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Corporate Social Responsibility along the Global Value Chain

Abstract

Firms are under increasing pressure to meet stakeholders' demand for Corporate Social Responsibility (CSR) along their global value chains. We study the incentives for and investments in CSR at different stages of the production process. 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. The model predicts an increasing CSR profile for suppliers along the value chain: from upstream suppliers with low CSR to downstream suppliers with higher CSR. We confirm this prediction using Indian firm-level data. We compute a firm's value chain position combining product-level information in our data with the World Input-Output Database. We find that more downstream firms have higher CSR expenditures as measured by a combination of staff welfare spending and social community spending.

JEL-Codes: D230, F120, F140, F180, F610, F630, L230, M140, O120.

Keywords: corporate social responsibility, global value chains, incomplete contracts, property rights theory, GVC positioning, India, emerging markets.

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1 Introduction

Reports of negative social and environmental externalities within global value chains (GVCs) fuel rejection of globalization all over the world. Concerns about negative social and environmental impacts of GVCs especially in developing and emerging economies are widespread and boosted by tragedies such as the Rana Plaza collapse in 2013. Firms are therefore increasingly under pressure to assure that certain minimum standards are not only respected by the firm itself, but also by suppliers along its value chain.

This can pose substantial problems to firms in the Global North, as labor and environmental regulation varies greatly across countries and many foreign suppliers operate under very lenient regulation. When suppliers invest in order to comply with standards above their domestic legal requirements, this is an investment in Corporate Social Responsibility (CSR), by definition (e.g., McWilliams and Siegel, 2001). CSR investments along the GVC 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.

With this paper, we contribute to a better understanding of the factors that drive CSR along the global value chain. More specifically, we ask: which role does the value chain position of firms play for their CSR investments?

We make two main contributions. First, after arguing the case for the relevance of incomplete contracts for CSR, we analyze a model of CSR investments along a value chain of a continuum of suppliers based on Antràs and Chor (2013). In our model, CSR investments of suppliers in the Global South provide product differentiation when selling the final product to caring consumers in the Global North. We find that with incomplete contracts, CSR levels are lower in upstream stages and higher when the supplier is closer to the final consumer. Higher cumulative CSR levels in previous stages foster CSR investment at the current stage, which leads to this increasing profile of CSR along the value chain. 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 in order to empirically investigate how it affects a firm's monetary CSR spending. Our empirical analysis supports the theoretical prediction.

A central premise of our analysis is that suppliers make their decisions on CSR in an environment of incomplete contracts. The firm selling the final good is thus unable to write binding contracts on the production standards in supplier factories. We now plead the case for the relevance and the type of incomplete contracts along global value chains. Failure to assure sufficient levels of CSR in supplier factories can result in reputational damage or even lead to consumer boycotts. These boycotts go against leading firms in a

diverse set of industries and are often triggered by misconduct of international suppliers (for examples, see Baron, 2016, or Herkenhoff and Krautheim, 2020). The case of the "sweatshop campaign" against Nike in the 1990s is probably the best documented and most researched case in point. Massive protests and consumer boycotts ultimately led Nike to implement compulsory codes of conduct for all its suppliers.[1] Harrison and Scorse (2010) show that the campaigns caused a strong increase in the real wages in Indonesian factories manufacturing for Nike. Locke (2013a), however, shows that more than a decade after the initiation of legally binding codes of conduct combined with an auditing system, substantial compliance problems persisted in Nike's value 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, Toffel and Hugill (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.

This highlights that despite the option to impose legally binding codes of conduct, firms succeed only partially in enforcing sufficient production standards in supplier factories. In our view, this observation suggests that *incomplete contracts* play an important role for understanding CSR investments especially along GVCs. To be more specific: while labor and environmental standards can be precisely specified for instance in legally binding codes of conduct, the contractional incompleteness arises when it comes to verifiability and enforceability in a court of justice. A typical notion of incomplete contracts is that the non-contractible actions are "observable, but not verifiable" (Hart and Moore, 1999, p. 118). We argue in Section 2.2 that this definition applies here. Central to the argument is the difference between circumstantial evidence on a supplier's infringements that is sufficient for caring consumers to re-assess their valuation of the

[1] After massive campaigns and boycotts in 1997, the annual report of Nike for the year 1998 shows a reduction in footwear sales in the United States by $255 million, mostly due to a glut in inventory, and a decline in profits by 49.8% and 20% decrease in the stock price (see Nike, 1998). 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 doesn't want to buy products made under abusive conditions." (New York Times, 1998).

product on the one hand and the type of evidence that would hold in a court - possibly one located in a country with weak legal institutions - on the other.[2]

This places the analysis of CSR along GVCs in the context of a large literature started by the seminal contribution of Antràs (2003). This literature focuses on incomplete contracts between a firm and its international suppliers with non-contractible investments in physical production factors or product quality. Especially the latter - a possibly observable, possibly non-verifiable, intangible property - exhibits many similarities with CSR investments. We therefore build on this literature when addressing the following question: how do incomplete contracts shape the supplier's CSR investments along the international value chain?

As most production processes are sequential in nature and span from very upstream to very downstream activities, Antràs and Chor (2013) seems to be the natural starting point for our analysis in Section 2. Antràs and Chor (2013) analyze the role of incomplete contracts for the interaction between a firm and a continuum of suppliers engaged in a sequential production process, the firm's value chain. We adjust and extend their model in a way that allows us to analyze investments in CSR under incomplete contracts, i.e., when CSR is not contractible.

We assume that while the firm and its consumers are located in the Global North, suppliers are located in the Global South and operate under less stringent regulation. We introduce a group of 'caring' consumers who appreciate a product's 'ethical quality' determined by the production standards (CSR) respected by suppliers along the value chain.[3] In line with the findings in Bartling et al. (2015), in our model, CSR along the value chain provides vertical product differentiation for the final product. Higher CSR investments by suppliers therefore allow the firm to charge a higher markup. Carried out by independent suppliers, however, these CSR investments are not under the control of the firm.

We use our model to analyze the patterns of CSR along the value chain and find an increasing profile: while CSR investments at upstream stages are low, they are higher for more downstream suppliers. This pattern arises because under incomplete contracts, the

[2]There is a recent and quickly expanding literature on relational contracts in developing countries surveyed in Macchiavello (2021), which supports our notion of the relevance of incomplete contracts in sourcing relationships between firms. Casaburi and Macchiavello (2019) show how imperfect contract enforcement generates barriers to entry in the Kenya diary 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 Equador depending on market power. Most informative for our modeling (see Section 2.2.1), Cajal-Grossi et al. (2020) show that suppliers in the Bangladeshi garment sector obtain higher prices when selling to relational buyers than when selling to spot buyers.

[3]Both 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.

cumulative CSR investment in previous stages provides the supplier with an incentive to choose a higher CSR level. This increasing CSR profile is the main testable implication of our model, which we take to the data in Section 3.[4]

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 in several influential studies (e.g., Goldberg et al., 2010a,b; De Loecker et al., 2016). 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 (Boehm and Oberfield, 2020) amplifies the problem that contracts between the supplier and the headquarter are observable but not verifiable (Hart and Moore, 1999).

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 measure 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.[5]

Our approach to computing a firm's value chain position has similarities to the one in Chor et al. (2021). We proceed in two steps. 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 upstreamness of each industry and year in India. Second, to each product in a firm's portfolio, we assign the value of annual upstreamness of

[4]Similar to Antràs and Chor (2013), our model can in principle also generate a decreasing profile of CSR along the value chain. In our model the CSR profile increases, as soon as the varieties produced in a final good sector (e.g., different types of notebooks) are more substitutable in the eyes of consumers than different levels of CSR across production stages. In the wording of Antràs and Chor (2013), CSR investments are then *sequential complements* along the value chain. We believe that this is an inherently plausible assumption. When consumers care about, say, the use of organic cotton *as well as* decent work conditions, moderate investments in both CSR dimensions will yield some reasonable level of perceived ethical quality. Failing to use organic cotton, however, it will be difficult to maintain the level of perceived ethical quality by improving work conditions. The assumption is that this substitution will be more difficult compared to the relative ease with which a consumer can substitute one variety by another variety of identical ethical quality.

[5]Our analysis differs from most of the previous work on CSR in several important ways. Pisani et al. (2017) survey the literature in management sciences and highlight that CSR is primarily measured via interviews, data from international organizations and corporate, stock index or sustainability rating databases. Especially data from corporate and sustainability ratings rely on information from large and publicly listed companies, typically in developed rather than emerging economies. In this context, CSR activities are measured with indeces that condense information on issues like human rights, the environment, community relations, diversity, safety and corporate governance (see, e.g., Marano and Kostova, 2016). Other studies use standards implemented by firms like corporate codes of conduct, certifications, sector-specific labels/standards and international standards with regard to environmental, social and labor aspects (e.g., Mayer and Gereffi, 2010; Nadvi, 2008).

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 effect of a firm's value chain position on its CSR expenditure relying 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.

In our analysis, we control for a large set of 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. One could consider staff welfare spending as a part of the overall compensation package of employees. If, e.g., due to higher skill intensity, downstream firms offer better compensation packages, 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. To address this concern, we construct a firm-specific wage measure based on industry information in a similar fashion to our firm-level GVC position. We include it in our main specifications and thus identify the statistically significant negative effect of upstreamness on CSR spending after taking out the variation in staff welfare spending that is due to differences in employee compensation.

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. We control for visibility by adding marketing and advertising expenses as an additional variable. We also smooth CSR spending over two years in order to control for lumpy CSR spending.

This paper is firmly 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), recently surveyed in Antràs and Chor (2021). To our knowledge, our paper is the first to introduce CSR investments as a non-contractible variable into this literature. This opens up both the theoretical and

the empirical toolkit of this literature to the analysis of social and environmental issues in globalized production that feature prominently in the public debate.[6]

There is an extensive empirical strand of this literature surveyed in Antràs and Yeaple (2014) and Antràs (2016), 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.

Our work also relates to the recent literature in international economics studying the "globalization backlash", the massive skepticism economic globalization encounters in many countries (Pavcnik, 2017, Harms and Schwab, 2020). This literature is surveyed in a recent chapter in the Handbook of International Economics by Colantone et al. (2021). The focus is on different frictions, which create winners and losers from international trade, with the existence of losers leading to the backlash. More recently, also psycho-social aspects related to identification are considered, e.g., as a driver of (populist) trade policy (Grossman and Helpman, 2021). In a similar vein, we are interested in an additional and complementary source of skepticism of globalization: the constant violation of "ethical minimum standards" in international production an increasing number of consumers and civil society actors are concerned about. It emerges from the combination of the internationalization of production, massive differences in national regulations, and incomplete contracts along global value chains.

Much of this frustration manifests itself in the activity of internationally active advocacy NGOs, which campaign against infringements of ethical minimum standards in global value chains. According to Baron (2012), these NGOs use both confrontational strategies (like consumer boycotts) as well as cooperative approaches (like labels). While

[6]Closest in this respect is recent work by Herkenhoff and Krautheim (2020) who introduce (un)ethical production and consumer boycotts into the Antràs (2003) framework and establish a link between offshoring and unethical production both theoretically and empirically.

we do not explicitly consider NGO activity in our analysis, they certainly play a role for the link between the CSR levels and consumer demand, i.e., the 'perceived ethical quality' in our model. Our work therefore also relates to a number of papers that consider advocacy NGOs, CSR, and responsible sourcing in the context of international production. Aldashev et al. (2015) consider the impact of NGO campaigns on industry structure in a setting with endogenous markups and monopolistic competition. Krautheim and Verdier (2016) analyze the endogenous emergence of a consumer-financed NGO in response to the offshoring decision of a firm. Hatte and Koenig (2020) use recently available data on NGO campaigns to carry out a gravity analysis of international NGO campaigns. Koenig et al. (2021) build on this approach and explicitly link it to the internationalization of production. Alfaro-Ureña et al. (2021) develop a quantitative general equilibrium model to study the effects of responsible sourcing in origin countries. They use detailed data on affiliates of multinationals in Costa Rica to provide evidence on the effects of responsible sourcing rollouts, and calibrate the model for counterfactual analysis. The most related paper in this context is Herkenhoff and Krautheim (2020) who, starting from Antràs (2003) and the related empirical literature, show that the possibility of unethical production affects the international organization of production, linking integration to ethical and outsourcing to unethical production.

There is a large and expanding 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. Crifo and Forget (2015) list three theoretical assumptions reflecting three different drivers of CSR. Two of these directly relate to our modeling choices: imperfect competition and contract incompleteness (see, e.g., their Figure 1, p. 114). Moreover, they also survey the large body of empirical literature on CSR which mainly focuses on the effect, rather than the determinants, of CSR. We contribute to the latter part of that literature by analyzing the impact of a firm's value chain position on its CSR spending. In terms of our measure of CSR and the coverage of our data within the Indian economy, our study has some important differences to most of the empirical literature on CSR. Most of the literature uses qualitative measures combined into indices. Moreover, usually the information is obtained by the mandatory CSR reporting of listed firms in developed rather than emerging economies (e.g., Pisani et al., 2017). Our continuous measure in monetary units covering a substantial part of the Indian economy allows us to study a large number of non-listed medium-sized and large firms, whose CSR investments would otherwise be overlooked.

Empirical evidence on the role of global value chain relationships for CSR is generally scarce. Noteworthy exceptions are Schiller (2018) and Newman et al. (2018). 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 motivates his purely empirical work alluding to the same notion of incomplete contracts that is at the heart of our theoretical model: the inability of a firm to fully control CSR investments of its suppliers along the value chain. Schiller (2018) provides evidence that is 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. Our theoretical work uncovers the role of the value chain position of the supplier as a driving factor, which we then confirm empirically.

Most related to our empirical analysis is Newman et al. (2018). They exploit CSR indicators that capture compliance with labor standards, community and management-related CSR practices to analyze the transmission of socially responsible behavior through trade in Vietnamese firms. They find that a firm's CSR increases with exporting and importing and varies across export destinations. The internationalization of supply chain relationships therefore seems to matter for CSR activities of firms. Moreover, they 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. Using a time-varying, firm-specific measure of a firm's value chain position, our approach allows us to directly measure the GVC position of firms and to analyze its effect on their 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 analyze a model of CSR by independent suppliers along the global value chain. We show that in equilibrium our theory implies an increasing CSR profile along the value chain, a prediction which we take to the data in Section 3.

2.1 Setup

We propose a model of sequential production with incomplete contracts along the value chain based on Antràs and Chor (2013) and incorporate consumer valuation for ethical production practices and CSR investment. In our benchmark model, we consider the case of a firm in North producing a (potentially) differentiated variety ω of a consumption

good. The value chain of the firm is international with a continuum of independent suppliers in South contributing to a sequential production process.

2.1.1 Preferences

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 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, $q(\omega)$.[7] The preferences of caring consumers are given by:

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

with $\rho \in (0, 1/2)$.[8] 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. For simplicity, we assume that ethical quality is the only means of vertical differentiation across varieties.[9] 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:

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

[7] 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.

[8] 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 2.3. 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.

[9] See Aghion et al. (2020) for a recent example of such a modeling approach.

2.1.2 A Chain of Suppliers

We consider a firm in North that has part of its value chain in South, where environmental and labor regulation are not up to the standards of caring consumers. Since the focus of our analysis is neither the integration vs. outsourcing decision of the firm (as in Antràs and Chor, 2013) nor in the splitting of the value chain between countries (as in Costinot et al., 2013), we assume that each firm has a sequential production process with unit measure of required inputs, which are all provided by *independent suppliers in South*.

For each intermediate j, there is a large number of specialized potential suppliers in South. The firm picks one supplier for each input.[10] We assume that inputs - and therefore suppliers - can be ordered according to their place in the value chain with $j = 0$ being the most upstream input and $j = 1$ the most downstream one. For simplicity, we also assume that all stages are identical across varieties.

2.1.3 CSR and Perceived Ethical Quality

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 $s(j)$. 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:

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

The parameter $\alpha > 0$ governs the substitutability of CSR levels across suppliers. A value of unity would imply perfect substitutability, which we do not consider to be a plausible case for the substitutability of CSR levels across suppliers. In Footnote 4, we provide an intuition for $\alpha > 0$ based on an example of consumers caring for both organic inputs and fair treatment of workers. We argue that not delivering on one dimension is not easily compensated by investing more into the other dimension. 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 lies between zero and one and represents the ease with which a consumer can substitute one ethically differentiated variety for another with

[10] In Footnote 24, we show that it is optimal for a firm serving caring consumers to pick only one supplier for each stage.

the identical level of ethical quality. Different to α, we argue that this substitutability should be relatively high. We therefore focus our analysis on the case where $\alpha < \rho$.[11]

2.1.4 Production of Physical Output

We assume that 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

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

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.[12]

It follows that the quantity of the input the firm sources at stage j is given by $x(j) = q(\omega)$.[13] 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:

$$\int_0^1 c_x\ dj = c_x. \tag{5}$$

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

[11] 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 plausible 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.

[12] 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 lead 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 2.2.1. This implies that the firm can always assure the right sequencing and the required quantity for each input.

[13] We postpone the detailed discussion of why this is the case to Footnote 21, as the argument relies on the effects of the input market introduced below.

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.[14]

2.2 Incomplete Contracts and CSR along the Value Chain

We now describe the options of the firm to source inputs used in production and specify demand by caring as well as non-caring consumers. We then introduce incomplete contracts and analyze the firm-supplier interaction and the resulting CSR investments along the value chain.

2.2.1 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.[15] 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.[16]

[14]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.

[15]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. (2021) show that in the coffee market fair trade certification is linked to higher sales.

[16]In recent work, Cajal-Grossi et al. (2020) 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.

2.2.2 Demand and Firm Revenue

Let us first consider a firm serving non-caring consumers. These firms do not have to incur a fixed cost and operate under perfect competition with a market price $p_h = c_x$, implying zero profits. They can either source the inputs for all stages from the input market or source input j from a matched supplier. The indifference of non-caring consumers to CSR investments implies that the firm has no reason to pay a price above the marginal production cost for each input along the value chain. Competing with suppliers on the input market, also a matched supplier will not invest in costly CSR. In the eyes of non-caring consumers, output of different firms is perfectly substitutable, they will therefore only buy from firms with the lowest prices, i.e., firms with zero CSR along the value chain. At the same time, the output of firms serving non-caring consumers is of no value at all to caring consumers, as they derive no utility from consumption when $\varepsilon(\omega) = 0$.

Let us now turn to a firm serving caring consumers. The firm must pay an initial fixed cost f of marketing its output to caring consumers.[17] A positive value of perceived ethical quality $\varepsilon(\omega) > 0$ then provides vertical product differentiation and allows the firm to charge a price above marginal cost - a price at which non-caring consumers are unwilling to buy. It directly follows that firms specialize in serving either caring or non-caring consumers by opting for imperfect competition with 'ethical differentiation' or perfect competition. We will get back to this decision when analyzing the industry equilibrium of our model in Section 2.4.1.

Maximizing utility of caring consumers in Equation (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

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

[17] We think of these costs as expenses informing consumers about the product and establishing credibility for the ethical content of its production process.

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.

2.2.3 Incomplete Contracts

The substantial compliance problems many firms face along their value chain alluded to the relevance of contractual incompleteness in the context of CSR by suppliers. Contractual incompleteness between a firm and its international suppliers is at the heart of a large literature discussed in the Introduction. There is a broad consensus that - especially the international - firm-supplier relationship is plagued by incomplete contracts.

One 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: limited verifiability and enforceability by a third party, especially a court.

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.[18]

These arbitrary examples provide us with two important insights related to contractual incompleteness, especially with the concepts of observability and verifiability discussed below. In the above examples, it is 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 production conditions. Such circumstantial evidence possibly obtained by breaking domestic laws is in many cases sufficient to convince caring consumers to re-assess their valuation of the product.[19] This type of circumstantial and/or illegally obtained evidence is, however, insufficient in a court of justice. 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

[18]For a vivid description of the typical problems of auditors in the field, see Locke (2013b), p.35-37.

[19]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`.

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.

In the case of CSR investments - or especially their absence - it is therefore relatively simple to learn about what is (probably) going on in a given factory, which in many cases is sufficient for consumers to respond. But it is infinitely harder to produce more than circumstantial evidence for a systematic, continuous, large-scale violation of e.g. codes of conducts by a supplier. This produces the standard notion in the incomplete contracts literature that the action is "observable but not verifiable" (e.g. Hart and Moore, 1999) at least at reasonable cost.[20]

2.2.4 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 equation (4), incomplete contracts do not lead to underinvestment in quantities and the outcome is therefore observationally equivalent to a setting of complete contracts.[21] 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

[20] 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.

[21] 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 $x(m)$.

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 $\beta \geq 1/2$.

2.2.5 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.[22] We follow the baseline model in Antràs and Chor (2013) in assuming that

[22] 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 2.1.3, 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.

this incremental contribution of the supplier to the secured revenues is the surplus of the match and therefore also the surplus bargained over.[23]

2.2.6 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 equation (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 (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 equation (7).

2.3 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 investments at different production stages in this partial equilibrium context. In Section 2.4 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:

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

[23] 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.

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 equation (8), the above equation links the optimal CSR level at stage m to all previous CSR levels. Under the maintained assumption discussed in Section 2.1.3 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 equation (11) with equation (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 equation (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. Equation (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.[24]

[24]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

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:

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

Based on equation (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 equations (14) and (17) and use the definition of $A = EP^{\frac{\rho}{1-\rho}}$ to get the optimal CSR investment at stage m,

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

We can now state the following lemma:

Lemma 2 *Equation* (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 equation* (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

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.

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.

2.4 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.

2.4.1 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 equation (15) equal to zero, plugging in the optimal $q(\omega)$ from equation (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.[25] From this, we get a second expression for the price index as a function of the number of firms n as

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

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

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

Combining equation (19) with equation (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

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

[25] Details of the derivations are provided in Appendix A.1.

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 equations* (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.

2.4.2 Equilibrium CSR along the Global Value Chain

Combining equations (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 equation* (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 2.1.3), 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.

2.5 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.

2.5.1 Testable Implications: Partial vs. Industry Equilibrium

As pointed out above, comparison of the partial equilibrium expression for CSR (18) and its industry equilibrium counterpart (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 equation (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.

One could test this implication from partial equilibrium empirically by taking, e.g., the share of sales going to OECD countries as a proxy for being exposed to stronger demand for ethical quality. 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 (see equations (21) and (22)). 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. The partial equilibrium analysis nevertheless points to its relevance, and we therefore include in our regressions a proxy for OECD export exposure as a control variable.

2.5.2 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 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.[26]

[26]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

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.[27] Our sample covers the years 2000 to 2013. The Prowess database contains a wide range of Indian firm-level information. 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.

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 strategy.[28] We exploit differences in the product mix across firms as well as within firms over time to construct a firm-specific measure of the global value chain 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

approach allows us to investigate the non-contractible variable directly and thereby closes a gap in the previous literature.

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

[28] 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 (2018), Bos and Vannoorenberghe (2018) and Barrows and Ollivier (2021).

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. Compliance with the law changes the CSR decision of a firm and might also change its reporting behavior.[29] In order 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.[30] 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 decision 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

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

[30] In order to control for potential anticipation effects, we carry out a robustness test (available upon request) where we exclude the years 2011 to 2013. We find that our results are unaffected.

primarily refers to the commitment to behave ethically and to contribute to economic 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 are 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 for social occasions, etc. These community-related expenses closely refer to the catalog of community-related CSR activities applied by Newman et al. (2018) and Newman et al. (2020).[31]

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 are able to directly exploit variation of 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).

[31]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. The results for the extended CSR measure including environmental expenses stay robust and are available upon request.

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 position of CSR, but to actually 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

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

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 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.[32] 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 time period, the average

Table 1: Industry upstreamness measure for India

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

Source: Own calculation based Antràs and Chor (2018) and WIOD data.
Note: Only tradable industries are considered.

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

[32]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 time span. The exclusion of non-tradable industries affects 20 industries in WIOD, e.g., *public administration and defence; compulsory social security*, *education* and *accommodation and food service activities*.

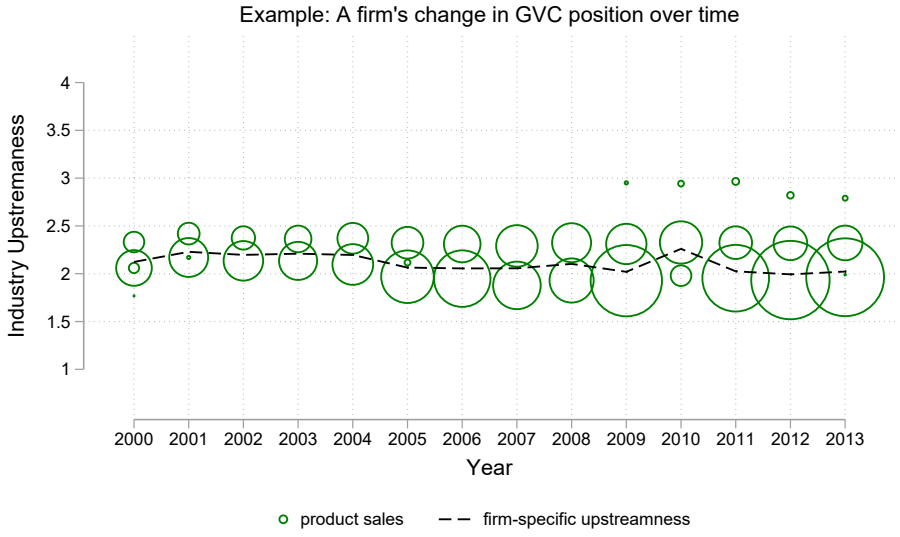
average of upstreamness of the firms' product portfolio as illustrated in equation (26), so that

$$U_{ft} = \sum_{v=1}^{V} \frac{sales_{fvt}}{sales_{ft}} U^{vt}, \tag{26}$$

where U_{ft} is the level of upstreamness of firm f at time t selling products from V different industries.[33] 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.[34]

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). Figure 1 illustrates these sources of variation for a firm from the electrical equipment industry. This firm serves as an example for an average firm in our sample in terms of CSR spending, upstreamness and number of products. It has several products that belong to industries that differ in terms of

Figure 1: A firm's GVC position change 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.

the upstreamness position. Over time, the firm's product portfolio changes as a new

[33] 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 in order 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.

[34] 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.

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.

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 decision 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. In order 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 Poisson Pseudo-Maximum Likelihood (PPML). In order to apply OLS, we take the natural logarithm of a firm's CSR spending ($log(CSR\,spending_{ft})$). This removes firms with zero CSR spending from our sample. Our alternative specification applying PPML with $CSR\,spending_{fvt}$ as the dependent variable allows us to keep zeros in the data.[35] Our main explanatory variable of interest is a firm's GVC position at time $t-1$, U_{ft-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, equation (27) is a repeated cross-section in which we include state δ_s and industry-year γ_{vt} fixed effects. We include state fixed effects δ_s in order 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.,

[35]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 Tenreyro, 2006).

tobacco), or there might be industrial disasters that affect certain industries in specific years. Accordingly, equation (27) exploits variation *between* firms within the same state, main industry, and year.

Second, equation (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 6.8 years on average.

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

The variable $log(Wages)$ is a proxy for firm-level wage payments to control for the possibility that wages vary systematically with the value chain position. One could consider staff welfare spending a part of the overall compensation package for employees. If downstream firms offer better compensation packages (e.g., due to higher skill intensity), a negative relationship between upstreamness and CSR spending (partly measured by staff welfare spending) could then be interpreted as actually reflecting the negative relationship between upstreamness and employee compensation. We control for this by taking 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.[36] In particular, 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.[37] 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 $OECD\,export\,exposure$ controls for the possibility that some firms are more exposed to more demanding markets. The variable builds on the assumption that stakeholders in OECD countries are, on average, more demanding. This measure is constructed similar to our upstreamness and wage measures 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.[38] The variable $domestic\,inputs/all\,inputs$ proxies for a

[36]The wage bill is available for a subset of firms in Prowess. However, since there are many zeros and because the provision of the number of employees is not compulsory for firms, we decide not to include the wage bill and prefer to use our combined measure.

[37]See Appendix B for more details on the calculation.

[38]See Appendix B for more details on the calculation.

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 141,263 USD per year on CSR. The highest amount spent on CSR in the sample, USD 142 million in 2006, is 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.

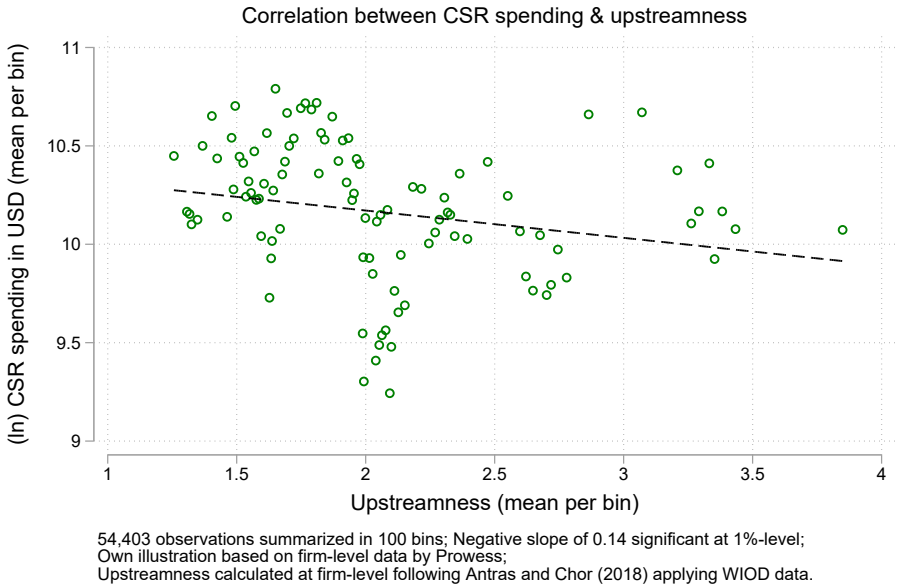
Table 2: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CSR (in USD)	81,755	141,263.1	1,260,103	0	142,000,000
log CSR	54,403	10.16	1.83	7.13	18.77
Upstreamness	81,755	2.05	0.54	1.17	4.08
log Wages	81,755	3.21	0.43	1.92	4.79
OECD export exposure	81,755	0.31	0.22	0.00	0.86
Export share	81,506	0.11	0.25	0.00	1.00
Domestic inputs/total inputs	81,755	0.38	0.48	0.00	2.75
State owned	81,755	0.00	0.04	0.00	1.00
Foreign owned	81,020	0.06	0.25	0.00	1.00
log Sales	79,644	1.48	2.51	-6.68	11.07
log Age	81,742	2.78	0.74	0.00	5.01
number of products	74,815	2.95	2.31	1.00	51.00
number of 2-digit industries per firm	74,815	1.52	0.80	1.00	10.00

Source: CMIE Prowess.
Note: Only tradable industries are considered.

Figure 2 illustrates in a binscatter plot the correlation between firms' CSR spending and their GVC position. Each dot represents the mean CSR spending per upstreamness bin. This figure shows that there is on average lower CSR spending among firms with a more upstream GVC position. We test this pattern more rigorously using equations (27) and (28) described above.

Figure 2: Correlation between firms' CSR and GVC position



3.3.3 Empirical Results

Table 3 shows our key empirical results. Columns (1) to (3) present results for the cross-sectional specifications based on equation (27) and columns (4) to (6) present those for the panel specification based on equation (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 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 -0.24. 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

Table 3: Regression results

	(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
VARIABLES		w/o zeros	incl. zeros		w/o zeros	incl. zeros
Upstreamness	-0.213***	-0.235**	-0.226**	-0.133***	-0.174***	-0.157***
	(0.051)	(0.105)	(0.109)	(0.039)	(0.060)	(0.059)
log(Wages)	0.241***	-0.080	-0.049	0.221***	0.003	0.002
	(0.078)	(0.190)	(0.192)	(0.039)	(0.096)	(0.097)
OECD export exposure	0.083	0.563**	0.646***	0.285***	0.525***	0.559***
	(0.105)	(0.236)	(0.232)	(0.065)	(0.117)	(0.118)
Export share	0.379***	0.151	0.202	0.143***	0.225***	0.268***
	(0.046)	(0.188)	(0.187)	(0.040)	(0.083)	(0.083)
Domestic inputs/total inputs	0.203***	0.226***	0.296***	0.054***	0.093***	0.123***
	(0.024)	(0.070)	(0.071)	(0.016)	(0.030)	(0.031)
State owned (D)	0.523*	0.139	0.161	0.148	0.049	0.051
	(0.272)	(0.172)	(0.181)	(0.169)	(0.094)	(0.094)
Foreign owned (D)	1.037***	0.522***	0.562***	0.047	0.186***	0.191***
	(0.046)	(0.093)	(0.095)	(0.049)	(0.067)	(0.068)
log(Sales)	0.582***	0.858***	0.882***	0.314***	0.458***	0.465***
	(0.008)	(0.028)	(0.028)	(0.010)	(0.025)	(0.025)
log(Age)	0.219***	0.197***	0.222***	0.137***	0.296***	0.314***
	(0.015)	(0.051)	(0.051)	(0.030)	(0.063)	(0.062)
Year dummy	No	No	No	Yes	Yes	Yes
Industry x Year & State dummy	Yes	Yes	Yes	No	No	No
Firm dummy	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	0.970

Robust standard errors in parentheses clustered at the firm-level; [a]adjusted within R^2
*** p<0.01, ** p<0.05, * p<0.1

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 observation 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.

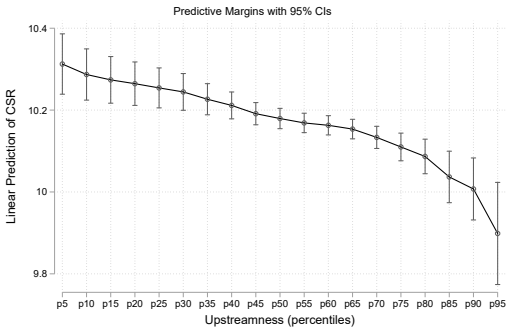
In order to analyze the economic relevance of the findings, Figure 3 illustrates the predicted level of CSR spending based on the first four columns, while varying the GVC position and holding all other variables constant at their means.[39] In all four columns, the negative relationship is clearly visible 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 164,229 USD compared to 105,554 USD at the 95th percentile. Accordingly, comparing a very upstream position with U_{ft-1} equal to 3.29 to a very downstream position with U_{ft-1} equal to 1.33 increases the predicted CSR spending by 55.59%, 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.

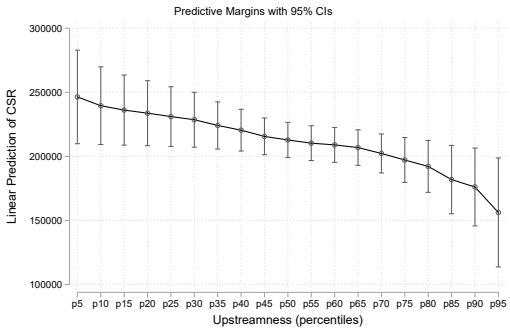
[39]The marginal effects of linear models with fixed effects (like our columns 1-4) can be computed an illustrated as in Figure 3. This in not possible in a non-linear model with fixed effects (our columns 5 and 6).

Figure 3: A firm's GVC positioning and predicted CSR spending

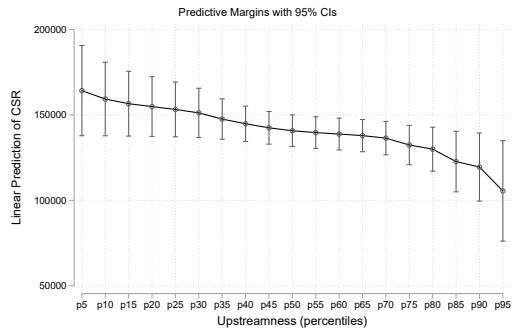
(a) Col. 1



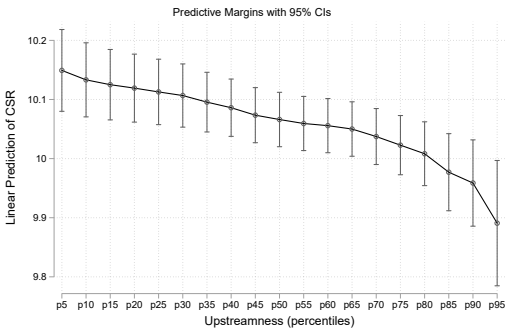
(b) Col. 2



(c) Col. 3



(d) Col. 4



Besides the effect of the value chain position on CSR spending, which is a novelty in the literature on CSR determinats, also the findings concerning our control variables provide some interesting insights for this literature. We find only tentative support in columns (1) and (4) that a firm's CSR spending increases with the wage level. 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 strong indication of a positive relationship between exposure to highly demanding market and CSR spending. Firms producing in sectors with a high share of exports towards OECD countries do engage significantly more in CSR in five out of six specifications. An increase of 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 one-percent level

in all 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.

3.4 Robustness

To analyze the robustness of our results, we run further alternative specifications. First, we smooth CSR spending over two years to control for the possibility that firms' CSR spending concentrates around a specific year. Second, we control for firms' advertising expenses to control for the fact that higher CSR expenditure by firms in more downstream industries could be driven by their greater visibility to final consumers.

3.4.1 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 4.

Table 4: Robustness check: Smoothed CSR spending

	(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
VARIABLES		w/o zeros	incl. zeros		w/o zeros	incl. zeros
Upstreamness	-0.213***	-0.278***	-0.274**	-0.146***	-0.232***	-0.212***
	(0.048)	(0.103)	(0.107)	(0.035)	(0.051)	(0.051)
log(Wages)	0.250***	-0.026	0.008	0.250***	0.044	0.045
	(0.071)	(0.181)	(0.183)	(0.036)	(0.089)	(0.089)
OECD export exposure	0.187*	0.613***	0.693***	0.281***	0.517***	0.561***
	(0.097)	(0.229)	(0.226)	(0.057)	(0.121)	(0.120)
Export share	0.391***	0.119	0.157	0.162***	0.194**	0.211***
	(0.045)	(0.203)	(0.202)	(0.036)	(0.077)	(0.076)
Domestic inputs/total inputs	0.208***	0.240***	0.294***	0.062***	0.133***	0.147***
	(0.023)	(0.070)	(0.071)	(0.015)	(0.028)	(0.028)
State owned (D)	0.556**	0.168	0.185	0.127	-0.099**	-0.095**
	(0.283)	(0.160)	(0.165)	(0.148)	(0.042)	(0.041)
Foreign owned (D)	1.098***	0.561***	0.591***	0.055	0.099	0.104
	(0.046)	(0.090)	(0.092)	(0.054)	(0.073)	(0.073)
log(Sales)	0.543***	0.853***	0.870***	0.275***	0.494***	0.501***
	(0.007)	(0.025)	(0.026)	(0.008)	(0.022)	(0.022)
log(Age)	0.266***	0.258***	0.276***	0.219***	0.425***	0.447***
	(0.014)	(0.052)	(0.052)	(0.028)	(0.061)	(0.061)
Year dummy	No	No	No	Yes	Yes	Yes
Industry x Year & State dummy	Yes	Yes	Yes	No	No	No
Firm dummy	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; [a]adjusted within R^2
*** p<0.01, ** p<0.05, * p<0.1

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 significant at the 5%-level in column (3) and at the 1%-level in the remaining five specifications.

3.4.2 Controlling for Visibility

More downstream firms are closer to final consumers and may therefore be more visible. A higher visibility may for example increase the probability that some infringement is recognized and/or sanctioned by consumers. In this case higher visibility would provide an additional incentive for CSR investments and our findings could be driven by the visibility of firms rather than their GVC position. Customer awareness can be proxied by spending on marketing and advertising (Servaes and Tamayo, 2013). Firms with higher marketing expenses are more visible. The same could be true for more downstream firms as it may be easier for customers to observe firms that are closer to the final product. Table 5 shows the results when we control for our proxy of visibility, a firm's *selling and distribution expenses*, which include marketing, advertising and distribution spending.

Table 5: Regression results: Controlling for selling expenses

	(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
VARIABLES		w/o zeros	incl. zeros		w/o zeros	incl. zeros
Upstreamness	-0.223***	-0.252**	-0.248**	-0.085**	-0.154**	-0.137**
	(0.050)	(0.105)	(0.108)	(0.040)	(0.064)	(0.063)
log(Wages)	0.269***	-0.144	-0.110	0.171***	0.005	-0.007
	(0.082)	(0.195)	(0.196)	(0.040)	(0.100)	(0.100)
OECD export exposure	0.119	0.381*	0.433**	0.327***	0.547***	0.594***
	(0.103)	(0.207)	(0.206)	(0.068)	(0.125)	(0.126)
Export share	0.189***	0.263***	0.271***	0.102**	0.167*	0.165*
	(0.048)	(0.092)	(0.093)	(0.042)	(0.085)	(0.085)
Domestic inputs/total inputs	0.167***	0.165**	0.199***	0.065***	0.098***	0.122***
	(0.024)	(0.066)	(0.066)	(0.017)	(0.030)	(0.031)
State owned (D)	0.447*	0.125	0.147	0.166	0.054	0.054
	(0.235)	(0.152)	(0.157)	(0.173)	(0.094)	(0.094)
Foreign owned (D)	0.881***	0.457***	0.486***	0.036	0.183**	0.187**
	(0.044)	(0.083)	(0.085)	(0.047)	(0.074)	(0.077)
log(Sales)	0.431***	0.743***	0.757***	0.309***	0.458***	0.465***
	(0.011)	(0.041)	(0.041)	(0.012)	(0.034)	(0.034)
log(Age)	0.213***	0.210***	0.222***	0.129***	0.324***	0.333***
	(0.015)	(0.046)	(0.047)	(0.031)	(0.066)	(0.066)
(log) Adv Market Exp	0.226***	0.110***	0.117***	0.083***	0.029	0.029
	(0.008)	(0.023)	(0.023)	(0.006)	(0.018)	(0.018)
Year dummy	No	No	No	Yes	Yes	Yes
Industry x Year & State dummy	Yes	Yes	Yes	No	No	No
Firm dummy	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; [a]adjusted within R^2
*** p<0.01, ** p<0.05, * p<0.1

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. This shows that while the visibility

seems to have merit for a firm's CSR decision, there is a separate and distinct role of upstreamness in determining CSR expenditure, giving further support to our model's prediction of the role of incomplete contracts in the determination of CSR spending along the value chain.

4 Conclusion

Globalized value chains 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 increasingly 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.

In this paper, we argued that contractual incompleteness, commonly perceived as one of the key features of supply-chain relationships, also shapes the provision of CSR along the value chain. Building on Antràs and Chor (2013), we analyzed a model of CSR investments of a continuum of suppliers along the value chain. In our model, CSR along the value chain provides product differentiation and allows the firm to set a price above marginal cost. We showed that incomplete contracts imply an increasing CSR profile with more downstream suppliers featuring higher CSR expenditures.

We confirmed this prediction using Indian firm-level data. Merging product-level information with the World Input-Output Database (WIOD), we constructed a measure of a firm's GVC position. Using combined staff welfare spending and social community spending as our measure of CSR expenditure, we found strong support for our prediction. Our results were robust to the inclusion of a large set of fixed effects, control variables and several robustness checks. Most notably our results hold when we control for wages and visibility for final consumers at the firm level.

Our main empirical finding is highly relevant for policy makers. When the aim is to attain comparable levels of CSR along the value chain, our results show that efforts should be focused on firms in more upstream industries. Our theory implies that the economic incentives for CSR investments are lowest in upstream industries. Therefore, policies should aim at providing additional incentives at these stages. Moreover, taking our model at face value, these investments will be beneficial not only because they raise the CSR level at the respective stage, but because they also trigger higher CSR investments at all following stages.

In this paper, we highlighted the relevance of incomplete contracts for CSR investments depending on the value chain position of the supplier. Turning the attention to the role of contractual incompleteness for CSR and ethical production in global

value chains opens 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. 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.

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A Theory Appendix

A.1 Industry Equilibrium with Incomplete Contracts

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

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

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

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 equation (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 equation (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:

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

$$\text{s.t. } w(j) - c_x\tilde{x}(j) \geq 0$$

$$t(j) - c_s\tilde{s}(j) \geq 0$$

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

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

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

$$\begin{aligned} \tilde{q}(\omega) &= \frac{\rho \tilde{r}(\omega)}{c_x} \\ \tilde{s}(j)^{1-\alpha} &= \frac{\tilde{r}(\omega)\rho}{c_s} \left(\int_0^1 \tilde{s}(j)^{\alpha} dj \right)^{-1} \end{aligned}$$

Expressing $\left(\int_0^1 \dots dj \right)$ 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 equation (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 equation (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 equations (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 equation (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 equation (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 equation (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 $s(1) < \tilde{s}$ 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 $\beta \geq 1/2$.[40] 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

[40]Recall that $\beta \geq 1/2$ directly stems from Antràs (2003) and $0 < \alpha < \rho$ is discussed in Section 2.1.3.

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 equation (A.12) in equation (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 $\tilde{\varepsilon}$

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

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 8 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

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

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 $P^{-\frac{\rho}{1-\rho}} = \int_{\omega \in \Omega} \left(\frac{\varepsilon(\omega)^{\nu}}{p(\omega)} \right)^{\frac{\rho}{1-\rho}} d\omega$. Using the definition of $\varepsilon(\omega)$ given in equation (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 equations (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 equation (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 equation (A.22) yields a differential equation analogous to equation (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 equation (13) as

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

Plugging this back into equation (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 equation (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 equation (A.25) evaluated at $m = 1$, the solution to the maximization problem yields

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

analogous to equation (17).

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

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

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

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

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

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 equation (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

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

B Empirical Appendix

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

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:

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

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

$$OECD\_export\_exposure_{ft} = \sum_{v=1}^{V} \frac{sales_{fvt}}{sales_{ft}} \frac{exports\_OECD_{vt}}{exports\_total_{vt}}, \tag{B.2}$$

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.