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Corporate Social Responsibility along the global value chain

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Regular article

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ABSTRACT

Locating substantial parts of the production process in developing and emerging economies, many firms face an increasing demand by stakeholders for Corporate Social Responsibility (CSR) along their value chains. Contractual incompleteness between firms and their suppliers at different stages of production can exacerbate the ability to meet these demands. We analyze a model of sequential production with incomplete contracts where CSR by independent suppliers differentiates the final product in the eyes of caring consumers. Progressing down the value chain, our model predicts an increasing CSR profile from upstream suppliers with low CSR to downstream suppliers with higher CSR. We confirm this prediction using Indian firm-level data – computing a firm's value chain position by combining its product-level sales information with the World Input–Output Database. We find that more downstream firms report higher CSR expenditures as measured by a combination of staff welfare spending and social community spending.

1. Introduction

Participation in global value chains (GVCs) is often considered a path to development for low- and middle-income countries (OECD/WTO, 2013; World Bank, 2020). Concerns about negative social and environmental impacts of GVCs in those countries are, however, widespread and boosted by tragedies such as the Rana Plaza collapse in 2013. Consumers have responded to these concerns by becoming increasingly vocal about their demand for ethical standards along the *entire* value chain. With large parts of today's value chains located in developing and emerging economies characterized by high leniency

with regard to environmental or labor regulation and/or enforcement, this requires that suppliers invest in Corporate Social Responsibility (CSR). CSR investments – by definition – extend beyond local legal requirements (e.g., McWilliams and Siegel, 2001) and are therefore key for meeting the demands of an ever growing number of ethically concerned consumers and, more broadly, for the general acceptance (or not) of globalized production in the public debate.

Persistent and sizable compliance issues concerning labor and environmental practices in the value chains of a large number of firms indicate, however, how difficult it can be for firms to impose CSR

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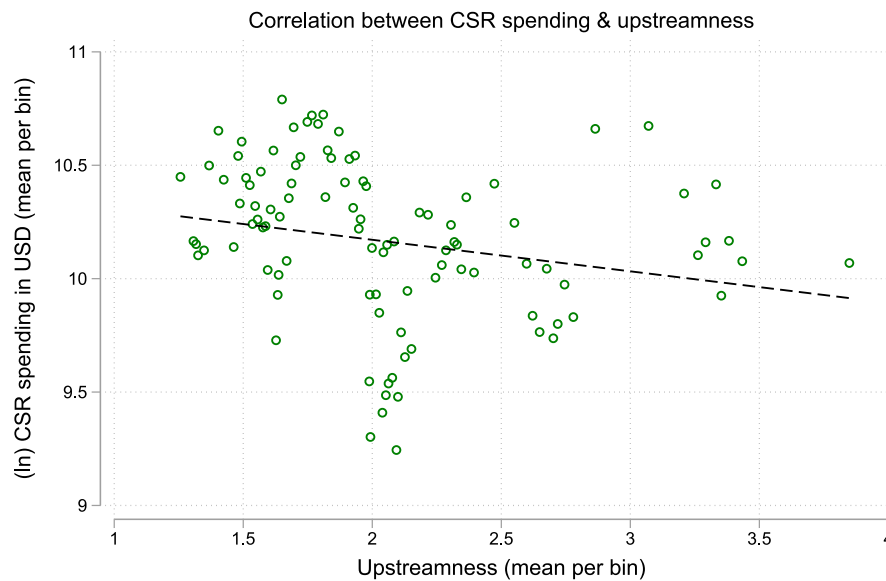


Fig. 1. Correlation between firms' CSR and GVC position.

Corporate Social Responsibility (CSR) spending plotted against an upstreamness measure computed at the firm-level following Antràs and Chor (2018). Own illustration based on Indian firm-level data by Prowess, presented in Section 3. 54,394 observations summarized in 100 bins. The negative slope of 0.14 is significant at the 1%-level and suggests that more upstream firms have lower CSR expenditures than more downstream firms.

levels on their international suppliers, e.g., through legally binding codes of conduct (e.g., Locke, 2013b). In line with this observation, the literature on CSR has identified *incomplete contracts* as a key market imperfection in the analysis of CSR (see Crifo and Forget, 2015). Not focusing on CSR, but on the international organization of production, Antràs and Chor (2013) analyze the role of incomplete contracts for the firm-supplier interaction and find that the value chain position of a supplier affects its contribution to the production process.

In this paper, we apply the intuition of Antràs and Chor (2013) to the analysis of CSR investments along the global value chain. More specifically, we ask the following questions: Which role does the value chain position of suppliers play in their CSR investments? What are the resulting patterns of CSR along a value chain, from upstream to downstream production stages?

Fig. 1 provides a first glance at the relationship between CSR spending and the value chain position, here of Indian firms. The figure highlights a statistically significant unconditional correlation: more upstream firms tend to have lower CSR investments than the more downstream firms, suggesting an increasing CSR profile “along the value chain”, i.e., from upstream to downstream (in Fig. 1, from right to left).¹

We make two main contributions. First, we analyze a model of non-contractible CSR investments by suppliers in a sequential production process (a value chain). In our model, CSR investments of suppliers in the Global South provide horizontal and vertical product differentiation when selling the final product to caring consumers in the Global North. We find that the equilibrium CSR investments are low in upstream stages, increase along the value chain, and peak at the most downstream stages. Second, we test this prediction employing Indian firm-level data. Combining detailed information on a firm's product mix with the World Input–Output Database (WIOD), we construct a measure of a firm's GVC position to empirically investigate how it affects a firm's monetary CSR spending. Our empirical analysis supports the theoretical prediction: CSR expenditure increases along the value chain i.e., from upstream to downstream firms, confirming the unconditional correlation in Fig. 1. We complement these results providing evidence that points at the relevance of incomplete contracts for this pattern.

In our model, firms and consumers are located in the Global North, while suppliers are located in the Global South and operate under lenient regulation. We introduce a group of ‘caring’ consumers who appreciate a product's ‘ethical quality’ embodied in environmental and welfare improvements (CSR) implemented by suppliers along the value chain.² In line with a common approach both in Economics and in the Business literature (see e.g., Kitzmuller and Shimshack, 2012, Crifo and Forget, 2015, and Ding et al., 2022, respectively, and references therein), we model CSR as providing product differentiation allowing the firm to charge a (higher) markup.³

A central premise of our analysis is that suppliers make their decisions on CSR in an environment characterized by incomplete contracts: the firm selling the final good to consumers cannot write binding contracts prescribing production standards in supplier factories. We argue in detail in Section 2.1 that for the case of CSR, contracts are incomplete as the supplier's action is “observable, but not verifiable” (Hart and Moore, 1999, p. 118).⁴ Central to the argument is the difference between circumstantial evidence on a supplier's infringements of ethical standards (observability) on the one hand and, on the other hand, evidence that will hold in a court of law (verifiability). While circumstantial evidence can be sufficient for caring consumers to re-assess their valuation of the product and therefore demand, it is

² Surveys (e.g., O'Rourke, 2005, and Loureiro and Lotade, 2005) as well as field experiments with real purchasing decisions (e.g., Hiscox and Smyth, 2011, and Hainmueller et al., 2015) suggest that consumers do care about the ethical content of their consumption and in fact have a higher willingness to pay for ‘ethical’ products.

³ Note that this standard view on CSR as providing product differentiation is conceptually different to an approach where CSR acts like an insurance against NGO campaigns and consumer boycotts. The two approaches are not mutually exclusive and share some common features. In our view, including massive and well-mediatized NGO campaigns into the analysis would also have implications for the number of ethically concerned consumers. In order to keep the analysis concise, we keep the fraction of caring consumers constant and focus of CSR as providing ethical product differentiation.

⁴ While enforcement by MNEs can improve compliance, monitoring by MNEs is imperfect and cannot be expected to ensure full compliance (Boudreau, 2022).

¹ Details on the data as well as definitions are provided below.

insufficient in a court of law, especially so in countries with weak legal institutions.⁵

We introduce the above elements – caring consumers and incomplete contractability of CSR – into a model of sequential production along the lines of Antràs and Chor (2013). We find an increasing profile of the suppliers' equilibrium CSR investments along the value chain: while CSR investments at upstream stages are low, they increase along the value chain towards more downstream stages. This pattern arises because under incomplete contracts, the cumulative CSR investment in previous stages provides the supplier with an incentive to choose a higher CSR level. We derive the complete industry equilibrium with free entry and find that endogenizing the number of firms has important implications for identifying testable implications. While in the partial equilibrium (taking aggregate variables as given), CSR investments increase in the total expenditure on ethically differentiated goods, this effect vanishes in the industry equilibrium. This leaves us with a single and clear testable implication of our model: the increasing profile of CSR along the value chain, which we take to the data in Section 3.

Several policy implications directly emerge from our theory. First, as higher CSR levels at upstream stages encourage CSR investments at more downstream stages (sequential complementarity), policy interventions targeting CSR at upstream stages may benefit CSR along the entire value chain. Second, for governments aiming at decent work and economic growth (as specified in the UN's Sustainable Development Goal 8), the fact that the more upstream stages of production feature the lowest CSR levels, provides an incentive to strategically focus industrial policy towards specialization in more downstream production stages. Third, policy initiatives like the EU Directive on Corporate Sustainability Due Diligence, the French Duty of Vigilance Law or the German Due Diligence Law shift the responsibility for supplier actions to firms. Our analysis hints at the limited ability of a firm to impose ethical standards on its suppliers and highlights that this problem is particularly severe for suppliers at upstream stages of production. Future due diligence regulation should take this asymmetry along the value chain into account.

We test our model's prediction using the Indian firm-level dataset *Prowess* provided by the Centre for Monitoring Indian Economy (CMIE), which has been used by Goldberg et al. (2010a), Goldberg et al. (2010b), De Loecker et al. (2016), Bos and Vannoorenbergh (2018), as well as Barrows and Ollivier (2021), among others. It is a special feature of this dataset that it contains information on the firms' *staff welfare spending* as well as *social community spending*. We use these items to construct a measure of a firm's CSR spending in monetary units, which we observe for 15,512 medium-size and large firms between 2000 and 2013 in India.

Our approach to computing a firm's value chain position parallels the procedure in Chor et al. (2021). First, we use the World Input-Output Database (WIOD) and apply the methodology from Antràs et al. (2012) and Antràs and Chor (2018) to compute the yearly upstreamness of each Indian industry. Second, to each product in a firm's portfolio, we assign the value of annual upstreamness of its industry and calculate the firm's value chain position, its upstreamness, as the sales-weighted average of its products' upstreamness values.

We estimate the relationship between a firm's value chain position on its CSR expenditure. In our analysis, we control for a large set of

⁵ Crifo and Forget (2015) survey a literature on CSR in management sciences and industrial organization. They list imperfect competition and contract incompleteness as central drivers of CSR (see, e.g., their Figure 1, p. 114). Schiller (2018) motivates his purely empirical work alluding to the same notion of incomplete contracts: the inability of a firm to fully control CSR investments of its suppliers. Moreover, there is a recent and quickly expanding literature on relational contracts in developing countries surveyed in Macchiavello (2022) and Boudreau et al. (2023), which lends support to our modeling on incomplete contracts in value chains involving developing and emerging economies.

firm-level determinants of CSR identified in the literature (e.g., Newman et al., 2018; Görg et al., 2018; Schiller, 2018). These include a measure of internationalization (share of exports in total sales), exposure to more demanding customers (measured by the fraction of exports to OECD countries), local embeddedness (share of domestically sourced inputs), firm size (total sales), age and firm ownership (dummies for state-owned and foreign-owned firms). Importantly, we control for the possibility that wage levels may vary systematically along the value chain using a firm-specific wage measure that combines industry-level information on labor compensation with a firm's product mix.⁶

In our estimations, we rely on two different types of variation. First, in a cross-sectional specification, we control for several established firm-level drivers of CSR and industry-year as well as state fixed effects. This approach exploits variation in the value chain position of firms that share the same main industries. Second, in a more demanding specification, we exploit the time dimension of our data. By including firm fixed effects, we identify the effect from changes in a firm's GVC position over time. In both cases, we find strong support for our model's prediction: more downstream firms have higher CSR levels. Comparing firms at the 5th and the 95th percentile, our preferred specification indicates that predicted CSR spending is 55.31% higher for the downstream firm compared to the upstream firm.

We complement the main empirical findings of our paper by investigating the role of incomplete contracts for these results. We use sub-national World Bank Doing Business data on court costs to measure judicial inefficiency for 17 Indian states. As the data are only available for 2009, we are limited to a cross-sectional analysis using one year of our data. Despite the restricted sample, we find that, in line with our model, CSR spending increases with a steeper slope along the value chain in regions with high judicial inefficiency, i.e., the effect of incomplete contracts predicted by the model is more pronounced in regions with lower contract enforcement.

Our results also hold in several robustness checks. In one of them, we address the possible concern that more downstream producers might simply be more visible to final consumers and therefore face higher pressure to invest in CSR. This would constitute a complementary channel also linking downstreamness to higher CSR spending. We therefore control for visibility by adding marketing expenses as an additional control variable and find that our effect is robust to its inclusion. In a second robustness check, we show that our results are robust to using CSR not in levels but relative to expenditure as independent variable. Moreover, we show that our results are robust to smoothing CSR spending over two years to control for the possibility that firms' CSR spending is concentrated in a specific year. Further, our results are robust to applying inverse hyperbolic sine (i.h.s.) transformation as an alternative to Poisson Pseudo Maximum Likelihood (PPML) to include observations without CSR spending. Finally, we account for the possibility that firm-specific shocks may drive both CSR spending and downstreamness using an instrumental variable approach. Also in this case our results are confirmed.

Our work relates to the recent literature studying the “globalization backlash”, the massive skepticism economic globalization encounters in many countries (Pavcnik, 2017), which is surveyed in Colantone et al. (2022). We are interested in an additional and complementary source of skepticism towards globalization: the ongoing violation of ethical standards in international production — attracting criticism from consumers and actors in civil society. Moreover, while the literature above

⁶ Controlling for firm-specific wages addresses the following concern: If staff welfare spending is a part of the overall compensation package, downstream firms might offer systematically higher pay due to higher skill intensity, for example. A negative correlation between upstreamness and CSR spending (as measured in part by staff welfare spending) could then be interpreted as actually reflecting the negative relationship between upstreamness and employee compensation.

focuses on public regulation, we are interested in patterns of voluntary self-regulation along international value chains.

There are several strands of literature that focus on the (consequences of) the demand for ethical minimum standards in international value chains. In the absence of effective international regulation (Battaglini and Harstad, 2020), this demand manifests itself as pressure on firms to self-regulate international production, a process Baron (2003) terms *private politics*. In Baron (2012), he argues that key actors of private politics are advocacy NGOs which use both confrontational strategies (like consumer boycotts) as well as cooperative approaches (like labels) to directly influence the actions of firms (instead of affecting government policies in the case of *public politics*). Our analysis therefore relates to the literature on labels, with the fair trade label being the best documented and most researched case in point.⁷ The other strand of literature is a recent and expanding literature on the role of international advocacy NGO activity for international production and development.⁸ The latter is more focused on NGO campaigns and consumer boycotts. Our object of study, CSR along the value chain, is closer to the former, as it emphasizes the opportunity for firms to increase demand and markups, rather than the risk of facing a devastating boycott. In fact, the provision of labels by NGOs can be seen as a mechanism to strengthen the positive effect of CSR investments on demand. In our paper, we take this positive effect as a given and study how it shapes CSR investments along the value chain.⁹

There is a recent and quickly expanding literature on relational contracts in developing countries surveyed in Macchiavello (2022) and Boudreau et al. (2023), which supports our notion of the relevance of incomplete contracts in sourcing relationships especially involving developing and emerging economies.¹⁰ Most informative for our modeling (see Section 2.3.1), Cajal-Grossi et al. (2023) show that suppliers in the Bangladeshi garment sector obtain higher prices when selling to relational buyers than when selling to spot buyers. While these papers provide valuable insights into the contracting relationships to overcome contractual incompleteness in an environment with weak legal institutions, they do not analyze the relation to CSR investments.

Our theory is rooted in the large literature studying the role of incomplete contracts for the international boundaries of the firm, based on the seminal contributions of Antràs (2003) and Antràs and Helpman (2004), surveyed in Antràs and Yeaple (2014) and Antràs (2016). We build our modeling on (Antràs and Chor, 2013) where a firm's value chain is modeled as a sequential production process. Like most of this literature, they focus on the integration vs. outsourcing decision along the value chain. Costinot et al. (2013) also model international sourcing as a sequential production process, but without incomplete contracts. They focus on the endogenous fragmentation of the value

chain across countries. We abstract from both the international make-or-buy decision and the allocation of tasks across countries. Our main focus, in contrast, is on CSR investments along a sequential value chain characterized by incomplete contracts. Our modeling opens up both the theoretical and the empirical toolkit of the literature on international sourcing with incomplete contracts to the analysis of social and environmental issues in globalized production that feature prominently in the public debate. Closest to our paper in this respect is recent work by Herkenhoff and Krautheim (2022), who analyze a model featuring caring consumers, consumer boycotts and incomplete contracts to study the effects on the international make-or-buy decision in a setting with a single supplier. We, in contrast, study the determinants of CSR investments based on a model that features a continuum of suppliers along a sequential value chain. This allows us to study the effect of a supplier's value chain position on its CSR investments and therefore the profile of CSR along the value chain.

There is an extensive empirical strand of this literature, with Alfaro et al. (2019) being a recent example. These papers directly relate to the theoretical underpinnings, where incomplete contracts lead to underinvestment in a relationship-specific non-contractible variable (inputs, quality-adjusted inputs, etc.). As these non-contractible variables are notoriously difficult to observe in the data, the empirical studies turn to the observable optimal response of the firm to the underinvestment: the integration vs. outsourcing decision. Antràs and Chor (2013), for example, investigate the role of upstreamness of a supplier for its – empirically unobservable – quality-adjusted investment. To generate testable implications, they therefore turn to the observable optimal response of the firm to the underinvestment: depending on the upstreamness of the supplier, either integration or outsourcing delivers the right incentives minimizing the negative consequences of the underinvestment. Our empirical analysis complements the existing literature as we, in contrast, directly observe the non-contractible variable of interest: CSR spending. This allows us to investigate more directly the role of the GVC position for supplier investments under incomplete contracts.

There is a large literature on CSR at the intersection of the fields of management science and industrial organization. Kitzmuller and Shimshack (2012), Crifo and Forget (2015), and Pisani et al. (2017) provide surveys of this literature. This includes a large body of empirical studies on CSR which mainly focuses on the effect, rather than the determinants, of CSR. We take a different angle, contributing to a better understanding of the determinants of CSR by analyzing the impact of a firm's value chain position. Moreover, most of this literature uses indices combining qualitative measures obtained by mandatory CSR reporting of listed firms in developed rather than emerging economies (e.g., Marano and Kostova, 2016; Pisani et al., 2017). We, in contrast, use data from India, a key emerging economy, which not only allows us to construct a continuous monetary measure of CSR, but also to study the behavior of non-listed medium-sized and large firms.

Our empirical analysis complements a small number of empirical studies assessing the role of global value chain relationships for CSR. Noteworthy contributions are Schiller (2018), Newman et al. (2018), and Tanaka (2020). Schiller (2018) uses data restricted to large publicly listed companies to show that corporate environmental and social policies of firms are transmitted to suppliers in their value chain and studies the effect of these policies on firm performance. He provides evidence consistent with the interpretation that despite incomplete contracts, firms can still affect their supplier's CSR choices to some extent. We, in contrast, are interested in how the limited control of a firm over its suppliers shapes their CSR choices.

Most related to our empirical analysis are Newman et al. (2018) and Tanaka (2020). For firms in the garment sector in Myanmar, Tanaka (2020) shows that exporting improves working conditions, like fire safety, health management, and freedom of negotiation. Newman et al. (2018) exploit CSR indicators that capture compliance with labor standards, community and management-related CSR practices to analyze

⁷ The fair trade label is studied empirically, among others, by Hainmueller et al. (2015), de Janvry et al. (2015), and Dragusanu et al. (2022), and theoretically by Stähler and Richardson (2014) and Podhorsky (2015). See Dragusanu et al. (2014) for a survey. For studies of labels more generally, see Fischer and Lyon (2014), Heyes and Martin (2017), as well as Poret (2019).

⁸ See, e.g., Aldashev and Verdier (2009, 2010), Aldashev et al. (2015), Krautheim and Verdier (2016), Koenig et al. (2021), Fontagné and Limardi (2023).

⁹ Closest to our model in terms of the type of policy considered is Alfaro-Ureña et al. (2022) who develop a quantitative general equilibrium model to study the effects of responsible sourcing in origin countries based on data on affiliates of multinationals in Costa Rica.

¹⁰ Macchiavello (2010) uses a model with incomplete contracts to study the effect of vertical integration on the pervasive use of subcontracting arrangements among small firms in developing countries. Casaburi and Macchiavello (2019) show how imperfect contract enforcement generates barriers to entry in the Kenyan dairy sector. Machiavello and Morjaria (2021) highlight the importance of long-term relational contracts in the Rwandan coffee sector. Brugués (2020) analyzes the role of imperfect contracts in the textile, pharmaceutical and cement sectors in Ecuador depending on market power.

the transmission of socially responsible behavior through trade in Vietnamese firms. They find that a firm's CSR increases with exporting and importing, varying across export destinations. The internationalization of supply chain relationships therefore seems to matter for CSR activities of firms. Moreover, Newman et al. (2018) conjecture that in addition to the internationalization of buyer–seller relationships, the supplier's position along the value chain may matter and control for it using firm fixed effects. We, in contrast, use a time-varying, firm-specific measure of a firm's value chain position that allows us to directly measure the GVC position of a firm and to analyze its relationship to the firm's CSR spending.

The remainder of the paper is structured as follows. Section 2 presents our theoretical analysis of CSR along the global value chain. Section 3 outlines our empirical analysis. Section 4 concludes.

2. A model of CSR along the global value chain

In this section, we incorporate consumer valuation for ethical production practices and CSR investment into a model of sequential production with incomplete contracts based on Antràs and Chor (2013). We assume that each firm in the Global North has a value chain with unit measure of required inputs, which are all provided by independent suppliers in the Global South, where environmental and labor regulation is insufficient from the perspective of caring consumers in the Global North. We derive the industry equilibrium of the model and show that our theory implies an increasing CSR profile along the value chain — a prediction which we take to the data in Section 3.

2.1. Incomplete contractibility of CSR

Before turning to the outline of our model, we first plead the case for the relevance (and the type) of incomplete contracts for CSR along global value chains. Assuring sufficient CSR levels by suppliers is notoriously difficult to achieve. Nike's response to the “sweatshop campaign” in the 1990s is probably the best documented and most researched case in point. Protests against work conditions in Indonesian supplier factories led Nike to implement compulsory, legally binding codes of conduct for all its suppliers.¹¹ Harrison and Scorse (2010) show that the campaigns caused an increase in the real wages in Indonesian factories manufacturing for Nike. Locke (2013a), however, shows that more than a decade after the introduction of legally binding codes of conduct combined with an auditing system, substantial compliance problems persisted in Nike's supply chain. He analyzes data from factory audits of working conditions in more than 900 of Nike's suppliers located across fifty countries and finds that, despite the fact that all suppliers are obliged to sign the codes of conduct and despite large investments into monitoring, there still is a substantial number of suppliers that are ranked as “noncompliant”. In Asia, the noncompliant suppliers even constitute the majority. While Nike is a particularly well-documented case in point, these problems are by no means specific to Nike or the footwear and apparel sector. Based on data from one of the world's largest supply chain auditing firms containing 16,795 audits of 5,819 factories in 13 industries across 66 countries over a period of six years, Short et al. (2016, 2020) document widespread violations of codes of conduct in areas like child labor, forced labor, working hours, occupational health and safety, the minimum wage and disciplinary practices.

In our view, this calls for a model of CSR along GVCs that explicitly accounts for *incomplete contracts* between a firm and its suppliers. One

¹¹ In May 1998, Nike CEO Phil Knight famously made the following statement: “The Nike product has become synonymous with slave wages, forced overtime, and arbitrary abuse. I truly believe the American consumer does not want to buy products made under abusive conditions.” (New York Times, 1998).

standard way of motivating contractual incompleteness is that it is prohibitively costly — if possible at all — to cover all contingencies in a contract. This does not seem to be a major concern in our context: codes of conduct and similar contracts can specify minimum social, labor and environmental standards. In the case of CSR investments, the contractual incompleteness stems from another standard argument: the actions of the supplier are “observable but not verifiable” (e.g., Hart and Moore, 1999). This means that it is costless (or at least relatively cheap) to determine what is going on in a supplier's factory but it is prohibitively costly to hold the supplier accountable for the induced losses in a court of law.

There are quite general and well-known problems with verifying labor and environmental standards implemented in production plants, especially so in low-regulation countries. Safety equipment may be distributed one day, but not the other, fire exits may be accessible one day, but blocked the other, workers may fear the loss of their jobs, if they report forced and excessive overtime, toxic waste may be disposed into a river when no-one is watching.¹² It is nevertheless relatively cheap for, say, an advocacy NGO to talk to workers, measure toxins in waste water or send an undercover agent into a factory to find out about the actual production conditions. Such circumstantial evidence, possibly obtained by breaking domestic laws, is insufficient in a court of law. However, in many cases it is sufficient to convince caring consumers to re-assess their valuation of the product and to reduce demand.¹³ Producing the type of evidence that would lead to a conviction of the supplier — though in principle possible — will in many cases be prohibitively costly to produce. It would require a massive and continuous presence of auditors on site and even then, there is no guarantee that they will win the cat-and-mouse game with local management. This highlights that the notion in the incomplete contracts literature that the action is “observable but not verifiable” (e.g., Hart and Moore, 1999) applies to CSR investments along GVCs.¹⁴

2.2. Setup: Preferences and technology

We now turn to the formal description and analysis of our model starting with preferences and technology. Preferences include the second key feature of our modeling — besides incomplete contracts for CSR discussed above: consumer valuation for — and provision of — CSR along the value chain.

2.2.1. Preferences of caring consumers

Consumers derive utility from the consumption of different varieties of a final consumption good. We assume that all varieties share the *same physical properties*. There are two types of consumers in the Global

¹² For a vivid description of the typical problems of auditors in the field, see Locke (2013b), p. 35–37.

¹³ This is all the more so as NGOs are repeatedly reported to be the most trusted institutions among consumers before governments and the media. See, for example, the Edelman Trust Barometer for 2020, at <https://cdn2.hubspot.net/hubfs/440941/Trust%20Barometer%202020/2020%20Edelman%20Trust%20Barometer%20Global%20Report-1.pdf>.

¹⁴ In our modeling, we assume for simplicity that the firm and consumers can observe the *actual* level of CSR by the supplier — but that it is not verifiable by a court. In case that some readers take issue with the notion that the *actual* CSR level is observable but non-verifiable, note that this assumption can be relaxed — further broadening the gap between the cost of observing and the cost of verifying. For the mechanics of our model to function, we do not need the firm and consumers to observe the *actual* CSR investments. The firm only needs to know the CSR level which consumers *observe* or *perceive* (however misguided their perception may be) and which they use to form their opinion on the ethical quality, $\varepsilon(\omega)$. This observable/perceived CSR level is what determines the surplus of the match — but it is obviously impossible to condition on it in a contract, e.g., by specifying a fine in response to perceptions of consumer or allegations by NGOs.

North, which we label *caring* and *non-caring* (Davies, 2005; Besley and Ghatak, 2007).

The group of caring consumers values the implementation of high labor and environmental standards in the production process. For them, higher standards along the value chain translate into a higher *perceived ethical quality* of variety ω , $\varepsilon(\omega) \geq 0$, which caring consumers value as well as the *physical units* of variety ω they consume, $q(\omega)$.¹⁵ The preferences of caring consumers are given by:

$$U = \left(\int_{\omega \in \Omega} [\varepsilon(\omega) q(\omega)]^\rho d\omega \right)^{1/\rho}, \tag{1}$$

where Ω represents the set of available varieties. This way of modeling quality is standard in the trade literature, see, e.g., Baldwin and Harrigan (2011) and references therein. The perceived ethical quality of a variety depends of CSR levels at the different production stages along the value chain. We discuss this in detail in Section 2.2.4 below. In line with a common approach in the literature, we model CSR as providing product differentiation (see e.g., Kitzmuller and Shimshack, 2012 as well as Ding et al., 2022 and references therein). The degree of ethical differentiation is governed by the parameter $\rho \in (0, 1/2)$.¹⁶ For simplicity, we assume that ethical quality is the only means of differentiation across varieties.¹⁷

2.2.2. Preferences of non-caring consumers

Non-caring consumers are indifferent about ethical quality and therefore only care about the physical quantities they consume. As we assume that all varieties are identical in terms of their physical properties, in their eyes, varieties are homogeneous. Their utility is given by:

$$U' = \left(\int_{\omega \in \Omega} q(\omega) d\omega \right)^\rho. \tag{2}$$

The absence of the perceived ethical quality in these preferences as well as the absence of ethical differentiation of varieties as in Eq. (1) implies that for non-caring consumers, all varieties are perfect substitutes irrespective of their value of $\varepsilon(\omega)$.

2.2.3. Competition and market segmentation

In order to be able to sell to caring consumers, a firm has to incur a fixed cost f of marketing its output as an ethical product to caring

¹⁵ There is ample empirical evidence that consumers care about the ethical content of their consumption and have a higher willingness to pay for ‘ethical’ products. The evidence stems from surveys (O’Rourke, 2005, and Loureiro and Lotade, 2005) lab experiments (Bartling et al., 2015) as well as field experiments with real purchasing decision (e.g., Hiscox and Smyth, 2011, and Hainmueller et al., 2015). Basu and Tzannatos (2003) and Cone (2013) provide evidence that this awareness is increasing over time.

¹⁶ Restricting ρ to be smaller $1/2$ may seem to be an unusual assumption. The need for this assumption arises because the revenue function becomes convex in final output quantity $q(\omega)$ when demand is too elastic (large ρ), see Eq. (16) in Section 2.4. This effect arises in our model because choosing a higher ethical quality shifts the demand function outward *without* raising the marginal cost of physical production, as is usually the case in the quality literature (e.g., Baldwin and Harrigan, 2011, and references therein). In Appendix A.3 we show how this assumption can be easily relaxed by introducing a parameter $\nu \in (0, 1)$ representing the scope of (ethical) quality differentiation in the utility function used recently in Fan et al. (2015) and Bastos et al. (2018) as well as Aghion et al. (2020). In our benchmark model, we have $\nu = 1$. The smaller ν , the higher values of $\rho > 1/2$ are possible up to the usual upper bound of one. To keep the model as simple as possible, we choose to restrict the range of possible values for ρ rather than to introduce an additional parameter.

¹⁷ Product differentiation through CSR is one of the main explanations for CSR investments in the literature, see e.g., Ding et al. (2022) and references therein; see Aghion et al. (2020) for a related approach to modeling social-responsibility concerns.

consumers.¹⁸ Moreover, in order to sell to caring consumers, the firm will have to assure a positive level of perceived ethical quality, as for $\varepsilon(\omega) = 0$, Eq. (1) directly implies that demand from caring consumers will be zero (we discuss the determinants of $\varepsilon(\omega)$ below). Firms that payed the fixed cost f , e.g., to establish an ethical narrative, and assure $\varepsilon(\omega) > 0$, can sell to caring consumers. Eq. (1) implies that they operate under monopolistic competition and can charge a positive mark-up.

Firms that do not incur the fixed cost f cannot sell to caring consumers. They serve only non-caring consumers and the perfect substitutability of varieties in Eq. (2) implies that they operate under perfect competition with their price equal to marginal costs (we specify the marginal costs below and also show that these entail – quite intuitively – zero ethical quality of goods sold to non-caring consumers).

Note that entering the market for ethical goods provides a (discrete) vertical differentiation from the zero-CSR producers serving the non-caring consumers. At the same time, it allows the firm to enter a context where its variety is horizontally differentiated from the other ethically produced varieties. With these observations, it can already be seen at this point, that similar to e.g., Baron (2009) or Besley and Ghatak (2007), a separating equilibrium will arise with a group of ethically differentiated firms selling to caring consumers at high prices and a group of perfectly competitive firms selling to non-caring consumers at low prices. None of the two types of firms would want to (could) serve the other group of consumers simultaneously. In our analysis of the industry equilibrium of our model in Section 2.5.1, we will determine the equilibrium measure of ethically differentiated firms.

2.2.4. Ethical quality and CSR along the value chain

For each intermediate j , there is a large number of ex ante identical potential suppliers in South. The firm picks (is matched to) one supplier for each stage.¹⁹ For simplicity, we assume that all stages are identical across varieties.

The perceived ethical quality of variety ω , $\varepsilon(\omega)$, is determined by the environmental and labor standards implemented in the different production stages. We denote the implemented level of the standard at stage j by $s(j)$. We assume a sequential production process with $j = 0$ being the most upstream input and $j = 1$ the most downstream one. The level of CSR of the supplier at stage j is defined as the difference between $s(j)$ and the level of regulation in South, which we normalize to zero. Therefore, $s(j)$ also represents the level of CSR implemented by supplier j . We assume a constant marginal cost of CSR investment, c_s , which is identical across stages. The CSR levels across production stages shape the perceived ethical quality of variety ω :

$$\varepsilon(\omega) = \left(\int_0^1 s(j)^\alpha dj \right)^{1/\alpha}. \tag{3}$$

With the parameter $\alpha \in (0, 1)$, CSR levels across production stages are gross substitutes. This implies that perceived ethical quality is obtained by aggregating the CSR levels across all production stages. Because our assumption on α implies that we maintain some degree of complementarity between different stages, CSR investments that are homogeneously spread out over the entire supply chain lead to a higher level of perceived ethical quality than concentrating the investments in a small fraction of stages. But how much complementarity is actually warranted for CSR investments along the value chain?

¹⁸ We think of these costs as marketing expenses similar to investments in brand value and reputation. In this case, one element of this brand reputation may be a narrative of the superior ethical quality of the variety compared to varieties produced with inputs sourced on anonymous markets at the lowest possible price, a price that in and of itself is at odds with positive CSR levels (see our description of the production of goods for non-caring consumers below).

¹⁹ In Footnote 29, we show that it is optimal for a firm serving caring consumers to pick only one supplier for each stage.

Well-mediatised but rare events with strong impact on demand like the collapse of the Rana Plaza factory in 2013 or the Nike sweatshop campaign seem to suggest that extreme levels of complementarity may be appropriate when a single “bad apple” in the production chain jeopardizes total sales. Our aim, however, is not to model the effect of such events on the individual firms involved. Our modeling rather concerns the impact of a general awareness of and demand for ethical production (which may be spurred by such exceptional events). With CSR being defined as investments above and beyond local legal requirements, we deem it plausible that a level of zero in some stages does not have devastating effects on demand.

However, we would like to maintain some level of complementarity between CSR at different production stages. Technically, this implies that we should think of α as being relatively small, i.e., closer to zero than to unity. We will see below that the value of α relative to the value of ρ matters in our model. The latter also lies between zero and one (see Footnote 16) and represents the ease with which a consumer can substitute one ethically differentiated variety for another with the identical level of ethical quality. Given that the only source of horizontal differentiation lies in the different ethical narratives of otherwise identical varieties, and given our argument above that α should be relatively close to zero, we focus our analysis on the case where $\alpha < \rho$.²⁰

2.2.5. Production of physical output

Physical production along the value chain takes place according to a Leontief production function. This implies that the production of one unit of final output requires a fixed quantity of each intermediate input j . For simplicity, we assume symmetry across stages and normalize all the Leontief coefficients to 1. Physical output of variety ω is then given by

$$q(\omega) = \min_j \{I(j) x(j)\} \quad (4)$$

where the minimum is taken over all $j \in [0, 1]$ and $x(j)$ is the quantity of input j used in the production process. The indicator function $I(j)$ equals one if the input is provided at the appropriate stage and zero otherwise. This indicator function introduces sequentiality into the production process.²¹

It follows that the quantity of the input the firm sources at stage j is given by $x(j) = q(\omega)$.²² For simplicity, we assume identical marginal production costs c_x for all stages. The total production cost of one unit of the final output is therefore given by:

$$\int_0^1 c_x dj = c_x. \quad (5)$$

With this Leontief production function, we deviate from Antràs and Chor (2013) who assume gross substitutability across stages. Our choice

²⁰ In Antràs and Chor (2013), the parameter α governs the substitutability between quality-adjusted input quantities of the different suppliers (production stages). Clearly, here it would be much more difficult to argue why this – technical – substitutability should be larger or smaller than ρ . Antràs and Chor (2013) thus consider both cases (sequential complements and sequential substitutes) and build their empirical analysis on this distinction. We refrain from doing so for two reasons. First, we have argued above why we think $\alpha < \rho$ is appropriate and second, to our knowledge, there has yet to be found a dataset and a method to empirically determine the value of alpha (the substitutability of CSR levels across suppliers) for different sectors.

²¹ This may seem like a very fragile production process: any violation of the appropriate ordering or any failure of a supplier to contribute its intermediate leads to zero output. We assume, however, that the firm can always buy any input j on the input market, where a generic (zero-CSR) version of each input is readily available at marginal production costs of suppliers. We describe this input market in detail in Section 2.3.1. This implies that the firm can always assure the right sequencing and the required quantity for each input.

²² We postpone the detailed discussion of why this is the case to Footnote 26, as the argument relies on the effects of the input market introduced below.

of production technology is in line, however, with other papers in the literature on the internationalization of production like Grossman and Rossi-Hansberg (2008), Costinot et al. (2013), or Grossman and Helpman (2020). In our view, assuming that inputs along a value chain are complements rather than substitutes appears plausible. Consider, for example, the production of a car. Four wheels and one steering wheel are needed for an operational car and there is no way to substitute one type of wheel for another. Our choice is supported by a recent paper by Boehm et al. (2019) who find a level of complementarity close to Leontief between imported and domestic inputs for Japanese affiliates in the U.S.²³

2.3. Sourcing with sequential production

We now describe the options of the firm to source inputs from independent suppliers in a sequential production process with incomplete contracts. We specify demand by caring as well as non-caring consumers, discuss the hold-up problem resulting from incomplete contracts and specify the bargaining process between the firm and its suppliers.

2.3.1. Relational vs. Anonymous sourcing

Firms can choose to source any input j either from a matched supplier or from the input market. While CSR investments of a matched supplier contribute to the perceived ethical quality, $\varepsilon(\omega)$, an input sourced from the input market does not. We can think of this as an anonymous market where the input cannot be linked to a specific supplier in a way that would affect the perceived ethical quality of the final product. This can be the case when the identity of the producer(s) and/or information about production conditions are lost or not verifiable.²⁴ The large number of potential suppliers for each input j in South stands ready to produce any quantity of inputs for the world market for a price covering their physical production costs.²⁵

As CSR is costly and zero-CSR inputs are readily available for each production stage from the input market, firms serving non-caring consumers will source zero-CSR inputs only — irrespective of whether they source from the input market or their matched supplier. Marginal costs of these firms therefore amount to the physical production costs in Eq. (5), delivering the equilibrium price of zero-CSR varieties of $p_h = c_x$. Recall that markets for ethical varieties and zero-CSR varieties are perfectly segmented. This therefore concludes our analysis of the market for zero-CSR varieties sold to non-caring consumers. In the remainder of the analysis, we focus on ethically differentiated varieties sold to caring consumers. In this case, firms need to assure positive CSR levels along their value chain and therefore have an incentive

²³ The choice of perfect complementarity has the additional advantage that it allows us to study the decision of CSR investments in ethical quality independently of the decision on production quantities. Without perfect complementarity, our model would imply trade off between quantity and ethical quality in the eyes of caring consumers, an implication we neither find realistic nor appealing.

²⁴ Fair trade coffee beans nicely illustrate the point. There is a market for Fair Trade coffee beans and a market for ‘regular’ coffee beans. Due to limited demand and over-production of the Fair Trade farmers, some of the Fair Trade coffee beans are not sold under the Fair Trade label, but are sold as ‘regular’ coffee beans on the world market. As the production conditions cannot be inferred from the coffee bean itself, the information is lost and no buyer can use the Fair Trade label to advertise its final product — even though the coffee beans may have been produced respecting the Fair Trade standards. See, for example, Dragusanu et al. (2014) and de Janvry et al. (2015). Related to our modeling of ethical quality differentiation through CSR, Dragusanu et al. (2022) show that in the coffee market fair trade certification is linked to higher sales.

²⁵ In recent work, Cajal-Grossi et al. (2023) find patterns in the Bangladeshi garments sector that are consistent with our modeling: suppliers obtain higher prices when selling to relational buyers than when selling to spot buyers.

to cooperate with their matched suppliers who can choose to make a relationship-specific CSR investment at their stage j of the production process.

2.3.2. Demand and firm revenue

Maximizing utility of caring consumers in Eq. (1) subject to the budget constraint gives inverse demand as

$$p(\omega) = q(\omega)^{-(1-\rho)} \varepsilon(\omega)^\rho A^{1-\rho} \tag{6}$$

where $p(\omega)$ is the price of one physical unit of variety ω and $A = E/P^{-\rho/(1-\rho)}$ is a demand shifter consisting of total expenditure E as well as the price index P , which are both taken as given by the firm.

Firm revenue is $r(\omega) = p(\omega)q(\omega)$. Inserting (6) for $p(\omega)$ gives $r(\omega) = \varepsilon(\omega)^\rho q(\omega)^\rho A^{1-\rho}$. Combined with (3), this implies

$$r(\omega) = q(\omega)^\rho A^{1-\rho} \left(\int_0^1 s(j)^\alpha dj \right)^{\rho/\alpha} \tag{7}$$

Revenues depend positively on total scale of production, $q(\omega)$, the general level of demand, summarized in A , as well as the perceived ethical quality, which is composed of the CSR levels all along the value chain.

2.3.3. Hold-up and bargaining

We maintain the assumption on incomplete contracts for the physical input $x(m)$ from the Antràs literature. However, due to our assumption of a Leontief production technology from Eq. (4), incomplete contracts do not lead to underinvestment in quantities and the outcome is therefore observationally equivalent to a setting of complete contracts.²⁶ Grossman and Helpman (2020) also use a Leontief technology and make a related argument.

Because the CSR investment makes the input produced by a supplier at some stage m relationship-specific, the firm and its supplier face a standard hold-up problem and the need to share the surplus generated by the CSR investment. In the characterization of the interaction between the firm and the supplier, we closely follow the setting in Antràs and Chor (2013). The firm only pays the supplier after production has taken place, i.e., when the physical production costs are sunk, the CSR investment is sunk and the firm observes the implemented CSR level.

As outlined above, the firm can buy the necessary amount of input m on the input market in case the supplier does not deliver. By the same token, the supplier can sell the input on the input market if no agreement with the firm is reached. This implies that at the bargaining stage the supplier m has an outside option of $c_x x(m)$ and the firm has an outside option of $-c_x x(m)$. It is a standard result that in the equilibrium of the Nash bargaining game each party receives its outside option and the remaining surplus is split between the two parties according to their bargaining power, which we denote by β for the firm and $1 - \beta$ for the supplier. Given the symmetric outside options, this implies that at each stage the firm pays the supplier its production costs $c_x x(m)$ as well as a fraction $1 - \beta$ of the remaining surplus. We follow Grossman and Hart (1986), who assume a fifty-fifty split of the surplus, and Antràs (2003), who assumes that $\beta > 1/2$, and assume $\beta \geq 1/2$.

²⁶ Concerning the optimal input quantity $x(m)$ of a supplier under incomplete contracts and a Leontief production function, consider the following. For any given order size $q(\omega)$ issued by the firm to all its suppliers, a single supplier can either produce more than, less than, or exactly $q(\omega)$. Producing more would be inefficient, as the firm would not seek to buy it. With the CSR investment acting like a fixed cost for the supplier, and the surplus of the match, i.e., the compensation for the supplier, increases in $x(m)$ until $x(m) = q(\omega)$ is reached. This implies that the supplier maximizes its compensation for $x(m) = q(\omega)$, which is strictly preferred to zero CSR, which delivers zero profits for any $x(m)$.

2.3.4. Incremental contribution at stage m

As the firm is in full control of the sequencing of the production stages, we have $I(j) = 1 \forall j < m$ when bargaining at stage m takes place. Recall that the firm can always complete the remaining production stages $j \in [m, 1]$ with inputs purchased on the input market, which do not add to the perceived ethical quality of the final product. At stage m , the firm can therefore be *certain* to obtain *at least* the following revenues:

$$r(m) = q(\omega)^\rho A^{1-\rho} \left(\int_0^m s(j)^\alpha dj \right)^{\rho/\alpha} \tag{8}$$

These are the revenues the firm has secured up to stage m when negotiating with the supplier. The incremental contribution of the supplier at stage m can then be computed using Leibniz' rule:

$$r'(m) = \frac{\partial r(m)}{\partial m} = \frac{\rho}{\alpha} A^{\frac{\alpha(1-\rho)}{\rho}} q(\omega)^\alpha s(m)^\alpha r(m)^{\frac{\rho-\alpha}{\rho}} \tag{9}$$

The incremental contribution to revenue generated at stage m increases in total demand, as reflected by A , in the total scale of production, $q(\omega)$, and in the consumer valuation of the implemented standard, $s(m)$, as well as in all previous CSR investments included in $r(m)$. The assumption that $\alpha \in (0, \rho)$ assures that the latter effect is positive.²⁷ We follow the baseline model in Antràs and Chor (2013) in assuming that this incremental contribution of the supplier to the secured revenues is the surplus of the match and therefore also the surplus bargained over.²⁸

2.3.5. Bargaining along the value chain

Based on the bargaining between the firm and its supplier at stage m , we can now specify the game played by the firm and the continuum of suppliers along the value chain. Initially, the firm selects the physical output $q(\omega)$ it seeks to produce. The firm then selects one supplier for each stage j from a large pool of potential suppliers. Suppliers that were not selected by a firm stand ready to sell input j on the input market at any price larger or equal the production cost c_x . After this, production takes place sequentially starting at $j = 0$ and the firm assures that the optimal sequence of production is respected. Based on the information contained in Eq. (8), the supplier chooses its CSR investment $c_s s(m)$. At the end of the stage, firm and supplier bargain over the surplus of the match. The firm compensates the supplier for the physical production costs and pays it a fraction $(1-\beta)$ of its incremental contribution to total revenues, $r'(m)$, given by Eq. (9). After stage $j = 1$ is completed, the final consumption good is produced by the firm and sold to consumers generating total revenues given by Eq. (7).

2.4. CSR investments

We now turn to the CSR investments of suppliers. First, we consider an individual supplier and then the entire chain of suppliers taking aggregate variables as given. We analyze the determinants of CSR

²⁷ In this context, the assumption of $\alpha \in (0, \rho)$ merits some more discussion, as it relates to the key mechanism in Antràs and Chor (2013). Their central results stem from distinguishing the cases of $\alpha < \rho$ (sequential complements) and $\alpha > \rho$ (sequential substitutes), where α shapes the substitutability of input quantities across production stages. As outlined in Section 2.2.4, it seems to be an eminently plausible assumption that substitutability of CSR levels across production stages is quite low so that we consider the case of sequential complementarity in our baseline setting.

²⁸ This implies that supplier m 's indirect contribution to final revenue, which goes through the effect of supplier m 's investment on the investment decisions of more downstream suppliers, does not enter the bargaining. This simplifying assumption assures that the sequential bargaining of the firm with a continuum of suppliers remains tractable. Antràs and Chor (2013) show that this assumption can be relaxed and study an extension of the model that delivers the identical results on the supplier's investments as in the baseline model.

investments at different production stages in this partial equilibrium context. In Section 2.5 we derive the industry equilibrium of our model and analyze the equilibrium determinants of CSR along the value chain.

The supplier at stage m of the production process knows that it will be compensated for the production cost either by the firm or by selling on the input market. Production costs therefore do not enter the supplier's problem, which is given by:

$$\max_{s(m)} \pi_s(m) = (1 - \beta)r'(m) - c_s s(m). \tag{10}$$

This leads to the following expression for the production standard at stage m :

$$s(m) = \left[(1 - \beta) \frac{\rho}{c_s} A \frac{\alpha(1-\rho)}{\rho} q(\omega)^\alpha \right]^{\frac{1}{1-\alpha}} r(m)^{\frac{\rho-\alpha}{\rho(1-\alpha)}}. \tag{11}$$

Quite intuitively, the optimal level of CSR at stage m is decreasing in the marginal cost of CSR c_s , increasing in the supplier's bargaining power, $1 - \beta$, and increasing in the order size $q(\omega)$ placed by the firm. Combined with Eq. (8), the above equation links the optimal CSR level at stage m to all previous CSR levels. Under the maintained assumption discussed in Section 2.2.4 that $\alpha \in (0, \rho)$, CSR investment at stage m is increasing in previous CSR levels. This allows us to state the following lemma:

Lemma 1. *With $\alpha \in (0, \rho)$, CSR investments along the value chain are sequential complements, i.e., higher levels in previous stages lead to a higher optimal level of CSR in stage m .*

Proof. In the text.

When the incentives for CSR investment of suppliers depend on previous investments by other suppliers, the position in the value chain relative to other suppliers can become a crucial determinant of CSR investment. We therefore now turn to the sequence of CSR investments along the complete value chain. Combining Eq. (11) with Eq. (9), we obtain

$$r'(m) = \frac{1}{\alpha} \left(\frac{1 - \beta}{c_s} \right)^{\frac{\alpha}{1-\alpha}} \left[\rho A \frac{\alpha(1-\rho)}{\rho} q(\omega)^\alpha \right]^{\frac{1}{1-\alpha}} r(m)^{\frac{\rho-\alpha}{\rho(1-\alpha)}}. \tag{12}$$

Using the initial condition $r(0) = 0$, solving this differential equation delivers

$$r(m) = \left(\frac{1 - \rho}{1 - \alpha} \right)^{\frac{\rho(1-\alpha)}{\alpha(1-\rho)}} \left(\frac{1 - \beta}{c_s} \rho \right)^{\frac{\rho}{1-\rho}} A q(\omega)^{\frac{\rho}{1-\rho}} m^{\frac{\rho(1-\alpha)}{\alpha(1-\rho)}}. \tag{13}$$

We can now plug this into Eq. (11), which delivers CSR investments at stage m as

$$s(m) = \left(\frac{1 - \rho}{1 - \alpha} \right)^{\frac{\rho-\alpha}{\alpha(1-\rho)}} \left(\frac{1 - \beta}{c_s} \rho \right)^{\frac{1}{1-\rho}} A q(\omega)^{\frac{\rho}{1-\rho}} m^{\frac{\rho-\alpha}{\alpha(1-\rho)}}. \tag{14}$$

This expression for CSR investments at stage m accounts for CSR investments in all previous stages, which affect the optimal choice at stage m according to Lemma 1. Eq. (14) shows that the standard implemented at stage m depends on the size of the order $q(\omega)$ placed by the firm, which we determine next.²⁹

Total physical output $q(\omega)$ is chosen by the firm in the first stage of the game. The firm knows that it will either have to purchase inputs on the input market or has to compensate its suppliers for their production costs. In either case, costs are given by $\int_0^1 c_x q(\omega) dj = c_x q(\omega)$. The problem of the firm is therefore given by:

$$\max_{q(\omega)} \pi_F(\omega) = \beta r(\omega) - c_x q(\omega) - f. \tag{15}$$

²⁹ Note that the fact that $s(m)$ increases in the size of the order $q(\omega)$ placed by the firm implies that the firm has an incentive to order the entire quantity of input m from one single supplier, as this maximizes the level of the standard under which production takes place and therefore also maximizes the level of perceived ethical quality of the final product.

Based on Eq. (13) evaluated at $m = 1$, we can write total revenue as

$$r(\omega) = \left(\frac{1 - \rho}{1 - \alpha} \right)^{\frac{\rho(1-\alpha)}{\alpha(1-\rho)}} \left(\frac{1 - \beta}{c_s} \rho \right)^{\frac{\rho}{1-\rho}} A q(\omega)^{\frac{\rho}{1-\rho}}. \tag{16}$$

Differentiating $\pi_F(\omega)$ with respect to $q(\omega)$ and setting the derivative equal to zero gives the optimal quantity $q(\omega)$ as

$$q(\omega) = \left(\frac{1 - \rho}{1 - \alpha} \right)^{\frac{\rho(1-\alpha)}{\alpha(1-2\rho)}} \left(\frac{1 - \beta}{c_s} \rho \right)^{\frac{\rho}{1-2\rho}} \left(\frac{\rho}{1 - \rho} \frac{\beta}{c_x} A \right)^{\frac{1-\rho}{1-2\rho}}. \tag{17}$$

We can combine Eqs. (14) and (17) and use the definition of $A = EP^{\frac{\rho}{1-\rho}}$ to get the optimal CSR investment at stage m ,

$$s(m) = \left(\frac{1 - \rho}{1 - \alpha} \right)^{\frac{\rho-\alpha}{\alpha(1-2\rho)}} \left(\frac{1 - \beta}{c_s} \rho E \right)^{\frac{1-\rho}{1-2\rho}} \left(\frac{\rho}{1 - \rho} \frac{\beta}{c_x} P \right)^{\frac{\rho}{1-2\rho}} m^{\frac{\rho-\alpha}{\alpha(1-\rho)}}. \tag{18}$$

We can now state the following lemma:

Lemma 2. *Eq. (18) characterizes how suppliers along a firm's value chain optimally choose their CSR levels taking aggregate variables as given (partial equilibrium). The production standard is higher in more downstream stages, i.e., suppliers that are closer to the final consumer invest more in CSR. With the price index P taken as given, CSR investments also increase in the total expenditure on ethically differentiated goods E .*

Proof. This follows directly from Eq. (18) and $\rho < 1/2$.

Lemma 2 shows that the supplier's CSR investment increases in m , i.e., CSR is higher in more downstream stages. The result reflects the fact that CSR investments are sequential complements along the value chain, as pointed out in Lemma 1. In addition, the overall level of CSR investment across all stages is increasing in aggregate expenditure on ethically differentiated goods. We will see below that E disappears from the equation when we solve for the industry equilibrium of our model. There, a supplier's position in the value chain will emerge as the key determinant of its CSR expenditures in our model.

2.5. Equilibrium CSR

We now derive the industry equilibrium of the model with free entry of final goods producers. This allows us to analyze the equilibrium determinants of CSR investments at the different stages of production.

2.5.1. Industry equilibrium

To solve for the industry equilibrium, we assume free entry and final good producers with homogeneous levels of productivity normalized to 1 so that it must hold that $\pi_F(\omega) = 0 \forall \omega$.

Setting Eq. (15) equal to zero, plugging in the optimal $q(\omega)$ from Eq. (17), and using the fact that $A = EP^{\frac{\rho}{1-\rho}}$ gives an expression for the price index P as

$$P = \left(\frac{1 - \alpha}{1 - \rho} \right)^{\frac{\rho-\alpha}{\alpha\rho}} \left(\frac{1 - \alpha}{\beta E} \right)^{\frac{1-\rho}{\rho}} \frac{c_s c_x}{\rho^2 (1 - \beta)} \left(\frac{f}{1 - 2\rho} \right)^{\frac{1-2\rho}{\rho}}. \tag{19}$$

Next, we solve for the equilibrium number of firms using the optimal pricing rule and the definition of the ideal price index from demand.³⁰ From this, we get a second expression for the price index as a function of the number of firms n as

$$P = n^{-\frac{1-\rho}{\rho}} \frac{c_x c_s}{\rho^2 (1 - \beta)} \frac{1 - 2\rho}{f} \left(\frac{1 - \alpha}{1 - \rho} \right)^{\frac{1-\alpha}{\rho}}. \tag{20}$$

Combining the two results for the price index, one from free entry, Eq. (19), and one from demand, Eq. (20), gives the equilibrium number of firms as

$$n = \frac{\beta E}{1 - \rho} \frac{1 - 2\rho}{f}. \tag{21}$$

³⁰ Details of the derivations are provided in Appendix A.1.

Combining Eq. (19) with Eq. (17) on the one hand, and the definition of $A = EP^{\frac{\rho}{1-\rho}}$ on the other hand, yields expressions for order size $q(\omega)$ and the market size parameter A in industry equilibrium as

$$q(\omega) = \frac{\rho}{c_x} \frac{f}{1-2\rho} \tag{22}$$

and

$$A = \left(\frac{1-\alpha}{1-\rho} \right)^{\frac{\rho-\alpha}{\alpha(1-\rho)}} \frac{1-\alpha}{\beta} \left[\frac{c_s c_x}{\rho^2 (1-\beta)} \right]^{\frac{\rho}{1-\rho}} \left(\frac{f}{1-2\rho} \right)^{\frac{1-2\rho}{1-\rho}}. \tag{23}$$

This allows us to state the following lemma:

Lemma 3. *In industry equilibrium with free entry in the final goods sector, final goods producer size $q(\omega)$ and the equilibrium market size parameter A are both independent of exogenous aggregate expenditure E .*

Proof. Follows directly from Eqs. (22) and (23).

Market and firm size are both independent of the aggregate level of expenditure E in the economy. The reason is that in our setup of free entry with homogeneous final good producers, any increase in aggregate spending will be fully compensated by additional entry into the final goods sector.

2.5.2. Equilibrium CSR along the global value chain

Combining Eqs. (18) and (19), the CSR level implemented at stage m can be written as

$$s(m) = \frac{f}{1-2\rho} \frac{(1-\alpha)\rho}{c_s} \frac{1-\beta}{\beta} m^{\frac{\rho-\alpha}{\alpha(1-\rho)}}. \tag{24}$$

It only depends on parameters and the production stage m . We can now state the following proposition:

Proposition 1 (Equilibrium CSR Along the Global Value Chain). *With CSR investments across production stages being sequential complements, CSR expenditures $s(m)$ in industry equilibrium are increasing along the value chain from upstream to downstream stages.*

Proof. This follows directly from Eq. (24).

This constitutes the main theoretical result of our paper: equilibrium CSR levels increase along the value chain as suppliers get closer to the final consumer. The result is driven by the fact that investments in CSR are sequential complements, as established in Lemma 1: the larger CSR investments at a given stage m , the higher the incentive for more downstream suppliers to invest more. Comparison of the partial equilibrium expression (18) and the equilibrium expression in (24) shows that the increasing profile, our central finding, persists in industry equilibrium. The effect of total expenditure E established in Lemma 2, however, does not survive endogenizing the price index P . We argue below that we use this difference to draw the line between the core testable implication of our model, which holds in industry equilibrium, and variables we merely control for in the empirical analysis, as they play a role in the partial equilibrium analysis only.

Comparison of Proposition 1 to the outcome under complete contracts (see Appendix A.2) shows that the increasing profile of CSR results from the setting of incomplete contracts. We argued above that CSR investments are in many cases observable but non-verifiable (Hart and Moore, 1999). Our model therefore hints at a general problem that may well be a typical feature of CSR along global value chains: when CSR investments are sequential complements (the case for which we argued in Section 2.2.4), the early stages of the production process are the ones that are crucial for the choices along the entire value chain; at the same time, these are the stages with the lowest CSR investments. This implies that for both headquarters and policy makers who seek to increase overall CSR levels along the value chain, the upstream stages of production are the most important ones to target.

2.6. Discussion and link to the data

Before we turn to the empirical analysis, we pause to first discuss how we link our theoretical results to the data. We then place our analysis in the context of the literature on incomplete contracts in international economics and explain why our theory-informed empirical analysis closes a gap in this literature.

2.6.1. Testable implications: Partial vs. Industry equilibrium

As pointed out above, comparison of the partial equilibrium expression for CSR (Eq. (18)) and its industry equilibrium counterpart (Eq. (24)) shows that the central prediction of our theory – the increasing profile of CSR along the value chain – also holds in industry equilibrium. We bring this prediction to the data in Section 3, where we also provide a detailed description of the data. At this stage, simply note that we use Indian firm-level data together with input–output tables to compute a firm-level measure of upstreamness. Moreover, we observe CSR investments at the firm level. This allows us to investigate the negative relationship between upstreamness and CSR investments established in Proposition 1. If we had ended the theoretical analysis with the partial equilibrium expression for CSR investments in Eq. (18), we could have deduced additional testable implications from the theory. Specifically, taking the price index P as given, Lemma 2 states that the CSR investments by the supplier at stage m of the production process increase in total expenditures on ethically differentiated goods, E . Proposition 1, however, shows that when the equilibrium price index is accounted for, the effect of E vanishes. This is an implication of the simple (Krugman, 1980) structure of our modeling of the ethically differentiated homogeneous final good producers, which leads them to having a constant equilibrium size. Adjustments to changes in aggregate variables are exclusively driven by adjustments in the number of firms but not by adjustments of CSR at the firm-level (see Eqs. (21) and (22)).³¹

As the impact of demand for ethical products does not survive the computation of the industry equilibrium, we do not consider it a core testable implication of our model. As it is, however, a partial equilibrium prediction and because its vanishing is intimately linked to the assumption of homogeneous firms, we still consider it a relevant prediction of our theory that merits further analysis in the empirical section, where we take the share of sales going to OECD countries as a proxy for being exposed to stronger demand for ethical quality.

2.6.2. A direct measure of the non-contractible variable

As indicated above, our data allow us to take a very direct approach to linking our model to the data. In our opinion, this approach fills a gap in the empirical literature on the role of incomplete contracts in international economics. The literature is surveyed in Antràs and Yeaple (2014) and Antràs (2016), with Alfaro et al. (2019) being a recent example. The empirical studies are grounded in theoretical models, where incomplete contracts lead to underinvestment in a relationship-specific non-contractible variable (typically quality-adjusted inputs). In our model, this non-contractible variable is CSR investment, which has some similarities with the quality dimension in the mentioned literature. It goes without saying that such non-contractible variables are difficult to measure. The literature therefore typically resorts to the observable organization of production as a dependent variable, which – according to the theory – is driven by the unobservable non-contractible variable. Nunn (2007) sheds empirical light on this theoretical mechanism showing that relationship-specificity shapes the

³¹ This result stems from the proportionality of the equilibrium number of firms and market size that is well known from the Krugman (1980) model. In our setup, the countervailing effects of increasing CSR investments due to larger aggregate expenditure and decreasing CSR investment due to competition for market shares from additional entrants exactly cancel.

patterns of international trade. Based on Nunn (2007), Nunn and Trefler (2008) construct a country- and industry-specific measure of contractual completeness. They find that improved contracting of the inputs provided by the supplier favors integration over outsourcing. Our analysis adds an additional and complementary dimension: To our knowledge, ours is the first paper to use a direct measure of the non-contractible variable. This becomes possible as we shift the attention from some technical, but by construction externally unobservable, product or service characteristic to CSR investments, for which we do have a firm-level measure in our data. We can therefore directly study the effect – in our case of a supplier's value chain position – on the non-contractible variable without recurring to the organization of production as a substitute observable outcome for the unobservable (under)investment decision.³²

3. GVC position and CSR in India

In this section, we take the model to the data by testing whether CSR spending is larger when firms are positioned more downstream in global value chains. We begin with the description of the data.

3.1. Data description

For our analysis, we combine the World Input–Output Database (WIOD, Timmer et al., 2015) with the Prowess database.³³ Our sample covers the years 2000 to 2013. The Prowess database contains a wide range of Indian firm-level information for medium-size and large firms. Its coverage of the Indian economy is comprehensive, with total production of all companies in Prowess accounting for more than 80% of India's GDP (Bos and Vannoorenberghe, 2018). The data are collected by the Centre for Monitoring Indian Economy (CMIE), which mainly sources information from annual reports of firms, stock exchanges and regulators. India is particularly well-suited to bring the theoretical predictions of our model to the data. First, the reduction in trade barriers following India's accession to the WTO in 1995 substantially increased India's integration into GVCs. Second, compared to most developed countries, firms in India are much less constrained by labor and environmental standards leaving ample room for voluntary CSR investments. Finally, related to our assumption of incomplete contracts, the congested court system amplifies the problem that contracts between the supplier and the headquarter are observable but not verifiable (Boehm and Oberfield, 2020; Hart and Moore, 1999).

In our theory, CSR is any action by a supplier that leads to an increase in the perceived ethical quality of the final product. This can be any action that makes the supplier appear more ethical in the eyes of consumers. We therefore use details on firms' spending on staff welfare and expenses for the benefit of society or the community in general as our measure of a firm's CSR activities, our dependent variable. It is a unique feature of the data, and especially rare in an emerging economy context, that we can observe this information at the firm level. We describe the variable in more detail in Section 3.2.1.

Moreover, the data include detailed information on general firm characteristics such as annual sales, export activity, ownership, input sourcing, age and the product mix. The latter is key for our empirical

³² We do acknowledge that the analysis of the determinants of the integration vs. outsourcing decision of the firm is an important endeavor in its own right. Here, we simply want to highlight that our approach allows us to investigate the non-contractible variable directly and thereby closes a gap in the previous literature.

³³ We use the Prowess vintage of December 2017. Data were downloaded from <https://prowessdx.cmie.com> on February 1, 2018. The WIOD release 2016 was downloaded from <http://wiod.org/home>. Data were downloaded on July 22, 2019.

strategy.³⁴ We exploit differences in the product mix across firms as well as within firms over time to construct a firm-specific measure of the GVC position. To do so, we combine the Prowess data with industry-level information from WIOD. In a first step, we follow Antràs et al. (2012) and Antràs and Chor (2018) and use WIOD to construct a time-varying measure of Indian industries' *upstreamness*. Linking WIOD industries to the firms' products from Prowess, we use the product-level sales shares as weights in the calculation of an average, firm-specific *upstreamness*, our measure of a firm's value chain position. We describe the calculation of our main independent variable in more detail in Section 3.2.2.

Notably, multi-product firms account for 47% of Indian manufacturing firms and 80% of manufacturing output Goldberg et al., 2010b, p.1043. Therefore, a key feature of our approach is that even for firms within the same main industry, measured GVC positions may differ across firms, either because of differences in the product mix or because of differences in the sales weights of identical product mixes. Our measure also varies over time and within firms if a firm's product sales weights change or if it adds or drops products. In addition, a firm's value chain position may change over a longer horizon if the position of its products changes.

Section 135 of the 2013 Indian Companies Act obliges firms above a certain turnover and profitability threshold to spend 2% of their average net profits on CSR from 2014 onwards. Compliance with the law changes the CSR decision of a firm and might also change its reporting behavior.³⁵ To avoid such a discontinuity in their CSR spending, we limit the analysis to the period between 2000 and 2013, although our data are available up to 2014.³⁶ In the next section, we describe our key variables of interest, CSR spending and a firm's GVC position, in more detail.

3.2. Measuring CSR spending along GVCs

A complex set of motives can drive a firm's strategy on CSR spending (Bénabou and Tirole, 2010; Crifo and Forget, 2015). Crifo and Forget (2015) describe a firm's CSR decisions as a response to market imperfections with the aim of satisfying social preferences of at least one stakeholder. In the context of GVCs, satisfying these social preferences becomes even more complex as firms face not just domestic but also foreign stakeholder demands (Newman et al., 2018). Consumers in developed countries increasingly demand that minimum standards for working conditions and environmental aspects of production are observed also at production sites abroad. Before we focus on the empirical specification, we explain our measure of CSR spending.

3.2.1. Measuring a firm's CSR spending

There is no general agreement about the definition of CSR nor a common way of quantifying CSR spending (Crifo and Forget, 2015; Newman et al., 2020). Shirodkar et al. (2018) claim that in the context of developing and emerging countries, CSR primarily refers to the commitment to behave ethically and to contribute to economic

³⁴ Goldberg et al. (2010b) emphasize that it is a rare feature of the Prowess database that it captures annual changes in the product mix at the firm level. This feature stems from the Indian 1956 Companies Act requiring firms to disclose product-level information on capacities, production and sales in their annual reports. Several previous studies have used this information, e.g., Goldberg et al. (2010a), Goldberg et al. (2010b), De Loecker et al. (2016), Barrows and Ollivier (2021), Bos and Vannoorenberghe (2018) and Barrows and Ollivier (2021).

³⁵ See Dharmapala and Khanna (2018) for more details on the legislation and an evaluation of the effects on firm's CSR activities.

³⁶ To control for potential anticipation effects, we carry out robustness tests (available upon request) where we exclude the years 2011 to 2013 and where we exclude firms that are affected by the reform. We find that our results are unaffected.

development. McWilliams and Siegel (2001, p.117) define CSR more strictly as “actions that appear to further some social good, beyond the interests of the firm and that which is required by law”. In this paper, we follow this concept and a large literature by defining our dependent variable as social spending beyond what is required by law (Bénabou and Tirole, 2010; Crifo and Forget, 2015; Newman et al., 2018, 2020).

We argue that this approach is especially well-suited in the context of GVC integration of firms originating from developing or emerging countries because these firms are operating in a relatively lax social and environmental regulatory setting. Facing lenient domestic regulation, firms respond to market failure with higher CSR spending to satisfy stakeholder demands (Bénabou and Tirole, 2010; Crifo and Forget, 2015). In the context of GVC integration, the CSR decision of firms located in developing countries is determined by relatively higher demand for CSR by foreign stakeholders (Newman et al., 2018).

Our data allow us to directly observe monetary CSR spending on own staff welfare and expenses for the benefit of the society or the community. We use this information to measure what we call *production standard* or *CSR investment* in the theoretical model. *Staff welfare spending* refers to various amenities that are made available to the employees for their general welfare and go beyond regular compensation in the form of salaries. Staff welfare spending includes free or subsidized medical treatment, transportation facilities, recreation facilities, staff food, and canteen expenses. These aspects all cover labor welfare, which is the predominant component of CSR spending in emerging economies (Newman et al., 2018). *Society or community spending* refers to expenses on building or maintaining public parks, garden maintenance, building temples, constructing roads or contributing to social occasions, etc. These community-related expenses closely refer to the catalog of community-related CSR activities applied by Newman et al. (2018, 2020).³⁷

Following Dharmapala and Khanna (2018), we replace missing CSR information with zeros. This appears plausible in this setting as we see no obvious reason why firms with positive CSR spending would not report it; firms with zero CSR, in contrast, may have an incentive not to report rather than to declare zero CSR.³⁸

Our ability to observe the money amount of CSR spending allows us to investigate the continuous relationship between CSR spending and a firm’s position in GVCs. Accordingly, we can directly exploit variation in the level of CSR spending across firms and within a firm over time. We argue that our focus on observable data of the monetary expenses related to CSR, but not labeled CSR, substantially reduces a possible bias due to self-reporting of firms as discussed in Newman et al. (2020).

3.2.2. Measuring a firm’s value chain position

We now turn to the key explanatory variable of interest: a firm’s GVC position. Our model predicts that a firm’s CSR spending depends crucially on its position in the value chain. Without recurring to a theoretical model, Newman et al. (2018) control for the role of the value chain position by using a time-invariant firm fixed effect. Our data allow us to not only control for a possible impact of the value chain

³⁷ Another important CSR component is spending related to environmental issues. Although we observe expenses on environmental causes in our data, we do not include this dimension in our main specification. The reason is that we cannot be sure that these expenses are truly voluntary. This variable could also capture, e.g., compulsory investment in environmentally friendly technologies required by law.

³⁸ Also note that we will see in 3.3.3 that this assumption is only relevant in two of our six specifications. In the other specifications, all zeros in CSR spending are dropped, investigating the intensive margin of CSR, i.e. variation across firms with positive CSR and the variation of positive CSR values within a firm over time. Further analysis (reported in Table B.2 in the appendix) reveals that also the results of the two specifications including zero CSR observations are not affected by the choice to treat missing values of CSR as zeros.

position of CSR but to estimate the effect. To do so, we calculate a time-varying and firm-specific measure of a firm’s position in GVCs based on a combination of value chain information of industries from the World Input–Output Database and the Prowess information on product-level sales of firms.

In a first step, we calculate Indian industries’ position in GVCs based on contributions by Antràs et al. (2012) and Antràs and Chor (2018). They show how World Input–Output Tables can be used to calculate an industry’s *upstreamness*, measuring the distance of an industry’s sales from final consumption. In line with this approach, we start by computing upstreamness U_k^v of industry v in country k (India) by computing

$$U_k^v = 1 \frac{F_k^v}{Y_k^v} + 2 \frac{\sum_{w=1}^W \sum_{l=1}^L a_{kl}^{vw} F_l^w}{Y_k^v} + 3 \frac{\sum_{w=1}^W \sum_{l=1}^L \sum_{x=1}^W \sum_{m=1}^L a_{kl}^{vw} a_{lm}^{wx} F_m^x}{Y_k^v} + \dots, \tag{25}$$

where F_k^v/Y_k^v is the share of global final consumption in industry v ’s gross output in country k . The following terms capture the proximity to final consumption of industry v in country k through its sales in intermediates. For instance, the second summand includes the share of output from industry v in country k , which is consumed by industry w in country l and sold to final consumers, multiplied by a_{kl}^{vw} , which measures the dollar amount of industry v ’s output in country k needed to produce one dollar worth of industry w ’s output in country l .

The upstreamness of an industry is the weighted average of the number of stages that separate the typical unit of output in industry v from final consumers. The weighting scheme gives a higher weight to the more indirect sales. If industry v ’s output in country k is completely sold to final consumers, U_k^v equals unity. If a part of the output is sold as intermediates, U_k^v is above one and a higher value of U_k^v associates with higher upstreamness. Accordingly, larger values of U_k^v are associated with increased distance to final consumption.

We use the WIOD to apply this methodology to the Indian economy. We exclude non-tradable industries in the construction of our key dependent variable.³⁹ Table 1 shows summary statistics of the derived industry upstreamness measure for 34 tradable 2-digit industries based on the ISIC-4 classification. In our period, the average upstreamness of Indian industries varies between 1.22 (water transport) and 3.80 (mining and quarrying). Across all industries, the average upstreamness is 2.05. The maximum value for upstreamness (4.08) is measured in the *mining and quarrying* industry in 2008 and the minimum (1.17) is measured in the *water transport* industry in 2012. Looking at manufacturing industries only, the most downstream manufacturing industry is *manufacture of basic pharmaceutical products and pharmaceutical preparations* (1.51), while *manufacture of chemicals and chemical products* (3.33) is the most upstream one.

Next, we combine the industry-level upstreamness measure with product-level sales information to obtain a measure of upstreamness at the firm level. For each firm-year observation, we use the product-level sales shares as weights to calculate the weighted average of upstreamness of the firms’ product portfolio as illustrated in Eq. (26), so that

$$U_{f_t} = \sum_{v=1}^V \frac{\text{sales}_{f_t}^{vt}}{\text{sales}_{f_t}} U_{f_t}^v, \tag{26}$$

³⁹ We base the classification of industries as non-tradable on the export pattern revealed in WIOD. To avoid that an industry with negligibly small exports is defined as tradable in one year and as non-tradable in the next year, we define a threshold, above which an industry is classified as tradable. The threshold is defined as the lowest amount that avoids any switching between being classified as tradable or non-tradable during our covered period. The exclusion of non-tradable industries affects 20 industries in WIOD, e.g., *public administration and defense; compulsory social security, education and accommodation and food service activities*.

Table 1
Industry upstreamness measure for India.
Source: Own calculation based (Antràs and Chor, 2018) and WIOD data.

ISIC-4 industry	Mean	Sd	Min	Max
Mining and quarrying	3.80	0.18	3.52	4.08
Manufacture of chemicals and chemical products	3.33	0.06	3.21	3.40
Manufacture of coke and refined petroleum products	2.79	0.20	2.52	3.05
Manufacture of basic metals	2.71	0.07	2.60	2.80
Manufacture of paper and paper products	2.63	0.08	2.48	2.74
Manufacture of other non-metallic mineral products	2.34	0.03	2.29	2.42
Manufacture of rubber and plastic products	2.33	0.03	2.28	2.40
Manufacture of fabricated metal products, except machinery and equipment	2.27	0.04	2.20	2.32
Telecommunications	2.24	0.10	2.08	2.42
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	2.17	0.06	2.05	2.24
Manufacture of computer, electronic and optical products	2.14	0.20	1.93	2.58
Wholesale and retail trade and repair of motor vehicles and motorcycles	2.10	0.06	2.02	2.20
Warehousing and support activities for transportation	2.07	0.07	1.96	2.18
Retail trade, except of motor vehicles and motorcycles	2.07	0.05	1.99	2.15
Wholesale trade, except of motor vehicles and motorcycles	2.07	0.05	1.99	2.15
Manufacture of electrical equipment	2.00	0.10	1.88	2.17
Printing and reproduction of recorded media	2.00	0.07	1.88	2.12
Legal and accounting activities; activities of head offices; management consultancy activities	2.00	0.07	1.86	2.08
Land transport and transport via pipelines	1.95	0.05	1.87	2.03
Manufacture of machinery and equipment n.e.c.	1.94	0.07	1.83	2.05
Manufacture of furniture; other manufacturing	1.90	0.10	1.77	2.08
Forestry and logging	1.88	0.05	1.81	1.97
Manufacture of other transport equipment	1.84	0.21	1.58	2.19
Crop and animal production, hunting and related service activities	1.78	0.06	1.65	1.83
Architectural and engineering activities; technical testing and analysis	1.71	0.15	1.51	1.97
Other service activities	1.66	0.07	1.52	1.80
Manufacture of textiles, wearing apparel and leather products	1.63	0.05	1.55	1.71
Manufacture of motor vehicles, trailers and semi-trailers	1.61	0.09	1.49	1.75
Manufacture of food products, beverages and tobacco products	1.54	0.06	1.42	1.61
Manufacture of basic pharmaceutical products and pharmaceutical preparations	1.51	0.03	1.47	1.56
Air transport	1.51	0.14	1.26	1.71
Computer programming, consultancy and related activities; information service activities	1.46	0.09	1.29	1.59
Construction	1.34	0.04	1.28	1.44
Water transport	1.22	0.05	1.17	1.37
Across all industries	2.05	0.54	1.17	4.08

Note: Only tradable industries are considered.

where U_{ft} is the level of upstreamness of firm f at time t selling products from V different industries.⁴⁰ The measure accounts for the product mix by weighting a product’s GVC position U^{vt} with its share of total sales in year t .⁴¹

Our measure of a firm’s GVC position U_{ft} has three sources of variation. First, the measure is affected by changes in a firm’s product portfolio, i.e., if a firm drops or adds new products. Second, for a given product mix, the relative importance of the different products may change. Third, the GVC position of the different products in a firm’s portfolio changes over time (e.g., because some of the firm’s products are increasingly used in more downstream industries).⁴²

The Prowess database contains a broad range of firm-level information allowing us to address the relation of upstreamness and CSR investments. The database is, of course, not free of limitations. Most importantly in our context, buyer–seller relationships cannot be identified in the data: neither do we know the identities of upstream suppliers a firm in our data is sourcing from, nor do we know its

⁴⁰ Our approach is comparable to the approach by Chor et al. (2021), who also combine an industry GVC measure with a firm’s product information. They use firms’ exports (imports) in an industry in total exports (imports) as weights to derive a firm-specific GVC position for Chinese firms. Similar to our derived GVC measure, the respective GVC measure varies over time within a firm.

⁴¹ For some firms, there is no product-level information available. In these cases, we take the upstreamness of the main industry of the firm as the measure of the GVC position. This affects 8.49% of the observations, which enter our empirical estimation.

⁴² Fig. B.1 in the Appendix illustrates the sources of variation for a firm in the electrical equipment industry.

customers. In terms of the model, we have information about individual ‘suppliers’ (firms in our data), like CSR spending and value chain position, but we do not observe their linkages along an actual value chain. Moreover, we do not have the empirical equivalent of the ‘final goods producer’ in the model. Therefore, we cannot test any prediction of the model concerning the effect of actions of upstream suppliers on more downstream suppliers (like sequential complementarity) or concerning the effect of characteristics of the final goods sector like the substitutability of varieties.

3.3. Empirical specification

We start the discussion of the empirical methodology with a description of the main empirical setup, including the presentation of other independent variables, which may drive CSR decisions of firms. After discussing descriptive statistics, we present the empirical results.

3.3.1. Empirical set-up

Proposition 1 predicts that CSR expenditures increase along the value chain from upstream to downstream stages. To empirically test this prediction, we estimate the following two equations.

$$Y_{fvt} = \alpha_0 + \beta_1 U_{ft-1} + \beta_2 X_{ft-1} + \gamma_{vt} + \delta_s + \epsilon_{fvt}, \tag{27}$$

$$Y_{fvt} = \alpha_0 + \beta_1 U_{ft-1} + \beta_2 X_{ft-1} + \zeta_f + \tau_t + \epsilon_{fvt}, \tag{28}$$

where Y_{fvt} measures CSR spending of firm f active in main industry v in year t . In our main specifications, we apply two different estimators, OLS and PPML. To apply OLS, we take the natural logarithm of a firm’s CSR spending ($\log(\text{CSR spending}_{ft})$). We therefore drop firms with

zero CSR spending from our sample to capture the intensive margin effect, describing the relationship between CSR spending and value chain position for firms with positive CSR spending. Our alternative specification applying PPML with $CSR\ spending_{fvt}$ as the dependent variable allows us to keep zeros in the data. Hence the specifications using PPML with zeros also capture extensive margin effects, i.e. switches from zero to positive CSR.⁴³

Our main explanatory variable of interest is a firm's GVC position at time $t-1$, $U_{f,t-1}$. In all regressions, we expect $\beta_1 < 0$, which indicates lower CSR spending for more upstream firms.

In our choice of fixed effects, we use two different approaches to analyze the relation between CSR spending and upstreamness. First, Eq. (27) is a repeated cross section in which we include state δ_s and industry-year γ_{vt} fixed effects.⁴⁴ We include state fixed effects δ_s to capture differences between Indian states which may affect the level of CSR spending in all firms alike, for example, differences in labor regulation. The industry-year fixed effects γ_{vt} capture shocks common to all firms in a particular industry and year. Some industries may be under tighter public scrutiny in general (e.g., tobacco), face higher levels of market concentration, or there might be industrial disasters that affect certain industries in specific years. Accordingly, Eq. (27) exploits variation *between* firms within the same state, main industry, and year.

Second, Eq. (28) exploits time-series variation within firms. We only include firm fixed effects ζ_f and year fixed effects τ_t . ζ_f captures unobservable firm characteristics, which are time-invariant. τ_t captures year-specific shocks to CSR spending common to all firms. In this specification, we thus exploit within-firm variation over time. In our data, we observe a firm for 6.8 years on average.

$X_{f,t-1}$ includes firm-level control variables to capture alternative drivers of CSR spending. Similar to $U_{f,t-1}$, the control variables enter with a one-year time lag. We now present these control variables in more detail.

As discussed in Section 2.6.1, in partial equilibrium, results predict higher CSR levels for larger market size of ethical goods (the parameter E in the model, see Eq. (14)). The variable *OECD export exposure* controls for the possibility that some firms are more exposed to more ethically demanding markets. The variable builds on the assumption that stakeholders in OECD countries are, on average, more ethically demanding. The measure is constructed similar to the upstreamness based on WIOD industry data as an industry's exports to OECD countries relative to the industry's total exports weighted with a firm's product portfolio.⁴⁵

The variable $\log(Wages)$ is a proxy for firm-level wage payments.⁴⁶ We take the hourly compensation paid in Indian industries from WIOD

⁴³ PPML is widely used in the literature of international economics and does not require taking the natural logarithm of the dependent variable. Thus, using PPML also allows us to explore within firm variation over time for those firms that start spending on CSR during our analyzed period. Moreover, it outperforms its alternatives in the presence of many zeros and heteroskedasticity (Silva and Tenreiro, 2006). Over the last years, OLS using inverse hyperbolic sine (i.h.s.) transformation of the depending variables became a popular alternative to consider zero observations. In Section 3.4.5, we apply OLS with i.h.s. transformation to verify the robustness of the results. However, since OLS with i.h.s. is sensitive to the unit of the dependent variable (cf. Aihouton and Henningsen, 2020; McKenzie, 2023), we remain with PPML as our preferred specification.

⁴⁴ Our results are robust to the inclusion of industry-year-state fixed effects (cf. Table B.5 in the appendix).

⁴⁵ See Appendix B for more details on the construction of the variable. As discussed in Section 2.6.1, the partial equilibrium prediction vanishes in the industry equilibrium. We therefore prefer to treat it as a control variable, noting, however, that it does test a partial equilibrium prediction of our model and therefore deserves special attention among the control variables.

⁴⁶ Unfortunately, the provision of the number of employees is not compulsory for firms and hence we cannot reliably calculate the wage per employee.

and use the product-level information of firms to generate a firm-level control variable that is similar in spirit to our firm-level upstreamness and OECD export exposure measures. More specifically, we calculate the variable as an industry's average hourly compensation to employees weighted by a firm's product sales in the respective industry and year (see Appendix B for details). There are several reasons why CSR spending and wages may be correlated. Flammer (2015) and Newman et al. (2020) find a positive effect of CSR on labor productivity, suggesting a positive relation to wages, while Newman et al. (2020) also find evidence pointing at substitutability of wages and CSR. There are good arguments for a link between CSR and wages. A firm paying "living wages", for example, is paying higher wages as one form of CSR, which may then be correlated with our CSR measure containing elements related to worker welfare. If wages varied systematically along the value chain, this may bias our results, which leads us to control for wages.⁴⁷

The variable *export share* captures a firm's internationalization as the share of export sales in total sales. In introducing this control variable, we follow Newman et al. (2018) who find that exporting firms are more likely to invest in CSR. They argue that a key driver is a change of stakeholder preferences with entry into export markets. Internationalization broadens the set of stakeholders, also including foreign governments, buyers of intermediates and consumers. The variable *domestic inputs/all inputs* proxies for a firm's local embeddedness. It is calculated as the share of domestically sourced inputs over all inputs. Newman et al. (2020) argue that dependence on local inputs positively affects firms' social activities within their community. The dummies *state owned* and *foreign owned* capture differences in shareholder preferences depending on the type of ownership. For example, Brucal et al. (2019) show that Indonesian firms improve their CO2-efficiency after foreign acquisition. Finally, the variable $\log(Sales)$ controls for size and $\log(Age)$ for the age of a firm. Both variables are calculated by taking the respective natural logarithm. In both specifications, we cluster the error terms ϵ_{fvt} at the firm level. We now turn to the presentation of descriptive statistics.

3.3.2. Descriptive statistics

Table 2 reports summary statistics of all relevant variables based on the sample employed in the empirical estimations. On average, firms spend 141,269 USD per year on CSR. The highest amount spent on CSR in the sample, USD 142 million in 2006, was spent by a firm active in the *machinery and equipment* industry, producing 51 products spanning ten WIOD industries.

In the overall sample, the average level of firm-specific upstreamness is 2.05, with values ranging from 1.17 to 4.08. The firms reporting product-level information produce on average 2.95 products from 1.52 WIOD industries. The multi-product nature of most firms illustrates that it is not sufficient to control only for the main product's GVC position because this would neglect differences in GVC positions across the firm's products. In terms of internationalization, 6.49% of the firms are foreign-owned and the firms export on average 11.36% of sales.

3.3.3. Main empirical results

Table 3 shows our key empirical results. Columns (1) to (3) present results for the cross sectional specifications based on Eq. (27) and columns (4) to (6) present those for the panel specification based on Eq. (28). The cross section OLS estimation is shown in column (1). Since we take the natural logarithm of CSR spending, firms without any CSR spending in a respective year do not enter the sample. Columns (2) and (3) report results from PPML estimations. Column (2) serves as a bridge between OLS and the full PPML as it reports the PPML results

⁴⁷ We find a moderate positive correlation of about 0.3 between our variables measuring upstreamness and wages, implying that, if anything, the more downstream firms tend to pay lower wages.

Table 2
Summary statistics.
Source: CMIE Prowess.

Variable	Obs	Mean	Std. Dev.	Min	Max
CSR (in USD)	81,749	141,268.6	1,260,149	0	142,000,000
log CSR	54,397	10.16	1.83	7.13	18.77
Upstreamness	81,749	2.05	0.54	1.17	4.08
OECD export exposure	81,749	0.31	0.22	0.00	0.86
log Wages	81,749	3.21	0.43	1.92	4.79
Export share	81,500	0.11	0.25	0.00	1.00
Domestic inputs/total inputs	81,749	0.35	0.44	0.00	1.00
State-owned	81,749	0.00	0.04	0.00	1.00
Foreign-owned	81,014	0.06	0.25	0.00	1.00
log Sales	79,638	1.48	2.51	-6.68	11.07
log Age	81,736	2.78	0.74	0.00	5.01
number of products	74,809	2.95	2.31	1.00	51.00
number of 2-digit industries per firm	74,809	1.52	0.80	1.00	10.00

Note: Only tradable industries are considered.

Table 3
Regression results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.211*** (0.051)	-0.234** (0.104)	-0.225** (0.108)	-0.135*** (0.039)	-0.184*** (0.061)	-0.170*** (0.060)
OECD export exposure	0.086 (0.105)	0.567** (0.235)	0.651*** (0.231)	0.288*** (0.065)	0.533*** (0.118)	0.567*** (0.120)
log(Wages)	0.238*** (0.078)	-0.083 (0.190)	-0.053 (0.192)	0.223*** (0.039)	0.009 (0.096)	0.010 (0.097)
Export share	0.379*** (0.046)	0.149 (0.187)	0.200 (0.186)	0.143*** (0.040)	0.222*** (0.083)	0.265*** (0.083)
Domestic inputs/total inputs	0.228*** (0.027)	0.245*** (0.078)	0.323*** (0.078)	0.041** (0.018)	0.045 (0.033)	0.081** (0.034)
State-owned (D)	0.520* (0.273)	0.139 (0.172)	0.161 (0.181)	0.148 (0.169)	0.049 (0.094)	0.050 (0.094)
Foreign-owned (D)	1.037*** (0.046)	0.522*** (0.093)	0.562*** (0.095)	0.048 (0.049)	0.188*** (0.065)	0.193*** (0.067)
log(Sales)	0.582*** (0.008)	0.857*** (0.028)	0.881*** (0.028)	0.315*** (0.010)	0.463*** (0.025)	0.472*** (0.025)
log(Age)	0.219*** (0.015)	0.197*** (0.051)	0.221*** (0.051)	0.141*** (0.030)	0.302*** (0.063)	0.323*** (0.063)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	54,394	54,394	81,749	51,645	51,645	64,851
Number of firms	11,291	11,291	15,512	8,533	8,533	9,596
Pseudo/Adjusted R ²	0.577	0.837	0.842	0.140 ^a	0.975	0.969

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

for the sample of firms reporting positive CSR spending only. Column (3) shows the results of the PPML estimation including firms with zero CSR spending, which allows us to use a substantially larger sample.

In the cross sectional estimations, the unrestricted sample includes 81,749 observations (column (3)), while the exclusion of firms reporting zero CSR spending reduces the sample to 54,394 observations (columns (1) and (2)).

Upstreamness is negative and significant in all three specifications. The coefficients are quite stable across specifications, ranging between -0.21 and -0.23. Firms that are located more upstream have lower CSR spending compared to firms that are more downstream. We take this finding on the relationship between CSR spending and a firm's GVC position as support for our model's prediction of higher CSR spending in more downstream firms.

In the panel estimations in columns (4) to (6), we report the results from the specification that exploits time variation within firms. Except

for the fixed effects structure, they mirror columns (1) to (3). Again, we find the expected negative effect for upstreamness. It is significant at the 1%-level in all three specifications. The OLS estimation and the PPML estimation excluding zero CSR spending exploit information from 8,533 firms and 51,645 observations in total, respectively. The specification of column (6) also includes firms which report zero CSR spending in some years. This increases the number of observations to 64,851 and the number of firms to 9,596. Again, we take the significant findings of the panel estimations as empirical support for our theoretical prediction of increasing CSR spending along the GVC. Firms that become more upstream over time spend less on CSR on average.

To analyze the economic relevance of the findings, Fig. 2 illustrates the predicted level of CSR spending based on the first four columns, while varying the GVC position and holding all other variables constant

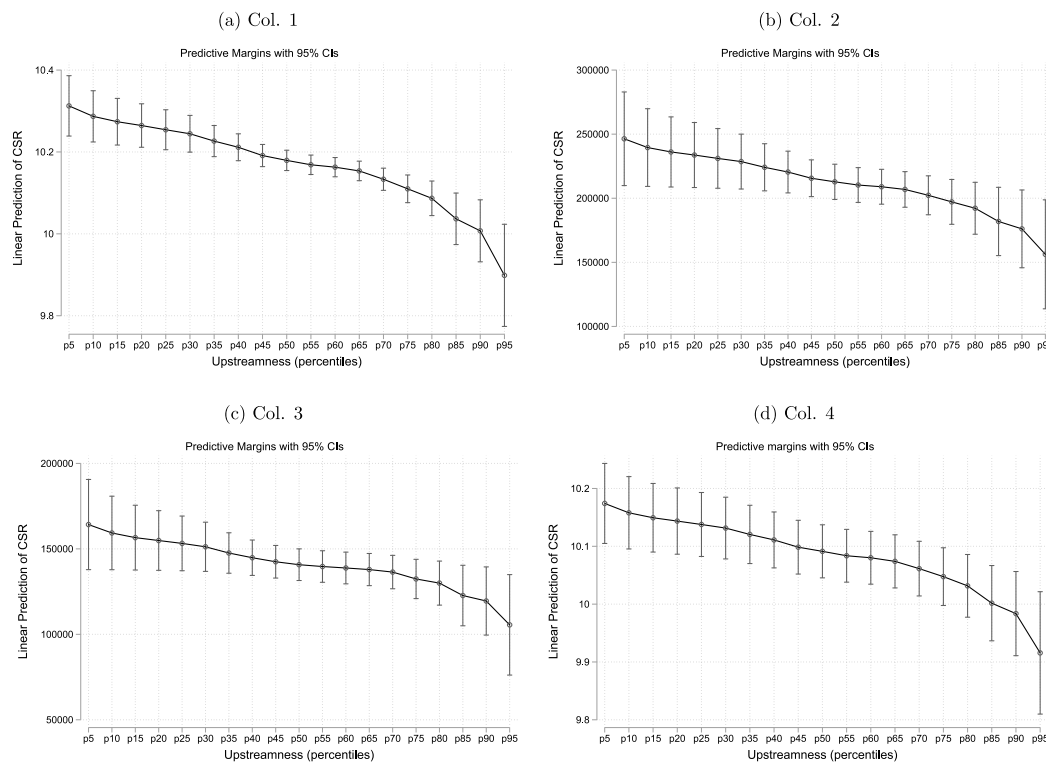


Fig. 2. A firm’s GVC positioning and predicted CSR spending.

at their means.⁴⁸ In all four columns, the negative relationship is visible across all percentiles. Turning to the graph based on column (3), which includes also zero reported CSR spending, we find at the fifth percentile a predicted CSR spending of 164,130 USD compared to 105,679 USD at the 95th percentile. Accordingly, comparing a very upstream position with $U_{f,t-1}$ equal to 3.29 to a very downstream position with $U_{f,t-1}$ equal to 1.33 increases the predicted CSR spending by 55.31%, which is arguably an economically relevant magnitude.

Our empirical estimations thus strongly support our main prediction that more downstream firms spend more on CSR. The empirical finding is both statistically significant and economically meaningful.

Besides the effect of the value chain position on CSR spending, which is a novelty in the literature on CSR determinants, also the findings concerning our control variables provide some interesting insights for this literature. In line with the partial equilibrium predictions of our model in Eq. (14), CSR spending increases with export exposure to OECD countries. Only in the first specification, applying OLS and excluding firms without CSR spending, there is no significant relationship. Since the relationship is significant at the 1%-level in the remaining specifications, the empirical results strongly imply that firms selling to markets with presumably stronger demand for ethical goods tend to have higher CSR levels. As for wages, we find only tentative support that a firm’s CSR spending increases with the wage level. The relationship is only significant in columns (1) and (4). On the one hand, this suggests that focusing purely on wages paid by firms does not sufficiently capture its goodwill towards employees and society. However, when interpreting our results one has to bear in mind that we neither have wage bill information of the firms nor a split of wages by skill-levels. Moreover, we find that an increase in exports relative to total sales significantly increases a firm’s CSR spending. The latter effect is significant in all panel estimations and the OLS estimation

of the cross section. Accordingly, we can conclude that an increase in export activity is associated with the level of CSR spending. This result speaks to the role of export markets in incentivizing suppliers’ social activities and is in line with Newman et al. (2018). Moreover, domestic linkages are a powerful determinant of CSR spending and are significant at the 1%-percent level in all cross sectional specifications and at the 5% level in two panel specifications. We take this as empirical support for the claim that firms with strong regional ties also commit to regional sustainable development, including spending on social and community CSR (Newman et al., 2020). Finally, we turn to the role of shareholders. While state ownership is significant only in one specification, foreign ownership is significant in five out of six specifications. The latter might reflect the commitment of foreign owners to international standards in labor conditions, including CSR activities.

3.3.4. Contract enforcement

We complement our main results from above with an analysis of the effect of contractual imperfections. In our model, incomplete contracts lead to an under-investment in CSR and – in combination with the sequential bargaining process along the value chain – to the increasing CSR profile from upstream to downstream suppliers. We show in Appendix A.2 that with complete contracts, the model implies a flat CSR profile along the value chain, which shows that our main result is a direct consequence of contractual imperfections. In this section, we will analyze empirically, if different degrees of contractibility (here: across regions) imply different slopes of the CSR profile with a slope of zero representing the benchmark case of zero contractual imperfections.

There exists substantial variation in contract enforcement across Indian states e.g., Boehm and Oberfield, 2020. Here, we exploit these differences across states to analyze whether states differ systematically in terms of the relationship between CSR spending and the value chain position. We expect the negative relationship revealed in the previous section to be more pronounced in states with weaker contract enforcement.

⁴⁸ The marginal effects of linear models with fixed effects (like our columns 1–4) can be computed and illustrated as in Figure 3. This is not possible in a non-linear model with fixed effects (our columns 5 and 6).

We measure contract enforcement with information on judicial (in)efficiency using sub-national World Bank Doing Business data.⁴⁹ Similar to Sheng and Yang (2016), who analyze Chinese data, we employ a court cost variable. This variable measures the official costs of going through court procedures relative to the value of the debt claims. High court costs indicate inefficiencies in the legal system (Sheng and Yang, 2016). For India, the data encompasses 17 states (see Table B.1). While the coverage is not exhaustive, it does include a substantial portion of the firms in our sample. Unfortunately, the measure is only available for the year 2009, limiting us to a cross-sectional analysis along the lines of Table 3 columns (1)–(3) for 2009.

We employ two distinct approaches to determine whether a firm operates in a state with low judicial quality (high-cost share). First, the binary variable *Judicial inefficiency (a)* takes a value of one if the firm is in a state with judicial inefficiency above the level of judicial efficiency the median firm is confronted with in its own state. For our second measure, we take the median state instead. While the first approach splits the group of firms in the sample into two groups of equal size, the second splits the states in two groups of equal size, delivering the binary variable *Judicial inefficiency (b)* taking the value of one if the firm is in a state with above median judicial inefficiency. Notably, with 79%, the majority of firms operate in these states.

Table 4 presents the results, including an interaction term between our measures of judicial inefficiency and upstreamness.⁵⁰ Columns (1), (4), and (7) present the results of the main specifications limited to the year 2009 and to firms located in states where we can measure judicial inefficiency. As before, we use OLS and PPML with and without zeros. The subsequent columns introduce the relevant interaction term between judicial inefficiency and upstreamness. In all these specifications, state dummies are included making the (state-specific) level of judicial inefficiency obsolete.

Although limited to only one year, the main result of our paper – that CSR spending significantly decreases with upstreamness – remains robust for all specifications. All interaction terms are statistically significant and have the expected negative sign. This implies that firms in regions with low contractual enforcement deviate more strongly and in the way predicted by the model from the benchmark of complete contracts (with a predicted slope of zero).⁵¹

3.4. Robustness

In this section, we present several robustness checks. First, we control for firms' visibility for final consumers as an alternative mechanism that could explain more CSR spending in downstream GVC positions. Second, we measure CSR in relative terms by calculating CSR as share of expenditure. Third, we control for labor intensity as an alternative to our wage measure. Fourth, we smooth CSR spending over two years to control for the possibility that firms' CSR spending concentrates around a specific year. Fifth, we apply OLS with i.h.s. transformation as an alternative to the PPML estimator. Finally, to address possible concerns related to endogeneity, we control for firm-specific shocks to upstreamness.⁵²

⁴⁹ Data were downloaded from <https://subnational.doingbusiness.org/en/reports/subnational-reports/india> on August 1, 2023.

⁵⁰ The sample is limited to the year 2009 but similarly to the main specifications, we use lagged variables. The data on judicial efficiency was published in 2009 but collected prior to that year.

⁵¹ In line with our model, these results highlight the relevance of incomplete contracts for CSR investments along the value chain. We interpret this as strong support for our model. It should be noted, however, that there remains an alternative mechanism relying on incomplete contracts: if for some reason, contracts are less incomplete in more downstream production stages, incomplete contracts would also lead to an increasing CSR profile along the value chain. As our data do not allow us to distinguish between the two approaches, we have to leave this for future research.

⁵² In Appendix B, we report additional robustness checks.

3.4.1. Firms' visibility to final consumers

More downstream suppliers and their actions may be more visible to final consumers, and therefore, their CSR may affect demand for the final product more strongly. In this case, higher visibility in more downstream stages would provide an additional incentive for CSR investments and our findings could be driven by the visibility of firms rather than their GVC position. We see this as a rather ad hoc but plausible mechanism complementary to our model's mechanism: the two are not mutually exclusive and reinforce rather than offset one another.

In order to control for higher visibility/consumer awareness of more downstream sectors, in the spirit of Servaes and Tamayo (2013), we use a firm's *selling and distribution expenses*, which include marketing, advertising, and distribution spending as our proxy for visibility. Table 5 shows the results when we control for our proxy of visibility.

The sample size of our broadest sample (column (3)) is reduced by 21% compared to our main results in Table 3, as not all firms report on marketing expenses. However, we still cover a large part of the sample. CSR and marketing expenses are indeed highly correlated, but the effect of upstreamness on firms' CSR spending does remain statistically significant and economically meaningful. While visibility seems to play a role for a firm's CSR decision, there is a separate and distinct role of upstreamness in determining CSR expenditure, which is in line with our model's prediction.

3.4.2. CSR as share of expenditure

In our main specification, our dependent variable is measured as total CSR spending and we control for firm size by including $\log(\text{Sales})$ as an independent variable. In this robustness check, we maintain $\log(\text{Sales})$ in the specification but use CSR spending relative to a set of other expenses as the dependent variable directly accounting for size effects on the side of expenses rather than sales.

The Prowess database covers 27 domains of expenditure like spending on raw materials, stores and spares but also outsourcing of jobs, rent and lease rent costs. The wage bill is also one of them. Clearly, wages have a CSR component: paying "living wages", for example, are CSR expenditures. But wages are also driven by many other factors. We therefore chose not to include wages in our CSR measure, see Section 3.2.1. Due to their CSR component, however, we do not include the wage bill in the denominator of our relative CSR measure. To account for the average wage level at the value chain position of the firm, we still control for the $\log(\text{Wages})$ variable described in Section 3.3.1.

Even though the data quality of Prowess is very high, there are some unrealistic shares, e.g., turning negative or larger than one. Instead of cleaning these entries by hand, which would be somehow arbitrary, we cut off the highest percentile and values below zero.⁵³ Table 6 summarizes the results measuring CSR as a share of expenditure.

The results confirm our findings from the main specification: also with CSR relative to a broad set of other expenditures of the firm (accounting for size effects on the expenditures-side) as the dependent variable, our model's predictions on the link between CSR and value chain position are confirmed.

3.4.3. Labor intensity

Downstream industries tend to be more labor intensive. Our CSR measure contains elements of worker welfare, which may be higher in more labor intensive industries. In this section we analyze whether our results are robust to the inclusion of labor intensity in our regressions.

As highlighted above, it is a limitation of the Prowess data that information on the number of employees is not compulsory to report, which precludes us from computing labor intensity at the firm level for our sample. We therefore apply a similar procedure to the construction of the wage variable (see Section 3.3.1) to build a measure for labor

⁵³ We did not cut off the lowest percentile because in this case, we would lose all observations with zero CSR spending.

Table 4
Regression results: Controlling for contract enforcement.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Cross section								
	(ln) CSR			CSR in USD					
	OLS			w/o zeros			incl. zeros		
Upstreamness	-0.303*** (0.102)	-0.260** (0.106)	-0.175 (0.113)	-0.644*** (0.222)	-0.473** (0.219)	-0.452** (0.230)	-0.667*** (0.220)	-0.477** (0.220)	-0.457* (0.233)
Judicial inefficiency (a) x Upstreamness		-0.098* (0.059)			-0.389*** (0.149)			-0.396*** (0.148)	
Judicial inefficiency (b) x Upstreamness			-0.176** (0.070)			-0.287** (0.137)			-0.298** (0.137)
OECD export exposure	0.087 (0.195)	0.090 (0.195)	0.086 (0.195)	0.424 (0.406)	0.440 (0.404)	0.403 (0.402)	0.655* (0.395)	0.662* (0.395)	0.636 (0.391)
log(Wages)	0.276* (0.156)	0.276* (0.156)	0.277* (0.155)	0.267 (0.431)	0.299 (0.420)	0.293 (0.425)	0.241 (0.415)	0.275 (0.408)	0.255 (0.409)
Export share	0.413*** (0.074)	0.412*** (0.074)	0.416*** (0.074)	0.434** (0.173)	0.444*** (0.169)	0.455*** (0.171)	0.424** (0.172)	0.436*** (0.167)	0.446*** (0.169)
Domestic inputs/ total inputs	0.232*** (0.049)	0.231*** (0.049)	0.231*** (0.049)	0.532*** (0.138)	0.527*** (0.135)	0.528*** (0.137)	0.588*** (0.135)	0.584*** (0.132)	0.584*** (0.134)
State-owned (D)	0.714** (0.298)	0.698** (0.300)	0.724** (0.299)	0.087 (0.180)	0.067 (0.177)	0.074 (0.173)	0.124 (0.171)	0.095 (0.190)	0.101 (0.176)
Foreign-owned (D)	1.036*** (0.067)	1.036*** (0.067)	1.037*** (0.067)	0.355** (0.145)	0.348** (0.142)	0.355** (0.144)	0.405*** (0.145)	0.398*** (0.142)	0.406*** (0.144)
log(Sales)	0.562*** (0.013)	0.561*** (0.013)	0.561*** (0.013)	0.901*** (0.057)	0.895*** (0.054)	0.897*** (0.056)	0.932*** (0.055)	0.926*** (0.052)	0.928*** (0.054)
log(Age)	0.169*** (0.024)	0.170*** (0.024)	0.170*** (0.024)	0.098 (0.089)	0.097 (0.087)	0.094 (0.088)	0.118 (0.090)	0.117 (0.088)	0.113 (0.089)
Industry & State (D)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,393	4,393	4,393	4,393	4,393	4,393	6,831	6,831	6,831
Pseudo/Adjusted R ²	0.574	0.574	0.574	0.849	0.850	0.849	0.853	0.854	0.854

Robust standard errors in parentheses clustered at the firm level.

Judicial inefficiency (a) equals 1 if the cost of enforcement share is higher than that of the median firm.

Judicial inefficiency (b) equals 1 if the cost of enforcement share is higher than that of the median state.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5
Regression results: Controlling for marketing expenses.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	(ln) CSR	CSR in USD	CSR in USD	(ln) CSR	CSR in USD	CSR in USD
	OLS	PPML	PPML	OLS	PPML	PPML
		w/o zeros	incl. zeros		w/o zeros	incl. zeros
Upstreamness	-0.222*** (0.050)	-0.251** (0.105)	-0.247** (0.108)	-0.089** (0.040)	-0.163** (0.065)	-0.149** (0.065)
OECD export exposure	0.121 (0.103)	0.386* (0.207)	0.439** (0.205)	0.330*** (0.068)	0.552*** (0.127)	0.600*** (0.128)
log(Wages)	0.266*** (0.082)	-0.147 (0.195)	-0.113 (0.196)	0.173*** (0.040)	0.013 (0.100)	0.003 (0.100)
Export share	0.189*** (0.048)	0.261*** (0.092)	0.269*** (0.093)	0.101** (0.042)	0.165* (0.085)	0.163* (0.085)
Domestic inputs/total inputs	0.187*** (0.026)	0.177** (0.073)	0.214*** (0.073)	0.051*** (0.019)	0.045 (0.032)	0.073** (0.033)
State-owned (D)	0.445* (0.236)	0.125 (0.152)	0.147 (0.157)	0.166 (0.173)	0.053 (0.093)	0.053 (0.093)
Foreign-owned (D)	0.881*** (0.044)	0.457*** (0.083)	0.487*** (0.085)	0.037 (0.047)	0.185** (0.073)	0.189** (0.075)
log(Sales)	0.431*** (0.011)	0.743*** (0.041)	0.757*** (0.041)	0.310*** (0.012)	0.464*** (0.034)	0.472*** (0.034)
log(Age)	0.213*** (0.015)	0.210*** (0.046)	0.222*** (0.047)	0.133*** (0.031)	0.330*** (0.067)	0.342*** (0.066)
log(Adv Market Exp)	0.226*** (0.008)	0.110*** (0.023)	0.117*** (0.023)	0.083*** (0.006)	0.029 (0.018)	0.029 (0.018)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	49,400	49,400	64,379	47,064	47,064	55,498
Number of firms	10,180	10,180	12,720	7,832	7,832	8,460
Pseudo/Adjusted R ²	0.616	0.844	0.845	0.162 ^a	0.975	0.971

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

Table 6
Regression results: CSR as share of total expenditure.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	CSR/expenses OLS	CSR/expenses PPML w/o zeros	CSR/expenses PPML incl. zeros	CSR/expenses OLS	CSR/expenses PPML w/o zeros	CSR/expenses PPML incl. zeros
Upstreamness	-0.001*** (0.000)	-0.237*** (0.058)	-0.292*** (0.062)	-0.001** (0.000)	-0.110** (0.051)	-0.110* (0.058)
OECD export exposure	0.000 (0.001)	0.104 (0.118)	0.575*** (0.135)	0.002*** (0.001)	0.276*** (0.080)	0.337*** (0.098)
log(Wages)	0.000 (0.001)	0.071 (0.088)	0.053 (0.097)	0.001* (0.000)	0.114** (0.050)	0.072 (0.059)
Export share	0.003*** (0.000)	0.356*** (0.043)	0.501*** (0.048)	-0.000 (0.000)	-0.034 (0.050)	0.048 (0.062)
Domestic inputs/total inputs	0.000** (0.000)	0.096*** (0.033)	0.263*** (0.041)	0.000 (0.000)	0.036 (0.024)	0.072** (0.028)
State-owned (D)	-0.001 (0.002)	0.046 (0.193)	-0.018 (0.251)	0.001 (0.001)	0.163 (0.171)	0.179 (0.207)
Foreign-owned (D)	0.005*** (0.000)	0.573*** (0.044)	0.520*** (0.044)	0.001 (0.000)	0.063 (0.049)	0.095* (0.051)
log(Sales)	-0.002*** (0.000)	-0.201*** (0.007)	-0.007 (0.007)	-0.001*** (0.000)	-0.128*** (0.011)	-0.004 (0.013)
log(Age)	0.002*** (0.000)	0.258*** (0.019)	0.286*** (0.023)	0.001*** (0.000)	0.146*** (0.036)	0.048 (0.042)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm dummy	No	No	No	Yes	Yes	Yes
Year dummy	No	No	No	Yes	Yes	Yes
Observations	53,502	53,502	80,857	50,783	50,783	63,763
Number of firms	11,168	11,168	15,444	8,440	8,440	9,485
Pseudo/Adjusted R ²	0.298	0.0639	0.0583	0.0123 ^a	0.133	0.143

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

intensity using data from the WIOD Socio Economic Accounts. We proceed in two steps. First, we calculate industry labor intensity as the ratio of employees over capital stock and confirm that more downstream firms are indeed more labor intensive in our sample. Second, to make the industry-specific information firm-specific, we weigh the industry labor intensity by firms' product sales in the respective industries.

It turns out that our labor intensity variable and our wage variable are strongly correlated with a coefficient of -0.79. To avoid potential problems of collinearity, we refrain from including both variables in our regressions simultaneously.

Table 7 reports the results when we include the labor intensity variable in our regressions instead of the wage variable.

Labor intensity is positively related to CSR investments but only significant in the two cross sectional PPML specifications. It is precisely in the cross section PPML case, where upstreamness is not significant, while it remains significant at the 5%-level in all other specifications. Overall, the results show that our main findings, especially on the panel estimations, are robust to the inclusion of labor intensity as a control.⁵⁴

3.4.4. Smoothed CSR spending

Like other forms of firm spending (e.g., investments), CSR might vary from year to year. For instance, a firm might make substantial investments in the community infrastructure in one year and refrain from further CSR spending in the following years. To account for this, we smooth CSR spending by taking the moving average of two years, more precisely, years t and $t - 1$, as the dependent variable. We present the results of this robustness check in Table 8.

⁵⁴ This interpretation finds further support in an additional unreported analysis (available upon request), where we find that dropping the observations with the largest 1% of CSR spending, upstreamness is again highly significant across all specifications including the ones using PPML with cross sectional data.

The results continue to support our theoretical prediction. The effect of upstreamness on CSR remains negative and statistically significant when using smoothed CSR spending. It is significant at the 5%-level in column (3) and at the 1%-level in the remaining five specifications.

3.4.5. Inverse hyperbolic sine transformation

In our main specification, we use PPML alongside OLS, as the former allows us to keep the zeros in the data. An alternative approach is to use the inverse hyperbolic sine (i.h.s.) transformation, allowing us to estimate OLS in natural logs including the zero observations. It is a feature of this method that it is sensitive to the unit choice (cf. Aihouton and Henningsen, 2020, De Brauw and Herskowitz, 2021, and Chen and Roth, 2023). We therefore consider CRS spending both in USD and in million USD. For the former case, a higher weight is mechanically placed on the extensive margin (switches from zero CSR to positive CSR), while in the latter case, the intensive margin (cross sectional variation across firms with positive CSR and variation in CSR spending within the firm over time), has a stronger effect. We are inclined towards measuring CSR spending in million USD, as our testable implication in Proposition 1 concerns the intensive rather than the extensive margin.⁵⁵

⁵⁵ Taking our model at face value, a supplier has zero CSR in equilibrium only when it is matched to a firm serving non-caring consumers. The only reason for a supplier to have positive CSR is to be matched to a firm serving caring consumers. In terms of our model, the extensive margin is therefore not very informative: a switch from zero to positive CSR would not be driven by changes in the upstreamness, but by being matched to a different partner (noting, of course, that our model is static so formally, no switches occur). In equilibrium, all suppliers matched to a firm serving caring consumers will have positive CSR levels, but, crucially, these CSR levels will increase along the value chain. This is the prediction we seek to test. Therefore, it is the variation in CSR levels across firms with positive CSR or the variation over time of CSR spending within a firm that speaks to our theory.

Table 7
Regression results: Controlling for labor intensity.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.120** (0.054)	-0.072 (0.120)	-0.050 (0.121)	-0.137*** (0.040)	-0.200*** (0.073)	-0.185** (0.073)
OECD export exposure	0.255** (0.113)	0.962*** (0.241)	1.065*** (0.233)	0.312*** (0.070)	0.508*** (0.141)	0.543*** (0.143)
log(Labor intensity)	0.041 (0.039)	0.227** (0.099)	0.233** (0.098)	-0.046* (0.026)	-0.035 (0.069)	-0.033 (0.069)
Export share	0.383*** (0.046)	0.153 (0.187)	0.204 (0.186)	0.146*** (0.040)	0.219*** (0.083)	0.262*** (0.082)
Domestic inputs/total inputs	0.227*** (0.027)	0.242*** (0.077)	0.319*** (0.078)	0.041** (0.018)	0.046 (0.033)	0.082** (0.034)
State-owned (D)	0.525* (0.272)	0.133 (0.174)	0.156 (0.184)	0.160 (0.172)	0.048 (0.092)	0.049 (0.093)
Foreign-owned (D)	1.041*** (0.046)	0.522*** (0.092)	0.562*** (0.094)	0.045 (0.049)	0.184*** (0.064)	0.189*** (0.065)
log(Sales)	0.582*** (0.008)	0.856*** (0.028)	0.880*** (0.028)	0.316*** (0.010)	0.463*** (0.025)	0.472*** (0.025)
log(Age)	0.217*** (0.015)	0.193*** (0.051)	0.218*** (0.051)	0.139*** (0.030)	0.302*** (0.063)	0.323*** (0.063)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	54,394	54,394	81,749	51,645	51,645	64,851
Number of firms	11,291	11,291	15,512	8,533	8,533	9,596
Pseudo/Adjusted R ²	0.577	0.838	0.843	0.138 ^a	0.975	0.969

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

Table 8
Robustness check: Smoothed CSR spending.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.211*** (0.048)	-0.277*** (0.103)	-0.274** (0.107)	-0.148*** (0.035)	-0.247*** (0.053)	-0.229*** (0.053)
OECD export exposure	0.189* (0.097)	0.617*** (0.229)	0.698*** (0.225)	0.286*** (0.057)	0.529*** (0.125)	0.573*** (0.123)
log(Wages)	0.248*** (0.071)	-0.029 (0.181)	0.004 (0.183)	0.251*** (0.036)	0.054 (0.089)	0.055 (0.089)
Export share	0.391*** (0.045)	0.117 (0.203)	0.155 (0.202)	0.162*** (0.036)	0.191** (0.077)	0.208*** (0.076)
Domestic inputs/total inputs	0.236*** (0.026)	0.262*** (0.078)	0.322*** (0.079)	0.045*** (0.016)	0.076** (0.030)	0.093*** (0.030)
State-owned (D)	0.553* (0.284)	0.168 (0.160)	0.185 (0.165)	0.127 (0.148)	-0.099** (0.042)	-0.096** (0.040)
Foreign-owned (D)	1.097*** (0.046)	0.561*** (0.090)	0.592*** (0.092)	0.056 (0.054)	0.101 (0.072)	0.106 (0.072)
log(Sales)	0.543*** (0.007)	0.852*** (0.025)	0.870*** (0.026)	0.275*** (0.008)	0.501*** (0.022)	0.509*** (0.022)
log(Age)	0.265*** (0.014)	0.257*** (0.052)	0.275*** (0.053)	0.223*** (0.028)	0.435*** (0.062)	0.459*** (0.063)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	59,090	59,090	81,749	56,706	56,706	65,839
Number of firms	11,660	11,660	15,512	9,269	9,269	9,823
Pseudo/Adjusted R ²	0.592	0.847	0.851	0.192 ^a	0.983	0.980

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

Table 9
Regression results: Applying inverse hyperbolic sine transformation.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	CSR in USD PPML	asinh CSR OLS	asinh mCSR OLS	CSR in USD PPML	asinh CSR OLS	asinh mCSR OLS
				incl. zeros		
Upstreamness	-0.225** (0.108)	-0.441*** (0.126)	-0.042*** (0.008)	-0.170*** (0.060)	0.035 (0.130)	-0.035*** (0.005)
OECD export exposure	0.651*** (0.231)	1.301*** (0.255)	-0.058*** (0.013)	0.567*** (0.120)	1.386*** (0.235)	-0.006 (0.009)
log(Wages)	-0.053 (0.192)	0.449** (0.176)	0.032*** (0.010)	0.010 (0.097)	0.037 (0.142)	0.054*** (0.010)
Export share	0.200 (0.186)	1.149*** (0.125)	0.033*** (0.010)	0.265*** (0.083)	0.296* (0.151)	0.019*** (0.006)
Domestic inputs/total inputs	0.323*** (0.078)	1.159*** (0.077)	0.006 (0.005)	0.081** (0.034)	0.418*** (0.073)	0.009*** (0.002)
State-owned (D)	0.161 (0.181)	0.818* (0.492)	0.289* (0.170)	0.050 (0.094)	-0.001 (0.443)	0.012 (0.030)
Foreign-owned (D)	0.562*** (0.095)	1.591*** (0.103)	0.305*** (0.023)	0.193*** (0.067)	0.268* (0.157)	0.026 (0.019)
log(Sales)	0.881*** (0.028)	1.081*** (0.012)	0.039*** (0.002)	0.472*** (0.025)	0.805*** (0.024)	0.015*** (0.001)
log(Age)	0.221*** (0.051)	0.534*** (0.036)	0.038*** (0.003)	0.323*** (0.063)	-0.031 (0.104)	0.002 (0.005)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	81,749	81,749	81,749	64,851	64,851	64,851
Number of firms	15,512	15,512	15,512	9,596	9,596	9,596
Pseudo/Adjusted R ²	0.842	0.428	0.294	0.969	0.0669 ^a	0.0272 ^a

Robust standard errors in parentheses clustered at the firm level.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

We therefore run two specifications. The first specification measures CSR spending in USD, $asinh(CSR)$, and the second measures CSR spending in million USD, $asinh(CSRmUSD)$. Both i.h.s. transformed dependent variables are derived as follows⁵⁶:

$$asinh(y) = \ln \left(y + (y^2 + 1)^{1/2} \right). \tag{29}$$

Table 9 presents the empirical results applying OLS i.h.s. transformation. We run the regression on the same sample as the PPML estimation including zeros, which is the widest coverage of firms in our empirical set-up and makes it comparable to prior results. The PPML results, which are not sensitive to the unit choice of the dependent variable, are included in columns (1) and (4). Columns (2) and (3) include the results for the cross section estimation applying OLS i.h.s. transformation of CSR in USD and million USD, respectively. Columns (5) and (6) include the results for the corresponding panel estimations.

The results show that overall our main findings are robust to applying the i.h.s. transformation. The cross section results for upstreamness in columns (2) and (3) are significant at the 1%-level. The levels of the estimates differ considerably also highlighting the sensitivity of the approach to the selected unit of CSR. In the panel estimation, the relationship loses significance for the transformation of CSR spending in USD but remains significant at the 1%-level for the transformation of CSR in million USD. The differences in the panel estimations are in line with the previously described intuition that within firm variation in upstreamness is better suited to explain the intensive margin, rather than the extensive margin.

3.4.6. Shocks to upstreamness

So far, we show robust evidence for the negative correlation between CSR investment and upstreamness predicted by our model. However, one might be worried about a firm-level shock that affects both

CSR spending and upstreamness. Recall that upstreamness is determined by two components, the firm’s product portfolio on the one hand and the upstreamness of each product’s industry on the other. The latter is arguably exogenous to the firm. As the product portfolio is endogenous, a firm-specific shock could affect it and CSR spending simultaneously.

We therefore apply a two-stage least squares (2SLS) instrumental variable (IV) approach.⁵⁷ To do so, we derive an exogenous measure for the change of a firm’s value chain position from $t - 2$ to $t - 1$ in the spirit of shift-share (or Bartik) instruments (e.g., Autor et al., 2013 and Borusyak et al., 2022). More specifically, for every firm i , we consider firms having the same main five-digit industry v as firm i between $t - 2$ and $t - 1$. In order to exclude common state-specific shocks, we only consider firms located in other states than firms i . Based on this, we can calculate the shift in the value chain position of firm i , which is arguably exogenous to it.

Although time variation of upstreamness is relatively low, the factors of change vary between 0.547 and 1.657. Beyond these high values, the 10%-percentile with 0.960 and the 90%-percentile with 1.038 further indicate variation which we can empirically exploit.

To derive the estimated instrumental variable of a firm’s value chain position in $t - 1$, we multiply a firm’s value chain position, U_{ft-2} , by the shift:

$$Z_{ft-1,t-2} = U_{ft-2} \left(\frac{U_{vst-1} - U_{vst-2}}{U_{vst-2}} + 1 \right), \tag{30}$$

with $Z_{ft-1,t-2}$ being the (lagged) instrument for firm f at time t using the base-year $t - 2$. Moreover, U_{svt-1} is the average value chain position of firms active in industry v at time $t - 1$ (excluding firms in state s).

Eq. (31) and Eq. (32) summarize the first stages of the instrumental variable approach for the cross section and panel estimation,

⁵⁷ The approach is most comparable to the OLS-specifications in the main specification (columns (1) and (4)).

⁵⁶ The respective distributions are displayed in Fig. B.2 in Appendix B.

Table 10
2-SLS estimation results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cross section		Panel		Cross section		Panel	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
$Z_{f,t-1}$	0.772*** (0.011)		0.494*** (0.016)		0.772*** (0.018)		0.494*** (0.028)	
$\widehat{Upstreamness}$		-0.220*** (0.065)		-0.183** (0.076)		-0.220** (0.096)		-0.183* (0.099)
OECD export exposure	-0.073*** (0.014)	0.091 (0.117)	-0.023 (0.026)	0.307*** (0.075)	-0.073** (0.030)	0.091 (0.172)	-0.023 (0.049)	0.307*** (0.089)
log(Wages)	0.174*** (0.016)	0.269*** (0.087)	0.132*** (0.018)	0.211*** (0.045)	0.174*** (0.034)	0.269** (0.137)	0.132*** (0.036)	0.211*** (0.064)
Export share	-0.004 (0.003)	0.386*** (0.050)	-0.003 (0.009)	0.162*** (0.045)	-0.004 (0.004)	0.386*** (0.093)	-0.003 (0.007)	0.162*** (0.039)
Domestic inputs/total inputs	0.004** (0.002)	0.209*** (0.029)	0.009** (0.004)	0.019 (0.020)	0.004* (0.002)	0.209*** (0.029)	0.009** (0.004)	0.019 (0.017)
State-owned (D)	0.010 (0.015)	0.432 (0.269)	-0.009 (0.019)	0.184 (0.165)	0.010 (0.015)	0.432 (0.282)	-0.009 (0.017)	0.184 (0.160)
Foreign-owned (D)	-0.003 (0.002)	1.011*** (0.048)	0.008 (0.011)	0.036 (0.055)	-0.003 (0.002)	1.011*** (0.066)	0.008 (0.010)	0.036 (0.057)
log(Sales)	0.000 (0.000)	0.597*** (0.008)	-0.006*** (0.002)	0.302*** (0.011)	0.000 (0.001)	0.597*** (0.030)	-0.006*** (0.002)	0.302*** (0.018)
log(Age)	-0.001 (0.001)	0.264*** (0.017)	0.001 (0.006)	0.189*** (0.040)	-0.001 (0.001)	0.264*** (0.022)	0.001 (0.008)	0.189*** (0.047)
Constant	-0.067 (0.041)	7.808*** (0.259)	0.656*** (0.065)	8.499*** (0.226)	-0.067 (0.084)	7.808*** (0.568)	0.656*** (0.101)	8.499*** (0.259)
Industry × Year & State (D)	Yes	Yes	No	No	Yes	Yes	No	No
Firm (D)	No	No	Yes	Yes	No	No	Yes	Yes
Year (D)	No	No	Yes	Yes	No	No	Yes	Yes
Observations	44,009	44,009	43,367	43,367	44,009	44,009	43,367	43,367
Number of clusters	9,688	9,688	9,036	9,036	462	462	461	461
Adjusted/pseudo R ²	0.956	0.590	0.347 ^a	0.197 ^a	0.956	0.590	0.347 ^a	0.197 ^a
F-statistic	1,030		22.48		979		22.48	

Robust standard errors in parentheses clustered at the firm level in columns (1) to (4) and five-digit industry-level in columns (5) to (8).

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

respectively.

$$Y_{f,t-1} = \alpha_0 + \beta_1 Z_{f,t-1,t-2} + \beta_2 X_{f,t-1} + \gamma_{vt} + \delta_s + \epsilon_{fvt}, \quad (31)$$

$$Y_{f,t-1} = \alpha_0 + \beta_1 Z_{f,t-1,t-2} + \beta_2 X_{f,t-1} + \zeta_f + \tau_t + \epsilon_{fvt}. \quad (32)$$

In the second stage, we include the predicted values from the first stage (Eq. (33) and Eq. (34)):

$$Y_{fvt} = \alpha_0 + \beta_1 \widehat{U}_{f,t-1} + \beta_2 X_{f,t-1} + \gamma_{vt} + \delta_s + \epsilon_{fvt}, \quad (33)$$

$$Y_{fvt} = \alpha_0 + \beta_1 \widehat{U}_{f,t-1} + \beta_2 X_{f,t-1} + \zeta_f + \tau_t + \epsilon_{fvt}, \quad (34)$$

with Y_{fvt} being the natural logarithm of a firm's CSR spending and $\widehat{U}_{f,t-1}$ being the predicted value of the value chain position in $t - 1$. Similar to the main specification, the error terms are clustered at the firm level. However, error terms might be correlated between firms being active in a similar main industry. Also following [Borusyak et al. \(2022\)](#) in the context of shift-share instruments, we consider similar exposure to changes in the value chain position in an alternative specification by clustering error terms at the 5-digit industry-level. [Table 10](#) includes the results, including the first stage.

The results of the first stages give insights on the relevance (columns (1), (3), (5), and (7)). In all specifications, the instrumental variable is significant at the 1%-level and the reported F-statistics do not indicate that the specifications suffer from weak instruments. We therefore conclude that our instruments are relevant.

The second stage results show that our main result, the negative relationship between upstreamness and CSR investment, is significant in all specifications. Clustering the error term at the five-digit industry-level increases the magnitude of the error terms and with it decreases the level of significance. This is in line with expectation since the exogenous variation of a firm's value chain position is derived from

shifts in the value chain position at this level. Our results remain robust also in these more demanding specifications: downstream firms have higher CSR expenditure.

However, one might consider the base-year weight $U_{f,t-2}$ as too close to $t - 1$. For the panel, this is not a concern, as identification in the panel stems from changes in the value chain position within the firm from one year to the other. For the cross section, we experiment with alternative base-years. [Table 11](#) includes the results using the base-years $t - 3$ to $t - 7$.⁵⁸

The effect of upstreamness on CSR spending is remarkably robust. It only loses statistical significance at a lag of seven years, when more than half of the observations are lost compared to the $t - 2$ case reported in [Table 10](#).

4. Conclusion

Globalized value chains involving developing and emerging economies characterize modern-day production. With different stages of production being performed in different countries, they are also performed in very diverse regulatory environments. With consumers in the Global North being more and more concerned about the environmental and social footprints of their consumption choices, firms are increasingly under pressure to assure that certain minimum standards are not only respected by the firm itself, but also by suppliers along its GVC.

⁵⁸ The results of the first stage are reported in [Appendix B](#). All IVs are significant at the 1%-level. As to be expected, the coefficient size and F-statistics decrease with larger lags. The smallest F-value is for the base-year $t - 7$. It takes the value of 65.45, still indicating a valid instrument (cf. [Table B.3](#)).

Table 11
2-SLS estimation results: Cross section with lagged upstreamness.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Base-years									
	t-3	t-3	t-4	t-4	t-5	t-5	t-6	t-6	t-7	t-7
<i>Upstreamness</i>	-0.236*** (0.079)	-0.236** (0.117)	-0.290*** (0.092)	-0.290** (0.123)	-0.335*** (0.106)	-0.335*** (0.120)	-0.277** (0.121)	-0.277* (0.149)	-0.222 (0.149)	-0.222 (0.167)
OECD export exposure	0.121 (0.129)	0.121 (0.186)	0.118 (0.141)	0.118 (0.181)	0.129 (0.153)	0.129 (0.187)	0.130 (0.165)	0.130 (0.198)	0.187 (0.183)	0.187 (0.219)
log(Wages)	0.281*** (0.095)	0.281* (0.148)	0.321*** (0.105)	0.321** (0.142)	0.376*** (0.112)	0.376*** (0.136)	0.375*** (0.120)	0.375** (0.155)	0.382*** (0.135)	0.382** (0.168)
Export share	0.410*** (0.054)	0.410*** (0.099)	0.413*** (0.057)	0.413*** (0.100)	0.422*** (0.060)	0.422*** (0.102)	0.451*** (0.063)	0.451*** (0.105)	0.494*** (0.067)	0.494*** (0.105)
Domestic inputs /total inputs	0.197*** (0.031)	0.197*** (0.030)	0.202*** (0.033)	0.202*** (0.032)	0.199*** (0.034)	0.199*** (0.033)	0.199*** (0.036)	0.199*** (0.034)	0.208*** (0.038)	0.208*** (0.036)
State-owned (D)	0.383 (0.268)	0.383 (0.280)	0.384 (0.275)	0.384 (0.287)	0.399 (0.279)	0.399 (0.294)	0.396 (0.273)	0.396 (0.287)	0.327 (0.269)	0.327 (0.281)
Foreign-owned (D)	0.993*** (0.049)	0.993*** (0.066)	0.974*** (0.051)	0.974*** (0.066)	0.961*** (0.053)	0.961*** (0.067)	0.943*** (0.054)	0.943*** (0.068)	0.983*** (0.057)	0.983*** (0.072)
log(Sales)	0.610*** (0.009)	0.610*** (0.030)	0.620*** (0.010)	0.620*** (0.030)	0.630*** (0.010)	0.630*** (0.030)	0.643*** (0.010)	0.643*** (0.030)	0.641*** (0.011)	0.641*** (0.030)
log(Age)	0.310*** (0.020)	0.310*** (0.024)	0.353*** (0.023)	0.353*** (0.027)	0.397*** (0.026)	0.397*** (0.031)	0.444*** (0.029)	0.444*** (0.034)	0.457*** (0.033)	0.457*** (0.037)
Constant	7.659*** (0.279)	7.659*** (0.579)	7.665*** (0.296)	7.665*** (0.601)	7.345*** (0.312)	7.345*** (0.576)	7.069*** (0.329)	7.069*** (0.564)	6.908*** (0.362)	6.908*** (0.616)
Industry × Year and State (D)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm (D)	No	No	No	Yes	No	No	No	No	No	No
Number of clusters	8,347	450	7,389	441	6,810	437	6,283	427	5,328	411
Observations	37,201	37,201	32,068	32,068	27,669	27,669	23,586	23,586	19,146	19,146
Adjusted R ²	0.603	0.603	0.611	0.611	0.620	0.620	0.632	0.632	0.635	0.635

Robust standard errors in parentheses clustered at the firm level in columns (1), (3), (5), (7), and (9) and five-digit industry level in columns (2), (4), (6), (8), and (10). The respective first stage results are shown in Table B.3.

*** p < 0.01, ** p < 0.05, * p < 0.1.

In our model, CSR along the value chain provides ethical product differentiation and allows the firm to set a price above marginal cost to caring consumers. We extend the common notion of contractual incompleteness in supply chain relationships to the provision of CSR along the value chain. Building on the model of sequential production by Antràs and Chor (2013), we analyze CSR investments by a continuum of independent suppliers along the value chain. We find an increasing CSR profile with more downstream suppliers featuring higher CSR expenditures.

We confirm this prediction using Indian firm-level data. Merging product-level information with the World Input–Output Database, we construct a measure of a firm’s GVC position. Using combined staff welfare spending and social community spending as our measure of CSR expenditure, we find strong support for our prediction. Moreover, we provide evidence that the predicted pattern is more pronounced in regions of India with stronger contractual incompleteness, measured by the inefficiency of the legal system. Our findings are confirmed in a substantial number of robustness checks.

Our main results are highly relevant for policy makers. Most importantly, our analysis reveals that the economic incentives for CSR investments are lowest in upstream industries. Concerning laws on corporate sustainability due diligence, this implies that the obligation of firms to assure ethical standards along their supply chain is particularly difficult to meet for upstream suppliers. By the same token, when the aim of the policy maker is to attain high levels of CSR along the entire value chain, our results show that efforts should be focused on suppliers in more upstream industries. Finally, for governments aiming at decent work and economic growth (as specified in the UN’s Sustainable Development Goal 8) the fact that more upstream stages of production are characterized by low CSR investments, provides an incentive to strategically focus industrial policy towards specialization in more downstream production stages.

In this paper, we highlight the relevance of incomplete contracts for CSR investments depending on the value chain position of the supplier.

Introducing contractual incompleteness for CSR and ethical production in global value chains opens up a whole range of promising avenues for future research. Especially so, as it opens up the rich theoretical and empirical toolkit of the literature on the international organization of production to the analysis of CSR and ethical production in global value chains involving developing and emerging economies. In this context, future research should further investigate the relevance of incomplete contracts for CSR in global production. To this end, new theories could be developed to neatly link existing or novel empirical measures of contractual incompleteness to firm’s CSR investments.

CRedit authorship contribution statement

Philipp Herkenhoff: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft. **Sebastian Krauthem:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing. **Finn Ole Semrau:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Frauke Steglich:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data. Replication files are available at <https://github.com/FraukeSteglich/CSR-along-the-GVC>.

Appendix A. Theory appendix

A.1. Industry equilibrium with incomplete contracts

We use Eq. (19) to calculate the values of $q(\omega)$ and $s(m)$ in industry equilibrium from Eqs. (14) and (17).

$$q(\omega) = \frac{\rho}{c_x} \frac{f}{1-2\rho} \tag{A.1}$$

$$s(m) = \frac{1-\alpha}{\beta} \frac{(1-\beta)\rho}{c_s} \frac{f}{1-2\rho} m^{\frac{\rho-\alpha}{\alpha(1-\rho)}} \tag{A.2}$$

Using the definition of $\varepsilon(\omega)$ we then get

$$\varepsilon(\omega) = \left(\int_0^1 s(m)^\alpha dm \right)^{\frac{1}{\alpha}} = \frac{1-\alpha}{\beta} \frac{(1-\beta)\rho}{c_s} \frac{f}{1-2\rho} \left(\frac{1-\rho}{1-\alpha} \right)^{\frac{1}{\alpha}}. \tag{A.3}$$

Plugging this, the solution for $q(\omega)$, as well as the expression for P into inverse demand gives the pricing rule as

$$p(\omega) = A^{1-\rho} q(\omega)^{-(1-\rho)} \varepsilon(\omega)^\rho = \frac{c_x}{\rho} \frac{1-\rho}{\beta}. \tag{A.4}$$

Using $\varepsilon(\omega)$ and $p(\omega)$ in the definition of the price index from demand, $P^{-\frac{\rho}{1-\rho}} = \int_0^n \left(\frac{\varepsilon(\omega)}{p(\omega)} \right)^{\frac{\rho}{1-\rho}} d\omega$, gives Eq. (20), a second expression for the price index as a function of the number of firms, n . Combining the two expressions gives the equilibrium number of firms from Eq. (21),

$$n = \frac{\beta E}{1-\rho} \frac{1-2\rho}{f}. \tag{A.5}$$

A.2. Complete contracts

In this section, we solve the model for the case of complete contracts. Under complete contracts, the headquarter can offer fully specified contracts to each supplier j and will approach them in the right order. The headquarter offers a contract consisting of a physical quantity $x(j)$ and an according payment $w(j)$, as well as an implemented production standard $s(j)$ with the according payment $t(j)$. To make comparison with the baseline model feasible, we denote all endogenous variables in the complete contracts case with a tilde. The headquarter then maximizes its profits with respect to the four choice variables above, subject to two conditions:

$$\begin{aligned} \max_{\{\tilde{x}(j), w(j), \tilde{s}(j), t(j)\}_{j \in [0,1]}} \tilde{\pi}_F(\omega) &= \tilde{q}(\omega)^\rho \tilde{A}^{1-\rho} \left(\int_0^1 \tilde{s}(j)^\alpha dj \right)^{\frac{\rho}{\alpha}} \\ &- \int_0^1 w(j) dj - \int_0^1 t(j) dj - f \\ \text{s.t. } w(j) - c_x \tilde{x}(j) &\geq 0 \\ t(j) - c_s \tilde{s}(j) &\geq 0 \end{aligned}$$

Due to the large number of available suppliers, the headquarter can lower the payments $w(j)$ and $t(j)$ so that the constraints are binding and the supplier walks away with zero profits. Because $\tilde{x}(j) = \tilde{q}(\omega)$, we have

$$\int_0^1 w(j) dj = c_x \int_0^1 \tilde{x}(j) dj = c_x \tilde{q}(\omega). \tag{A.6}$$

and because of the binding constraints, $\int_0^1 t(j) dj = c_s \int_0^1 \tilde{s}(j) dj$.

This implies that we can restate the headquarter's problem in terms of $\tilde{q}(\omega)$ and $\tilde{s}(j)$ as

$$\begin{aligned} \max_{\tilde{q}(\omega), \{\tilde{s}(j)\}_{j \in [0,1]}} \tilde{\pi}_F(\omega) &= \tilde{q}(\omega)^\rho \tilde{A}^{1-\rho} \left(\int_0^1 \tilde{s}(j)^\alpha dj \right)^{\frac{\rho}{\alpha}} \\ &- c_x \tilde{q}(\omega) - c_s \int_0^1 \tilde{s}(j) dj - f \end{aligned} \tag{A.7}$$

Differentiating with respect to the choice variables gives the first order conditions

$$\tilde{q}(\omega) = \frac{\rho \tilde{r}(\omega)}{c_x}$$

$$\tilde{s}(j)^{1-\alpha} = \frac{\tilde{r}(\omega) \rho}{c_s} \left(\int_0^1 \tilde{s}(j)^\alpha dj \right)^{-1}$$

Expressing $\left(\int_0^1 \tilde{s}(j)^\alpha dj \right)$ in terms of revenue $\tilde{r}(\omega)$ gives $\tilde{s}(j)$ conditional on a level of output $\tilde{q}(\omega)$ as

$$\tilde{s}(j) = \tilde{s} = \tilde{r}(\omega)^{\frac{\rho-\alpha}{\rho(1-\alpha)}} \tilde{A}^{-\frac{\alpha(1-\rho)}{\rho(1-\alpha)}} \tilde{q}(\omega)^{\frac{\alpha}{1-\alpha}} \left(\frac{\rho}{c_s} \right)^{\frac{1}{1-\alpha}} \quad \forall j$$

The difference to Eq. (11) is that here stage j standard depends on total revenue $\tilde{r}(\omega)$ instead of revenue up to that stage $r(j)$.

Plugging this back into the revenue expression from the maximization problem gives equilibrium revenue $\tilde{r}(\omega)$ as a function of $\tilde{q}(\omega)$ as

$$\tilde{r}(\omega) = \tilde{A} \left[\tilde{q}(\omega) \frac{\rho}{c_s} \right]^{\frac{\rho}{1-\rho}} \tag{A.8}$$

Plugging the result for $\tilde{r}(\omega)$ back into \tilde{s} from above gives

$$\tilde{s} = \tilde{A} \tilde{q}(\omega)^{\frac{\rho}{1-\rho}} \left(\frac{\rho}{c_s} \right)^{\frac{1}{1-\rho}} \quad \forall j \tag{A.9}$$

This gives a symmetric equilibrium investment in the standard \tilde{s} at each stage j as a function of exogenous parameters and conditional on the scale of production $\tilde{q}(\omega)$.

We know from the first FOC that

$$\tilde{q}(\omega) = \frac{\rho \tilde{r}(\omega)}{c_x}$$

and using the result for $\tilde{r}(\omega)$ from Eq. (A.8) gives that the optimal scale of production is given by

$$\tilde{q}(\omega) = \left[\rho \left(\frac{\tilde{A}}{c_x} \right)^{1-\rho} c_s^{-\rho} \right]^{\frac{1}{1-2\rho}} \tag{A.10}$$

Combining the results of Eqs. (A.9) and (A.10) gives equilibrium CSR investment at each stage j as

$$\tilde{s} = \left[\rho \left(\frac{\tilde{A}}{c_s} \right)^{1-\rho} c_x^{-\rho} \right]^{\frac{1}{1-2\rho}} \quad \forall j \tag{A.11}$$

Using the fact that with free entry, profits are zero for all (homogeneous) firms, and applying this to Eq. (A.7) gives the first expression for the equilibrium price index as

$$\tilde{P} = \rho^{-2} c_s c_x \left(\frac{f}{1-2\rho} \right)^{\frac{1-2\rho}{\rho}} E^{-\frac{1-\rho}{\rho}} \tag{A.12}$$

Plugging this into Eq. (A.11) for $\tilde{A} = E \tilde{P}^{\frac{\rho}{1-\rho}}$ gives

$$\tilde{s} = \frac{\rho}{c_s} \frac{f}{1-2\rho}. \tag{A.13}$$

Level of CSR with complete contracts and comparison to incomplete contracts. Under complete contracts, the optimal CSR investment is uniform across all production stages j and is given by $\tilde{s} = \frac{\rho}{c_s} \frac{f}{1-2\rho}$. The uniformity result arises because all stages in the production process enter symmetrically into the production of ethical quality. Therefore, a headquarter able to write complete contracts has no incentive to assign different levels of investments to suppliers at different stages along the value chain.

It is instructive to compare this result with our main result from Eq. (24). In fact, it is possible to express $s(m)$ as a function of the complete contracts result \tilde{s} as

$$s(m) = (1-\alpha) \frac{1-\beta}{\beta} m^{\frac{\rho-\alpha}{\alpha(1-\rho)}} \tilde{s}. \tag{A.14}$$

Under incomplete contracts, CSR levels are smaller than the CSR investments under complete contracts for all – even the most downstream – stages of production. To see this, consider the following: Under our assumption that $\alpha < \rho$ and because $s(m)$ is increasing in m , showing that $s(1) < \bar{s}$ will be sufficient. This holds when $\beta > \frac{1-\alpha}{2-\alpha}$. Because $1/2 > \frac{1-\alpha}{2-\alpha}$, this condition is always satisfied under our maintained assumption of $\beta \geq 1/2$.⁵⁹ It is apparent that there are two reasons for underinvestment in the incomplete contracts case relative to complete contracts. First, there is a term that applies equally to all stages, which results from individual profit maximization of suppliers along the value chain. Second, m denotes the position in the value chain. So while there is underinvestment at each stage, the underinvestment is more severe for smaller m , i.e., further upstream.

Remaining industry equilibrium results. For completeness, we also report the remaining variables of the industry equilibrium with complete contracts. Using $\tilde{A} = E\tilde{P}^{\frac{\rho}{1-\rho}}$ and Eq. (A.12) in Eq. (A.10), gives the production quantity in industry equilibrium as

$$\tilde{q}(\omega) = \frac{\rho}{c_x} \frac{f}{1-2\rho}.$$

Using this result in inverse demand

$$\tilde{p}(\omega) = \tilde{A}^{1-\rho} \tilde{\varepsilon}(\omega)^\rho \tilde{q}(\omega)^{\rho-1}$$

as well as the definition of $\tilde{\varepsilon}$

$$\tilde{\varepsilon}(\omega) = \left(\int_0^1 \tilde{s}(j)^\alpha dj \right)^{\frac{1}{\alpha}} = \bar{s}$$

gives the optimal pricing rule as

$$\tilde{p}(\omega) = \frac{c_x}{\rho}. \tag{A.15}$$

With the definition of the optimal price index

$$\tilde{P} = \left(\int_0^{\tilde{n}} \left[\frac{\tilde{p}(\omega)}{\tilde{\varepsilon}(\omega)} \right]^{-\frac{\rho}{1-\rho}} d\omega \right)^{-\frac{1-\rho}{\rho}}$$

we get a second expression for the price index,

$$\tilde{P} = \frac{c_s c_x}{\rho^2} \frac{1-2\rho}{f} \tilde{n}^{-\frac{1-\rho}{\rho}}, \tag{A.16}$$

which, combined with (A.12) gives the equilibrium number of firms as

$$\tilde{n} = (1-2\rho) \frac{E}{f} \tag{A.17}$$

A.3. The extended model

In this section, we show that our main result continues to hold in an extended version of the model, in which we introduce an additional parameter $\nu \in (0, 1)$ that captures the scope of ethical quality differentiation. The extension generalizes the model outlined in Section 2 and collapses to the baseline version for $\nu = 1$. This extension allows us to relax the assumption of $\rho < 1/2$. In particular, for arbitrarily small ν , the maximum possible value ρ approaches one. See Footnote 16 for a discussion.

For expositional simplicity, we maintain the same notation as in the main text. It is well understood that the expressions in this section and in the main text are identical for $\nu = 1$ only.

In the model setup, the only change is in the utility function, which now reads as

$$U = \left(\int_{\omega \in \Omega} [\varepsilon(\omega)^\nu q(\omega)]^\rho d\omega \right)^{\frac{1}{\rho}}. \tag{A.18}$$

⁵⁹ Recall that $\beta \geq 1/2$ directly stems from Antràs (2003) and $0 < \alpha < \rho$ is discussed in Section 2.2.4.

Utility maximization subject to the budget constraint gives inverse demand for variety ω as

$$p(\omega) = \varepsilon(\omega)^\nu \rho q(\omega)^{-(1-\rho)} A^{1-\rho}, \tag{A.19}$$

where $A = EP^{\frac{\rho}{1-\rho}}$ and $P^{-\frac{\rho}{1-\rho}} = \int_{\omega \in \Omega} \left(\frac{\varepsilon(\omega)^\nu}{\rho(\omega)} \right)^{\frac{\rho}{1-\rho}} d\omega$. Using the definition of $\varepsilon(\omega)$ given in Eq. (3), firm revenue can be written as

$$r(\omega) = \left(\int_0^1 s(j)^\alpha dj \right)^{\frac{\nu\rho}{\alpha}} q(\omega)^\rho A^{1-\rho} \tag{A.20}$$

A.3.1. Incomplete contracts

With incomplete contracts, inverse demand and firm revenues are still given by Eqs. (A.19) and (A.20).

Revenue secured up to stage m is given by

$$r(m) = q(\omega)^\rho A^{1-\rho} \left(\int_0^m s(j)^\alpha dj \right)^{\frac{\nu\rho}{\alpha}} \tag{A.21}$$

and the incremental contribution of stage m to overall revenue then follows as

$$\frac{\partial r(m)}{\partial m} = r'(m) = \frac{\nu\rho}{\alpha} s(m)^\alpha r(m)^{\frac{\nu\rho-\alpha}{\nu\rho}} q(\omega)^{\frac{\alpha}{\nu}} A^{\frac{(1-\rho)\alpha}{\nu\rho}}. \tag{A.22}$$

As in the baseline model, each supplier maximizes its profits, composed of the share $1 - \beta$ of the incremental contribution to final revenue net of expenditure for the production standard,

$$\max_{s(m)} \pi_s(m) = (1 - \beta) r'(m) - c_s s(m). \tag{A.23}$$

Differentiating these profits with respect to $s(m)$ gives the analog of Eq. (11) from the baseline model as

$$s(m) = \left[(1 - \beta) \frac{\nu\rho}{c_s} q(\omega)^{\frac{\alpha}{\nu}} A^{\frac{(1-\rho)\alpha}{\nu\rho}} \right]^{\frac{1}{1-\alpha}} r(m)^{\frac{\nu\rho-\alpha}{\nu\rho(1-\alpha)}}. \tag{A.24}$$

Plugging this back into Eq. (A.22) yields a differential equation analogous to Eq. (12) in the baseline model. The solution gives an expression for revenue secured up to stage m as a function of parameters, A , and $q(\omega)$ analogous to Eq. (13) as

$$r(m) = \left(\frac{1 - \nu\rho}{1 - \alpha} \right)^{\frac{\nu\rho(1-\alpha)}{\alpha(1-\nu\rho)}} \left(\frac{1 - \beta}{c_s} \nu\rho \right)^{\frac{\nu\rho}{\alpha(1-\nu\rho)}} A^{\frac{1-\rho}{1-\nu\rho}} q(\omega)^{\frac{\rho}{1-\nu\rho}} m^{\frac{\nu\rho(1-\alpha)}{\alpha(1-\nu\rho)}}. \tag{A.25}$$

Plugging this back into Eq. (A.24) gives the production standard implemented at stage m as a function of parameters, $q(\omega)$, and A as

$$s(m) = \left(\frac{1 - \beta}{c_s} \nu\rho \right)^{\frac{1}{1-\nu\rho}} \left(\frac{1 - \nu\rho}{1 - \alpha} \right)^{\frac{\nu\rho-\alpha}{\alpha(1-\nu\rho)}} q(\omega)^{\frac{\rho}{1-\nu\rho}} A^{\frac{1-\rho}{1-\nu\rho}} m^{\frac{\nu\rho-\alpha}{\alpha(1-\nu\rho)}}, \tag{A.26}$$

analogous to Eq. (14) in the baseline model.

To choose the optimal scale of production the firm has to solve

$$\max_{q(\omega)} \pi_F \omega = \beta r(\omega) - c_x q(\omega) - f. \tag{A.27}$$

Using Eq. (A.25) evaluated at $m = 1$, the solution to the maximization problem yields

$$q(\omega) = \left(\frac{1 - \nu\rho}{1 - \alpha} \right)^{\frac{\nu\rho(1-\alpha)}{\alpha(1-\rho(1+\nu))}} \left(\frac{1 - \beta}{c_s} \nu\rho \right)^{\frac{\nu\rho}{1-\rho(1+\nu)}} \times \left[A^{1-\rho} \left(\frac{\beta}{c_x} \frac{\rho}{1 - \nu\rho} \right)^{1-\nu\rho} \right]^{\frac{1}{1-\rho(1+\nu)}}, \tag{A.28}$$

analogous to Eq. (17).

Turning to the industry equilibrium, using Eq. (A.25) evaluated at $m = 1$ as well as Eq. (A.28) in Eq. (A.27) and setting it to zero gives a first expression for the price index, analogous to Eq. (19) as

$$P = \left(\frac{f}{1 - \rho(1 + \nu)} \right)^{\frac{1-\rho(1+\nu)}{\rho}} \frac{c_x}{\rho} \left(\frac{c_s}{(1 - \beta) \nu\rho} \right)^\nu E^{-\frac{1-\rho}{\rho}} \beta^{-\frac{1-\nu\rho}{\rho}} \times (1 - \alpha)^{\frac{1-\nu\rho}{\rho}} \left(\frac{1 - \alpha}{1 - \nu\rho} \right)^{\frac{\nu\rho-\alpha}{\alpha\rho}}. \tag{A.29}$$

Example: A firm's change in GVC position over time



Notes: Average firm in terms of upstreamness, number of products and CSR spending was chosen for illustrative purposes. Firm from electrical equipment industry.

Fig. B.1. A firm's GVC position change over time.

We can use this result to calculate the values of $q(\omega)$ and $s(m)$ in industry equilibrium using Eqs. (A.26) and (A.28).

$$q(\omega) = \frac{\rho}{c_x} \frac{f}{1 - \rho(1 + \nu)} \tag{A.30}$$

$$s(m) = \frac{1 - \alpha}{\beta} \frac{(1 - \beta) \nu \rho}{c_s} \frac{f}{1 - \rho(1 + \nu)} m^{\frac{\nu \rho - \alpha}{\alpha(1 - \nu \rho)}} \tag{A.31}$$

The above equilibrium expression for $q(\omega)$ shows that $q(\omega)$ remains positive for a larger range of values for ρ . More precisely, while in the case of $\nu = 1$, we had to impose $\rho < 1/2$, we can now impose a weaker condition, $\rho < 1/(1 + \nu)$. As ν grows arbitrarily close to zero, the upper bound of the admissible range for ρ approaches unity. The equilibrium expression for $s(m)$ shows that our main result continues to hold also in this extended version. For our model to predict an upward sloping profile of CSR along the value chain, we need to assume that $\alpha < \nu \rho$.

The remaining equilibrium variables can be calculated as follows. Using the definition of $\varepsilon(\omega)$ we then get

$$\varepsilon(\omega) = \left(\int_0^1 s(m)^\alpha dj \right)^{\frac{1}{\alpha}} = \frac{1 - \alpha}{\beta} \frac{(1 - \beta) \nu \rho}{c_s} \frac{f}{1 - \rho(1 + \nu)} \left(\frac{1 - \nu \rho}{1 - \alpha} \right)^{\frac{1}{\alpha}} \tag{A.32}$$

Plugging this, the solution for $q(\omega)$ as well as the expression for P into inverse demand gives the pricing rule as

$$p(\omega) = A^{1 - \rho} q(\omega)^{-(1 - \rho)} \varepsilon^{\nu \rho} = \frac{c_x}{\rho} \frac{1 - \nu \rho}{\beta} \tag{A.33}$$

Using $\varepsilon(\omega)$ and $p(\omega)$ in the definition of the price index from demand, $P^{-\frac{\rho}{1 - \rho}} = \int_0^n \left(\frac{\varepsilon(\omega)^\nu}{p(\omega)} \right)^{\frac{\rho}{1 - \rho}} d\omega$, gives a second expression for the price index as a function of the number of firms, n . Combining the two expressions gives the equilibrium number of firms as

$$n = \frac{\beta E}{1 - \nu \rho} \frac{1 - \rho(1 + \nu)}{f} \tag{A.34}$$

A.3.2. Complete contracts

In the case of complete contracts, we can state the firm's problem analogous to Eq. (A.7) as

$$\max_{\tilde{q}(\omega), \{\tilde{s}(j)\}_{j \in [0,1]}} \tilde{\pi}_F(\omega) = \tilde{q}(\omega)^\rho \tilde{A}^{1 - \rho} \left(\int_0^1 \tilde{s}(j)^\alpha dj \right)^{\frac{\nu \rho}{\alpha}}$$

$$- c_x \tilde{q}(\omega) - c_s \int_0^1 \tilde{s}(j) dj - f, \tag{A.35}$$

with the only difference being the parameter ν attached to ethical quality. Following steps analogous to those outlined in Appendix A.2 gives the following results in industry equilibrium. The production standard $\tilde{s}(j) = \tilde{s} \forall j$ is given by

$$\tilde{s} = \frac{\nu \rho}{c_s} \frac{f}{1 - \rho(1 + \nu)}. \tag{A.36}$$

Because \tilde{s} is identical across stages, it also holds that $\tilde{\varepsilon}(\omega) = \tilde{s}$. The optimal quantity of final good production is given by

$$\tilde{q}(\omega) = \frac{\rho}{c_x} \frac{f}{1 - \rho(1 + \nu)}, \tag{A.37}$$

while the optimal price is given by

$$\tilde{p}(\omega) = \frac{c_x}{\rho} \tag{A.38}$$

and the equilibrium number of firms is given by

$$\tilde{n} = [1 - \rho(1 + \nu)] \frac{E}{f}. \tag{A.39}$$

Appendix B. Empirical appendix

B.1. Within firm's variation in upstreamness

Fig. B.1 illustrates the sources of variation for a firm in the electrical equipment industry. The depicted firm serves as an example of an average firm in our sample in terms of CSR spending, upstreamness and number of products. The firm has several products that belong to industries that differ in terms of the upstreamness position. Over time, the firm's product portfolio changes as a new product is added and one is dropped and the importance of products measured by their sales share changes as well. The firm's upstreamness position (black dashed line) varies over time in line with the changes in the product portfolio.

B.2. Measuring wages & export exposure to OECD countries

This section provides details on two control variables, namely, the measure of wages and the measure of export exposure to OECD countries.

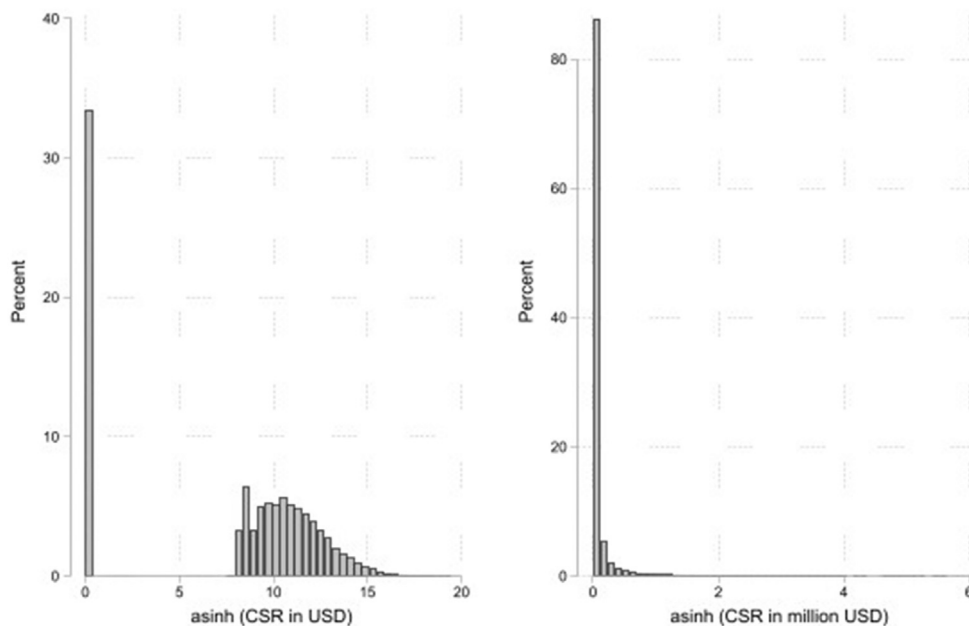


Fig. B.2. Distribution of the i.h.s. transformed dependent variables measuring CSR spending in USD and million USD.

Wages: We control for the possibility that wages vary systematically with the value chain position. In Prowess, the wage bill is available for a subset of firms. However, there are many zeros and the provision of the number of employees is not compulsory for firms so that we cannot compute wages per employee. We therefore decide not to include the wage bill from the firm-level data and prefer to use a proxy for hourly wages taken from WIOD. We take the hourly compensation paid in Indian industries from WIOD and use the product-level information of firms to generate a firm-level control variable that is similar in spirit to our firm-level upstreamness measure. To this end, we calculate *Wages* as an industry’s average hourly compensation to employees weighted by a firm’s product sales in the respective industry and year. This delivers our control variable of interest, which is computed in the following way:

$$Wages_{ft} = \sum_{v=1}^V \frac{sales_{fv}}{sales_{ft}} compensation_{vt}. \tag{B.1}$$

We thus compute *Wages_{ft}* taking industry *v*’s average hourly compensation to employees in year *t* and weighting it with a firm’s product sales in the respective industry.

OECD export exposure: The Prowess data do not cover information on the export destinations of firms. In order to control for heterogeneity in destination markets, we construct a proxy for *exposure to OECD markets* based on information taken from WIOD. This measure is constructed similar to our upstreamness and wage measures based on WIOD industry data as

$$OECD_export_exposure_{ft} = \sum_{v=1}^V \frac{sales_{fv}}{sales_{ft}} \frac{exports_OECD_{vt}}{exports_total_{vt}}, \tag{B.2}$$

where we take an industry *v*’s exports to OECD countries relative to industry *v*’s total exports in year *t* and weight this according to a firm’s product portfolio.

B.3. Additional descriptive statistics

In Section 3.4.5 we apply inverse hyperbolic sine (i.h.s.) transformation and consider CRS spending both in USD and in million USD because i.h.s. transformation is sensitive to the unit choice. Fig. B.2

Table B.1

Judicial inefficiency by Indian states: Cost to enforce a commercial contract (in % of claim).

Source: World Bank Doing Business India 2009.

States	Judicial inefficiency
Bihar	16.9
Andhra Pradesh	17.7
Rajasthan	19.0
Punjab	20.0
Assam	22.5
Uttar Pradesh	24.0
Orissa	25.2
Tamil Nadu	25.2
Madhya Pradesh	26.0
West Bengal	26.5
Kerala	30.1
Jharkhand	30.3
Gujarat	30.5
Haryana	31.0
Karnataka	33.0
NCT of Delhi	33.7
Maharashtra	39.5

illustrates the differences in distributions of the dependent variable depending on the choice of the units.

B.4. Additional results

Handling of missing values in the CSR variable: As discussed in Section 3.2.1, we follow Dharmapala and Khanna (2018) and replace missing CSR values with zeros. To ensure that our results are not driven by this assumption, we report the results when missing CSR values are not replaced by zeros in Table B.2. Note that four of our specifications do not include zeros and are therefore not concerned (columns (1), (2), (4), and (5)). The two specifications including zero CSR observations (columns (3) and (6)) show that our main results are not affected by our choice to treat missing values of CSR as zeros.

First stage results for the cross section with lagged upstreamness: Table B.3 reports the first stage results belonging to the second stage results shown in Table 11 in Section 3.4.6.

Table B.2
Regression results when missing CSR values are not replaced by zeros.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Cross section			Panel		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.211*** (0.051)	-0.234** (0.104)	-0.233** (0.104)	-0.135*** (0.039)	-0.184*** (0.061)	-0.185*** (0.061)
OECD export exposure	0.086 (0.105)	0.567** (0.235)	0.581** (0.234)	0.288*** (0.065)	0.533*** (0.118)	0.525*** (0.119)
log(Wages)	0.238*** (0.078)	-0.083 (0.190)	-0.087 (0.190)	0.223*** (0.039)	0.009 (0.096)	0.014 (0.096)
Export share	0.379*** (0.046)	0.149 (0.187)	0.153 (0.188)	0.143*** (0.040)	0.222*** (0.083)	0.222*** (0.083)
Domestic inputs/total inputs	0.228*** (0.027)	0.245*** (0.078)	0.247*** (0.078)	0.041** (0.018)	0.045 (0.033)	0.043 (0.033)
State-owned (D)	0.520* (0.273)	0.139 (0.172)	0.144 (0.173)	0.148 (0.169)	0.049 (0.094)	0.048 (0.094)
Foreign-owned (D)	1.037*** (0.046)	0.522*** (0.093)	0.523*** (0.093)	0.048 (0.049)	0.188*** (0.065)	0.188*** (0.065)
log(Sales)	0.582*** (0.008)	0.857*** (0.028)	0.859*** (0.028)	0.315*** (0.010)	0.463*** (0.025)	0.458*** (0.025)
log(Age)	0.219*** (0.015)	0.197*** (0.051)	0.198*** (0.051)	0.141*** (0.030)	0.302*** (0.063)	0.305*** (0.063)
Industry × Year & State (D)	Yes	Yes	Yes	No	No	No
Firm (D)	No	No	No	Yes	Yes	Yes
Year (D)	No	No	No	Yes	Yes	Yes
Observations	54,394	54,394	55,361	51,645	51,645	52,696
Number of firms	11,291	11,291	11,370	8,533	8,533	8,703
Adjusted/Pseudo R ²	0.577	0.837	0.838	0.140 ^a	0.975	0.975

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

^a Adjusted within R².

Table B.3
2-SLS estimation results: First stage — Cross section with lagged upstreamness.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Base-years									
	t-3	t-3	t-4	t-4	t-5	t-5	t-6	t-6	t-7	t-7
$Z_{f,t-1,t-3}$	0.651*** (0.016)	0.651*** (0.026)								
$Z_{f,t-1,t-4}$			0.575*** (0.017)	0.575*** (0.026)						
$Z_{f,t-1,t-5}$					0.512*** (0.018)	0.512*** (0.026)				
$Z_{f,t-1,t-6}$							0.465*** (0.021)	0.465*** (0.028)		
$Z_{f,t-1,t-7}$									0.416*** (0.024)	0.416*** (0.029)
OECD export exposure	-0.121*** (0.021)	-0.121*** (0.045)	-0.158*** (0.027)	-0.158*** (0.054)	-0.174*** (0.034)	-0.174*** (0.065)	-0.193*** (0.039)	-0.193*** (0.071)	-0.188*** (0.047)	-0.188*** (0.081)
log(Wages)	0.243*** (0.024)	0.243*** (0.049)	0.286*** (0.029)	0.286*** (0.057)	0.313*** (0.033)	0.313*** (0.063)	0.327*** (0.037)	0.327*** (0.070)	0.323*** (0.042)	0.323*** (0.078)
Export share	-0.002 (0.005)	-0.002 (0.006)	0.001 (0.007)	0.001 (0.008)	0.003 (0.008)	0.003 (0.009)	0.000 (0.009)	0.000 (0.010)	0.001 (0.011)	0.001 (0.012)
Domestic inputs/total input	0.005* (0.003)	0.005 (0.004)	0.005 (0.003)	0.005 (0.004)	0.004 (0.004)	0.004 (0.004)	0.004 (0.004)	0.004 (0.005)	0.003 (0.005)	0.003 (0.006)
State-owned (D)	0.015 (0.022)	0.015 (0.021)	0.015 (0.024)	0.015 (0.023)	-0.010 (0.018)	-0.010 (0.017)	-0.032 (0.031)	-0.032 (0.032)	-0.043 (0.031)	-0.043 (0.030)
Foreign-owned (D)	-0.006 (0.004)	-0.006 (0.004)	-0.007* (0.004)	-0.007 (0.005)	-0.010* (0.005)	-0.010* (0.005)	-0.011* (0.006)	-0.011* (0.006)	-0.011* (0.007)	-0.011 (0.007)
log(Sales)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)

(continued on next page)

Table B.3 (continued).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Base-years									
	t-3	t-3	t-4	t-4	t-5	t-5	t-6	t-6	t-7	t-7
log(Age)	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.003 (0.004)	0.003 (0.004)
Constant	-0.031 (0.064)	-0.031 (0.128)	-0.011 (0.080)	-0.011 (0.152)	0.030 (0.097)	0.030 (0.174)	0.074 (0.109)	0.074 (0.199)	0.172 (0.128)	0.172 (0.226)
Industry × Year & State (D)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm (D)	No	No	No	No	No	No	No	No	No	No
Observations	37,201	37,201	32,068	32,068	27,669	27,669	23,586	23,586	19,146	19,146
Number of clusters	8,347	450	7,389	441	6,810	437	6,283	427	5,328	411
Adjusted R ²	0.937	0.937	0.929	0.929	0.923	0.923	0.918	0.918	0.915	0.915
F-statistic	349.9	265.1	232.4	194.4	157.2	143.8	109.3	90.51	66.69	65.45

Robust standard errors in parentheses clustered at the firm level in columns (1), (3), (5), (7), and (9) and five-digit industry level in columns (2), (4), (6), (8), and (10). Respective second stage results are presented in Table 11.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table B.4

Panel regression results: Excluding switchers and balanced panel.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	w/o switchers			Balanced		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.157*** (0.043)	-0.234*** (0.072)	-0.230*** (0.071)	-0.115 (0.075)	-0.220** (0.099)	-0.201** (0.098)
OECD export exposure	0.289*** (0.075)	0.536*** (0.138)	0.584*** (0.141)	0.381*** (0.121)	0.595*** (0.194)	0.683*** (0.196)
log(Wages)	0.185*** (0.046)	-0.084 (0.116)	-0.081 (0.117)	0.289*** (0.071)	-0.129 (0.162)	-0.136 (0.164)
Export share	0.132*** (0.048)	0.119 (0.091)	0.156* (0.091)	0.042 (0.085)	-0.086 (0.130)	-0.099 (0.131)
Domestic inputs/total inputs	0.036* (0.022)	0.020 (0.035)	0.060 (0.038)	0.076** (0.036)	0.046 (0.054)	0.106* (0.060)
State-owned (D)	0.159 (0.207)	0.036 (0.093)	0.035 (0.094)	0.108 (0.238)	0.031 (0.106)	0.034 (0.109)
Foreign-owned (D)	0.032 (0.052)	0.199** (0.079)	0.208*** (0.080)	0.011 (0.061)	0.236** (0.117)	0.246** (0.120)
log(Sales)	0.305*** (0.011)	0.448*** (0.030)	0.451*** (0.030)	0.402*** (0.021)	0.515*** (0.045)	0.522*** (0.045)
log(Age)	0.120*** (0.035)	0.276*** (0.074)	0.310*** (0.074)	0.370*** (0.082)	0.434*** (0.164)	0.482*** (0.163)
Firm dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39,087	39,087	48,690	14,312	14,312	17,022
Number of firms	6,283	6,283	7,096	1,406	1,406	1,447
Adjusted/Pseudo R ²	0.130 ^a	0.976	0.970	0.206 ^a	0.978	0.975

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Columns 1–3: Exclusion of switchers, i.e. firms that exit and re-enter the data.

Columns 4–6: Restricted to balanced panel, i.e. keeping only firms that are in the sample for the whole period (2000–2013).

^a Adjusted within R².

Handling of firm entry and exit: The Prowess data is an unbalanced panel and we observe entry and exit of firms in our data. First, we consider a sample without “switchers”, i.e. firms that are switching in and out of the data. As reported in Table B.4 in columns (1)–(3), our results remain robust. Although this sample is not a balanced panel, it illustrates that our results are not driven by firms exiting

and re-entering. Moreover, in columns (4)–(6), we report the results for the balanced panel considering only firms that we observe in all 14 years (2000–2013). Compared to the full sample, more than 90% of observations are lost in the balanced sample. Nevertheless, we still find a statistically significant effect of upstreamness on CSR in the PPML specifications (columns (5) and (6)).

Table B.5
Regression results: Alternative set of fixed effects.

Variables	(1)	(2)	(3)
	Cross section		
	(ln) CSR OLS	CSR in USD PPML w/o zeros	CSR in USD PPML incl. zeros
Upstreamness	-0.237*** (0.052)	-0.372*** (0.087)	-0.376*** (0.089)
OECD export exposure	0.112 (0.113)	0.742*** (0.220)	0.884*** (0.217)
log(Wages)	0.304*** (0.082)	0.070 (0.174)	0.079 (0.174)
Export share	0.382*** (0.050)	0.093 (0.189)	0.162 (0.189)
Domestic inputs/total inputs	0.219*** (0.027)	0.209*** (0.077)	0.287*** (0.077)
State-owned (D)	0.325 (0.290)	0.249* (0.139)	0.244* (0.146)
Foreign-owned (D)	0.987*** (0.048)	0.563*** (0.085)	0.602*** (0.087)
log(Sales)	0.584*** (0.009)	0.850*** (0.021)	0.874*** (0.021)
log(Age)	0.203*** (0.016)	0.198*** (0.047)	0.220*** (0.048)
0.220***	(0.016)	(0.047)	(0.047)
Industry × Year × State dummy	Yes	Yes	Yes
Observations	52,048	52,048	78,760
Number of firms	10,994	10,994	15,154
Adjusted/Pseudo R ²	0.594	0.883	0.885

Robust standard errors in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1.

Alternative fixed effects: Table B.5 reports the results when controlling for industry-year-state fixed effects in the cross section specifications (columns (1)–(3)) instead of industry-year and state fixed effects in our preferred specification. Compared to Table 3, results remain qualitatively unaffected.

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