j$ on ESG scores by firm to get an idea of which of the two effects prevails. We can also couple (21) with additional assumptions on the exact shape of $G_j$ and leverage variation in ESG Scores to get tentative estimates of the compensating differential. The validity of results will however crucially

hinge on the accuracy of the assumptions in our context of study.

The second approach exploits the methodology introduced by Bonhomme, Lamadon, and Manresa (2019) and will thus be referenced as the BLM specification. Using the full structure of wages and moves across firms, it is indeed possible to perform a two-step procedure where first (i) firms are classified into classes according to a k-means clustering algorithm on the empirical distribution of wages and ESG scores and then (ii) worker type distributions across firm classes and log-earnings distributions specific to classes and worker types are estimated using an EM algorithm. As a result, each firm is assigned a class, and it is possible to calculate the posterior probability that a worker belongs to a type for each worker. Equation (21) can then be estimated with type fixed effects and we also get a measure of $\mathbb{P}[j|s]$ in equation (20). Notice that taking logarithms of this expression we get:

$$\begin{aligned}\log \mathbb{P}[j|s] = \tau \underbrace{\left[\frac{1-\alpha(1-\tau)}{1+\tau\alpha}\log A_j - \frac{\alpha}{1+\tau\alpha}\log H_j\right]}_{\text{firm effect } \psi_j} + \tau \log G_j(s, E_j) + \tau \log B_j(s) \\ - \log \sum_{j'} \left[A_{j'}^{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}} H_{j'}^{\frac{-\alpha}{1+\tau\alpha}} G(s, E_{j'}) B_{j'}(s)\right]^{\tau}\end{aligned} \tag{22}$$

This equation can now be estimated because the last term depends only on type $s$ and can thus be captured by a type fixed effect, while the firm fixed effect is exactly the same as in (21). Both the ESG amenity $G_j$ and the non-ESG amenity $B_j$ depend on firm and type and cannot thus be distinguished unless a functional form for the relationship between $G_j$ and $E_j$ is assumed. Notice, however, that we do not need any additional assumption anymore.

Finally, in order to recover all parameters and thus to fully estimate the model, it will be necessary to identify $\alpha$, $\tau$ and the cost function $C_j$ through additional conditions related to firm value added and ESG investment choice. Modelling explicitly both class and firm choice could provide a way to

estimate a more flexible specification, the intuition being that when firms have comparable technology and ESG Scores but one is considerably more attractive than the other the the difference in size can be ascribed to the difference in non-ESG amenities.

The next sections present each of our empirical specifications and show their results. Section 6 focuses on the AKM empirical model, section 7 presents the BLM grouped fixed effects estimation and section 8 discusses the full estimation of all parameters in the model.

**Sample selection.** Given our empirical strategy, we carefully build a sample that is appropriate for our analysis. In particular, we merge ESG Scores with matched employer-employee data through unique firm identifiers (SIREN) and we filter the merged dataset in order to obtain observations that are comparable. The wealth of variables and variability in type of employment and conditions impose a number of choices, which we explain briefly here.

The main variable of interest for our empirical research design is gross salary in constant euros, which we divide by the number of hours worked to obtain a measure of hourly wages. We filter out all observations that have missing values (only 3) or null gross salary (0 observations). Also, we select individuals between 25 and 55 years of age to avoid confounding effects due to the start and end of careers (student jobs, retirement specificities, etc.).

It is important to mention that the variable for number of hours in our dataset indicates the total number of hours paid according to the contract, but it may not reflect the actual number of hours worked. There is significant variability in the relationship between the number of hours and pay duration. For example, people who worked year-round have anywhere between 0 and 6,000 hours worked. Even when selecting only individuals that are reported as full-time employees, there remains considerable dispersion. For this reason, we use both the number of hours and employment duration (in days) together to select only workers who worked at least one week in the entire year and had a

total number of hours worked per week between 35 and 44, which are the minimum and maximum limits allowed under French law for a full employment contract. This results in a much more regular relationship between hours worked and employment duration.

In our dataset, observations are already selected to ensure a single entry per year per individual per plant. Yet the sample still contains about 2600 repeated observations, where the same workers appear in two different firms in the same year. We could simply select the worker-firm-year observation that has the longest duration or the highest pay but a quick check suggests that this could lead to losing many moves across firms in the sample. For example, suppose there is an individual who worked for firm A in 2017, still worked for A in 2018 but switched to B in the same year and finally moved to firm C in 2019. If we keep only the longest or the best paid job we might pick A for 2018 as well and loose the information about the intermediate connection through B. After a quick check, the number of double observations are 1148, for a total of 573 potential connections that we might loose. Therefore we filter these observations in order to always keep the intermediate link (firm B in the example). To break all remaining ties, we select jobs with the latest start date in the year or the first firm by unique identifier in case the start date is the same.

Notice also that when performing the AKM analysis we need to focus on a subset of firms that are connected by at least one move, otherwise the firm fixed effects will not be identified and there might be spurious comparisons. Before every interactive regression, we extract from the subset of all movers the unique identifiers of the firms and select only those that are in the largest connected set.

# 6 Reduced-form AKM Approach

**AKM Specification.** The key equation for an approach in the spirit of Abowd, Kramarz, and Margolis (1999) is (21):

$$\log w_j(s) = \underbrace{\log \frac{\tau}{(1+\tau)}(1-\alpha)}_{\text{intercept } a} + \underbrace{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}\log A_j - \frac{\alpha}{1+\tau\alpha}\log H_j}_{\text{firm effect } \psi_j} + \underbrace{\log A(s)}_{\text{worker effect } \theta_s}$$

This corresponds to a two-way fixed effect regression of log-wages on firm fixed effects $\psi_j$ and individual fixed effects $\theta_i$, under the assumption that types are as many as the number of individuals. We also implicitly assume that log-earnings are observed with an independent and identically distributed error $\eta_{ijt}$ that respects the conditional mean independence assumption. Equation (21) then results in the following specification:

$$\log w_{ijt} = a + \psi_j + \theta_i + \eta_{ijt} \tag{R.1}$$

that can be estimated with OLS under the assumption that our model is correct and that the measurement error respects the conditional mean independence assumption:

**Assumption I.** *(Conditional mean independence.) The error term $\eta_{ijt}$ satisfies $[\eta_{ijt}|i,j] = 0$.*

In the following, whenever we introduce measurement error we will suppose Assumption (I) is respected.

A few remarks are here in order. First, remember that the firm effect $\psi_j$ is a composition of an $A_j$ term, which refers to productivity, and an $H_j$ term which refers to both productivity and preferences. The relationships between these terms and ESG Scores are interesting in their own right. Proposition 2 states that high-productivity firms choose higher corporate responsibility levels. At the same time,

the term $H_j$ is directly linked to ESG preferences $H_j$: the stronger worker preferences for ESG are, the greater is $H_j$. Therefore, theory predicts both $A_j$ and $H_j$ to be positively correlated with ESG Scores $E_j$. However, $A_j$ enters $\psi_j$ positively, while $A_j$ enters negatively.Consequently, the global relationship between $H_j$ and $E_j$ is only informative about which of the two effects prevails but not on each of them separately.

Second, notice that all time-invariant difference in wages across individuals and firms is captured by either one of the two fixed effects, but in the original contribution of Abowd, Kramarz, and Margolis (1999) and subsequent work, it is usual to include time-varying characteristics that might be of interest, both at the individual and the firm level. The goal is usually to separate out the contribution of these observed characteristics from unobserved individual and firm-level factors. In our case, however, we are only interested in distinguishing the variation in wages that can be ascribed to firms from the variation that can be ascribed to workers, no matter whether it is related to observed or unobserved factors. It is important therefore to take into account variables that could confound this distinction, even though we have not explicitly modelled them. One such variable for example is tenure. The goal of this analysis is not forcibly to separate tenure from unobserved individual effects $\theta_i$, because in principle we could consider a worker type to include tenure as well. All the discussion so far would still apply. However, we do care about distinguishing the effect of tenure from firm effects $\psi_j$. If all the individuals that move between firm A and firm B have longer experience than those that move from A to firm C we might infer $\psi_B$ to be larger than $\psi_C$ even though firms might be equally productive.

A closely related issue is the time dimension. Our analysis in Section 4 is conditional on a time period $t$, without restriction. But the implicit assumption behind regression (R.1) is that firm and worker productivity are fixed in time, as well as preferences and ESG Scores. Variation in log-wages

over time will be entirely imputed to the error $\eta_{ijt}$. Two problems then arise: (i) omitting time-varying characteristics can lead to biased estimates of the fixed effects and (ii) this specification does not allow to exploit the time variation in ESG Scores observed in the data. Regarding (i), if time-varying characteristics make log-wages on average higher on some periods, Assumption I clearly does not hold. Rather than focusing on each variable separately, a simple way to address this concern is to add year fixed effects, as in Lachowska et al. (2023). Taking stock of the observations raised in the current and the previous paragraph, one would ideally augment (R.1) to include both time and experience, so that the following specification would be robust to trends:

$$\log w_{ijt} = a + \beta x_{it} + \psi_j + \theta_i + t + \eta_{ijt} \tag{R.2}$$

where $x_{it}$ is experience and $t$ is a dummy for years. As pointed out in Card et al. (2018), however, including both experience and time fixed effects can be problematic for the correct estimation of individual fixed effects.

As for (ii), estimating (R.2) for the whole period between 2002 and 2021 will still give us a unique firm fixed effect $\psi_j$ per firm $j$. All moves between firms at all years are used to compute the fixed effect. But firms are assigned an ESG Score every year. Therefore, the only meaningful way to compare the firm fixed effect to ESG Scores is to regress it on the mean ESG Score over the 2002-2021 period.

Results from both regression (R.1) and (R.2), performed on the respective largest connected set of firms, are shown in Table 2. As we can see, individual fixed effects are significantly increasing in mean (log) ESG Scores, no matter the set of controls. This might happen because more productive workers sort into greener firms as predicted by our model. Firm fixed effects instead do not exhibit a significant relationship with (log) ESG Scores. Perhaps the effect of technology and worker preferences for ESG

offset each other in the period of study. Alternatively, comparing aggregate fixed effects across time with mean ESG Scores might mask a lot of across-years variations. We will explore this possibility in the next paragraph.

Table 2: Results from the AKM Specification.

| | Firm FE | | | Individual FE | | |
|---|---|---|---|---|---|---|
| Mean ESG Score | -0.03 | 0.03 | 0.05 | 0.33*** | 0.32*** | 0.26*** |
| | (0.13) | (0.11) | (0.11) | (0.01) | (0.00) | (0.00) |
| Intercept | 0.82 | 0.30 | 0.21 | 1.27*** | 1.22*** | 1.03*** |
| | (0.51) | (0.45) | (0.44) | (0.02) | (0.02) | (0.02) |
| *First stage controls* | | | | | | |
| Time FE | N | Y | Y | N | Y | Y |
| Experience | N | N | Y | N | N | Y |
| Observations | 125 | 125 | 125 | 113,009 | 113,009 | 112,976 |
| R-squared | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.02 |

*Notes*: The dependent variables are estimated fixed effects from the AKM regression. Independent variables are in logarithms. First stage controls refer to observables (in logarithms) and fixed effects included in the AKM regression. Standard errors are in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

**TV-AKM Specification.** Given the previous paragraph specification and results, one is left wondering whether it is possible to refine the analysis, making use of the yearly nature of the ESG ratings. If we consider the choice of ESG investment to be performed at each time period, then the $H_j$ term varies across time. The appropriate specification becomes:

$$\log w_{ijt} = a + \beta x_{it} + \psi_{jt} + \theta_i + \eta_{ijt} \tag{23}$$

where $\psi_{jt}$ is a year-firm fixed effect. Beware that we had to drop the year fixed effects because they

would be collinear to year-firm fixed effects. Such applications of the AKM framework are sometimes called "time-varying" AKM or TV-AKM (Lachowska et al., 2023). Comparing the fixed effect $\psi_{jt}$ across firms $j$ and years $t$ still combines productivity and preferences variations. To illustrate, consider any $j \in 1, \ldots, J$ and any $t \in [2001, 2021]$. Then:

$$\begin{aligned}\psi_{jt} &= \underbrace{\frac{1-\alpha(1-\tau)}{1+\tau\alpha}}_{a_1} \log A_j - \underbrace{\frac{\alpha}{1+\tau\alpha}}_{a_2} \log H_{jt} = \\ &= a_1 \log A_j - a_2 \log \sum_s A(s) D_t(s) \left[ \underbrace{\frac{\tau(1-\alpha)}{(1+\tau)}}_{a_3} A(s) G(s, E_{jt}) B_j(s) \right]^{\tau}\end{aligned} \tag{24}$$

where $D_t(s) = \frac{N(s)}{\sum_{j'} [w_{j't}(s) G(s, E_{j't}) B_{j'}(s)]^{\tau}}$ is a market index for an individual of type $s$ at time $t$. So the correlation between $\psi_{jt}$ and $E_{jt}$ will be a compounded effect of the variation of $A_j$, $D_t$, $E_{jt}$ and $B_j$. Firm and time effects control for the presence of the $A_j$, $D_t$ and $B_j$, as long as non-ESG amenities $B_j$ do not vary over time (cf. Appendix A.4), as stated in the following:

**Assumption II.** *During the period of study, non-ESG amenities are fixed, i.e.* $B_{jt}(s) = B_j(s)$ *for all* $s$*, all* $t$ *and all* $j$*.*

Furthermore, observe that each element in the second term summation can be seen as $G(s, E_{jt})$ weighted by a coefficient that depends both on $j$, $t$ and $s$. A regression of $\psi_{jt}$ on $E_{jt}$ would thus approximately identify an upper bound on the average rate of change of $G(s, E_{jt})$ across $s$, as shown under an additional assumption in Appendix A.4. Additionally assuming the specific functional form $G(s, E_{jt}) = \exp(\gamma_{st} E_{jt})$, the regression exactly identifies the weighted average of the slope of preferences with respect to $E_{jt}$, across types $s$ for a given period $t$. Let us write formally:

**Assumption III.** *Worker preferences for ESG have the shape* $G(s, E_{jt}) = \exp(\gamma_{st} E_{jt})$*.*

Under Assumption (I) to (III) it is then possible to estimate the average slope of worker preferences for corporate sustainability across worker types through a regression of the firm-year fixed effect $\psi_{jt}$ on yearly ESG scores $E_{jt}$, controlling for firm and year effects. This is also equivalent to a direct estimation of an enhanced AKM model of the form:

$$\log w_{ijt} = a + \beta x_{it} + \beta_t \log E_{jt} + t + \psi_j + \theta_i + \nu_{ijt} \tag{25}$$

The above specification, estimated on the largest connected set of year-firm pairs, produces the results shown in Table (3) for firms and (4) for individuals. Interestingly, the relationship between year-firm fixed effects and (log) ESG Score is positive and significant, but becomes insignificant when adding controls for year and firm. Restricting the coefficient to be unique across time, however, masks significant across-year heterogeneity. We report coefficients on ESG Score for 2004, 2008, 2013, 2017 and 2021 to illustrate and keep the table readable. Coefficients for the earlier years are positive and significant or insignificant, indicating that the compensating differential for higher ESG Score at the beginning of the period of study was positive. In later years, the coefficient becomes negative, suggesting a negative compensating differential. This implies that at least some worker types in the later years do care about ESG Scores and are willing to accept lower wages in order to work for a firm that has a better sustainability score.

The results from the regression of individual fixed effects on ESG Scores show a significant positive relationship, thus confirming results from AKM and suggesting that more productive individuals sort into firms with better ESG scores.

**R-AKM Specification.** An implicit assumption behind the previous specifications (23) and (25) is that firm productivity and worker types are fixed across time. Although the inclusion of time-

Table 3: Results from TV-AKM and Enhanced AKM - Firms.

| | Year-Firm FE | | | | log Wage | |
|---|---|---|---|---|---|---|
| ESG Score | 0.004*** | -0.014 | | | | |
| | (0.001) | (0.032) | | | | |
| ESG Score × 2004 | | | 0.207*** | 0.163*** | 0.117*** | 0.086*** |
| | | | (0.027) | (0.023) | (0.013) | (0.013) |
| ESG Score × 2008 | | | -0.055 | -0.053 | 0.052 | 0.042 |
| | | | (0.056) | (0.057) | (0.030) | (0.032) |
| ESG Score × 2013 | | | -0.126** | -0.136*** | -0.146*** | -0.166*** |
| | | | (0.049) | (0.049) | (0.031) | (0.043) |
| ESG Score × 2017 | | | -0.149*** | -0.177*** | -0.0136*** | -0.179*** |
| | | | (0.041) | (0.039) | (0.038) | (0.043) |
| ESG Score × 2021 | | | -0.179** | -0.232*** | -0.256*** | -0.311*** |
| | | | (0.063) | (0.060) | (0.079) | (0.086) |
| Intercept | -0.17*** | | | | | |
| | (0.06) | | | | | |
| *First stage controls* | | | | *Controls* | | |
| Experience | N | N | N | Y | N | Y |
| *Second stage controls* | | | | | | |
| Year FE | N | Y | Y | Y | Y | Y |
| Firm FE | N | Y | Y | Y | Y | Y |
| Clustered SE | N | N | Year | Year | Year | Year |
| Observations | 348 | 348 | 348 | 348 | | |
| R-squared | 0.06 | 0.94 | 0.94 | 0.91 | | |

*Notes*: The dependent variables are estimated fixed effects from the AKM regression in columns 1-4 and log-wages in columns 5-6. Independent variables are in logarithms. First-stage controls refer to observables (in logs) and fixed effects included in the AKM regression. Standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 4: Results from TV-AKM - Individuals.

| | Individual FE | |
|---|---|---|
| Mean ESG Score | 0.39*** | 0.29*** |
| | (0.01) | (0.00) |
| Intercept | 1.54*** | 1.44*** |
| | (0.02) | (0.02) |
| *First stage controls* | | |
| Experience | N | Y |
| Observations | 104,079 | 104,049 |
| R-squared | 0.05 | 0.04 |

*Notes*: The dependent variables are estimated fixed effects from the AKM regression. Independent variables are in logarithms. First-stage controls refer to observables (in logs) and fixed effects included in the AKM regression. Standard errors in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

varying individual characteristics $x_{it}$ and time trends should be reassuring, one might still worry that systematic unobserved differences across time could confound the variation due to ESG Scores. Also, the firm year fixed effect in $\psi_{jt}$ of (23) and the $\beta_t$ coefficient in (25) will be identified by variation in salaries of workers that stay at the same firm for different years. Our model is silent about the exact dynamics of job movements, so this is not in principle a problem. Still, we might be concerned that salaries of stayers usually only tend to grow with tenure.

One way to address this concern is to estimate (R.2) on consecutive two-years time windows, so that the firm fixed effect is only identified by movers and worker effects are allowed to vary unrestrictedly across years. This specification is sometimes referred to as "revolving" AKM or R-AKM (Lachowska et al., 2023). Reassuringly, as shown in Table 5, individual fixed effects are positively and significantly related to the logarithm of ESG scores and the coefficient does not seem to exhibit a strong time trend. Also, when the regression is performed on year-firm fixed effects instead, coefficients keep the same sign as in the previous TV-AKM specification, but they lack power. As the relationship between individual fixed effects and ESG scores does not seem to vary a lot across time, it is likely that the lower precision in the R-AKM regression on firm effects is due to the lower number of observations. Remember that each coefficient is identified exclusively by moves between firms in a given year. But the number of connected firms per year varies between 8 and 29, which seems too low to provide the necessary variation for a precise estimate of all firms effects.

# 7 Grouped Fixed Effects: BLM Approach

*[In progress]*

Table 5: Results from R-AKM.

| | Year-Firm FE | | | | Individual FE | |
|---|---|---|---|---|---|---|
| ESG Score | 0.032* | 0.13 | | | 0.372*** | |
| | (0.18) | (0.21) | | | (0.003) | |
| ESG Score × 2004 | | | | | | 0.465*** |
| | | | | | | (0.003) |
| ESG Score × 2008 | | | 0.02 | 0.11 | | 0.420*** |
| | | | (0.26) | (0.25) | | (0.003) |
| ESG Score × 2013 | | | -0.74* | -0.72* | | 0.448*** |
| | | | (0.35) | (0.37) | | (0.003) |
| ESG Score × 2017 | | | -0.40 | -0.38 | | 0.420*** |
| | | | (0.27) | (0.28) | | (0.003) |
| ESG Score × 2021 | | | -0.55 | -0.52 | | 0.353*** |
| | | | (0.64) | (0.68) | | (0.003) |
| Intercept | -1.12 | | | | | |
| | (0.75) | | | | | |
| *First stage controls* | | | | | | |
| Experience | N | N | N | Y | | |
| *Second stage controls* | | | | | | |
| Year FE | N | Y | Y | Y | | |
| Firm FE | N | Y | Y | Y | | |
| Clustered SE | | | Year | Year | | Year |
| Observations | 330 | 330 | 330 | 307 | 587,908 | 587,908 |
| R-squared | 0.006 | 0.73 | 0.72 | 0.20 | 0.12 | 0.15 |

*Notes*: The dependent variables are estimated fixed effects from the AKM regression or log wages. Independent variables are in logarithms. First-stage controls refer to observables (in logs) and fixed effects in the AKM regression. Standard errors in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

# 8 Structural Estimation

*[In progress]*

# 9 Conclusion

In this paper, we propose a framework to analyze the impact of corporate social responsibility on the labour market. In our model, the preference of some types of workers towards CSR leads firms that engage in sustainable practices to substitute towards those types. Since firms that are more productive choose higher levels of ESG investment, the distribution of worker preferences for ESG matters. When the most productive workers are also those that are more concerned with corporate sustainability, then greenness assortative matching enhances productivity assortative matching and might therefore increase total aggregate output, raising welfare concerns about the mitigation of production externalities. Also, when this happens, the average skill wage gap might increase.

Since effects could have either sign depending on the underlying preference distribution and the patterns of heterogeneous productivity across worker types and firm, we take our model to the data, developing an empirical research design that is comprised of three consecutive steps: (i) a two-way fixed effect approach *à la* Abowd, Kramarz, and Margolis (1999), (ii) a grouped fixed effects strategy in the spirit of Bonhomme, Lamadon, and Manresa (2019) and finally (iii) a full fledged structural estimation of the model that would allow to identify all parameters and perform counterfactual analysis. Following (i), we show that, under some assumptions, a regression of year-firm fixed effects from an AKM specification on yearly ESG Scores identifies a weighted average of worker preferences across time. Results from this procedure show that the relationship between the fixed effect and ESG Scores is increasing for the earlier years in the period of study, but then decreases over time and becomes

decreasing for later years. This is direct evidence of a sign reversal in compensating differentials for ESG Scores, meaning that workers in recent years have on average accepted lower wages to work for a firm with higher corporate sustainability. These results motivate further empirical analysis, which is necessary to relax some of the assumptions needed for the reduced-form specification to hold and also to allow identification and estimation of the full parameter space of the model.

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# A Proofs and Derivations

## A.1 Proposition 1.

*Proof.* Dropping the $j$ subscript, for any $s$, differentiation of (10) leads to:

$$\frac{\partial w^*(s,E)}{\partial E} = (-\alpha)\Lambda^{-1}(E)w^*(s,E)\sum_{s'}\left[\frac{\partial S(s')}{\partial w^*(s',E)}\frac{\partial w^*(s',E)}{\partial E} + \frac{\partial S(s')}{\partial E_j}\right]A(s') \tag{26}$$

where $\frac{\partial S(s')}{\partial E_j}$ is the derivative of $S(s',w,E)$ with respect to the third argument only – calculated at $w = w^*(s',E)$ – and we make an abuse of notation, by indicating $\frac{\partial S(s')}{\partial w^*(s',E)}$ the derivative of $S(s',w,E)$ with respect to the second argument, calculated at $w^*(s',E)$. Formally, it would be $\frac{\partial S(s')}{\partial w^*(s',E)} = \frac{\partial S(s')}{\partial w}\big|_{w=w^*(s',E)}$.

Now, we can us the fact that compensating differentials are proportional across type and within the same firm, as a consequence of equation (12):

$$\frac{\partial w^*(s',E)}{\partial E} = \frac{w^*(s',E)}{w^*(s,E)}\frac{\partial w^*(s,E)}{\partial E}$$

Replacing back in (10):

$$\frac{\partial w^*(s,E)}{\partial E} = (-\alpha)\Lambda^{-1}(E)\left[\sum_{s'}\frac{\partial S(s')}{\partial w^*(s',E)}w^*(s',E)\frac{\partial w^*(s,E)}{\partial E}A(s') + w^*(s,E)\sum_{s'}\frac{\partial S(s')}{\partial E_j}A(s')\right] \tag{27}$$

And finally rearranging:

$$\frac{\partial w^*(s,E)}{\partial E}\left[1+\alpha\Lambda^{-1}(E)\sum_{s'}\frac{\partial S(s')}{\partial w^*(s',E)}w^*(s',E)A(s')\right]=(-\alpha)\Lambda^{-1}(E)w^*(s,E)\sum_{s'}\frac{\partial S(s')}{\partial E_j}A(s') \tag{28}$$

Under Assumption 1, the term on the RHS is negative, because labour supply is strictly increasing in $E$ for at least some worker type. The coefficient in the square brackets on the LHS is positive because labour supply is increasing in wages. Therefore, the compensating differential $\frac{\partial w^*(s,E)}{\partial E}$ is negative for any $s$. □

## A.2 Proposition 2.

*Proof.* Let us indicate with $w_j^*(s,A_j,E_j)$ the optimal wage for type $s$ at firm $j$ given $A_j$ and $E_j$. Replacing the constraint, the profit of the firm wit respect to corporate social responsibility can be written as:

$$\begin{aligned}\Pi_j(A_j,E_j)=&A_j\left(\sum_s A(s)S_j(s,w_j^*(s,A_j,E_j),E_j)\right)^{1-\alpha}-\\&-\sum_s w_j^*(s,A_j,E_j)S_j(s,w_j^*(s,A_j,E_j),E_j)-C_j(E_j)\end{aligned} \tag{29}$$

We proceed by monotone comparative statics. Suppose two firms $p$ and $q$ differ in productivity and $A_p>A_q$. Denote $E_p$ the value of ESG that maximizes $\Pi_e$ and $E_q$ the maximizer of $\Pi_q$. Then, $E_p>E_q$ if for any $j$, $\frac{\partial^2\Pi_j}{\partial A_j\partial E_j}>0$. To prove the proposition, it is then sufficient to show that the cross derivative of profit $\Pi_j$ is positive.

Let us denote $\Lambda_j(A_j,E_j)=\sum_s A(s)S_j(s,w_j^*(s,A_j,E_j),E_j)$. Start by computing the derivative of

profit $\Pi_j$ with respect to $A_j$. We drop the subscript $j$ for readability:

$$\begin{aligned}
\frac{\partial \Pi}{\partial A} &= \Lambda(A,E)^{1-\alpha} + A(1-\alpha)\Lambda(A,E)^{-\alpha}\frac{\partial \Lambda}{\partial A} - \sum_s \left[\frac{\partial w^*(s)}{\partial A}S(s) + w^*(s)\frac{\partial S(s)}{\partial w^*(s)}\frac{\partial w^*(s)}{\partial A}\right] = \\
&= \Lambda(A,E)^{1-\alpha} + \sum_s \left[A(1-\alpha)\Lambda(A,E)^{-\alpha}A(s)\frac{\partial S(s)}{\partial w^*(s)}\frac{\partial w^*(s)}{\partial A} - \frac{\partial w^*(s)}{\partial A}S(s) - w^*(s)\frac{\partial S(s)}{\partial w^*(s)}\frac{\partial w^*(s)}{\partial A}\right] = \\
&= \Lambda(A,E)^{1-\alpha} + \sum_s \left[\frac{1+\tau}{\tau}w^*(s)\frac{\partial S(s)}{\partial w^*(s)}\frac{\partial w^*}{\partial A} - \frac{\partial w^*}{\partial A}S(s) - w^*(s)\frac{\partial S(s)}{\partial w^*(s)}\frac{\partial w^*(s)}{\partial A}\right] = \\
&= \Lambda(A,E)^{1-\alpha} - \sum_s \frac{\partial w^*}{\partial A}S(s)\left[\frac{1+\tau}{\tau}\frac{w^*}{S(s)}\frac{\partial S(s)}{\partial w^*} - 1 - \frac{w^*}{S(s)}\frac{\partial S(s)}{\partial w^*}\right] = \\
&= \Lambda(A,E)^{1-\alpha}
\end{aligned} \tag{30}$$

The last passage is due to the fact that $\tau$ is the elasticity of labour supply. Now the cross derivative is:

$$\frac{\partial \Pi}{\partial A \partial E} = (1-\alpha)\Lambda(A,E)^{-\alpha}\sum_s A(s)\left[\frac{\partial S(s)}{\partial w^*}\frac{\partial w^*}{\partial E} + \frac{\partial S(s)}{\partial E}\right] \tag{31}$$

Under Assumption 1, the compensating differential is negative so from equation (26) we know that the sum on the RHS is positive. This is equivalent to say that when workers like sustainability then raising sustainability increases the total workforce efficiency. We conclude then that the cross derivative is positive and thus demonstrate the proposition.

□

## A.3 Definition (17) and derivation of fixed point equation.

Remember that solving the model leads to the following system of equations:

$$Y_j = A_j \left( \sum_s A(s) S_j(s) \right)^{1-\alpha} \tag{13}$$

$$w_j(s) = \frac{\tau}{(1+\tau)} (1-\alpha) A_j \left( \sum_{s'} A(s') S_j(s') \right)^{-\alpha} A(s) \tag{14}$$

$$S_j(s) = N(s) \frac{[w_j(s) G(s, E_j) B_j(s)]^\tau}{\sum_{j'} [w_{j'}(s) G(s, E_{j'}) B_{j'}(s)]^\tau} \tag{15}$$

$$C_j'(E_j) = \sum_s \frac{w_j(s)}{\tau} \frac{\partial S_j(s)}{\partial E_j} \tag{16}$$

Let us show why defining $H_j$ as in (17), i.e. $H_j = \sum_s A(s) D(s) \left[ \frac{\tau(1-\alpha)}{(1+\tau)} A(s) G(s, E_j) B_j(s) \right]^\tau$ is particularly helpful. Define $D(s)$ as in Section 6 (omitting the time subscript for readability), i.e. $D(s) = \frac{N(s)}{\sum_{j'} [w_{j'}(s) G(s, E_{j'}) B_{j'}(s)]^\tau}$. The term $D(s)$ then depends exclusively on $s$ and represents an aggregate indicator of offered utility by all firms $j', \in \{1, \ldots, J\}$ in the market for workers of type $s$.

Then (15) becomes $S_j(s) = D(s)[w_j(s)G(s,E_j)B_j(s)]^\tau$. We can plug the expression into (14) to get:

$$
\begin{aligned}
& w_j(s) = \frac{\tau}{(1+\tau)}(1-\alpha)A_j\left(\sum_{s'}A(s')D(s')[w_j(s')G(s',E_j)B_j(s')]^\tau\right)^{-\alpha}A(s) \quad \leftrightarrow \\
\leftrightarrow \quad & A(s)D(s)[w_j(s)G(s,E_j)B_j(s)]^\tau = \\
= A(s)D(s)&\left[\frac{\tau}{(1+\tau)}(1-\alpha)A_j\left(\sum_{s'}A(s')D(s')[w_j(s')G(s',E_j)B_j(s')]^\tau\right)^{-\alpha}A(s)G(s,E_j)B_j(s)\right]^\tau \quad \rightarrow \\
\rightarrow \quad & \sum_s A(s)D(s)[w_j(s)G(s,E_j)B_j(s)]^\tau = \\
& = \sum_s A(s)D(s)\left[\frac{\tau}{(1+\tau)}(1-\alpha)A_j\left(\sum_{s'}A(s')D(s')[w_j(s')G(s',E_j)B_j(s')]^\tau\right)^{-\alpha}A(s)G(s,E_j)B_j(s)\right. \\
\leftrightarrow \quad & \left[\sum_s A(s)D(s)[w_j(s)G(s,E_j)B_j(s)]^\tau\right]^{1+\tau\alpha} = \sum_s A(s)D(s)\left[\frac{\tau(1-\alpha)}{(1+\tau)}A_jA(s)G(s,E_j)B_j(s)\right]^\tau \quad \leftrightarrow \\
\leftrightarrow \quad & \left[\sum_s A(s)S_j(s)\right]^{1+\tau\alpha} = A_j^\tau \underbrace{\sum_s A(s)D(s)\left[\frac{\tau(1-\alpha)}{(1+\tau)}A(s)G(s,E_j)B_j(s)\right]^\tau}_{H_j}
\end{aligned}
\tag{32}
$$

As we can see, $H_j$ would depend directly on preferences only through $G(s,E_j)$. Of course, $D(s)$ still contains terms $w_j(s)$ and $G(s,E_j)$, but these will be aggregated at the level of the market for workers of skill $s$. Focusing on the RHS of (32) and definition (17), we can intuitively think of $H_j$ as the relative importance of individual specific factors (both worker type productivity and preferences) with respect to the market aggregate utility indicator $D(s)$, summed across markets for worker types. Looking at the LHS of (32), we can also think of $H_j$ as the relative importance of total workforce productivity with respect to firm-specific productivity.

Let us now derive from the system of equations a fixed point correspondence in $H_j$. It is immediate

from the last expression (32) and equation (13) that $H_j$ also satisfies:

$$\left(\frac{Y_j}{A_j}\right)^{\frac{1+\tau\alpha}{1-\alpha}} = A_j^{\tau} H_j \tag{33}$$

But, combining the production equation (13) respectively with the wages equation (14) and with the supply equation (15), we obtain:

$$w_j(s) = \frac{\tau}{(1+\tau)}(1-\alpha)A_j \left(\frac{Y_j}{A_j}\right)^{-\frac{\alpha}{1-\alpha}} A(s) \tag{34}$$

$$\left(\frac{Y_j}{A_j}\right)^{\frac{1}{1-\alpha}} = \sum_s A(s)N(s)\frac{[w_j(s)G(s,E_j)B_j(s)]^{\tau}}{\sum_{j'}[w_{j'}(s)G(s,E_{j'})B_{j'}(s)]^{\tau}} \tag{35}$$

Putting these two expression together:

$$\begin{aligned}\left(\frac{Y_j}{A_j}\right)^{\frac{1}{1-\alpha}} &= \sum_s A(s)N(s)\frac{\left[\frac{\tau}{(1+\tau)}(1-\alpha)A_j\left(\frac{Y_j}{A_j}\right)^{-\frac{\alpha}{1-\alpha}} A(s)G(s,E_j)B_j(s)\right]^{\tau}}{\sum_{j'}\left[\frac{\tau}{(1+\tau)}(1-\alpha)A_{j'}\left(\frac{Y_{j'}}{A_{j'}}\right)^{-\frac{\alpha}{1-\alpha}} A(s)G(s,E_{j'})B_{j'}(s)\right]^{\tau}} \quad \leftrightarrow \\ \leftrightarrow \quad \left(\frac{Y_j}{A_j}\right)^{\frac{1+\tau\alpha}{1-\alpha}} &= \sum_s A(s)N(s)\frac{[A_jG(s,E_j)B_j(s)]^{\tau}}{\sum_{j'}\left[A_{j'}\left(\frac{Y_{j'}}{A_{j'}}\right)^{-\frac{\alpha}{1-\alpha}} G(s,E_{j'})B_{j'}(s)\right]^{\tau}}\end{aligned} \tag{36}$$

This defines a fixed point equation in $Y_j$. To show how we can express it as a function of $H_j$ instead, it is sufficient to use (33) to get:

$$H_j = \sum_s A(s)N(s)\frac{[G(s,E_j)B_j(s)]^{\tau}}{\sum_{j'}\left[A_{j'}\left(A_{j'}^{\tau}H_{j'}\right)^{-\frac{\alpha}{1+\tau\alpha}} G(s,E_{j'})B_{j'}(s)\right]^{\tau}} \tag{37}$$

Ideally, we want to show that there exists a solution to this equation and that it is unique, using

a fixed point theorem.

## A.4 Interpretation of TV-AKM regression

Let us start from equation (24):

$$\psi_{jt} = a_1 \log A_j - a_2 \log \sum_s A(s) D_t(s) \left[a_3 A(s) G(s, E_{jt}) B_j(s)\right]^\tau \tag{24}$$

Define weights $\omega_{jt}(s) = A(s)^{1+\tau} D_t(s) a_3^\tau B_j(s)^\tau$. Then:

$$\begin{aligned}
\psi_{jt} &= a_1 \log A_j - a_2 \log \sum_s \omega_{jt}(s) G(s, E_{jt})^\tau = \\
&= a_1 \log A_j - a_2 \log \sum_s \frac{\omega_{jt}(s) G(s, E_{jt})^\tau}{\sum_s \omega_{jt}(s)} - a_2 \log \sum_s \omega_{jt}(s) \leq \\
&\leq a_1 \log A_j - a_2 \tau \sum_s \frac{\omega_{jt}(s) \log G(s, E_{jt})}{\sum_s \omega_{jt}(s)} - a_2 \log \sum_s \omega_{jt}(s)
\end{aligned} \tag{38}$$

where the last inequality is due to the concavity of the logarithmic function and Jensen's Inequality. Ignoring the effect of $E_{jt}$ on $\omega_{jt}(s)$, the derivative of the RHS with respect to $E_{jt}$ is approximately:

$$-a_2 \tau \sum_s \frac{\omega_{jt}(s)}{\sum_s \omega_{jt}(s)} \frac{G'(s, E_{jt})}{G(s, E_{jt})} \tag{39}$$

Supposing non-ESG amenities $B_j$ do not vary over time, firm and year fixed effects control for the last term of the equation. Hence, approximating the relationship between $\psi_{jt}$ and $E_{jt}$ with a linear function will result in the coefficient on $E_j t$ being proportional to a weighted average of the relative rate of change of workers' preferences $G(s, E_{jt})$ across worker types $s$, if the rate of change does not depend on $E_j t$.

**Assumption IV.** *The rate of change of worker preferences for ESG does not depend on $E_jt$, i.e. there exists a function $f(st)$ such that $\frac{G'(s,E_{jt})}{G(s,E_{jt})} = f(s,t)$ for all $s$ and all $t$.*

Under Assumptions I, II and IV, a regression of year-firm fixed effects on ESG Scores will be informative about the sign of the compensating differential associated to corporate sustainability. It will also inform about the workers' preferences for ESG $G(s, E_{jt})$, in aggregate. In particular, its sign will be negative if and only if at least for some worker type $s$, $G'(s, E_{jt}) > 0$.

Under Assumption III, equation (24) becomes:

$$\psi_{jt} = a_1 \log A_j - a_2 \log \sum_s \omega_{jt}(s) \exp(\gamma_{st} E_{jt})^\tau \tag{40}$$

As a consequence:

$$\frac{\partial \psi_{jt}}{\partial E_{jt}} = -a_2 \frac{\sum_s \omega_{jt}(s) \tau \exp(\gamma_{st} E_{jt})^\tau \gamma_{st}}{\sum_s \omega_{jt}(s) \exp(\gamma_{st} E_{jt})^\tau} \tag{41}$$

which is a again weighted average of $\gamma_{st}$. A linear approximation of the relationship between $\psi_{jt}$ and $E_{jt}$ then gives directly a coefficient which is proportional to a weighted average of $\gamma_{st}$. In particular, this will be negative if and only if at least some $\gamma_{st}$ is positive.