Positioning and bargaining power in agri-food global value chains

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Abstract

Value creation forms the basis for the construction of global value chains (GVCs) and has received significant scholarly attention, yet the issue of value capture or power distribution along supply chains, "within" industries, is still unresolved. A recent property rights framework (Antràs and Chor, 2013; Alfaro et al., 2019) highlights how final firms exert power over their suppliers to optimally organize their sequential production process. In such an environment, how can suppliers (exporters) act strategically to reduce the power of the buyers (importers)? We contribute, theoretically and empirically, to a better understanding of the extent to which the division of surplus in the agri-food sector is affected by manufacturing exporters' position in GVCs. We argue that: (1) further upstream specialization along agri-food GVCs increases bargaining power (the "specialization effect"); (2) expansion along GVCs by importing more upstream inputs and exporting more processed goods also increase bargaining (the "expansion effect"); and (3) the "specialization effect" outweighs the "expansion effect" so that the overall effect is similar to the former. These theoretical hypotheses are tested using firm-level data on French agri-food industries (from French customs and the AMADEUS database) over 2002-2017 period. We build on the bilateral stochastic frontier model to measure the bilateral bargaining power of manufacturers. Following recent approaches in the literature, we identify manufacturers that participate in GVCs with those that jointly import and export, and measure their position in value chains through the level of transformation (*upstreamness*) of goods they use and produce. Hypotheses (1) and (3) are strongly supported and are mainly driven by product mix upgrade and the reduction of the *hol-up* problem, while hypothesis (2) is weakly supported and is only due to the high-quality production.

Keywords: Bargaining power, Division of surplus, Global value chains, Upstreamness, Agri-food industry.
JEL Codes: D20, D22, D23, D46, F10, L23, Q17.

1 Introduction

The emergence of gobal value chains (GVCs) raises the issues of how power is exerted, and how value is created, distributed, and captured along supply chains (De Marchi et al., 2020). The value capture, which is the set of activities that seize some part of the value created

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(Pham and Petersen, 2021), is mainly the expression of bargaining power, defined as the ability of a party to influence the terms and conditions of a contract in its favour (Argyres and Liebeskind, 1999). There is a long tradition in the literature on the supplier-buyer relationship that the most productive and strongest firms and those with critical resources in the supply chain obtain favourable terms of exchange and capture more value, which is reflected in the exertion of greater bargaining power (Emerson, 1962; Brandenburger and Stuart Jr, 1996; Crook and Combs, 2007; Hillman et al., 2009; Drees and Heugens, 2013). However, how position in GVCs affects value creation and value capture has received little attention (Dhyne et al., 2015; Mahy et al., 2021).

The GVCs analysis is identified as an analytical tool that allows for the identification of obstacles and opportunities between different stages of production or tasks, leading to the contractualization or integration of supplier-buyer relationships at international level (Taglioni and Winkler, 2016). The prevalence of global production networks has led to the identification of uncertainty and incomplete contracts as the most important bottlenecks in international relations (Antràs, 2015). Accordingly, organizational choices along the value chain become a key decision faced by firms worldwide (Antràs and Chor, 2013; Alfaro et al., 2019). Furthermore, strong lock-in effects and high fixed costs due to search and matching frictions in GVCs lead to bilateral negotiation of transaction prices between exporters and importers (Antràs, 2020). Therefore, international prices are not fully disciplined by market-clearing conditions, so that the division of surplus along the chain is governed by bargaining and two-sided market power. Assuming a sequential production process, a recent framework of property rights (Antràs and Chor, 2013; Alfaro et al., 2019) highlights how final firms exert power over their suppliers to optimally organize their production processes. In such an environment, how can suppliers act strategically to reduce the power of the buyers?

This paper attempts to answer this question by assessing how exporters' boundaries and organizational choices affects power distribution and value capture along supply chains. Specifically we theoretically and empirically study the effects of the position of production process and the specialization (or expansion) along the value chains on the division of surplus of agri-food exporters in their cross-border supplier-buyer relationships in GVCs. To do so, we explore the mechanisms through which position in GVCs affects the division of surplus of exporters. The suppliers increases the value extracted, by increasing their bargaining power, so that the terms "bargaining power", "value capture", "division of surplus" and "extracted value" are used interchangeably.

Our first contribution is to build on a general Nash-in-Nash bargaining game to provide a baseline conceptual framework that can characterize firm interactions and price-setting under incomplete contracts in GVCs, where the supplier-buyer relationship is governed by bargaining. The property right model, for instance, focus on the final firm's organizational decisions and determines the optimal division of surplus across production stages. In this study, we focus on the problem of an exporter (manufacturer) producing and exporting a variety of differentiated semi-finished or final products. A key feature of our framework is that manufacturer makes backward (inputs market) and forward (outputs market) organizational decisions and act strategically against a buyer firm (importer) to reach consumers in foreign markets. Indeed, in their inputs market, each manufacturer is thus confronted with the make-or-buy decision of producers in a context of international trade demonstrated by Antràs and Helpman (2004). On the output market, manufacturer chooses the processing level of its exported goods. Both decisions (backward and forward), combined, shape the span of the manufacturer's production stages in GVCs. To do so, we limit the analysis exclusively to manufacturers involved in GVCs *i.e.* those that both import and export (Baldwin and Yan, 2014; Antràs, 2020). We show that price setting through bilateral negotiations allows for variable markups due to two-sided bargaining power (unobservable price component), and marginal cost that depends on manufacturer's boundary choices along GVCs (observable price component). Then, we highlight the difficulty to model the direct relationship between the unexplained part of price variation that is due to bilateral bargaining power and the manufacturer's position in GVCs. To this aim, we build on existing studies on the impact of GVC position on division of surplus.

Our second contribution is to explore theoretically a manufacturer's decision over where to operate along the global production chain and which production stages to perform in order to increase its surplus. This impact pathways analysis of GVC position on division of surplus allows us to propose three corresponding research hypotheses. First, we argue that a manufacturer's decision to import more processed inputs and to export far from final demand allow it to achieve a functional specialization of the production process in the most upstream position in GVCs. Consequently, the manufacturer upgrades it product mix and production process, and faces a weak *hold-up* problem by reducing it stage-specific investments[1], thus considerably strengthening its bargaining power (the "specialization effect"). Second, manufacturers that export more proximate to final consumption are more productive and produce high quality products, so that they increase their bargaining power by importing further upstream inputs and exporting closer and closer to final demand, and therefore performing more production stages in GVCs (the "expansion effect"). Third, the "specialization effect" outweighs the "expansion effect", as manufacturers that widen their span in GVCs face high production costs, high stage-specific investments (Chor et al., 2021) and tariffs (Antràs, 2020)[2] that prevent them from increasing their division of surplus, compared to manufacturers that specialize further upstream in GVCs.

Our third contribution is to match our theoretical framework to the patterns of data. We use the detailed French agri-food firms trade data and the AMADEUS database over the 2002-2017 period. We distinguish a sample with re-exports excluded from the sample with all transactions, in order to capture the actual processing activities of manufacturers in GVCs. We build on a two-tier stochastic frontier model, developed by Polachek and Yoon (1987, 1996) and adapted, as the bilateral stochastic frontier analysis model to the bilateral trade by Li et al. (2022), to estimate the GVC bargaining power indices of French agri-food exporters (manufacturers) and the countries of their trade partners (importers). We use the unit values as a proxy of the export product prices paid by the importers, in equilibrium, to estimate the two-sided division of surplus. Previous studies seek to identify the different sources of value added embedded in trade flows by using input-output table (Hummels et al., 2001; Johnson and Noguera, 2012; Koopman et al., 2014; Borin and Mancini, 2019). However, it is difficult, if not impossible, to apply these methods to firm data (Antràs, 2020). To measure firms' market power, most of the work in the literature estimates the markup (see for example De Vries et al., 2021; del Valle and Fernández-Vázquez, 2023). However, market power mainly implies unilateral strategic behavior, whereas bargaining power involves interactions between two agents (Bonanno et al., 2018). The two terms are therefore quite different and, as we have shown, relationships in GVCs involve interactions between agents and bilateral power relations. The use of bargaining power indicators is very limited in the literature, due to the lack of data on firm-to-firm transactions. We contribute to this growing empirical literature on GVCs and global production networks by identifying value capture at the micro level of

[1] GVC participants often undertake numerous relationship-specific investments (such as the purchase of specialized equipment or product customization) that would be much less profitable if GVC links were broken. (Antràs, 2020; Antràs and Chor, 2022)

[2] High-income countries apply, on average, higher tariffs, leading to "tariff escalation", on more processed food products whereas low tariffs are applied on raw commodities goods.

the firm.

We exploit the U.S. detailed input-output table in order to explore the richness of French firm-level data. We seek to identify manufacturers' position in GVCs as the level of processing of the goods they purchase and/or sell abroad. The use of the U.S. input-output table for French firms is justified by the results of Antràs et al. (2012), which show a high degree of stability between the sectoral measures of the U.S. and some European countries economic production matrix. We confirm this relationship by performing the necessary empirical checks with the INSEE, OECD and GTAP input-output tables.[3] Based on this finding, we assume that France and the U.S. share the similar technological frontier, or have the same production functions, or share the same pattern of input use for the production of a given good. For example, we assume that the production of cheese requires the same use of dairy products, salt and other inputs everywhere in the world. Based on this assumption, Alfaro et al. (2016) and Acemoglu et al. (2016) define the linkages between industries (vertical integration) with data on firms worldwide, using the U.S. input-output table.

We empirically test the "specialization effect" and the "expansion effect", using sub-sample regressions distinguishing further upstream manufacturers and those closer to final demand. We then use the whole sample of re-exports excluded and all transactions to assess the relative importance of these two effects. We confirm our keys theoretical hypotheses. Indeed, the "specialization effect" holds in both samples (Re-exports excluded and All transaction samples), whereas the "expansion effect" is only observed in the sample with all transactions. The "specialization effect" outweighs the "expansion effect", so that the global effect is similar to the former. Additional tests confirm the robustness of the "specialization effect", whereas the "expansion effect" is not robust in the data. Furthermore, our empirical results highlight that the "specialization effect" is mainly driven by product mix upgrade and the reduction of the *hol-up* problem, while the "expansion effect" is only due to the production of high-quality goods.

Our approach is closely related to the burgeoning literature that examined the positioning of firms in GVCs, productivity-heterogeneity and performance. According to this literature, the positioning of firms in GVCs is a key driver in value creation and distribution. Indeed, Mudambi (2008) shows that firms in the industries on the upper and lower end of the value chain generally create more value, highlighting the "smile curve" hypothesis. Rungi and Del Prete (2018) and Baldwin and Ito (2021) find empirical support to this hypothesis. Firms that are more proximate to final demand may benefit directly from the interaction with final consumers to know in real-time their preferences and to undertake actions such as innovation and R&D activities to create adapted products. Furthermore, as shown by Costinot et al. (2013), productivity is higher in stages closer to final demand than in further upstream stages. Consequently, a more upstream position could prevent firms from increasing their bargaining power relative to the most productive firms, closer to final demand. However, based on the "smile curve" hypothesis, it should be noted that engaging in further upstream activities could also improve value capture, as the initial stages of the production process are associated with high-value-added activities such as innovation, R&D, design, marketing, branding, *etc.*. Mahy et al. (2021) and Ju and Yu (2015) find supportive evidence for this hypothesis by using Belgian and Chinese firms data respectively, through the "between" sectors effect. A main interest of this paper is to add to this burgeoning literature by focusing on distributional issues of value "within" sectors (agri-food industry) and processing firms (manufacturers).

This paper also deals with a recent theoretical and empirical literature testing various

[3]The *upstreamness* computed from the French table in the OECD database, the INSEE database and the GTAP database are highly correlated with the *upstreamness* from U.S. input-output table (0.65, 0.68 and 0.70, respectively).

aspects of firms' organizational decisions in GVCs, via backward and/or forward integration in the supply chain. Antràs and Helpman (2004) and Berlingieri et al. (2021) study the make-or-buy decision of final firms under a contractual frictions in a context of international market uncertainty. The former show that low-productivity firms outsource whereas the high productivity firms source from affiliates suppliers, and the latter show that more important inputs are more likely to be sourced from affiliated. Conconi et al. (2012) examine how the liberalization of product affects the ownership structure of final firms in an contractual frictions environment. They show that the terms of trade in supplier markets and the price of output of firms crucially shape the organizational choices, due to their effect on the division of surplus. The property rights model developed by Antràs and Chor (2013) and Alfaro et al. (2019) provides theoretical basis for the final firm boundary choices and firm organizational decisions along the GVC, based on the transaction cost approach. They show that the *hold-up* situation, shaped by the substitutability or complementarity and the contractibility of inputs, determines the firm's decision whether or not to integrate its suppliers. Del Prete and Rungi (2017) only partially confirm the results of the property rights model and find that firms producing intermediate goods prefer to integrate production stages, either backward or forward, closer to those they already perform and with similar technological characteristics. our approach focus on manufacturing firms that make backward and forward organizational decisions over their boundaries in GVCs, similar to Del Prete and Rungi (2017). To the best of our knowledge, this is the first time in the literature that the manufacturing exporters' (suppliers') boundary decisions have been modeled in relation to bilateral bargaining power.

More broadly, our paper is related to the literature where actors' behavior is guided by incentives indirectly related to profits and utility maximization, rather than imbalances of bargaining power resulting from differences in the dependency on potential economic partners. Based on power distribution along agri-food chains, James et al. (2013) rely on *network exchange theory* (NET) to explain the behavior of actors in the agri-food sector. According to this theory, economic transactions remain at the heart of the interaction between actors that are considered rational and seek the maximization of their profits, by increasing their bargaining power. Consequently, the behaviour of actors is essentially aimed at magnifying the level of dependence of potential economic partners. This theory allows to account for heterogeneity in the strategic behaviors of manufacturers in order to capture more surplus in the agri-food chain, by increasing their bargaining power.

The remainder of this paper is organised as follows. Section 2 sets the theoretical framework and provides keys intuitions from which we build our keys hypotheses; Section 3 outlines our empirical framework where we present the data explanations and our method. In Section 4, we report and explain our baseline results and the robustness tests are performed in Section 5. Section 6 includes the discussion of the results and provides some concluding remarks, focusing on the policy implications.

2 Theoretical framework

This section provides a theoretical basis for equilibrium price-setting mechanisms through negotiations between exporters and importers in the global supply chain, and highlights the existence of bilateral bargaining power. In other words, we describe a bargaining problem, based on the perspective of a lower and an upper bound of export product prices, that exporter and importer, respectively, have an incentive to negotiate in an industry global supply chain. This is similar to the problem of firm-to-firm trade with bilateral negotiations and two-sided bargaining power. Our bargaining model shows the extraction of the surplus of an agent, depending on his bargaining power. Then, in the presence of a sequential production process within a global supply chain and contractual frictions[4], we discuss how exporters adjust their position in GVCs to increase their bargaining power, and the mechanisms through which this occurs.

2.1 Exporter-Importer price setting

2.1.1 Consumers preferences and demand in the importer market

Consider a world consisting of J countries where consumers value a continuum of differentiated goods k. Preferences in country j are constant elasticity of substitution (CES) given by

$$\Upsilon_{jk} = \left[\int_{\Omega_{jk}} [\lambda_{jk}(\upsilon) q_{jk}(\upsilon)]^{\frac{\varepsilon_{jk}-1}{\varepsilon_{jk}}} \right]^{\frac{\varepsilon_{jk}}{\varepsilon_{jk}-1}} \tag{1}$$

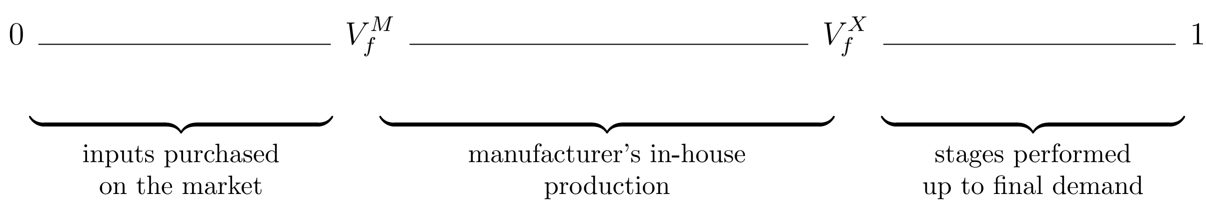
where Ω_{jk} is the set of available varieties of products k in country j, and $\varepsilon_{jk} > 1$ is the elasticity of substitution between different varieties that is common for all producers. $q_{jk}(\upsilon)$ is the quantity purchased for each variety of product k and $\lambda_{jk}(\upsilon)$ represents the quality perceived by consumers living in country j for variety υ of product k. We assume that consumers value quality when $\lambda_{jk}(\upsilon) > 1$, whereas $\lambda_{jk}(\upsilon) = 1$ in the standard approach without vertical differentiation (Gaigné and Gouel, 2022). All or part of variety υ of product k are imported, so that the resulting aggregate demand faces by the importer in country j is given by

$$q_{jk}(\upsilon) = A_{jk} [\lambda_{jk}(\upsilon)]^{\varepsilon_{jk}-1} [p_{jk}(\upsilon)]^{-\varepsilon_{jk}} \tag{2}$$

where $A_{jk} > 0$ indicates the market size in country j, and $p_{jk}(\upsilon)$ is the price of variety υ of product k paid by consumers in j. Note that demand is decreasing with price and increasing with market size, and quality when $\lambda_{jk}(\upsilon) > 1$.

2.1.2 Technology of exporter

Consider the supply side of the model where a continuum of manufacturing firms f in country i produce a set of varieties Ω_{fk} of products k. Similarly to Antràs and Chor (2013), Alfaro et al. (2019) and Chor et al. (2021), we assume that the production of a final good in a given industry requires the completion of a continuum of production stages $\nu \in [0, 1]$ that are sequentially integrated from a technological point of view. Subscript ν reflects the inverse of the level of processing, *i.e.* the inverse of the *upstreamness* of the product in the value chain developed by Fally (2012), Antràs et al. (2012) and Antràs and Chor (2013). A lower ν denotes a more upstream production stage, and $\nu = 1$ indicates the production of a final consumption good. The production process (value chain) of a final product can be synthesized by the following scheme:



[4]Contractual incompleteness reflects the third parties' inability to ensure that the clauses are enforced or that the components are compatible or not (see Alfaro et al., 2019).

All or part of the intermediate inputs of stages $\nu \in \left[0, V_f^M\right]$ are imported by manufacturers f, located in country i, so that their production technology are characterized as follows: manufacturer purchases on the market (imports) less processed intermediate inputs (up to processing level V_f^M) that it combines in a CES manner with an internally intermediate stages inputs to produce output more proximate to final demand (up to processing level V_f^X). The obtained output

$$q_{fk} = \theta_f \left(\int_{V_f^M}^{V_f^X} x_f(\nu)^{\frac{\sigma-1}{\sigma}} d\nu + q_{-if}^{M\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{3}$$

is exported to country j and used as an input to produce semi-finished or final consumption goods. Because we focus on manufacturer of goods located in a given country (France) we omit hereafter index i for simplicity of exposition.

Manufacturer uses a quantity q_{-if}^M of intermediate products, completed up to stage V_f^M, purchased (imported) around the world at price p_{-if}^M, and quantities $x_f(\nu)$ of internally produced inputs $\nu \in [V_f^M, V_f^X]$ to produce a quantity q_{fk} of an output completed up to stage V_f^X, which it sells in country j at price p_{fjk} if it supplies a compatible good to the importer in j, $q_{jk} = q_{fk}$. We assume that more transformed products, *i.e.* goods close to final demand face a higher market price: $p(\nu)' > 0$. The cost of in-house inputs is specific to each manufacturer. For each of these inputs $x_f(\nu)$, $\nu \in [V_f^M, V_f^X]$, the manufacturer incurs a variable cost $c_f(\nu)$, that can be view as the cost of labor inputs required to produce each unit of $x_f(\nu)$. Inputs are characterized by a constant elasticity of substitution $\sigma > 1$. Parameter θ_f reflects the productivity of manufacturer.

2.1.3 Exporter-Importer bilateral power: Nash-in-Nash bargaining game

We consider that each variety v of k is produced in country i and supplied to country j by a single manufacturer f, so that the market structure of v allows monopolistic competition, and there is free entry into the industry. Note that manufacturer can be multi-product, but we use the firm-product-destination triplet as the basic unit of our analysis in the empirical section, in line with our market structure hypothesis.

Neither consumers nor importers in country j know the conditions under which imported goods are produced and the inputs used.[5] Note also that the manufacturer f in country i does not invest in quality signalling, so that the importer and consumers in j discover quality when they handle the products. However, if manufacturer f supplies a compatible good to importer, the two agents establish a kind of relational GVC that may evolve over time. In such a case, the link between manufacturer in country i and importer in country j is characterized by supplier-buyer relationship that are conducted at arm's length and under a contractual frictions. The fixed and sunk costs of finding suitable suppliers of goods or suitable buyers of one's products implies that GVC participants are large with substantial bargaining power. To reduce search and matching frictions and their inherent costs, we assume that manufacturers rely on a continuum of intermediaries (importers) located in country j to distribute differentiated products, as in Gaigné et al. (2018). Furthermore, the prevalence of GVCs' trade is source of lock-in in cross-border supplier-buyer relationship (Monarch and Schmidt-Eisenlohr, 2017; Monarch, 2022; Martin et al., 2020; Antràs, 2020). As a result, transaction prices tend to be bilaterally negotiated and not fully disciplined by market-clearing conditions, so that the division of surplus along the chain is governed by bilateral bargaining power.

[5] This assumption may be invalid when standards exist.

We consider that each manufacturer produces and supplies a single variety to each importer specialized in the distribution of a single variety in country j. Thus, the mapping between manufacturers and importers being one-to-one. Suppose that manufacturing firm f in country i with bargaining power β_{fjk} and the importer in country j with bargaining power $1-\beta_{fjk}$ are playing a general Nash bargaining game. The sequence of events in the game is as follows:

1. Manufacturer and importer bargain over transaction price (and therefore the quantity) that maximizes total market rents.

2. The importer then takes transaction price as given and maximizes its profits by choosing a price paid by consumers, and the manufacturer takes as given exported quantity and chooses intermediate inputs that minimize its costs, simultaneously.

We solve the game via backward induction, focusing on a single manufacturing firm. At the second stage of the game, when $q_{jk}=q_{fk}=q_{fjk}$, the importer sets the selling price of the good to consumers on market j by maximizing its operating profit, related to the variety v in j, given by

$$\pi_{jk} = p_{jk}q_{fjk} - p_{fjk}q_{fjk} \tag{4}$$

where $p_{jk}q_{fjk}$ is the total revenues associated with market j and $p_{fjk}q_{fjk}$ is the total value of the imported good from f in country i.

Maximizing π_{jk} with respect to p_{jk} yields the following equilibrium price and quantity of variety v of product k paid by consumers to the importer in country j:

$$p^*_{jk} = \frac{\varepsilon_{jk}}{\varepsilon_{jk}-1}p_{fjk} \tag{5}$$

$$q^*_{fjk} = A_{jk}\lambda_{fjk}^{\varepsilon_{jk}-1}\left(\frac{\varepsilon_{jk}}{\varepsilon_{jk}-1}\right)^{-\varepsilon_{jk}} p_{fjk}^{-\varepsilon_{jk}} \tag{6}$$

It is worth noting that the equilibrium price of variety v of product k in country j follows the standard pricing rule by applying a constant markup, $\varepsilon_{jk}/(\varepsilon_{jk}-1)$, over marginal cost whatever the nature of the goods. The marginal cost of importer in market j corresponds to the unit value of the imported good paid to the manufacturer, p_{fjk}. q^*_{fjk} is increasing in perceived quality, λ_{fjk}, of foreign consumers.

Consider now the production technology of manufacturer. Notice that each manufacturer f in country i bears the trade cost, τ_{ijk}, modeled as iceberg costs, so that exporting the quantity q_{fjk} to j requires producing the quantity $\tau_{ijk}q_{fjk}$. Under the condition of certain outputs (negotiated in first stage), the problem of manufacturer's cost minimization satisfies:

$$\min_{q^M_{-if},x_f(\nu)} p^M_{-if}q^M_{-if} + \int_{V_f^M}^{V_f^X} c_f(\nu)x_f(\nu)d\nu \tag{7}$$

$$s.c. \qquad \overline{q}_{fjk} = \theta_f\left(\int_{V_f^M}^{V_f^X} x_f(\nu)^{\frac{\sigma-1}{\sigma}}d\nu + q_{-if}^{M\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$$

Thus, technology is such that the cost function of manufacturer f located in country i associated with its variety of product k exported to country j implies:

$$C_{fjk} = \frac{\tau_{ijk} q_{fjk}}{\theta_f} \left(p_{-if}^{M^{1-\sigma}} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}}, \tag{8}$$

Following Hallak and Sivadasan (2013), we decompose manufacturer f productivity into two components: $\theta_f = \varphi_f \lambda_{fjk}^{-\gamma}$, with $0 \leq \gamma < 1$. Productivity increases with manufacturer's efficiency φ_f, and decreases with the quality of produced goods λ_{fjk}.[6] Then, manufacturer's marginal cost function is:

$$Cm_{fjk} = \tau_{ijk} \frac{\lambda_{fjk}^{\gamma}}{\varphi_f} \left(p_{-if}^{M^{1-\sigma}} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}}. \tag{9}$$

This expression permits to integrate the common assumption that high quality products are more difficult to produce and require more expensive inputs.[7]

We can observe that the marginal cost is independent of output size, so that the profit of the manufacturer producing product k located in country i and exported to country j can be written as follows:

$$\pi_{fjk} = p_{fjk} q_{fjk} - Cm_{fjk} q_{fjk} \tag{10}$$

With the profit function of the manufacturer (10) and the importer (4) in hand, we go back to the first stage of the game where we can obtain the equilibrium exchange price between the two agents, p_{fjk}, which solves the following generalized Nash product:

$$\max_{p_{fjk}} \Big(p_{fjk} q_{fjk} - Cm_{fjk} q_{fjk} \Big)^{\beta_{fjk}} \Big(p_{jk} q_{fjk} - p_{fjk} q_{fjk} \Big)^{1-\beta_{fjk}} \tag{11}$$

By the first derivatives and after some manipulation, we can obtain the full expression of optimal prices as follows

$$p_{fjk}^{*} = \frac{\varepsilon_{ft} + \beta_{fjk} - 1}{\varepsilon_{ft} - 1} \left(p_{-if}^{M^{1-\sigma}} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}} \frac{\lambda_{fjk}^{\gamma}}{\varphi_f} \tau_{ijk}. \tag{12}$$

It is then straightforward to see that, as common in trade models, p_{fjk}^{*} shares the general form of prices paid by importer in equilibrium (Gaigné and Gouel, 2022). Hence, regardless of the market structure, the production technology and the characteristics of the destination market, manufacturers apply a markup, $(\varepsilon_{ft} + \beta_{fjk} - 1)/(\varepsilon_{ft} - 1)$, over the marginal cost, Cm_{fjk}. What's new is that the price policy set through bargaining allows for variable markups due to the bilateral bargaining power, β_{fjk}. It's imply that, although demands in market j are iso-elastic, the markup is not constant. Indeed, when $\beta_{fjk} \to 1$, *ceteris paribus*, manufacturer unilaterally sets its highest export price and maximizes its total revenues and profits, whereas importer brings the price close to the production cost when $\beta_{fjk} \to 0$ (perfect competition).

Bilateral bargaining power, β_{fjk}, could explain much of the price variation (Alviarez et al., 2023). However, it is less studied in the literature because it is unobservable and is generally considered exogenous (see for example Dhyne et al., 2022, Grossman and Helpman, 2020

[6] Previous research has shown that more productive firms produce and export higher quality goods (Johnson, 2012; Curzi and Olper, 2012; Curzi et al., 2015). The introduction of firm-specific efficiency (parameter φ_f) permits to reconcile this apparent contradiction.

[7] Parameter γ is the elasticity of marginal cost with respect to quality. It reflects the industry-specific variable cost of quality.

and Goldberg and Tille, 2013). Our model (equation (12)) makes explicit the unobservable (β_{fjk}) and observable (marginal cost, which depends on the span of production stages in GVCs, $[V_f^M, V_f^X]$) components of transaction prices.[8] Both β_{fjk} and $[V_f^M, V_f^X]$ are on the right-hand side of the equation (12), whereas our aim is to establish how the positioning in GVCs of manufacturing firms affects their bargaining power. This mainly explains the difficulty of building a satisfactory theory to identify the influencing factors of bargaining power, particularly in terms of positioning in GVCs.

The property rights model is one of the few frameworks to establish a relationship between bargaining power and the boundaries of final firms in the value chain, and shows that this relationship is shaped critically by the relative size of the demand elasticity parameter and the input substitutability parameter (Alfaro et al., 2019; Antràs and Chor, 2013). These results are then empirically invalidated for producers of intermediate inputs (Del Prete and Rungi, 2017). Based on these different positions in the literature, we discuss the mechanisms underlying the relationship between bargaining power and GVC position. We introduce a new angle by considering the division of surplus or value along GVCs as a proxy for bargaining power.

2.2 Positioning in GVCs and division of surplus

Theoretical debate on the relationship between positioning in GVCs and division of surplus is essentially based on resource dependency theory, which postulates that owners of critical assets in the supply chain have more power and extract more value from transactions (Pfeffer and Salancik, 2003; Casciaro and Piskorski, 2005; Hillman et al., 2009; Drees and Heugens, 2013). On this basis, Mudambi (2008)'s pioneering work that highlight the existence of the *smile curve* has received several supports in the literature. Indeed, Rungi and Del Prete (2018) show a non-linear U-shaped relationship between value creation of a firm and it distance from final demand. Baldwin and Ito (2021) support this view at firm level. They show that value added has shifted from the manufacturing sectors to service sectors at the lower end and the upper end of the value chains. Indeed, on the one hand Mahy et al. (2021) and Ju and Yu (2015) show that more upstream firms could be expected to improve their bargaining power and value capture, as the initial stages of the production process are associated with critical and high-value-added activities such as innovation, R&D and design. On the other hand, as shown by Cox et al. (2001) and Burch and Lawrence (2005), a critical supply chain assets in agri-food suply chains are related to the final demand (sales space, information on consumer consumption patterns, brand). Firms that are more proximate to final demand can capture a disproportionately share of the rent due to their proprietary access to private information about end-users that allow them to adopt a combination of strategies: marketing, customized products, branding, improved distribution technology, premium access to niche markets and the offer of after-sales services (see Pham and Petersen, 2021). These results mainly correspond to analyses "in-between" industries.

The property rights model, developed by Antràs and Chor (2013) and Alfaro et al. (2019), provides a rich set of theoretical predictions that explain the relationship between positioning in value chains and bargaining power. Indeed, the suppliers of sequentially complementary

[8] The effect of (observable) input prices on the export prices of GVC firms has been widely documented in the literature. This relationship can be ambiguous. Focusing mainly on the imported inputs, on the one hand, foreign sourcing of low-priced inputs can decrease export prices of GVCs' firms by bringing cost savings to these firms (Li and Miao, 2023), and enhancing productivity (Bas and Strauss-Kahn, 2014). On the other hand, the cost savings effect of imported inputs (Curzi et al., 2015; Curzi and Pacca, 2015; Ludema and Yu, 2016), as well as the import of more expensive high-quality inputs (Manova and Zhang, 2012; Bas and Strauss-Kahn, 2015) could lead to the upgrade of product quality and higher export prices.

inputs (low level of demand elasticity) upstream have great difficulty in valuing these inputs across producers of final goods.[9] This makes the suppliers of these inputs dependent and less likely not to honour the contractual relationship with the final firm. The same situation prevails when inputs are substitutable with the possibility of making complete contracts. Under these conditions, the suppliers of inputs face a *hold-up* problem that could considerably reduce their bargaining power in relation to the final firm. Nevertheless, this prediction can be challenged under certain market conditions. Thus, as shown by the model, in a contractual relationship where a final good producer uses substitutable inputs, its supplier can easily value the inputs outside the contractual relationship with the final producer. This could gives greater bargaining power to the upstream supplier relative to the final producer. The same situation prevails when the inputs are sequentially complementary but it is possible to have complete contracts for the upstream inputs. A high level of contractibility reduces the *hold-up* problem for suppliers of sequentially complementary inputs and may increase their bargaining power with respect to final producers. Empirically, the property rights model predictions are tested using the integration decisions of parent firms (final firms) over their suppliers as a proxy for the division of surplus.

2.2.1 Upstream specialization along GVCs and division of surplus

An empirical work by Del Prete and Rungi (2017) invalidated the property rights results when producers of intermediate inputs can integrate either backward or forward along the chain, and that demand elasticities do not play a significant role in these integration choices. This finding means that producers of intermediate inputs could organize their GVCs both backward and forward to strengthen their bargaining position, regardless of demand elasticities faced by buyers. The industrial organization literature shows that vertical integration makes it possible to offer lower prices by eliminating the double marginalization problem (Gaigné et al., 2018). However, the emergence of GVCs, characterized by the fragmentation of the production process among different countries, induces a form of hyper-specialization in functions and tasks and a governance approach based on the power distribution along supply chains. Specialization (performing narrow stages in GVCs by importing more processed inputs and exporting goods furthest from final demand) significantly reduces the stage-specific investment costs (associated with each additional stages performed in GVCs), reducing the "lock-in" effect. As a result, specialized manufacturers do not face a major *hold-up* problem, which considerably increases their bargaining power, according to the property rights framework (Antràs and Chor, 2013; Alfaro et al., 2019).

Other mechanisms may explain the relationship between specialization and bargaining power. Indeed, the hyper-specialization allows manufacturers, mainly in high-income countries, to concentrate most of their resources on domestic value added, enabling them to position themselves in high-value-added activities (innovation, R&D, design, branding, marketing, management and so on). This leads to high-quality production and efficiency gains within GVCs, as well as participation in more sophisticated value chains and niche markets (Humphrey and Schmitz, 2002).[10] This virtuous circle between specialization, high-value-added activities and productivity gains considerably increases the bargaining power of the manufacturer, which could capture high rents. In addition, in light of recent contributions in the GVCs and trade literature, there is a mechanism, empirically validate by Rungi and Del Prete (2018), which is described as a phenomenon of domestic retention of added value,

[9] Antràs and Chor (2013) and Alfaro et al. (2019) distinguish the complements (substitutes) case when the demand elasticity parameter is lower (higher) than the input substitutability parameter.

[10] Recent findings by Kordalska and Olczyk (2023) show a positive effect of wages and labor productivity on specialization in a R&D function.

where "high-value activities are preferably kept in origin countries and performed either by independent buyers/suppliers or by domestic affiliates integrated by multinational enterprises (MNEs)".

When manufacturers specialize by exporting less processed products (further upstream), it should be noted that the level of processing of their imports cannot be higher than that of their exports. Indeed, manufacturers import less processed inputs to perform their production activities in GVCs, and export more processed output. As a result, manufacturers that increase their surplus by specializing must necessarily specialize further upstream. As shown in Figure 1 for "Manufacturers I", we document the positive relationship between specialization and bargaining power as the "specialization effect". Based on the above considerations, we hypothesise the following:

Hypothesis 1: *The division of surplus of a manufacturer in its export market is positively affected by:*

(ii) the import of more processed inputs;

(i) the export of goods far from final demand;

(iii) the specialization in the most upstream stages of the production process in agri-food GVCs.

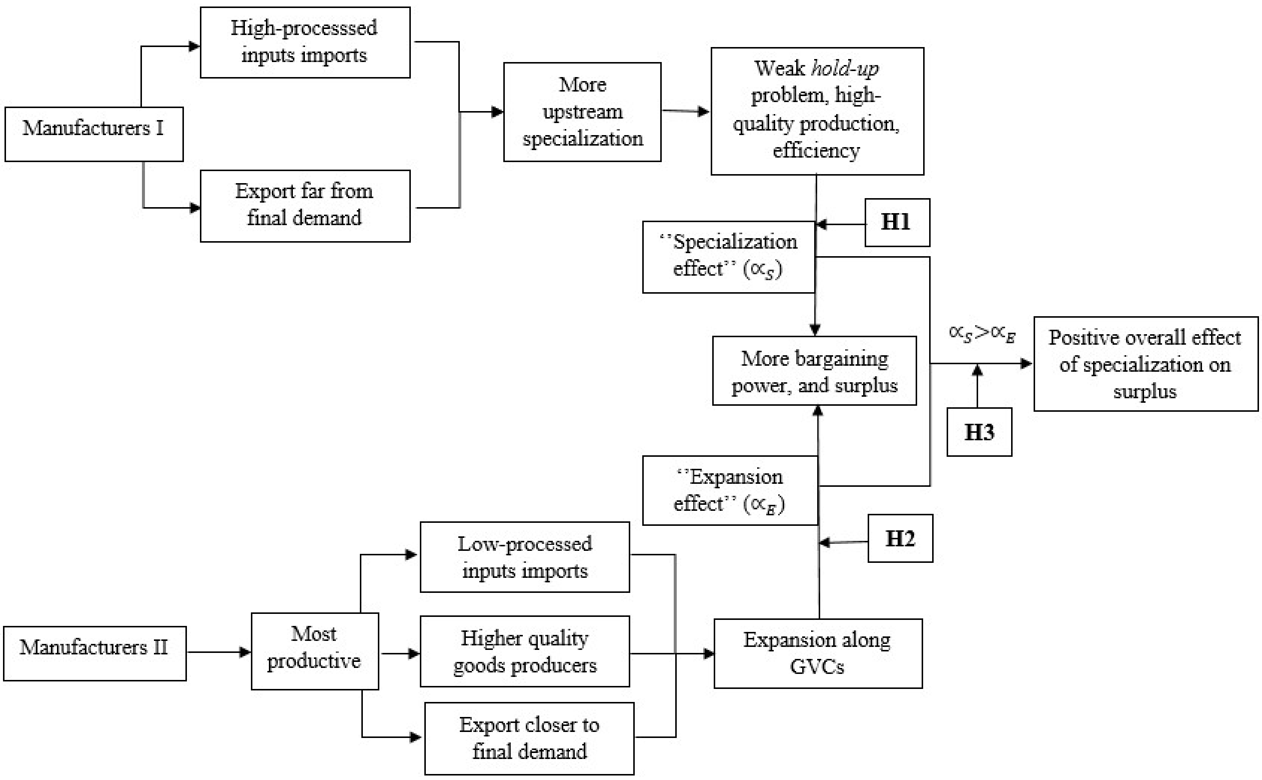


Figure 1: Impact pathways of GVC position on division of surplus and corresponding research hypotheses

2.2.2 Expansion along GVCs and division of surplus

In agri-food GVCs, manufacturers that produce goods closer to final demand are much more likely to specialize in low-skill, low-value-added activities, such as assembly and production of more generic goods, and face stronger competition, which could reduce their bargaining power. As a result, only more productive firms survive in production stages closer to final demand. Indeed, as discussed earlier, the expected positive relationship between positioning closer to final demand and the division of surplus along the supply chain is supported by the Melitz (2003) model applied to the value chain framework. Costinot et al. (2013) show that in an environment where the production of the final good is sequential and subject to mistakes, their occurrence closer to final demand is much more costly (as they involve more upstream stages) and leads to a decrease in value added intensity along value chains. Furthermore, there is some evidence in the literature that the level of technology and production efficiency are among the main drivers of GVC bargaining power (see Li et al., 2022). In agri-food industry, as fixed capital stocks are higher in stages that are more proximate to final demand, the cutoff productivity for firms to operate closer to final demand will be higher. These confirm that more productive firms produce more processed goods, resulting in higher productivity, and thus higher bargaining power closer to final consumption than upstream.

We also know from the property rights model that when the *hold-up* situation is less pronounced for the input suppliers with respect to the final producers, the latter decide whether or not to integrate these suppliers. Of course, Alfaro et al. (2019) show that more productive final firms integrate more production stages upstream, as well as Chor et al. (2021). As shown by Chor et al. (2021), increasing the span of production stages in GVCs is associated with higher added value. This is because each additional stage performed in GVCs additively adds value to the firm. As average productivity is higher closer to final demand in GVCs, manufacturers that produce and export more processed goods also export high-quality goods (Johnson, 2012; Curzi and Olper, 2012; Curzi et al., 2015), and perform more production stages by importing further upstream inputs (Chor et al., 2021). Consequently, average bargaining power could be higher in stages that are more proximate to final demand: the positive effect of productivity and higher-quality production is expected be higher than the negative effect of competition. These mechanisms are illustrated in Figure 1 for "Manufacturers II", and refer to the "expansion effect" that we summarize by hypothesizing that:

Hypothesis 2: *Manufacturer that produce and export more processed goods increase its division of surplus in export markets by:*

(ii) importing more upstream inputs;

(i) exporting closer and closer to final demand;

(iii) and, thus performing a larger number of production stages in GVCs.

2.2.3 "specialization effect" Vs "expansion effect": the overall effect

Our framework makes explicit the ambiguous role of GVC position in the division of surplus, as the "specialization effect" and the "expansion effect" are opposed. Indeed, upstream specialization increases the division of surplus, while the most productive firms, closer to final demand, have no interest, in terms of rent capture, in specializing. According to the relative importance of these two effects, the global effect of GVC position on division of surplus will be different. Its worth noting that the "specialization effect" and the "expansion effect" operate mainly through the same channels, namely efficiency and high-quality production. Furthermore, manufacturers that specialize further upstream in GVCs face weak *hold-up* problem, whereas manufacturers that produce closer to final demand and perform more production stages in GVCs face higher production costs (Chor et al., 2021), higher stage-specific investments, and higher tariff (Antràs, 2020).[11] As a result, we expect that the "specialization effect" outweighs the "expansion effect". This is what Figure 1 represents when "Manufacturers I" and "Manufacturers II" are together, leading to the third research hypothesis:

Hypothesis 3: *Overall, the "specialization effect" outweighs the "expansion effect", resulting in a global positive effect of specialization on the division of surplus.*

3 Empirical strategy

3.1 The dataset: French agri-food industries firms and international trade statistics

The first data source used in our empirical analysis is French customs, which identifies firms through their SIREN number. This database includes annual information on the value in Euro and the quantity of firm's bilateral imports and exports at product-partner level, over 2002-2017. The products are described at a very detailed 8-digit of Combined Nomenclature (CN) and 6-digit of CPF classification. This level gives us a detailed picture of the product composition of international purchases and sales made by the firms. All the information in the customs database is collected at the border by the French customs services and can provide information on the international activities of firms. In line with previous work (Baldwin and Yan, 2014; Antràs, 2020), we assume that participation to a GVC is reflected in the data by firms joint involvement in import and export activities. In the paper we focus only on firms that participate in GVCs, *i.e.* on firms that both import and export in a given year. For the purpose of our study, we distinguish two main samples: sample with all transactions (All) and re-export excluding sample (Re-export Exclude).[12] Re-exports account for a large share of transactions in our data (about 72% of the total value of exports) and are related in most cases to the main activity of exporters (about 73%). Excluding re-exports allows us to actually capture French exporters' processing activities in GVCs.[13]

Our second source of information is the AMADEUS database, which identifies French agri-food firms. It lists, with a good coverage of French firms, the main economic activity of each firm according to the NACE Rev.2 4-digit classification. The agri-food sector includes 32 NACE activity codes, all of which are present in the panel of French firms in the AMADEUS database. Limiting the analysis to a single sector – the agri-food – offers the advantage of reducing the effects of unobserved factors on firms' characteristics and decisions (strategies). Still, the data contains a certain degree of heterogeneity, due to the diversity of firms' economic activities (industries) in the agri-food sector. The indicator variable reflecting

[11] The division of surplus among manufacturers that produce more proximate to final demand is reduced, due to higher production costs and tariffs, while upstream manufacturers retain their competitive position and generate more surplus.

[12] We identify as a re-export when a firm imports and exports the same product, defined at the most disaggregated level possible (CN8), in the same year. Then we just remove the product from the flow of goods imported and exported by the firm in that year.

[13] We also exclude exports that do not reflect processing activities of agri-food firms in both samples, namely exports of live animals, hair, fur, and ivory, flowers, raw cereals, vegetal extracts, planting materials, food residues, and tobacco.

each firm's core activity permits us to capture the heterogeneity in the data. The AMADEUS database includes the turnover in Euro and the number of employees. Data on French firms in AMADEUS comes from DIANE, a Bureau Van Dijk database. DIANE collects statistics from the annual accounts and balance sheets of French firms. As a result, AMADEUS provides annual data and only includes firms that have published their annual accounts and balance sheets to the Registries of the Commercial Courts.

We match the two datasets using the unique identification (Siren) number of each firm. We can now identify agri-food firms and the international dimensions of their activities. We focus on food processing firms, *i.e.* whose core activity falls within chapters 10 and 11 of the 2-digit NACE Rev. 2 nomenclature (Manufacture of food products and Manufacture of beverages).

3.2 Data explanation

3.2.1 Explained variable

Empirical literature on the analysis of power relations in GVCs uses mainly the markup to measure market power.[14] It is worth noting that market power mainly involves unilateral strategic behavior aimed at manipulating the level of traded quantities, while bargaining power implies that two agents use a balance of power (or dependence) in their supplier-buyer relationship to influence the terms of trade (Bonanno et al., 2018).

The main challenge is to empirically estimate bilateral bargaining power in cross-border relations. As it is common in the bargaining model apply to the supplier-buyer relationship, there is a perspective of a lower and an upper bound of transaction prices, that buyer and seller, respectively, have an incentive to negotiate. From this perspective, Polachek and Yoon (1987, 1996) and Kumbhakar and Parmeter (2009) apply the bargaining model to the supplier-buyer relationship and estimate the extraction of the surplus on the value of an agent, depending on his bargaining power and information available. Using bilateral trade flows, Li et al. (2022) adapt the bargaining model approach to the context of international trade and compute the division of surplus of countries. This approach is very attractive, as it allows to estimate the bilateral division of surplus at the firm-to-firm pair and product level. However, their use in the literature is very limited due to the unavailability of data on firm-to-firm transactions.

We adopt this approach to estimate the division of surplus of French exporters and their trade partners in foreign markets. However, we only have information on French firms that export while the identity of their foreign trade partners is not known. Since we need to control the characteristics of the actors in the supplier-buyer relationship, we use the attributes of French firms and the economic characteristics of the countries of firms' trade partners.

Suppose that manufacturer f, located in country i, export at price p_{fjk} depending on the destination j and product type k. We drop index i to ease notation in the following equations. According to Polachek and Yoon (1987, 1996) and Kumbhakar and Parmeter (2009), p_{fjk} can be expressed as below:

$$p_{fjk} = \underline{p_{fjk}} + \beta_{fjk} \left(\overline{p_{jfk}} - \underline{p_{fjk}} \right) \tag{13}$$

[14] For example, De Vries et al. (2021) do not observe a significant relation between mark-ups and functional specialisation in GVCs, using Dutch firms. del Valle and Fernández-Vázquez (2023) use input-output table for 28 European countries and 14 manufacturing sectors between 2000 and 2014 and document the fact that the further upstream industries in GVCs have a significantly decreasing impact on market power and that this relationship is non-linear.

where $\underline{p_{fjk}}$ is the lowest export price that the manufacturer can accept, and $\overline{p_{jfk}}$ is the highest import price that the importer is willing to pay. β_{fjk} $(0 \leq \beta_{fjk} \leq 1)$, respectively $1 - \beta_{fjk}$, represents the bargaining power of the manufacturer, respectively importer. When the export price is reached as a result of bargaining, $\beta_{fjk}\left(\overline{p_{jfk}} - \underline{p_{fjk}}\right)$ represents the surplus extracted by the manufacturer. Based on the basic characteristics of manufacturer and importer, x, one can reach the export price, $\mu_{fjk}(x)$, regardless the influence of the bargaining power of the negotiating agents. $\mu_{fjk}(x)$ is considered as the benchmark export price. Consequently, $\mu_{fjk}(x) - \underline{p_{fjk}}$, respectively $\overline{p_{jfk}} - \mu_{fjk}(x)$ corresponds to the expected surplus of the manufacturer, respectively importer, when the transaction price is reached. Note that Equation (13) only captures the manufacturer's bargaining power, and can be rewritten to capture importer's bargaining power as well:

$$p_{fjk} = \mu_{fjk}(x) + \beta_{fjk}\left(\overline{p_{jfk}} - \mu_{fjk}(x)\right) - (1 - \beta_{fjk})\left(\mu_{fjk}(x) - \underline{p_{fjk}}\right) \tag{14}$$

where $\beta_{fjk}\left(\overline{p_{jfk}} - \mu_{fjk}(x)\right) \geq 0$ is the capability of the manufacturer to increase its export price by extracting a share of the importer's surplus, while $(1 - \beta_{fjk})\left(\mu_{fjk}(x) - \underline{p_{fjk}}\right) \geq 0$ is the capability of the importer to lower its purchase price by extracting a share of the manufacturer's surplus. The net surplus $NS_{fjk} = \beta_{fjk}\left(\overline{p_{jfk}} - \mu_{fjk}(x)\right) - (1 - \beta_{fjk})\left(\mu_{fjk}(x) - \underline{p_{fjk}}\right)$ describes the global effect of the bargaining on the transaction price.

Our theoretical modeling shows that β_{fjk} is related to the unobservable component of export prices. Based on price equation (12), we derive the following log-linear form to estimate at the manufacturer-product-destination level

$$\begin{aligned} \ln p_{fjkt} &= \mu_{fjkt}(x) + \xi_{fjkt}, \qquad (15) \\ \text{with } \mu_{fjkt}(x) &= \alpha_f \text{Controls}_{ft} + \alpha_j \text{Controls}_{jt} + \alpha_b b_{fjkt} + \alpha_s s_{fjkt} + FE_t + FE_k + FE_r + FE_j \\ \text{and } \xi_{fjkt} &= \omega_{fjkt} - u_{fjkt} + \nu_{fjkt} \end{aligned}$$

Equation (15) is similar to (14). $\ln p_{fjkt}$ is the outcome variable and corresponds to the manufacturer f's export price of a good, k, to the destination j in a given year t. We use the unit values as a proxy of the product export prices. To describe the product, we use the 8-digit of CN classification. Since β_{fjk} is not observable, we assume that it is included in the error term ξ_{fjkt}. x is the vector of covariates, including three types of control variables: the basic characteristics of the manufacturer, importer and variables that reflect the interdependence between manufacturers and importers in each product.[15]

We use the time-varying characteristics, Controls_{ft}, of French manufacturers like log productivity computed as turnover per worker, size (small: 1 to 49 employees - mid: 50 to 499 employee - large: 500 employees or more) as the attributes of French manufacturers. We control for the time-varying economic characteristics, Controls_{jt}, of destination markets of French manufacturers by including the countries' GDP per capita, industrial added value as a percentage of GDP, and agricultural added value as a percentage of GDP taken from the World Bank's WDI and CEPII database.

We control for two-sided market power by including the factors that reflect the interdependence between manufacturers and importers.[16] Similar to Alviarez et al. (2023), we use

[15]The fact that the manufacturer or importer can unilaterally influence the traded quantity reflects the exercise of market power (see Bonanno et al., 2018) on both sides of the transaction, which must be controlled to avoid bias in the estimation of bilateral bargaining power.

[16]When β_{fjk} is relatively low, the importer has a strong incentive to import large quantities because markup

the importer's buyer share (b_{fjkt}), defined as the share of importer j's quantity from f over the total quantity supplied by manufacturer f; and the manufacturer's supplier share (s_{fjkt}), defined as the share of manufacturer f's sales to j over importer j's total imports, for a given product k.[17]

The regression also controls for permanent observed and unobserved manufacturer's core industry- (control for σ, ε and the markup), product- (control for ε and the markup), year- and country- (control for trade cost) specific supply and demand shocks, by including manufacturer's core activity as the NACE Rev.2 4-digit industry code, HS four-digit of products, year and country of trade partners fixed effects.[18] α is the parameter vector to be estimated. Since our aim is to assess how the division of surplus is affected by GVC position patterns, we do not include firm fixed effects so as not to control for firm heterogeneities, such as production technology and, consequently, firm boundary and organization choices in GVCs.

To estimate Equation (15), we use a two-stage two-tier stochastic frontier. The first stage allows us to address the standard endogeneity bias associated with OLS regressions of prices on market shares (importer's buyer share and exporter's supplier share). We follow the approach adopted by Alviarez et al. (2023) to construct instrumental variables (IVs) for the bilateral shares exploiting the network structure of intermediate input trade: for the manufacturer's supplier share, we consider the sales of j's other exporters to importers other than j, and for the importer's buyer share, we consider the purchases of f's other importers from manufacturers other than f, for a given product k.

We use the predictions from the first stage in the two-tier stochastic frontier model estimate in the second stage, following Polachek and Yoon (1987, 1996) and Kumbhakar and Parmeter (2009). The two-stage estimation controls for the endogeneity of the bilateral shares and assumes that the error, ξ_{fjkt}, components are distributed independently of each other and from the regressors, x. The second stage of the model is then estimated by the maximum likelihood (ML) method, assuming that ν_{fjkt} is normally distributed ($\nu_{fjkt} \sim i.i.d.\ N(0, \delta_\nu^2)$, and that ω_{fjkt} and u_{fjkt} follow an exponential distribution ($\omega_{fjkt} \sim i.i.d.\ Exp(\delta_\omega, \delta_\omega^2)$ and $u_{fjkt} \sim i.i.d.\ Exp(\delta_u, \delta_u^2)$).

The division of surplus captured by manufacturers is $\omega_{fjkt} = \beta_{fjkt}\left(\overline{P_{fjkt}} - \mu(x)\right)$, while $u_{fjkt} = (1 - \beta_{fjkt})\left(\mu(x) - \underline{P_{fjkt}}\right)$ is the division of surplus captured by importers, and ν_{fjkt} is the classical error term. The net surplus corresponds to

$$NS_{fjkt} = \omega_{fjkt} - u_{fjkt}. \tag{16}$$

The higher this index is, the higher the bargaining power of manufacturing firms, and the higher the ability of manufacturer to capture the surplus relative to their buyers abroad.

Results of the two-stage two-tier stochastic frontier are reported in Table C.1 of Appendix

and prices are low. However, the manufacturer does not, as it could gain on high demand but would ultimately obtain only a relatively small share of the rent. Thus, exporting a small quantity creates a negative supply shock in the market that gradually enhances the manufacturer's bargaining power vis-à-vis the importer. As a result, the manufacturer has a greater incentive to increase the quantity of supply if his bargaining power increases. Similarly, when β_{fjk} is relatively high, the manufacturer sets a high export price, which reduces the quantity imported by the importer. This means that the manufacturer can gain on the price but lose in terms of traded quantity. The reduction in the quantity imported by the importer leads to a negative demand shock in the market, which will increase the importer's bargaining power relative to the manufacturer and steadily reduce the transaction price. These mechanisms operate mainly according to the interdependence between manufacturer and importer.

[17] Elasticity parameters, and thus markup depend on these market shares (see Alviarez et al., 2023).

[18] The best way to capture the effects of unobservable factors is to include CN8 product-level fixed effects. We cannot implement this solution because of the large number CN8 product in our sample and the difficulty of convergence of a maximum likelihood (ML) model, that we will use, with a so many fixed effects.

Table 1: Summary of surplus extracted and variance analysis– Two-stage two-tier frontier

Sample	Panel A: Re-exports excluded			Panel B: All		
Summary	# observations= 178,805			# observations= 323,557		
	ω_{fjkt} (Firms)	u_{fjkt} (Countries)	NS_{fjkt}	ω_{fjkt} (Firms)	u_{fjkt} (Countries)	NS_{fjkt}
Mean	56.71	41.93	14.78	59.88	41.90	17.99
Q1	29.37	25.77	-16.49	30.23	25.97	-15.26
Q2	40.39	31.82	8.56	41.96	31.78	10.18
Q3	65.01	45.86	39.24	69.30	45.48	43.33
	Variance analysys					
$\delta^2_\omega + \sigma^2_u + \delta^2_\nu$		66.59			69.85	
$(\delta^2_w + \delta^2_u)/(\delta^2_\omega + \delta^2_u + \delta^2_\nu)$		74.70			76.47	
$\delta^2_w/(\delta^2_\omega + \delta^2_u)$		64.66			67.14	
$\delta^2_u/(\delta^2_\omega + \delta^2_u)$		35.34			32.86	

Notes: Value expressed in percent.

C. We are particularly interested in the parameter estimates ω_{fjkt} and u_{fjkt}. Taken individually, their high level of significance indicates the presence of bargaining in the cross-border supplier-buyer relationship in both samples (Re-export excluded and All transaction samples). A quick analysis of the variance of manufacturers' export prices in Table 1 confirms that a large part of the variation is due to bargaining. Indeed, in the re-export excluded sample, the unexplained variation in log price is 66.59%, of which 74.70% is due to bargaining, and these results are close to those of the All transaction sample. How bargaining affects prices or not, and if so, in what direction varies by product and by manufacturer-country pair.

Bargaining affects price, on average, insofar as surplus extracted by manufacturer is higher than surplus extracted by importer leading to an increase in export price by 14.78% relative to benchmark prices, *ceteris paribus*, in the Re-export excluded sample. In the All transaction sample, the net surplus is 17.99% which means that manufacturers' export prices are, on average, at least 17.99% above the expected value of the match for the sample.

3.2.2 Core explanatory variables

The core explanatory variables are the *upstreamness* of manufacturers' input imports and output exports. First, we use methodology developed by Fally (2012), Antràs et al. (2012) and Antràs and Chor (2013) to calculate the *upstreamness* of an industry in production chain. Assuming an economy with S ($S \geq 1$) industries, industry r's *upstreamness* is computed as:

$$U_r = 1.\frac{F_r}{Y_r} + 2.\frac{\sum_{s=1}^{S} d_{rs}F_s}{Y_r} + 3.\frac{\sum_{s=1}^{S}\sum_{k=1}^{S} d_{rk}d_{ks}F_s}{Yr} + 4.\frac{\sum_{s=1}^{S}\sum_{k=1}^{S}\sum_{l=1}^{S} d_{rl}d_{lk}d_{ks}F_s}{Y_r} + \dots \quad (17)$$

where F_r is the value of industry r used for final consumption , d_{rs} is the value of the output of industry r needed to produce one unit of the output of industry s, i.e. the *direct requirements* coefficient, Y_r is the gross output of industry r.

U_r is the weighted average of the number of stages from final demand (consumption or investment) at which r enters as an input in production processes. The weights correspond to 1 for the part of r's output that goes to final consumption, 2 for the part of r's output used in another industry before being absorbed by final consumption and so on. The weights in expression (17) permit the definition of the importance of industry r's share in the total output of r at each production stage. This indicator is calculated from an input-output table. Focusing on a single industry (agri-food sector), we need a highly disaggregated input-output table to identify the level of transformation of each product in order to explore the richness of French firm-level data. Since the French input-output table comes at a very high level of industry aggregation (only 2 industries identify the agri-food sector in most available tables for France except the GTAP table which identifies about 20), we use the U.S. input-output table that uses a much more narrow definition of industries (405, of which 42 agri-food), and correspondences between U.S. and French industry codes to build a highly disaggregated table (604 4-digit NACE Rev.2 industries, of which 88 agri-food) using the exact industry codes that identify French firms' main economic activity in our data. However, this brings an important challenge because of multiple correspondences in both directions between U.S. and French industry codes. We solve this problem by allocating equal weights to all correspondences within each pair industry codes (see Appendix A for more details).

Table 2 reports some examples from the 604 NACE Rev.2 industries identified. Not surprisingly, among industries closer to final demand are retail and services industries. The most upstream industries tend to be related to the agricultural and farming activities which provide raw products that mainly used in the agri-food sector.

Table 3 shows some summary statistics of the *upstreamness* index, comparing the agri-food industry to the other industries.

Firm's position in global value chains Following Ju and Yu (2015) and Chor et al. (2021), we consider that the level of transformation (processing) of goods used and produced by a manufacturer indicates its position in the value chain.

Once the *upstreamness* indicators U_r are computed at industry level, we use Chor et al. (2021)'s approach to compute this indicator at firm level. We assume that all products in a given industry share the same level of *upstreamness*. We compute the *upstreamness* of imports (U^M_{ft}) for each manufacturer f as the weighted average *upstreamness* of industries to which belong the inputs imported by the manufacturer. We use a similar approach to compute the *upstreamness* of exports (U^X_{ft}). For our empirical analysis, we take the inverse of U^M_{ft} and U^X_{ft} to obtain $\nu \in [0, 1]$, which is consistent with our theoretical framework. The difference $V^X_{ft} - V^M_{ft}$ reflects the number of production stages performed by the supplier in the global production line. We refer to it as the *intensity of GVC participation* of the firm. More specifically:

$$\begin{aligned} U^M_{ft} &= \sum_r^S \frac{M_{frt}}{M_{ft}} U_r \Rightarrow V^M_{ft} = \frac{1}{U^M_{ft}} \\ U^X_{ft} &= \sum_r^S \frac{X_{frt}}{X_{ft}} U_r \Rightarrow V^X_{ft} = \frac{1}{U^X_{ft}} \\ GVC_{ft} &= V^X_{ft} - V^M_{ft} \end{aligned} \tag{18}$$

where M_{frt} and X_{frt} are the value of imports, respectively exports, of manufacturer f of products in industry r in period t. $M_{ft} = \sum_r^S M_{frt}$ and $X_{ft} = \sum_r^S X_{frt}$. Intuitively, the level of processing of sold (exported) products is higher than the level of processing of purchased (imported) products ($U^X_{ft} < U^M_{ft}$, so that $V^X_{ft} > V^M_{ft}$), as the sold products are closer to final consumption.

We present some stylized facts using only the Re-export excluded sample, but we obtain a similar picture with the All transaction sample. Figure 2a reports the aggregate trends of import- and export- *upstreamness* over the 2000-2018 period in the French agri-food sector. This figure illustrates the weighted average level of import- and export- *upstreamness* of all manufacturers,

Table 2: Industry upstreamness (selection)

NACE industry	Upstreamness
Retail sale of fruit and vegetables in specialised stores	1.01
Retail sale of meat and meat products in specialised stores	1.01
Retail sale of fish, crustaceans and molluscs in specialised stores	1.01
Retail sale of bread, cakes, flour confectionery and sugar confectionery	1.01
Retail sale of beverages in specialised stores	1.01
Manufacture of rusks and biscuits; of preserved pastry goods and cakes	1.08
Manufacture of soft drinks; of mineral waters and other bottled waters	1.09
Manufacture of bread; manufacture of fresh pastry goods and cakes	1.10
Manufacture of macaroni, noodles, couscous and similar farinaceous products	1.15
Manufacture of beer	1.19
Manufacture of prepared meals and dishes	1.20
Manufacture of grain mill products	1.21
Restaurants and mobile food service activities	1.22
Manufacture of wine from grape	1.23
Growing of vegetables and melons, roots and tubers	1.28
Processing and preserving of poultry meat	1.31
Manufacture of condiments and seasonings	1.35
Production of meat and poultry meat products	1.37
Operation of dairies and cheese making	1.38
Manufacture of cocoa, chocolate and sugar confectionery	1.39
Manufacture of sugar	1.42
Processing and preserving of meat	1.44
Growing of perennial crops	1.46
Processing of tea and coffee	1.47
Manufacture of fruit and vegetable juice	1.47
Processing and preserving of fish, crustaceans and molluscs	1.60
Marine fishing	1.66
Freshwater fishing	1.69
Freshwater aquaculture	1.86
Sewerage	1.89
Growing of sugar cane	2.07
Marine aquaculture	2.10
Raising of swine/pigs	2.10
Raising of other animals	2.15
Raising of poultry	2.16
Manufacture of starches and starch products	2.16
Manufacture of oils and fats	2.72
Raising of dairy cattle	2.98
Manufacture of prepared feeds for farm animals	3.24
Raising of other cattle and buffaloes	3.30
Growing of rice	3.38
Growing of cereals (except rice), leguminous crops and oil seeds	3.45
Post-harvest crop activities	3.61
Seed processing for propagation	3.61

Notes: Computed by authors from the U.S. input-output table converted to NACE Rev.2 4-digit.

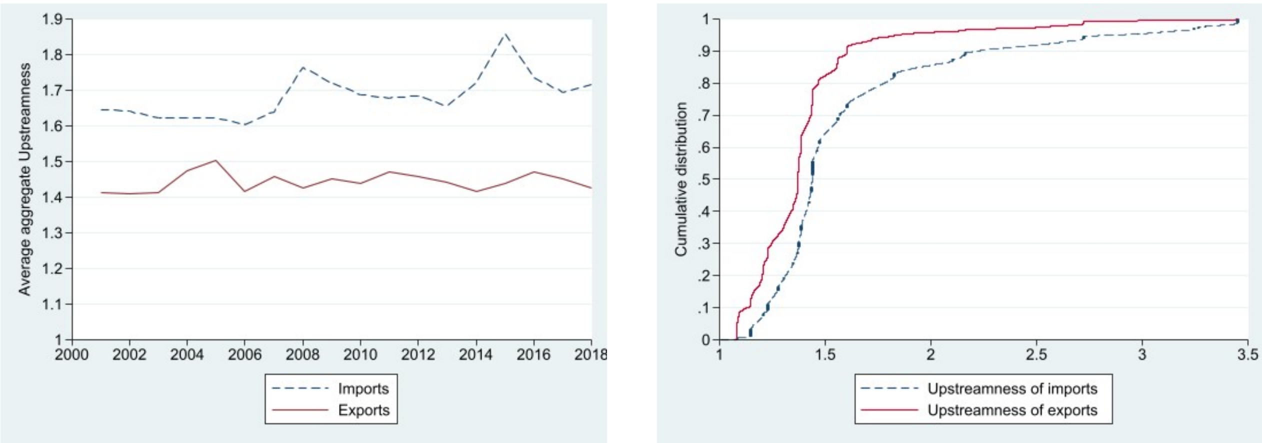
Table 3: Summary statistics of upstreamness index according to the type of industry

	Frequency	Min	Max	Mean	Std. dev.
Upstreamness - all industries	604	1.00	4.51	1.88	0.75
Upstreamness - agrifood	88	1.08	3.61	1.85	0.72

computed at sector-level:

$$U_t^M = \sum_f \frac{M_{ft}}{M_t} U_{ft}^M, \text{ and } U_t^X = \sum_f \frac{X_{ft}}{X_t} U_{ft}. \tag{19}$$

We use manufacturers' imports and exports as weights. $M_t = \sum_f M_{ft}$ and $X_t = \sum_f X_{ft}$ are total sector-level imports and exports in year t.



(a) Average import and export upstreamness

(b) Cumulative distribution of French firms

Figure 2: The *Upstreamness* of French agri-food firms

Two observations emerge from the analysis of Figure 2. First, the imports of French agri-food firms are persistently more upstream than their exports. This reflects the fact that manufacturers tend to import intermediate goods, less processed, which they use to produce goods with a higher level of transformation (Figure 2a). A similar pattern was shown by Chor et al. (2021) in the case of China. Note that countries that mainly export primary goods and import final products may present different situations. Chor (2014) illustrates the examples of Brunei, Myanmar, Australia, and New Zealand, whose exports are more upstream (mainly concentrated in agriculture and primary products) than imports. Furthermore, the cumulative distribution of the *upstreamness* of French agri-food manufacturers displays a similar pattern (Figure 2b). The gap between the import and export curves reflect an average span of production stages performed by these manufacturers.

Second, we observe a slight widening of the span of production stages performed by manufacturers in Figure 2a. This means that the French agri-food sector can be considered as an important contributor to the domestic value added of French exports.

Table B.1 in Appendix B summarizes the statistics of variables used in the empirical analysis for GVCs' (both importing and exporting manufacturers) manufacturers in French agri-food industry, and for both sample.

3.3 Empirical modelling

The paper focus on the effects of *upstreamness* of imports and exports of agri-food manufacturers on the bilateral division of surplus. We seek to test three main theoretical predictions that the division of surplus is affected by the *upstreamness* of imports, and exports, and the number of production stages performed in GVCs by manufacturers. Accordingly, we set the linear forms as follows:

$$NS_{fjkt} = \alpha_0 + \alpha_\nu\{\{\boldsymbol{V}^M_{ft}, \boldsymbol{V}^X_{ft}\}, \boldsymbol{V}^X_{ft} - \boldsymbol{V}^M_{ft}\} + \alpha_c \text{Controls}_{ft} + FE_f + FE_{rt} + FE_{rj} + FE_{jk} + \epsilon_{fjkt}, \tag{20}$$

where NS_{fjkt} is the outcome variable, obtained from (16), which captures the surplus obtained by manufacturer f in its export transaction to country j of product k in year t. The key regressors of interest are in turn the inverse of the two *upstreamness* measures (import upstreamness, V^M_{ft}, and export *upstreamness*, V^X_{ft}) which capture heterogeneity in the boundaries of French manufacturers in GVCs, and the difference between the two, $V^X_{ft} - V^M_{ft}$ which is informative about the number of stages performed by the manufacturers in GVCs, domestically. Our theoretical hypotheses suggest that α_ν should be positive and negative for V^M_{ft} and V^X_{ft}, respectively, and consequently negative for $V^X_{ft} - V^M_{ft}$ for manufacturers specializing further upstream in GVCs (H1) which we refer as the "specialization effect". The opposite effects ("expansion effect") occur for manufacturers that export closer to final demand (H2). As the "specialization effect" outweighs the "expansion effect", the overall effect is similar to the "specialization effect" (H3).

In regression (20), we includes time-varying manufacturer characteristics, Controls_{ft}, such as productivity and size group. Coefficient estimates of interest vary only marginally and all results are robust to the omission of these controls. We also control for permanent observed and unobserved manufacturer characteristics with manufacturer fixed effects, FE_f, and industry-specific supply and demand shocks with industry-by-year dummies, FE_{rt}, where r denotes the NACE Rev.2 4-digit industry code which correspond to the manufacturer f's primary activity. Likewise, countries of trade partners of French agri-food manufacturers are very diverse. To ensure that we do not mistake any other destination country × industry, we control for their specific supply and demand shocks, as well as institutional context (financial development and financial constraints, comparative advantage) by using industry-country fixed effects, FE_{rj}. We also control for country-specific and product-specific characteristics through the country-product fixed effects (FE_{jk}). These estimates are therefore not affected by the cross-border integration decisions or the intra-firm trade that could affect product price (see for example Berlingieri et al., 2021; Alfaro et al., 2019). These fixed effects also control for trade costs that vary by product and destination country, product market concentration, gravity factors (distance, market size, multilateral resistance, etc.), specificity of some product according to the codifiability or task required for their production, and so on.

We run regressions (20) by using ordinary least squares (OLS) to assess primarily robust correlations. Given the skews of the division of surplus, we drop observations in the top two and bottom two percentiles of the measure of the net surplus from the samples in all regressions. All standard errors are clustered by country in order to take into account the interdependence between manufacturers in each specific market.

As we control for manufacturer, industry-by-year, industry-by-country and product-by-country fixed effects (FE_f, FE_{rt}, FE_{rj} and FE_{jk}), and also including time-varying control variables in the regression, we compare changes within manufacturer-country-product over time. Furthermore, our rich set of fixed effects allows us to control for the potential omitted variable bias. Therefore, the signs and sizes of the coefficients of interest α_ν capture the within manufacturer-country-product heterogeneous effects of GVC position and the number of stages performed by French agri-food manufacturers on the bilateral division of surplus.

4 Empirical results

4.1 Does upstream specialization or expansion along GVCs affect the division of surplus?

Given that specialization along GVCs means importing more processed inputs and exporting far from final demand, the effects of manufacturer's position in GVCs and of specialization along the chain on the division of surplus are more pronounced when the production process is more upstream (H1). However, as the most productive manufacturers are closer to final demand in GVCs, export high-quality products and perform a larger number of production stages in GVCs by importing more upstream inputs and exporting more processed goods, they therefore capture more rents (H2). To test for such patterns, we deal with core activity heterogeneity of manufacturers. We generate sub-samples of manufacturers that are closer to final demand and those that are more upstream depending on whether the *upstreamness* of the NACE Rev.2 4-digit industry code of a manufacturer's core activity is below or above the sample median.

Using a sub-sample regressions in the data, we estimate Equation (20) with V^M_{ft} and V^X_{ft}, and $V^X_{ft} - V^M_{ft}$ as key variables, respectively. Table 4 shows the results with V^M_{ft} and V^X_{ft} as key regressors of interest, while Table 5 presents the results with $V^X_{ft} - V^M_{ft}$ as key variable. In both tables 4 and 5, the specifications in Columns 1 and 3 do not include the time-varying manufacturer characteristics, Controls_{ft}, unlike in Column 2 and 4. In Panel A, we consider the Re-export excluded sample, while Panel B deals with the All transaction sample. In all specifications, we use our set of fixed effects (manufacturer, industry-year, industry-country and country-product) to make it possible to compare the effects of our variables of interest within manufacturers, for a given destination-product and year.

Table 4: manufacturer's position in GVCs and division of surplus – low versus high level of *upstreamness* of the core activity of manufacturers

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream position	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^M_{ft}	0.0177	0.0040	0.0465	0.0743***	-0.0329**	-0.0345**	0.0398	0.0745**
	(0.0205)	(0.0208)	(0.0285)	(0.0277)	(0.0146)	(0.0155)	(0.0314)	(0.0320)
V^X_{ft}	0.0052	0.0131	-0.5522***	-0.4988***	0.2520***	0.2453***	-0.1920**	-0.1723**
	(0.0536)	(0.0540)	(0.0969)	(0.0931)	(0.0574)	(0.0567)	(0.0879)	(0.0823)
$\ln \text{Productivity}_{ft}$		0.1029***		0.0869***		0.0947***		0.1063***
		(0.0140)		(0.0082)		(0.0063)		(0.0051)
Firm size:								
Small_{ft}		reference		reference		reference		reference
Medium_{ft}		0.1004***		0.1232***		0.1100***		0.1673***
		(0.0103)		(0.0123)		(0.0078)		(0.0084)
Large_{ft}		0.1947***		0.1995***		0.1425***		0.1546***
		(0.0166)		(0.0225)		(0.0099)		(0.0154)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	52,725	52,725	52,977	52,977	120,880	120,880	133,401	133,401
R^2	0.735	0.736	0.684	0.685	0.727	0.728	0.641	0.643

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. $^* p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$.

Results of Panel A in Table 4 show that the coefficients of the variable V^M_{ft} and V^X_{ft} are positive and negative, respectively, only in the sub-sample of the most upstream position (Columns 3-4). They are both significant mainly when we control for the time-varying controls (Column 4). This means that importing more processed inputs and exporting far from final demand is associated with significantly higher division of surplus by manufacturers on their export market. In terms of magnitude, this means that each additional production stage outsourced by manufacturers, backward on their input market, increases their division of surplus by 4.65 to 7.43 p.p. Similarly, each additional production stage outsourced by manufacturers, forward on their export market, increases their surplus from 49.88 to 55.22 p.p. These findings are all in accordance with our theoretical hypotheses H1i and H1ii. In contrast, we found non-significant coefficients for V_{ft}^{M} and V_{ft}^{X} in the sub-sample of manufacturers closer to final demand, so that we do not confirm H2i and H2ii in the Re-export excluded sample.

All transactions sample results (Panel B in Table 4) confirm the previous findings, in line with H1i and H1ii, showing that the positive and negative signs of coefficients V_{ft}^{M} and V_{ft}^{X}, respectively, continue to hold only in the sub-sample of the most upstream position (Columns 3-4). We obtain inverse effects in the sub-sample of manufacturers closer to final demand, in accordance with H2i and H2ii, and the coefficients of V_{ft}^{M} and V_{ft}^{X} are significant. This shows that, although we found non-significant coefficients for V_{ft}^{M} and V_{ft}^{X} for the Re-export excluded sample (Columns 1-2 of Panel A in Table 4), manufacturers closer to final demand that re-export have a strong interest to export more proximate to final consumption, in order to capture more value. In addition, importing more upstream inputs also had a significantly positive impact on the division of surplus among re-exporting manufacturers. These results are perfectly in line with expectations (H2i and H2ii). Indeed, manufacturers that re-export essentially seek to maximize their control over the supply chain, creating a situation of backward oligopsony (input market of manufacturers) and forward monopsony (output market of manufacturers). This can result in significant re-exporting activities, where manufacturers import large quantities of the goods they already produce, which are then re-exported. This rationale is entirely consistent with what we observe in the data, since re-exports account for a large share of transactions and are linked, in most cases, to the manufacturers' core activity. More importantly, the negative relationship between V_{ft}^{M} and the division of surplus in the sub-sample of manufacturers closer to final demand which re-export means that re-export activities are complementary to manufacturers' processing activities in GVCs, and not a substitute for them. This further reinforces the aim of manufacturers to control a large part of the supply chain in order to strengthen their bargaining power in their export market.

To summarize, our theoretical assumptions H1i and H1ii are empirically validated in both samples, whereas prediction that manufacturers closer to final demand capture more surplus by importing further upstream inputs and exporting more processed goods (H2i and H2ii) hold only in the All transaction sample.

As discussed earlier, the surplus captured by a manufacturer in its export market increases as it specializes in further upstream stages in GVCs (H1iii). Note that specialization means that $V_{ft}^{X} - V_{ft}^{M}$ becomes increasingly narrow. However, manufacturers closer to final demand increase their surplus by extending the span of production stages in GVCs (H2iii). We test the effects of specialization (expansion) along GVCs, focusing on $V_{ft}^{X} - V_{ft}^{M}$ as key regressor of interest and using a sub-sample regressions. We therefore follow the same procedure as before, estimating (20), using a sub-sample of the position closer to final demand and the most upstream position in the manufacturers' core industry. Results in Table 5 show that the estimated coefficients of the $V_{ft}^{X} - V_{ft}^{M}$ term are negative and significant only in the sub-sample of the most upstream position of manufacturers' production process (columns 3-4 in Panel A). This definitively validates the "specialization effect" in Re-export excluded sample, and this result is also observed in the sub-sample of most upstream position in the All transaction sample (columns 3-4 in Panel B). Indeed, above all, our prediction (H1iii) continue to hold in both samples and the same conclusions apply, as before.

The "expansion effect" is not observed in Re-export excluded sample in Table 5 (Columns 1-2 in Panel A), whereas columns 1-2 in Panel B (All transaction sample) indicate a significant tendency to capture more surplus by expanding both backward and forward of manufacturers closer to final

Table 5: Manufacturer's expansion along GVCs and division of surplus – low versus high level of *upstreamness* of the core activity of manufacturers

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream position	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft} - V_{ft}^M)$	-0.0149	-0.0020	-0.1115***	-0.1293***	0.0591***	0.0600***	-0.0633**	-0.0896***
	(0.0169)	(0.0177)	(0.0247)	(0.0245)	(0.0164)	(0.0169)	(0.0295)	(0.0299)
ln Productivity$_{ft}$		0.1029***		0.0892***		0.0954***		0.1066***
		(0.0140)		(0.0085)		(0.0063)		(0.0052)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.1004***		0.1285***		0.1087***		0.1672***
		(0.0103)		(0.0131)		(0.0078)		(0.0084)
Large$_{ft}$		0.1948***		0.2111***		0.1397***		0.1548***
		(0.0166)		(0.0238)		(0.0098)		(0.0154)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	52,725	52,725	52,977	52,977	120,880	120,880	133,401	133,401
R^2	0.735	0.736	0.683	0.685	0.727	0.728	0.641	0.643

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

demand. Consequently, manufacturers closer to final demand that re-export need to perform more production stages in GVCs in order to capture more value, confirming prediction H2*iii*. These results are very similar to the previous ones in Table 4, and mainly confirm what we discussed earlier, namely that re-export activities are complements to manufacturers' processing activities in GVCs, among manufacturers closer to final demand in the All transaction sample.

Overall, our baseline results fully confirm the theoretical assumption that the division of surplus of manufacturers in their export market, increases as they specialize further upstream in GVCs (H1). These results are robust in both Re-export excluded and All transaction samples. Prediction H2 is only validated when manufacturers closer to final demand re-export.

4.2 Do "specialization effect" outweighs "expansion effect"?

Following our theoretical framework, we have hypothesized that the " specialization effect" outweighs the "expansion effect", and consequently the global effect of GVC position patterns on the division of surplus is similar to the "specialization effect" (H3). In this section, we test this hypothesis by estimating Equation (20), with V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ as the key regressors of interest. Results are reported in Table 6. Once again, specifications in Columns 1 and 3 do not include the time-varying manufacturer characteristics, Controls$_{ft}$, unlike in Columns 2 and 4, and we use our set of fixed effects, as previously, in all specifications. Panel A includes the Re-export excluded sample, and Panel B includes the All transaction sample.

Concerning our key variables in Columns 1-2 in the Re-export excluded sample (Panel A), we show that the coefficients of the variable V_{ft}^M and V_{ft}^X are positive and negative, respectively, and highly significant. This confirms that the " specialization effect" outweighs the "expansion effect", meaning that the global effect is consistent with the former. Note, however, that the coefficients are reduced by more than half for the variables V_{ft}^M and V_{ft}^X, compared to the baseline results for the sub-sample of the most upstream position in the re-export excluded sample (columns 3-4 of panel A in Table 4). This is due to the presence of two opposing effects (the "specialization effect" and the "expansion effect") in the whole Re-export excluded sample. A similar pattern is observed for the estimated coefficients of the $V^X_{ft} - V^M_{ft}$ term, that are all negative and significant (Columns 3-4 in Panel A).

Table 6: Manufacturer's position in GVCs and division of surplus

Sample	Panel A: Re-export excluded				Panel B: All			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^M_{ft}	0.0375**	0.0431**			0.0053	0.0130		
	(0.0169)	(0.0175)			(0.0165)	(0.0177)		
V^X_{ft}	-0.2533***	-0.2258***			0.0755	0.0816		
	(0.0547)	(0.0528)			(0.0576)	(0.0560)		
$(V^X_{ft} - V^M_{ft})$			-0.0659***	-0.0672***			0.0058	-0.0000
			(0.0158)	(0.0167)			(0.0175)	(0.0183)
ln Productivity$_{ft}$		0.0919***		0.0923***		0.1028***		0.1028***
		(0.0084)		(0.0084)		(0.0033)		(0.0033)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.1070***		0.1084***		0.1369***		0.1366***
		(0.0082)		(0.0084)		(0.0048)		(0.0048)
Large$_{ft}$		0.1892***		0.1909***		0.1452***		0.1444***
		(0.0137)		(0.0138)		(0.0087)		(0.0087)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	107,994	107,994	107,994	107,994	258,160	258,160	258,160	258,160
R^2	0.684	0.685	0.684	0.685	0.660	0.662	0.660	0.662

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We turn now to assess the validity of our hypothesis in the All transaction sample in Panel B of Table 6. We show that the coefficients V^M_{ft} and V^X_{ft} are all not significant. Furthermore, the sign of the coefficient V^X_{ft}, become positive (compared to the results in Panel A).This means that taking re-exports into account, which are preponderant in our data, shows that the manufacturers making them may have a greater interest in exporting closer to final consumption, in order to capture more value. the "specialization effect" and the "expansion effect" cancel each other out, hence these results. Indeed, to capture more rents, manufacturers in the sub-sample of most upstream position have no interest in re-exporting and will have every interest in specializing in the production of goods far from final demand, while manufacturers closer to final demand will have every interest in producing and re-exporting more processed goods. Similarly, the coefficients $V^X_{ft} - V^M_{ft}$ are also not significant in the All transaction sample (Columns 3-4 in Panel B).

These results fully confirm the theoretical assumption H3 when we consider only the actual processing activities of the manufacturers in GVCs (Re-export excluded sample). When re-exports are taken into account, the importance of processing activities in GVCs, and therefore specialization, in increasing surplus is ambiguous because the "expansion effect" is reinforced. This highlights the importance of specialization for manufacturers that only process in GVCs, while those that re-export in addition need to span more production stages in GVCs by importing further upstream inputs and producing closer to final consumption, in order to increase their bargaining power.

5 Robustness check

The above theoretical and empirical evidence indicates that more processed input imports and exports far from final demand, and consequently specialization of the production process in most upstream position along agri-food GVCs increase the bargaining power of manufacturer (*specialization effect*). However, manufacturers closer to final demand increase their bargaining power by importing further upstream inputs and exporting more processed goods, and thus performing more stages in GVCs (*expansion effect*). The global effect is similar to the "specialization effect" when re-exports are taken into account. We have performed three exercises to test the robustness of these results: (1) we conduct a placebo test, testing for the absence of endogeneity or random effects; (2) we generate sub-samples of position closer to final demand and most upstream position based on the *upstreamness* of the manufacturers' exports; and (3) we test quality-adjusted effects.

5.1 Placebo test

The OLS estimations of Equation (20) may be subject to a classic endogeneity problem as a common set of determinants, that cannot be observed and captured, affect both the GVC bargaining power indices and the GVC position patterns of manufacturers. Although we absorb permanent observed and unobserved manufacturer characteristics, sector-, product- and country-specific supply and demand shocks with manufacturer fixed effects, sector-by-year, country-by-product and country-by-year dummies respectively, other time-varying manufacturer features may not be observed, and controls may not be sufficient to capture all the influencing factors. Also, the relationship between the GVC position patterns and the GVC bargaining power indices may be due to random effects. We test for the absence of these biases by constructing a counterfactual placebo test. More specifically, using the existing data, we randomize the value of the GVC position measures to manufacturers and then regress the equation (20). We randomly selected 1,000 times, and are mainly interested in the position of the estimated coefficients of the variables of interest V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ in sub-sample and whole sample regressions (Tables 4, 5 and 6), relative to the distribution of the estimated coefficients from the placebo samples. If the main results presented in Tables 4, 5 and 6 are established, the placebo coefficients will not significantly deviate from the 0 point, and the estimated coefficients V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ will be at or beyond the tails of the distribution of coefficients estimated from the randomly generated pseudo-treatment groups.

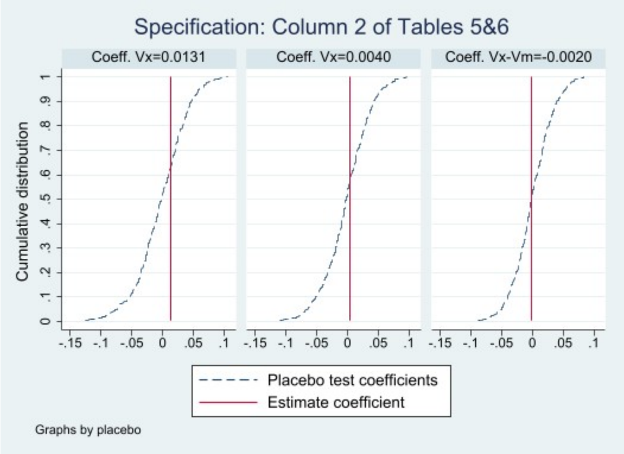
Figures 3 show the results of placebo test. As expected, most of the placebo coefficients are very close to 0 and normally distributed. The only times the tested coefficients are found at the heart of the distributions of coefficients estimated with placebo samples (Figures 3a and 3f) correspond to the moment they (tested coefficients) are not significant, and are close to 0 as well. Thus, all results indicate that there is no recognition bias in the model setting and the baseline results do not produce serious errors. These results are also confirmed by the mean values of the coefficients of the placebo treatment variables which do not significantly deviate from the 0 point.

5.2 Sub-sample regressions using *upstreamness* of exports of manufacturers

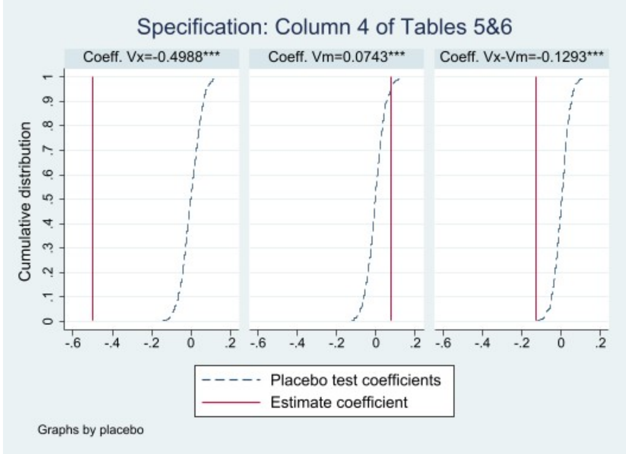
To validate our empirical hypotheses H1 and H2, we used sub-sample regressions based on manufacturers' core activity. However, in most cases, manufacturers are multi-product firms, making it difficult, if not impossible, to classify them. The only way to get a relatively precise idea of the manufacturers' activities is to observe their production. Assuming that export of goods does indeed reflect a manufacturer's production activities, we can capture its position in GVCs with greater precision, thanks to the *upstreamness* of exports indicator.

To test the robustness of baseline results in tables 4 and 5, we use heterogeneity in the processing levels of goods exported by manufacturers. To do this, we construct quintiles of the *upstreamness* of exports and consider the sub-samples of observations that lie in the first and last quintiles to run the regression (20).[19] The sub-sample in the first quintile corresponds to manufacturers producing and exporting goods closer to final consumption in GVCs, while the last quintile corresponds to

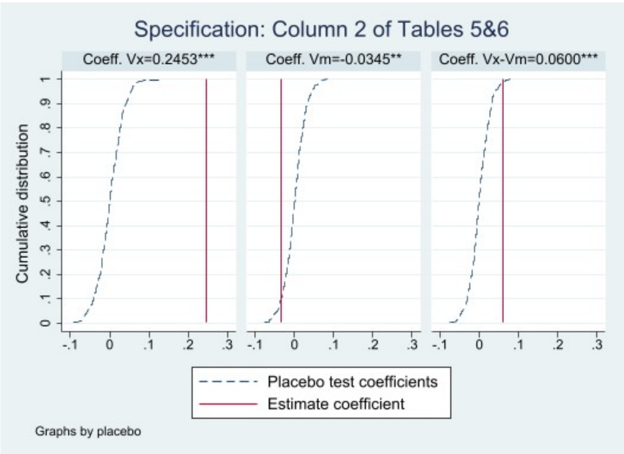
[19] We obtain similar results if we use median, as previously, or if the sample is divided into 3 and we use the top and bottom shares to make estimations.



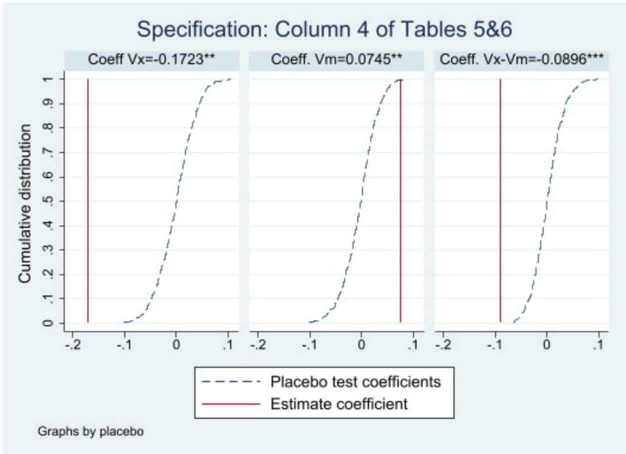
(a) Sub-sample regressions on more downstream firms in the Re-export excluded sample



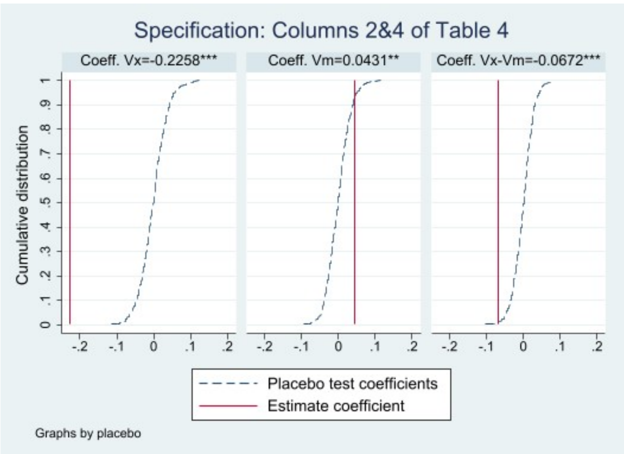
(b) Sub-sample regressions on more upstream firms in the Re-export excluded sample



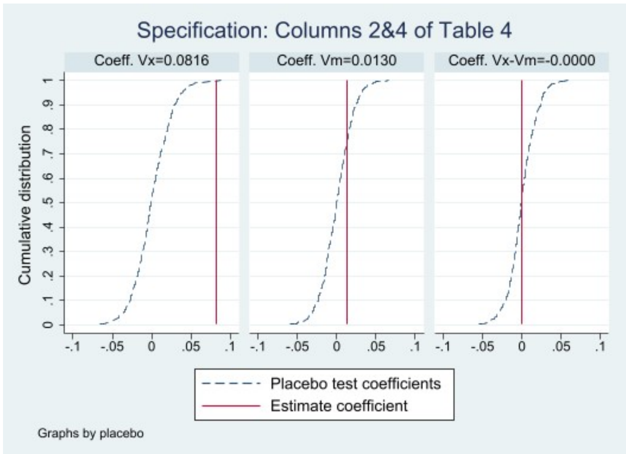
(c) Sub-sample regressions on more downstream firms in the All transaction sample



(d) Sub-sample regressions on more upstream firms in the All transaction sample



(e) Regressions with whole Re-export excluded sample



(f) Regressions with whole All transaction sample

Figure 3: Distribution of placebo coefficients of variables V_{ft}^X, V_{ft}^M, and $V_{ft}^X - V_{ft}^M$ versus estimated coefficients

manufacturers producing and exporting low processed goods (further upstream). We expect the hypotheses H1 and H2 to be confirmed in the first and last quintile sub-samples, respectively, and with strong coefficients than baseline results in Tables 4 and 5.

Columns 3-4 in Tables C.2 and C.3 of Appendix C present the results that confirm our expectations for the most upstream manufacturers. Indeed, whatever the sample considered (Re-export excluded or All transaction), further upstream specialization increases the division of surplus, with strong effects, compared to baseline results. In contrast, we do not confirm our hypothesis, H2, either in the Re-export excluded sample or in the All transaction sample.

5.3 Quality-adjusted effects

In this section, we explore the mechanism underlying previous effects of positioning in GVCs on division of surplus. As mentioned earlier, accurate estimate of bilateral bargaining power is challenging. It is worth noting that three main factors determine the division of surplus for manufacturers: two-sided market power[20], *hold-up* problem, efficiency and high-product production (see Figure 1). Since we control for two-sided market power and efficiency when estimating bargaining power, by including in the regression (15) the importer's buyer share, the manufacturer's supplier share and productivity, we can assume that the effects of GVC position on the division of surplus could be driven by high-quality production and the strength of *hold-up* problem faced by manufacturers. Indeed, given that manufacturers further upstream and those closer to final demand are both more efficient and produce higher quality products, our estimates of the coefficient of variables V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ will be biased upwards, in absolute terms. Therefore, this part tests the robustness of our results to this bias.

To do so, first, we follow Khandelwal et al. (2013) and Fan et al. (2015) and purge the export unit prices, and thus the division of surplus from quality components. We obtain the quality-adjusted prices $\ln \tilde{p}_{fjkt}$. Then, we replace the outcome variable $\ln p_{fjkt}$ in Equation (15) by $\ln \tilde{p}_{fjkt}$ and estimate the equation using a two-stage two-tier stochastic frontier. The new indicator of the division of surplus is therefore quality-adjusted.

By estimating equation (20) with the new quality-adjusted surplus indicators, we expect the effects obtained in Sections 4.1 and 4.2 to be strongly reduced in absolute terms, disappear or change sign. In such cases, we can safely conclude that the effects of GVC positioning on the division of surplus in GVCs are mainly due to high-quality production.

The role of high-quality production is most obvious when we run sub-sample regressions based on the *upstreamness* of the 4-digit NACE Rev. 2 industrial code of manufacturers' core activity. The results presented in tables 7 and 8 show that all the effects highlighted previously ("specialization effect" and "expansion effect") have weakened considerably. Indeed, we observe a more pronounced reduction, in absolute terms, in the coefficients V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$, compared to the baseline results in tables 4 and 5, with the exception in columns 1-2 of Panel A in both tables 7 and 8. The significant effects of V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$, observed in Panel B of the All transaction sample in Tables 4 and 5 have for the most part disappeared completely in Panel B of tables 7 and 8.

Building on these findings, we can safely conclude that our empirical validation of H1 and H2 is primarily driven by the product mix upgrade, and are fully consistent with theoretical discussions.

It is worth noting that, when the division of surplus is quality-adjusted, the effect of V_{ft}^X becomes negative and significant whereas coefficient of variable V_{ft}^M remains positive and non-significant in the sub-sample of manufacturers closer to final demand in the Re-export excluded sample (columns 1-2 of Panel A in Table 7). Consequently, the negative effect of $V_{ft}^X - V_{ft}^M$, oberved in columns 1-2 of Panel A in Table 5 becomes stronger in columns 1-2 of panel A in Table 8. This has important implications for the overall effect of GVC position on surplus in the re-export excluded sample. Indeed, Table 9 shows the results for the whole Re-export excluded and the All transaction samples. Compared to the results in Table 6, the estimates of the coefficients V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ have decreased considerably in both samples, in absolute terms (panel A and panel B). The coefficients V_{ft}^M, V_{ft}^X, and $V_{ft}^X - V_{ft}^M$ are still not significant in the All transaction sample (Panel B).

In the re-export excluded sample (Panel A in Table 9), although the significant effects of V_{ft}^M, compared to the baseline in Table 6, disappear completely, the effects of V_{ft}^X and $V_{ft}^X - V_{ft}^M$ remain

[20] See for example Alviarez et al. (2023)

Table 7: Manufacturer's position in GVCs and quality-adjusted surplus – low versus high level of *upstreamness* of the core activity of manufacturers

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream position	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^M_{ft}	0.0222	0.0148	0.0100	0.0218	-0.0128	-0.0065	0.0404	0.0672**
	(0.0287)	(0.0281)	(0.0194)	(0.0200)	(0.0194)	(0.0192)	(0.0270)	(0.0266)
V^X_{ft}	-0.1446*	-0.1408*	-0.1353***	-0.1036**	0.0265	0.0367	0.0196	0.0386
	(0.0783)	(0.0763)	(0.0410)	(0.0406)	(0.0596)	(0.0590)	(0.0560)	(0.0525)
ln Productivity$_{ft}$		0.0418***		0.0244***		0.0526***		0.0453***
		(0.0100)		(0.0059)		(0.0055)		(0.0037)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0708***		0.0594***		0.0847***		0.0985***
		(0.0120)		(0.0095)		(0.0093)		(0.0077)
Large$_{ft}$		0.1136***		0.1085***		0.1412***		0.1610***
		(0.0172)		(0.0125)		(0.0115)		(0.0143)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	50,396	50,396	51,911	51,911	116,225	116,225	130,249	130,249
R^2	0.465	0.466	0.514	0.514	0.445	0.447	0.450	0.452

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Manufacturer's expansion along GVCs and quality-adjusted surplus – low versus high level of upstreamness of the core activity of manufacturers

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft} - V^M_{ft})$	-0.0365	-0.0295	-0.0273	-0.0332*	0.0145	0.0104	-0.0304	-0.0496**
	(0.0280)	(0.0272)	(0.0174)	(0.0179)	(0.0194)	(0.0191)	(0.0249)	(0.0248)
ln Productivity$_{ft}$		0.0418***		0.0251***		0.0527***	0.0447***	
		(0.0100)		(0.0059)		(0.0056)	(0.0037)	
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0710***		0.0605***		0.0846***		0.0984***
		(0.0120)		(0.0096)		(0.0092)		(0.0077)
Large$_{ft}$		0.1129***		0.1108***		0.1408***		0.1605***
		(0.0172)		(0.0124)		(0.0114)		(0.0142)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	50,396	50,396	51,911	51,911	116,225	116,225	130,249	130,249
R^2	0.465	0.466	0.513	0.514	0.445	0.447	0.450	0.452

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

significant and negative. As a reminder, all these effects have become weaker when the division of surplus is quality-adjusted. These results highlight the key role played by the production and export of high-quality products in increasing the surplus obtained in bilateral negotiations, so that when surplus is quality-adjusted, the effect of GVC positioning on the division of surplus becomes weaker, in absolute terms. However, since the global effect of V_{ft}^X and $V_{ft}^X - V_{ft}^M$ are significant in panel A of Table 9, this means that the "specialization effect" is robust to product quality. Therefore, we conclude that strategic positioning further upstream by processing manufacturers, exporting goods far from final demand, enables them to improve their bargaining position thanks to a significant reduction in the *hold-up* problem against buyers, while we do not confirm the robustness of the "expansion effect".

Table 9: Manufacturer's position in GVCs and quality-adjusted surplus

Sample	Panel A: Re-export excluded				Panel B: All			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^M	0.0102	0.0138			0.0073	0.0214		
	(0.0144)	(0.0141)			(0.0163)	(0.0162)		
V_{ft}^X	-0.1470***	-0.1303***			0.0159	0.0343		
	(0.0477)	(0.0465)			(0.0353)	(0.0353)		
$(V_{ft}^X - V_{ft}^M)$			-0.0286*	-0.0294**			-0.0040	-0.0134
			(0.0150)	(0.0146)			(0.0163)	(0.0162)
ln Productivity$_{ft}$		0.0302***		0.0307***		0.0469***		0.0468***
		(0.0049)		(0.0049)		(0.0030)		(0.0030)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0631***		0.0641***		0.0899***		0.0897***
		(0.0095)		(0.0096)		(0.0059)		(0.0059)
Large$_{ft}$		0.1067***		0.1078***		0.1471***		0.1466***
		(0.0110)		(0.0110)		(0.0063)		(0.0063)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	104,656	104,656	104,656	104,656	250,451	250,451	250,451	250,451
R^2	0.457	0.458	0.457	0.458	0.415	0.416	0.415	0.416

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6 Discussion and concluding remarks

The present paper contributes to the existing debate on the power distribution, value creation and value capture along supply chains. We provide a novel and original contribution to the existing literature on the position of firms' production processes in GVCs and the value capture in agri-food supply chains, and test the mechanisms underlying these relationships. In our theoretical framework, we highlight the formation of transaction prices paid by importers to exporters at equilibrium in international trade, in an environment of contractual frictions and when bilateral bargaining power is present. We show that the markup is not constant, depending on two-sided bargaining power, and marginal cost depends on firm's boundary choices along GVCs. This makes it difficult to establish clear patterns of the relationship between the division of surplus and the position in GVCs of exporters. We explore the theoretical mechanisms of firms' position in GVCs affecting the division of surplus, and argue that: (*i*) importing more processed inputs and exporting far from final demand, and consequently specialization further upstream of the production process in agri-food GVCs increase the bargaining power of firms (the "specialization effect"); (*ii*) firms closer to final demand increase their bargaining power by importing further upstream inputs and exporting more processed goods, and thus performing more stages in GVCs (the "expansion effect"); and (*iii*) the "specialization effect" outweighs the "expansion effect", so that the global effect is similar to the "specialization effect". We highlight that the "specialization effect" is mainly driven by product mix upgrade and the reduction of the *hol-up* problem, while the "expansion effect" is only due to the production of high-quality goods.

To assess the evidence, we use 2002-2017 firm-level data on French agri-food industries (from French customs and the AMADEUS database) and the U.S. input-output table from the Bureau of Economic Analysis (BEA). we identify firms that participate in GVCs with those that jointly import and export. Building on Chor et al. (2021), we measure firms' position in value chains through the level of transformation (*upstreamness*) of goods they use and produce. We distinguish a sample with Re-export excluded from the sample with All transactions. The former allows us to capture the actual processing activities of firms in GVCs, compared to the latter. Considering that a firm-country trade at the product level is similar to the problem of search/matching/bargaining framework in the supplier-buyer relationship, following Polachek and Yoon (1987, 1996), Kumbhakar and Parmeter (2009) and Li et al. (2022), we estimate the bilateral division of surplus of firms and countries of their trade partners (importers), using a two-stage two-tier stochastic frontier model. The main features of our theoretical framework, namely hypotheses (*i*) and (*iii*), explain the full patterns observed in the data when re-exports are excluded, while hypothesis (*ii*) is only weakly supported.

Thus, the validation of the main theoretical hypothesis of this study clearly highlight the important role of the firms' position in improving performance in GVCs. The present results are in line with the "smile curve" hypothesis, both in terms of the position of firms further upstream and closer to final demand in GVCs. Indeed, in both the most upstream position and position closer to final demand, our results show that excluding or taking into account re-exports tend to confirm the validity of the "smile curve" hypothesis. This shows that there would be no difference of the "in-between" industries nature of the results of the "smile curve" hypothesis compared to the "within" sectors (agri-food sector) nature of the present results, mainly when re-exports are taken into account.

In the GVC literature, discussions of value creation and value capture have focused on the distribution of power in the relations between lead firms and suppliers or buyer-driven GVCs (Gereffi, 1994; Burch and Lawrence, 2013; Dallas et al., 2019). As shown by Cox et al. (2001) and Burch and Lawrence (2005), a critical supply chain assets in agri-food industry are related to the final demand (sales space, information on consumer consumption patterns, brand). Therefore, firms that are more upstream may face productive disadvantage that unable them to control the entire value chain, whereas firms closer to final demand increase their bargaining power. On this basis, Giovannetti and Marvasi (2018) show that Italian firms that are buyers of intermediate inputs and suppliers of final goods are more productive than midstream firms that are both buyers and suppliers of intermediate products, which in turn are more productive than upstream firms that produce intermediate products for other firms. In the similar vein, del Valle and Fernández-Vázquez (2023) documents the fact that industries further upstream in GVCs have a negative impact on markup. This suggests that firms closer to final demand in the supply chain create and capture more value, than further upstream firms. Our results weakly confirm these findings, only taking into account re-export and considering the sub-sample of firms with core activity closer to final demand. In addition, these effects are fully driven by high-quality production. Conversely, firms that position and specialize further upstream can act strategically by integrating narrow production stages upstream, producing high-quality products and reducing *hold-up* problem, leading to a robust strengthening of their GVC bargaining power de maniÃ¨re robuste. Ju and Yu (2015) and Mahy et al. (2021) find similar results.

Regarding the relationship between the specialization in GVCs and the value capture, Krugman et al. (1995), Fernandez-Stark and Gereffi (2019) and Antràs (2020) stated that production processes occurs through a number of stages, adding a little bit of value at each stage. Therefore, Chor et al. (2021) show that increasing the number of production stages performed by firms in GVCs is associated with greater value added. This is because each additional stage performed in GVCs additively adds value to the firm. Our work tackles this issue and shows that the nature of the tasks performed by firms in CVGs matters, and calls for a phenomenon of domestic retention of added value (see Rungi and Del Prete, 2018) that stipulates keeping high value-added activities domestically.

More interestingly, we show that firms' specialization along supply chains within France by importing more processed inputs and exporting closer to final demand, is associated with a considerable increase in GVC bargaining power. We found that it is preferable for firms to engage in a strategy of specialization along value chains by integrating narrow upstream production stages, unless re-exports are taken into account. In the latter case, firms closer to final demand could increase their surplus by performing more stages in GVCs. Our findings may be of interest to policymakers and industrial strategy of countries as our conclusions contribute to discussions on GVC resilience and re-shoring (see Marvasi, 2023) and on a phenomenon of domestic retention of value added (see Rungi and Del Prete, 2018). Indeed, the succession of international crises (Brexit, US-China trade war, Covid-19, war in Ukraine) increases geopolitical and foreign market uncertainties. For example, the Covid-19 pandemic unveiled the high fragility of the supply chain due to the reliance on offshore supplies in many countries, and thus a high degree of exposure of firms and countries to foreign shocks. Some recent evidence show that participation in GVCs through re-shoring could increase the resilience of GVCs by reducing exposure to foreign shocks, but at the cost of increased exposure to domestic shocks (Giroud and Ivarsson, 2020; Marvasi, 2023). Our results show, furthermore, that this strategy could also prevents firms from efficiency gains by reducing their GVC bargaining power if the firms are specialized in the supply of intermediate goods. As our results also suggest, re-shoring could be more attractive and relevant if the firms control a larger part of the production stages in GVCs, creating a backward oligopsony and forward monopsony situation, which could offer additional benefits by increasing their GVC bargaining power. However, the question of whether it could help to reduce foreign dependency is still open.

Our findings also contribute to the discussions of the industrial policy in the EU countries. Over the past decades, EU industrial policy strategies have focused on segmenting European industries into "headquarters" economies, which host high value-added activities and service units, and "factory" economies, which deal with the lower segments of value chains (Megyeri et al., 2023). In this respect, some countries such as Portugal or Greece are confined to a peripheral position in the sense that they are assumed to participate in the lower segments of GVCs and less integrated into international production networks, while others such as France or Germany participate in the higher segments of GVCs. These strategies are essentially based on the "between" industry heterogeneities that can inaccurately reflect the role of some countries in international markets and distorts the understanding of international integration. Our analysis highlights that the "within" industry heterogeneity, and especially the positioning of firms in a supply chain, also matters. Thus, industrial policies should focus not only on the characteristics of the country's economy, but also on the characteristics of each industry and in particular of tasks, in order to identify strategic positioning in a supply chain.

Furthermore, product quality is the most important element that drives firms to adapt their processes and make products eligible for consumer preferences in foreign markets. Most studies document the importance of the role of varying-quality products in explaining variations in trade outcomes across firms and countries (Verhoogen, 2008; Fajgelbaum et al., 2011; Baldwin and Harrigan, 2011; Crozet et al., 2012; Curzi and Olper, 2012; Crinò and Epifani, 2012; Aw-Roberts et al., 2020; Emlinger and Lamani, 2020), while how quality allows firms to succeed in GVCs remains largely unexplored. This study fills this gap by showing that product quality is also a most important element that allows firms to be successful in GVCs.

We are aware that the bilateral bargaining power index is assumed to be exogenous in the Nash bargaining framework. However, in our theoretical discussions and empirical analysis of the determinants of the division of surplus, we consider the bargaining power index to be endogenous. Although we have shown valid arguments that explain the determinants of surplus, the use of the Nash bargaining game to support the existence of bilateral bargaing power in international pricing mechanisms and our treatment of it in this study can be discussed and represent a potential limitation for our work. Therefore, theoretical works with endogenous bargaining power index represent a relevant avenue for future research.

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Appendices

A Input-output table

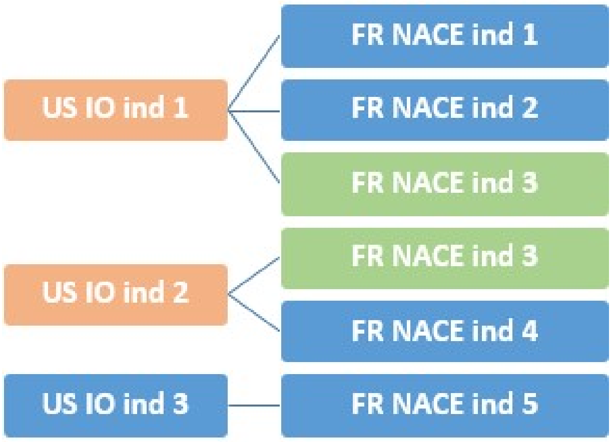
The measurement of the level of processing of products traded by firms relies on the information provided by the input-output table. The availability of these tables at detailed levels for each country remains an important challenge in carrying out this work. Moreover, our interest in the agri-food sector further complicates this task insofar as the European input-output tables are established at high levels of aggregation. In France, for example, the input-output tables provided by the OECD Structural Analysis database (OECD STAN) include only thirty industries, and only one concerns the agri-food industry. To overcome this issue, we use as a starting point the US input-output table, developed by the Bureau of Economic Analysis (BEA), which is available online, in open access[21]. More specifically, we rely on the most recent Use Table after redefinition at producer prices for 2012.

The US input-output table has the advantage to include information on production linkages between industries at a high level of disaggregation. It includes 405 industries (identified by individual 6-digit I-O codes) of which 42 are in the agri-food sector. It is important to take into account all the industries in the economy because the production of agri-food goods involves the use of inputs, raw materials and intermediate products from other sectors (for example, packaging). However, using the U.S. input-output table for an application on French data presents significant classification and matching challenges. We have developed a methodology to convert the U.S. input-output table to the 4-digit NACE Rev.2 codes level, reported for French firms.

The entries a_{ij} in Figure A.1.a report the value of intermediate goods of industry i used in the production of goods of industry j. In addition, there is a column (F_i) that reports the value of products i that goes into aggregate final uses, such as final consumption, investment, changes in inventories and net exports.

		Used inputs and value added			Final use	Total use
		US IO ind 1	US IO ind 2	US IO ind 3		
Supply of inter-medi-ate inputs	US IO ind 1	a_{11}	a_{12}	a_{13}	F_1	Y_1
	US IO ind 2	a_{21}	a_{22}	a_{13}	F_2	Y_2
	US IO ind 3	a_{31}	a_{21}	a_{33}	F_3	Y_3
Value added		VA_1	VA_2	VA_3		
Total output		Y_1	Y_2	Y_3		

(a) US input-output table



(b) Multiple industry correspondences

Figure A.1: US input-output table structure and correspondences with NACE Rev.2

The main challenge in using the U.S. I-O table on French data is that there is not a one-to-one correspondence between the U.S. IO and the NACE Rev.2 industries. Note that the U.S. IO codes are specific to the 2012 North American Industry Classification System (NAICS) structure. An U.S. IO code can correspond to one or more NAICS codes. The NAICS codes in turn have different levels of aggregation, from 2 digits (most aggregated level) to 6 digits (least aggregated level). We have mapped the U.S. IO codes to NACE Rev.2 codes using the links between the U.S. IO codes

[21] https://www.bea.gov/industry/input-output-accounts-data

		US IO ind 1			US IO ind 2		US IO ind 3
		FR NACE ind 1	FR NACE ind 2	FR NACE ind 3	FR NACE ind 3	FR NACE ind 4	FR NACE ind 5
US IO ind 1	FR NACE ind 1	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
	FR NACE ind 2	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
	FR NACE ind 3	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
US IO ind 2	FR NACE ind 3	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{4} a_{22}$	$\frac{1}{4} a_{22}$	$\frac{1}{2} a_{13}$
	FR NACE ind 4	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{4} a_{22}$	$\frac{1}{4} a_{22}$	$\frac{1}{2} a_{13}$
US IO ind 3	FR NACE ind 5	$\frac{1}{3} a_{31}$	$\frac{1}{3} a_{31}$	$\frac{1}{3} a_{31}$	$\frac{1}{2} a_{21}$	$\frac{1}{2} a_{21}$	a_{33}

(a) Equal weights for all correspondences within each pair of industry codes

	FR NACE ind 1	FR NACE ind 2	FR NACE ind 3	FR NACE ind 4	FR NACE ind 5
FR NACE ind 1	$b_{11} = \frac{1}{9} a_{11}$	$b_{12} = \frac{1}{9} a_{11}$	$b_{13} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{14} = \frac{1}{6} a_{12}$	$b_{15} = \frac{1}{3} a_{13}$
FR NACE ind 2	$b_{21} = \frac{1}{9} a_{11}$	$b_{22} = \frac{1}{9} a_{11}$	$b_{23} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{24} = \frac{1}{6} a_{12}$	$b_{25} = \frac{1}{3} a_{13}$
FR NACE ind 3	$b_{31} = \frac{1}{9} a_{11} + \frac{1}{6} a_{21}$	$b_{32} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{33} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12} + \frac{1}{6} a_{21} + \frac{1}{4} a_{22}$	$b_{34} = \frac{1}{6} a_{12} + \frac{1}{4} a_{22}$	$b_{35} = \frac{1}{3} a_{13} + \frac{1}{2} a_{13}$
FR NACE ind 4	$b_{41} = \frac{1}{6} a_{21}$	$b_{42} = \frac{1}{6} a_{21}$	$b_{43} = \frac{1}{6} a_{21} + \frac{1}{4} a_{22}$	$b_{44} = \frac{1}{4} a_{22}$	$b_{45} = \frac{1}{2} a_{13}$
FR NACE ind 5	$b_{51} = \frac{1}{3} a_{31}$	$b_{52} = \frac{1}{3} a_{31}$	$b_{53} = \frac{1}{3} a_{31} + \frac{1}{2} a_{21}$	$b_{54} = \frac{1}{2} a_{21}$	$b_{55} = a_{33}$

(b) Group weights across NACE industries

Figure A.2: Convert the US I-O table to the NACE Rev.2 4-digit level

and the NAICS 2012 codes and the correspondence table between NAICS 2012 and NACE Rev.2 provided by Eurostat [22]. However, there are several concerns with this mapping. As shown by Figure A.1.b, a 6-digit IO code may correspond to several 4-digit NACE Rev.2 codes. Similarly, a 4-digit NACE Rev.2 code may be associated with several 6-digit U.S. IO codes. Out of the the 1,547 U.S. IO-NACE Rev.2 code combinations, only 31 industries, (and 2 in the agri-food sector), had a one-to-one correspondence. In these circumstances, we chose to divide each a_{ij} entry in the U.S. I-O table equally among all (r, s) combinations of NACE Rev.2 codes to which the (i, j) entry corresponds (Figure A.2.a). We then simply take the sum of the (r, s) entries that are identical to obtain the entries b_{rs} of the new input-output table at NACE Rev.2 level. We end up with the table in Figure A.2.b.

For example, in Figure A.1.b the U.S. IO1, respectively IO2 codes correspond to 3, respectively 2 NACE codes and the NACE3 code corresponds to 2 I-O codes. Thus, in order to convert the structure of the U.S. I-O table from the level of U.S. IO codes (Figure A.1.a) to the level of NACE

[22] http://ec.europa.eu/eurostat/ramon/documents/NACE_REV2-US_NAICS_2012.zip.

Rev.2 codes (Figure A.2.b), we formally have performed the following transformations:

$$b_{rs} = \sum_{i,j} \frac{a_{ij}}{n_i \times n_j}, \text{with } (i \supseteq r \text{ or } i \subseteq r) \text{ and } (j \supseteq s \text{ or } j \subseteq s)\,. \quad \text{(A.7)}$$

where n_i, respectively n_j represent the number of different NACE Rev.2 codes associated with input i (in rows in Figure A.1.a), respectively, output j (in columns in Figure A.1.a). This transformation makes it possible to remain as close as possible to the structure of the initial U.S. I-O table, i.e. at the level of U.S. IO codes. This permits us to build a highly detailed input-output table for 604 4-digit NACE Rev.2 industries, of which 88 agri-food. Once this transformation has been carried out, we only need to compute the *upstreamness* indicator for the 4-digit NACE Rev.2 industries.

We check the stability of the *upstreamness* measure of industries between U.S. and France in order to test the relevance of using the U.S. table on French data. To do so, we use French input-output data from several sources: the OECD STAN database and the INSEE input-output table. Note that the OECD STAN database include 34 industries and the INSEE input-output contain 15 industries. Given the high level of aggregation of these two tables, we aggregate the input-output table constructed above, so as to have respectively the 34 industries present in the OECD STAN database - Aggregate NACE (34 industries) - and the 15 industries present in the INSEE table - Aggregate NACE (15 industries) . After that, we check how *upstreamness* computed from the French table in the STAN database, respectively in the INSEE database, compares with the Aggregate NACE (34 industries), respectively Aggregate NACE (15 industries). To verify the consistency of industry *upstreamness* across industries in different input-output table, we conduct a Spearman rank correlation test.

Table A.1 reports the Spearman rank correlation. We are particularly interested in the correlation between *upstreamness* from the pairs Aggregate NACE (34 industries) and OECD STAN database which are 0.65; Aggregate NACE (15 industries) and INSEE table which are 0.68. It useful to note that the rank correlation is always large and significantly different from zero at a p-value of 0.01.

Table A.1: Spearman (Pearson) correlation

	Aggregate NACE (34 industries)	Aggregate NACE (15 industries)	OECD STAN database (34 industries)	INSEE table (15 industries)
Aggregate NACE (34 industries)	1			
Aggregate NACE (15 industries)	-	1		
OECD STAN database (34 industries)	0.65 (0.66)	-	1	
INSEE table (15 industries)	-	0.68 (0.67)	-	1

Notes: Pearson correlation in brackets. Authors' own calculations based on U.S. input-output table converted to the 4-digit NACE Rev.2 level, French original input-output tables from OECD STAN database and INSEE.

The cross-industry variation of the *upstreamness* measure between French original input-output tables (OECD STAN database and INSEE table) and our constructed NACE level input-output table from U.S. table is largely consistent with the range of values reported by Fally (2012) for a subset of EU countries (Czech Republic, Luxembourg, Germany, Spain, *etc.*). In sum, this evidence gives us great confidence that the industry measures are stable across U.S. and France, at least at the higher level of aggregation, and confirm the relevance of using the U.S. table on French data.

B Descriptive statistics of variables

Table B.1: Summary statistics: Firms in GVCs

	Frequency	Median	Mean	Standard deviation
Panel A: Re-export excluding sample				
ln Productivity$_{ft}$	115,043	5.7746	5.8283	0.7971
Small firms (1 to 49 employees)	24,617	-	-	-
Middle-size firms (50 to 499 employees)	60,886	-	-	-
Large firms (500 employees or more)	29,540	-	-	-
NS_{fjkt}	115,043	0.0770	0.1170	0.4571
Export *upstreamness* (V_f^X)	115,043	0.7308	0.7346	0.0954
Import *upstreamness* (V_f^M)	115,043	0.6982	0.6642	0.1363
$V_f^X - V_f^M$	115,043	0.0253	0.0704	0.1392
Panel B: All transaction sample				
ln Productivity$_{ft}$	267,116	5.8633	5.9105	0.7541
Small firms (1 to 49 employees)	56,455	-	-	-
Middle-size firms (50 to 499 employees)	132,592	-	-	-
Large firms (500 employees or more)	78,069	-	-	-
NS_{fjkt}	267,116	0.0971	0.1604	0.4926
Export *upstreamness* (V_f^X)	267,116	0.7275	0.7287	0.1040
Import *upstreamness* (V_f^M)	267,085	0.7098	0.6876	0.1236
$V_f^X - V_f^M$	115,043	0.0253	0.0704	0.1392

C Estimate from the two-stage two-tier frontier function

Table C.1: Two-stage two-tier stochastic frontier estimates of French agri-food manufacturer' export market log price regression

Sample	Re-export excluded			All		
	Fist stage		Second stage	Fist stage		Second stage
Variables	ln (x_{fjkt}) (1)	ln (s_{fjkt}) (2)	ln p_{fjkt} (3)	ln (x_{fjkt}) (1)	ln (s_{fjkt}) (2)	ln p_{fjkt} (3)
ln $Inst_{fjkt}(x_{fjkt})$	-0.3288***	0.0989***		-0.3488***	0.1023***	
	(0.0026)	(0.0026)		(0.0021)	(0.0021)	
ln $Inst_{fjkt}(s_{fjkt})$	0.1118***	-0.4017***		0.1276***	-0.4250***	
	(0.0024)	(0.0026)		(0.0018)	(0.0020)	
ln Productivity$_{ftft}$	-0.0500***	0.3408***	-0.0927***	-0.0364***	0.4437***	-0.0894***
	(0.0073)	(0.0080)	(0.0028)	(0.0055)	(0.0061)	(0.0022)
Small$_{ft}$	reference	reference	reference	reference	reference	reference
Medium$_{ft}$	-0.2707***	0.4584***	-0.0672***	-0.2938***	0.6497***	-0.0759***
	(0.0119)	(0.0131)	(0.0047)	(0.0095)	(0.0104)	(0.0038)
Large$_{ft}$	-0.6613***	0.9529***	-0.0736***	-0.7773***	1.4124***	0.0349***
	(0.0160)	(0.0175)	(0.0067)	(0.0113)	(0.0124)	(0.0053)
ln GDP per capita	-0.0916*	-0.8456***	-0.0271	0.0550*	-0.6976***	-0.0651***
	(0.0469)	(0.0514)	(0.0181)	(0.0332)	(0.0364)	(0.0126)
Share of industrial value added	-0.0004	0.0066**	-0.0030***	0.0004	0.0084***	-0.0002
in GDP	(0.0028)	(0.0031)	(0.0011)	(0.0020)	(0.0022)	(0.0007)
Share of agricultural value added	0.0142*	0.0011	-0.0144***	-0.0040	-0.0067	-0.0090***
in GDP	(0.0082)	(0.0090)	(0.0032)	(0.0055)	(0.0060)	(0.0021)
ln Buyer share (b_{fjkt})			0.0825***			0.1179***
			(0.0030)			(0.0022)
ln Supplier share (s_{fjkt})			-0.0946***			-0.0888***
			(0.0022)			(0.0016)
Error term decomposition						
ω_{fjkt}			0.5671 ***			0.5988***
			(0.0000)			(0.0000)
u_{fjkt}			0.4193***			0.4190***
			(0.0000)			(0.0000)
ν_{fjkt}			0.4105***			0.4054***
			(0.0000)			(0.0000)
Year fixed effects	YES	YES	YES	YES	YES	YES
Firm's main activity fixed effects	YES	YES	YES	YES	YES	YES
Country fixed effets	YES	YES	YES	YES	YES	YES
4-digit product fixed effets	YES	YES	YES	YES	YES	YES
Observations	181,571	183,165	181,562	329,652	331,762	329,638
R^2	0.279	0.341		0.312	0.372	
Partial R^2	0.0825			0.0801		
F-stat	6007.1002			11457.0474		
Endogeneity test	6922.0862			15743.7082		
p-value	0.0000			0.0000		

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises all importers and all exporters of French agri-food industry firm-year observations between 2002-2017. Standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.2: Robustness test: Manufacturer's position in GVCs and division of surplus – low versus high level of *upstreamness* of exports

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream position	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^M_{ft}	-0.0356	-0.0613**	0.1937***	0.1903***	0.0066	0.0039	0.1443***	0.1160**
	(0.0321)	(0.0302)	(0.0386)	(0.0385)	(0.0210)	(0.0216)	(0.0539)	(0.0521)
V^X_{ft}	-0.3327	-0.3736	-0.4498***	-0.3573***	0.0743	-0.1570	-0.4182***	-0.0851
	(0.2832)	(0.2700)	(0.1241)	(0.1271)	(0.2264)	(0.2163)	(0.0980)	(0.1045)
ln Productivity$_{ft}$		0.1068***		0.0569***		0.1110***		0.0926***
		(0.0179)		(0.0170)		(0.0083)		(0.0080)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0601***		0.1469***		0.0977***		0.1487***
		(0.0170)		(0.0261)		(0.0142)		(0.0178)
Large$_{ft}$		0.1594***		0.0777		0.1373***		0.1327***
		(0.0316)		(0.0526)		(0.0222)		(0.0307)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	18,055	18,055	21,476	21,476	41,802	41,802	53,414	53,414
R^2	0.729	0.730	0.741	0.741	0.715	0.717	0.725	0.726

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3: Robustness test: Manufacturer's expansion along GVCs and division of surplus – low versus high level of *upstreamness* of exports

Sample	Panel A: Re-export excluded				Panel B: All			
Sub-sample	Position closer to final demand		More upstream position		Position closer to final demand		More upstream position	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft} - V^M_{ft})$	0.0250	0.0494	-0.2271***	-0.2112***	-0.0063	-0.0046	-0.2016***	-0.1101**
	(0.0322)	(0.0299)	(0.0339)	(0.0353)	(0.0209)	(0.0214)	(0.0451)	(0.0446)
ln Productivity$_{ft}$		0.1053***		0.0603***		0.1107***		0.0920***
		(0.0178)		(0.0167)		(0.0082)		(0.0075)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0628***		0.1513***		0.0972***		0.1476***
		(0.0174)		(0.0269)		(0.0142)		(0.0176)
Large$_{ft}$		0.1619***		0.0859		0.1366***		0.1313***
		(0.0316)		(0.0538)		(0.0224)		(0.0300)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	18,055	18,055	21,476	21,476	41,802	41,802	53,414	53,414
R^2	0.729	0.730	0.741	0.741	0.715	0.717	0.725	0.726

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises the matched French Customs-AMADEUS 2002-2017 data. Observations in the top two and bottom two percentiles of the measure of the net surplus are dropped. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D Quality-adjusted prices

The methodology proceeds in three steps. First, we estimate the quality of each manufacturer-product-destination-year observation by running the following linear form:

$$\ln q_{fjkt} + \varepsilon_k \ln p_{fjkt} = FE_{jkt} + e_{fjkt} \tag{D.1}$$

where FE_{jkt} are country-product-year fixed effects, which capture heterogeneity in destination-product-year triplets (consumer preferences, trade costs, markup, and market structure); q_{fjkt} is the quantity of product k exported by manufacturer f to country j in year t; p_{fjkt} is the price (unit value) of product k exported by manufacturer f to country j in year t and ε are the estimated trade elasticities at product level from Ossa (2015). The quality measure is computed from residual e_{fjkt} after estimating (D.1) with OLS:

$$\ln \widehat{\lambda}_{fjkt} = \frac{\widehat{e}_{fjkt}}{\varepsilon_k - 1} \tag{D.2}$$

Consequently, quality-adjusted prices are $\ln \tilde{p}_{fjkt} = \ln p_{fjkt} - \ln \widehat{\lambda}_{fjkt}$.