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RESEARCH PAPER

Grossman–Hart–Moore Goes to Italy: Rethinking the Boundaries of the Firm

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Abstract
This paper provides new empirical evidence on the boundaries of the firm, as shaped by the ownership (make-or-buy) and location (domestic-or-foreign) decisions of sourcing. In particular, we draw on the Grossman–Hart–Moore framework to investigate the role of input characteristics, investment spillovers and firm productivity in ownership and location decisions. For the purpose of the empirical analysis, we rely on original survey data of a stratified sample of Italian manufacturing firms, headquartered in Lombardy. Our probit, multinomial probit and conditional mixed process estimations suggest a number of robust regularities. Some of them confirm so far unexplored theoretical predictions from the Grossman–Hart–Moore framework; others provide new insights on specific relationships on which the theory is silent. As for ownership, we find that reliance on specific inputs and intangible inputs fosters integration over non-integration; moreover, firms acknowledging cross spillover effects are more likely to opt for joint-venture than non-integration. As for location, domestic sourcing prevails over foreign sourcing in presence of investment spillovers, whereas input characteristics play no role. Lastly, productivity is a major driver of the boundaries of the firm in that productive firms are more likely to source abroad than domestically. Holding across different econometric models and a number of robustness checks, our results contribute to the property rights theory of the firm and its recent developments.

Keywords Global value chain (GVC) · Ownership · Location · Boundaries of the firm · Grossman–Hart–Moore

JEL Classification F23 · D23 · C35 · L24

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1 Introduction

The increasing fragmentation of production across firms and countries' boundaries is unanimously considered the distinctive feature of the world economy over the last four decades (Antras 2020). Trade liberalisation and falling transportation costs, alongside rapid advances in information and communication technologies (ICT), are recognised as the driving forces behind it (Baldwin and Venables 2013; Alfaro et al. 2019; Antras and de Gortari 2020).

Still, recent events and emerging trends in the global economy have started to question the long-term prospects of 'global value chains' (GVCs). In light of the large research and development (R&D) expenditure required to keep pace with innovation, some slowdown in the adoption of ever more performing ICT can be expected (Antras 2020). Furthermore, the COVID-19 pandemic, the invasion of Ukraine by Russia and the technology war between US and China have exposed GVCs' vulnerability to international crises, eventually calling for a medium-run re-engineering of the boundaries of the firm (Javorcik 2020).

In our terminology, studying the boundaries of the firm means discussing which production tasks should be internalised and which should be externalised, either in the domestic or in a foreign country. For the sake of simplicity, consider a stylised framework in which production of a final good requires intermediate inputs. In this context, the final good producer takes two crucial decisions over sourcing. On one hand, it has to decide whether to manufacture the inputs by itself or to buy them from an independent input supplier. On the other hand, it has to decide whether to employ domestic or foreign components. We refer to the final good producer's make-or-buy choice as the ownership decision, and to the domestic-or-foreign choice as the location decision. In this simple framework, studying the boundaries of the firm means addressing sourcing issues, as shaped by ownership and location considerations.

Since GVCs entail fragmentation of production across firms and countries, to fully evaluate their medium and long-term prospects one needs to assess how the boundaries of the firm respond to changes in the global economy. To this aim, we empirically investigate determinants of the ownership and location decisions using original survey data of a representative sample of Italian manufacturing firms headquartered in Lombardy, one of the most industrialised European regions. Taking advantage of our rich database, we provide new evidence on so far unexplored determinants of ownership and location choices.

We rely on the property rights theory of the firm (PRT) as from the seminal contributions of Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995)—henceforth referred to as the Grossman-Hart-Moore (GHM) framework—and its most recent developments,[1] to model ownership and location decisions. More specifically, we consider three ownership regimes—integration, non-integration[2] and joint-venture—and two possible locations—domestic and foreign.

[1] See Sect. 2 for a literature review.

[2] 'Non-integration' is often referred to as 'outsourcing'. For consistency with the GHM framework, we stick to the label 'non-integration'.

Accordingly, our estimates rely on the probit, multinomial probit and conditional mixed process models.

From a theoretical point of view, we expect input characteristics to affect the ownership decision when integration is compared with non-integration (Antras and Helpman 2004). From an empirical point of view, we confirm that reliance on specific inputs and intangible inputs is a major driver of the make-or-buy decision. In our sample, firms employing specific inputs and intangible inputs prefer integration over non-integration; however, input characteristics neither affect the comparison between joint-venture and non-integration nor the location decision of Italian firms. Theoretically unexplored in the GHM framework, these findings are original of the present study.

A distinctive feature of GVCs is the continuous exchange of information about production activities as well as market conditions between the trading partners (Antras and Chor 2022). In an incomplete contract environment, such information flows are likely to translate into investment spillovers.[3] Based on recent developments of the PRT (Gattai and Natale 2016), we expect cross spillovers to be positive and statistically significant in explaining the ownership decision, when joint-venture is compared with non-integration. We report consistent evidence with our data. Moreover, we find that cross spillovers favour integration over non-integration—although this effect is much weaker than in the joint-venture/non-integration comparison—and the location choice, with domestic sourcing being favoured against foreign sourcing. These results are a novel contribution of the present analysis since no theoretical clue was available from the GHM framework on these matters.

Finally, we document a role for firm productivity in the domestic-or-foreign decision because productive firms are more likely to source abroad than domestically. This finding, consistent with the theory (Antras and Helpman 2004), confirms previous evidence on related issues (De Ponti and Gattai 2022; Bernasconi et al. 2022).

At this stage, it is worth mentioning that all the above results hold across different econometric models and a number of robustness checks.

To summarise, we believe that our contribution to the literature is twofold. On one hand, detailed survey data on input characteristics and investment spillovers allow us providing new evidence on the predictions of the PRT. Most of these predictions have so far remained unexplored due to the lack of suitable firm-level data. On the other hand, we document robust regularities on which the PRT is silent and thus deserve further investigation and may open new developments in the GHM framework.

The rest of the paper is organised as follows. Section 2 reviews the literature inspiring our conceptual framework. Section 3 describes the data. Section 4 presents our empirical methodology and results. Section 5 concludes and suggests future lines of research.

[3] By investment spillovers, we refer to the beneficial effects of one party's investment on the other party's outside option. Consider an input supplier serving more than one final good producer. Investments in R&D by one of its customers—the final good producers—may expose the input supplier to innovation that it can profitably implement for other customers as well. Likewise, investments in quality control by the input supplier may improve the reliability of the final good and its market share, thus increasing the bargaining power of the final producer vis-à-vis other input suppliers.

2 Literature Review

The boundaries of the firm have been studied quite extensively in the last two decades, from a variety of perspectives (for a survey, see Kano et al. 2020). Our conceptual framework grounds on the Contract Theory approach. In this field, a number of competing paradigms on the ownership decision have been developed to predict the boundaries of the firm (for a survey, see Gibbons 2005). Among these, the PRT has become particularly influential. Developed by Grossman, Hart and Moore in a series of seminal papers (Grossman and Hart 1986; Hart and Moore 1990; Hart 1995), the PRT casts the make-or-buy choice in terms of asset ownership.

In what follows, we describe the GHM framework (Sect. 2.1) and comment on recent developments that go beyond GHM either to model the location decision (Sect. 2.2) or to elaborate on the ownership decision (Sect. 2.3).

2.1 The Grossman–Hart–Moore Framework

Following Hart (1995), consider two firms—a final good producer (FP) and an input supplier (IS)—and two physical assets—a_1 and a_2, the former needed for final good production and the latter for input supply. Before production starts, FP and IS can undertake some investment in human capital that enlarges the surplus the parties generate when trading together more than it increases the value of the parties' outside option. In the PRT jargon, investments are relation-specific, i.e. they pay off more inside than outside the FP–IS relationship.

FP and IS would benefit from writing an enforceable contract over the division of the surplus and the amount of investment in human capital each party should undertake. However, it is a tenet of the legal profession (Schwartz 1992) that trading parties may fail to specify such a 'complete' contract.[4] It amounts to say that contracts tend to be 'incomplete'. As such, they turn out to be vague or silent on a number of key features (Tirole 1999) and have gaps, missing provisions or ambiguities (Salanié 1997).

Still, parties can allocate property rights over assets, giving rise to four possible ownership regimes: non-integration (FP owns a_1, and IS owns a_2), FP-integration (FP owns a_1 and a_2), IS-integration (IS owns a_1 and a_2) and joint control (both FP and IS have a veto power over the use of a_1 and a_2). We can think of FP-integration and IS-integration as backward and forward integration, respectively. In what follows, we drop the distinction between backward and forward and refer to either regime as integration.

If exchanges could be fully regulated by contracts, property rights would be irrelevant. When contracts are instead incomplete, the allocation of property rights matters because it confers residual control rights, i.e. the rights to decide whenever an unforeseen contingency, uncovered by the contract, occurs. Thus, in the GHM framework, the allocation of property rights defines the boundaries of the firm.

In particular, the choice of the ownership regime has efficiency implications because the marginal return of the investment in human capital by party *i* depends on the number of assets that party has access to. More specifically, it is increasing in the number of

[4] Milder assumptions on contract incompleteness would not affect the results in a meaningful way.

assets it controls as the latter affects the value of its outside option. Put another way, relation-specificity applies also in a marginal sense. Suppose parties fail to achieve an agreement on the division of the surplus. The party in control of the assets can exclude the non-controlling party from the usage of the assets and employ them to pursue its outside option. This increases the controlling party's bargaining position in the division of the surplus from trade, in turn depriving the non-controlling party of the return from the investment in human capital and reducing its incentive to invest. In a sense, relation-specific investments bound the parties together, preventing them from easily switching to alternative partners in case of disagreement. The combination of contract incompleteness and relation-specific investments produces underinvestment because parties fear to be held-up. Affecting the parties' incentive to invest, the allocation of property rights determines the total surplus from trade.

As the most notable finding, non-integration is the optimal ownership regime when assets are independent. In this case, each party's investment is equally important in the generation of surplus. On the other hand, integration is optimal when assets are complementary. In this case, one party's investment is more important than the other party's investment in the generation of the surplus.[5] In light of the above, joint control cannot do better than integration as it reduces the controlling party's incentive to invest without increasing the non-controlling party's incentive to invest. Likewise, joint control cannot outperform non-integration as it reduces both parties' incentive to invest. Therefore, joint control is never optimal in the GHM framework.

2.2 Beyond Grossman–Hart–Moore: from Local to Global Sourcing

A major limitation of the PRT in its original formulation is that it does not consider the international dimension of sourcing. In the 1990s, when sourcing was a local phenomenon, the PRT settled the debate about the boundaries of the firm.

However, globalisation has become an issue nowadays and sourcing can no longer be considered local. As a global phenomenon, it is governed by the interplay between ownership and location decisions. Absent joint control,[6] this causes four instances of firms' boundaries, denoted as domestic integration, domestic non-integration, foreign integration and foreign non-integration.

As a global phenomenon, sourcing has been recently investigated at the crossroad between Contract Theory and International Economics (for a survey, see Antras 2014; Gattai 2006; Spencer 2005).[7] From a theoretical perspective, the most important contributions are those by McLaren (2000), Grossman and Helpman (2002, 2003, 2005), Antras (2003), Ottaviano and Turrini (2007), and Antras and Helpman (2004). The framework, common to these theoretical models, is that final good production requires relation-specific inputs that the firm procures under contract incompleteness. McLaren

[5] This means that the increase in party *i*'s investment more than compensates for the decrease in party *j*'s investment in generating total surplus.

[6] Joint control is not addressed in this literature.

[7] Involving different legal systems, contracting across borders is likely to suffer from severe enforceability problems. This explains why Contract Theory has become the standard approach to study the make-or-buy decisions in the international context.

(2000) and Grossman and Helpman (2002) focused on the domestic side of the ownership decision. Grossman and Helpman (2003), Antras (2003), and Ottaviano and Turrini (2007) analysed the foreign side of the ownership decision. Grossman and Helpman (2005) studied the location decision. For the purpose of the present work, particular attention should be devoted to Antras and Helpman (2004), addressing ownership and location concerns in a joint theoretical framework. In this model, the ownership decision is sensitive to relation-specificity. As relying on specific inputs is risky under contract incompleteness, firms employing specific inputs prefer integration. The location decision depends on productivity. As operating abroad is costlier than operating domestically, only the most productive firms can undertake foreign sourcing. Assuming firms' heterogeneity, à la Melitz (2003), Antras and Helpman (2004) showed that in low-tech sectors, integration never occurs: lower-productivity firms engage in domestic non-integration, and higher-productivity firms engage in foreign non-integration. However, in high-tech sectors, all sourcing strategies may be undertaken: lower-productivity firms rely on domestic inputs, and higher-productivity firms rely on foreign inputs; among firms that source in the same country, the most productive engage in integration, and the least productive in non-integration.[8]

In the last two decades, a burgeoning empirical literature has grown rapidly to test the main predictions of Antras and Helpman (2004). Depending on data availability, Tomiura (2007a), Defever and Toubal (2013), and Corcos et al. (2013) studied the relative attractiveness of foreign non-integration and foreign integration. Tomiura (2005, 2009) and Ito et al. (2011) analysed foreign non-integration and domestic non-integration. Tomiura (2007b), Federico (2010), Kohler and Smolka (2011, 2021), De Ponti and Gattai (2022) and Bernasconi et al. (2022) considered all sourcing strategies in a joint empirical framework. The available evidence confirms the main theoretical predictions of the *Beyond GHM: from local to global sourcing* literature: irrespective of the year and country of analysis, firms that commit to foreign sourcing are, on average, more productive than firms that commit to domestic sourcing. Moreover, firms that engage in integration are, on average, more productive than firms that engage in non-integration.

2.3 Beyond Grossman–Hart–Moore: a Room for Joint Control

Another limitation of the PRT in its original formulation is that it fails to explain joint control, an allocation of property rights very common in cross-border investments. Even absent limits on foreign ownership, firms investing abroad may opt for joint-ventures rather than fully-owned subsidiaries (Arora and Fosfuri 2000; Desai et al. 2002; Filatotchev et al. 2007). In this sub-section, we review theoretical contributions that go beyond GHM by elaborating on the ownership decision as to embrace joint control.[9]

A number of studies have restored the optimality of joint control by relaxing the assumptions of the original PRT framework (for a survey, see Gattai and Natale 2017). A few contributions consider solutions to ex-post bargaining other than the Nash

[8] Antràs and Helpman (2008) allow for different degrees of contract incompleteness.

[9] Lack of suitable data has so far prevented empirical analysis on these matters.

bargaining solution (Chiu 1998; de Meza and Lockwood 1998; Halonen 2002; Manzini and Mariotti 2004; Schmitz 2013). Other studies introduce inefficiencies in ex-post bargaining (Bai et al. 2004; Matouschek 2004; Schmitz 2008; Hart 2009; Muller and Schmitz 2014) or allow for changes in the rules governing the allocation of property rights (Noldeke and Schmidt 1998; Maskin and Tirole 1999; Von Lilienfeld-Toal 2003; Gans 2005; Bai et al. 2004; Wang and Zhu 2005; Annen 2009). Lastly, a few contributions extend the Grossman-Hart-Moore framework accounting for repeated interaction (Halonen 2002; Rosenkranz and Schmitz 2004) or investigating the effect of the parties' investments on the ranking of ownership regimes (Rajan and Zingales 1998; Bel 2013; Cai 2003; Hart 1995; Rosenkranz and Schmitz 1999, 2003; Gattai and Natale 2016). For the sake of the present work, the latter group of theories is of particular interest, because of the testable predictions it derives.

Recall from Sect. 2.1 that, when assets are independent, non-integration is preferred to integration. Rajan and Zingales (1998) and Bel (2013) show that joint control can be optimal when assets are substitute, i.e. the marginal benefit of investment decreases in the number of assets that a party controls. This is because joint control is akin to block a party's access to its own outside option and thus it reduces that party's incentive to invest.

Cai (2003) considers two types of investment—specific and general. Specific investment is productive only within the relationship, while general investment is productive within the relationship and outside it. As long as specific and general investments are substitute in the cost function, any regime other than joint control induces too much general and too little specific investment. This establishes the optimality of joint control.

In Grossman and Hart (1986) and Hart and Moore (1990), parties invest in human capital; therefore, party i benefits from party j's investment only if they trade together. This implies the absence of investment spillovers in the PRT original framework, the so-called 'cross spillovers'. When investment is embedded in physical rather than human capital, Hart (1995) shows that joint control might be optimal. Under joint control, no party can use the asset without the consent of the other, which neutralizes the effect of any investment spillovers. Joint control dominates integration as long as the increase in the non-controlling party's investment raises the total surplus more than the decrease in the controlling party's investment reduces it.

Finally, Rosenkranz and Schmitz (1999, 2003) show the optimality of joint control in a set-up with just one asset and knowledge spillovers across parties. Gattai and Natale (2016) generalise this result to the case of two or more assets, accounting for 'asset-embodied' investments and 'footloose' investments as a source of cross spillovers. As the model predicts, joint control may prevail in presence of footloose investments.

To the best of our knowledge, lack of suitable data has so far prevented empirical analysis of the *Beyond GHM: a room for joint control* literature.

3 Data

This paper exploits original survey data, collected by the Authors for the purpose of a research project carried on at Università degli Studi di Milano-Bicocca. Data collection took place between April and July 2020, and involved a representative sample of Italian manufacturing firms headquartered in Lombardy.

Located in the North of Italy, Lombardy is one of the most developed and open regions in Europe. Its GDP per capita exceeds the national (EU) average by 34% (28%), and its volume of trade over value-added (73%) is 30% greater than the national average (Eurostat 2023). Lombardy's participation in GVCs is also remarkable with over 50% of its gross exports originating from participation in GVCs. Furthermore, Lombardy's share of value-added from foreign sources is the highest among Italian regions, witness to the importance of the region's international backward linkages (Iammarino et al. 2019). In order to address the boundaries of the firm consistently with the *Beyond GHM: from local to global sourcing* literature, Lombardy turned out to be the ideal locus for our study, since all sourcing strategies are represented in this region (Assolombarda 2019).

Our target sample of 1000 firms is drawn from the last national firm census and stratified according to geographical location, manufacturing activity, and firm size. Geographical location stratification is based on four macro areas that group neighbouring provinces according to their productive specialisation: northwest, northeast, southwest, and southeast.[10] The manufacturing activity stratification follows Pavitt's (1984) taxonomy, which classifies industries into four macro categories according to the source of technology and technical change: supplier-dominated, specialised suppliers, science-based, and scale intensive. Firm size stratification reflects the number of employees and is based on three main classes: firms with fewer than 10 employees, firms with 10–49 employees, and firms with more than 50 employees.

The number of firms in each stratum of the target sample was obtained to ensure proportionality with the total number of firms in the same stratum of the population.

All firms were contacted by phone and a multiple-choice questionnaire, relative to firms' background information and sourcing behaviour in 2019, was emailed to senior managers and CEOs.[11]

This study included 718 enterprises with a response rate of 70%. After dropping those firms that miss the relevant variable values, our sample consists of 562 firms, and it is highly representative of the entire population (Table 1).

Regarding the geographical location, the majority of firms are from the southwest area (38.26%), followed by the northeast (29.18%), northwest (25.09%), and southeast (7.47%). This evidence suggests that the manufacturing core of Lombardy is centred in Lodi, Milano, Monza e Brianza, and Pavia, whereas Cremona and Mantova account for a limited share of the local business.

For the manufacturing activity, supplier-dominated operations are the main economic activity, involving 38.79% of the sampled firms. They are followed by the

[10] Northwest includes Como, Lecco, Varese; northeast includes Bergamo, Brescia, Sondrio; southwest includes Lodi, Milano, Monza e Brianza, Pavia; southeast includes Cremona, Mantova.

[11] The questionnaire is available from the Authors upon request.

Table 1 Population and sample of Lombard enterprises, by geographical location, manufacturing activity, and firm size

	Population		Sample	
	Freq	Perc	Freq	Perc
Geographical location				
Northwest	17,400	20.54	141	25.09
Northeast	24,695	29.15	164	29.18
Southwest	36,064	42.57	215	38.26
Southeast	6553	7.74	42	7.47
Total	84,712	100.00	562	100.00
Manufacturing activity				
Supplier-dominated	36,730	43.36	218	38.79
Science-based	9297	10.98	93	16.55
Scale intensive	19,748	23.31	132	23.49
Specialised suppliers	18,937	22.35	119	21.17
Total	84,712	100.00	562	100.00
Firm size				
0–9	65,630	77.47	321	57.12
10–49	16,037	18.93	159	28.29
≥ 50	3045	3.60	82	14.59
Total	84,712	100.00	562	100.00

scale intensive (23.49%), specialised suppliers (21.17%) and science-based activities (16.55%), with the latter representing the smallest segment. These data confirm that the industrial texture of Lombardy is highly diversified, with multiple specialisations leading to a balanced mixture of traditional and high-tech activities.

Finally, regarding firm size, most of our firms (57.12%) are rather small, with fewer than 10 employees. Medium and large firms account for a limited 28.29% and 14.59% of the total, respectively. Given the importance of Lombardy for the Italian economy (ASR 2021), this suggests that a mass of small and medium enterprises, rather than a handful of huge conglomerates, is responsible for consistent shares of national value-added, GDP, export, and import.

With the questionnaire, we requested firms to report their core sourcing strategy in 2019.[12] Following the *Beyond GHM: from local to global sourcing* literature, we allowed the boundaries of the firm to rise from a combination of ownership and location decisions; following the *Beyond GHM: a room for joint control* literature, we elaborated on Antras and Helpman's (2004) taxonomy to incorporate the joint-venture into the firm's ownership decision, adding to integration and non-integration. To this aim, we adopted a wide definition of joint-ventures to embrace all partnerships among firms

[12] Since our survey was administered during the first wave of the pandemic, we chose to ask questions regarding the pre-COVID-19 period. Although we interviewed firms in 2020, their answers refer to 2019. Therefore, our survey data should not be affected by the pandemic.

in which the percentage of ownership lays between 10 and 95%, consistent with Raff et al. (2012).[13]

Regarding the location decision, 74.02% of our firms engage in domestic sourcing, employing 'made in Italy' components, whereas 25.98% prefer foreign sourcing, relying on foreign inputs (Table 3). As for the ownership decision, 64.59% of the sampled firms buy their inputs from independent suppliers, engaging in non-integration, against 35.41% that manufacture the components themselves either within their own boundaries (integration) or in joint-venture with an independent firm. Interestingly, only 7.12% of our firms rely on the latter, whereas integration involves 28.29% of the respondents.

When ownership and location decisions are combined, domestic non-integration becomes pervasive, accounting for 46.26% of the respondents; domestic integration and foreign non-integration follow closely, with shares equal to 23.67% and 18.33%, respectively. On the contrary, foreign integration (4.63%), domestic joint-venture (4.09%) and foreign joint-venture (3.02%) involve just a handful of respondents, consistent with Assolombarda (2019).[14]

For the purpose of the present research, our survey data have been complemented with balance sheet information downloaded from AIDA, a comprehensive database on Italian enterprises administered by Bureau van Dijk. This allows us explaining the boundaries of the firms through firm-level variables, according to the literature reviewed in Sect. 2.

4 Empirical Analysis

This section provides a detailed overview of our empirical analysis. In Sect. 4.1, we introduce the variables used for econometric purposes; in Sect. 4.2, we present the empirical methods and discuss our main results and robustness checks.

4.1 Variables

4.1.1 Dependent Variables

To assess the boundaries of Italian firms, we consider multiple dependent variables, in line with previous studies on global sourcing (Kohler and Smolka 2011; Federico 2010).

As for the location decision, the binary variable $Location_i$ is coded to capture firm i's domestic-or-foreign choice. It takes value 0 for firms engaged exclusively in

[13] The reader is referred to Gattai and Natale (2013) for an exhaustive definition of joint-ventures. Unfortunately, we have no information regarding the exact percentage of ownership in our data and therefore we cannot condition on that in our empirical analysis.

[14] Note that the unit of observation in our dataset is firm i, not the individual relationship between firm i and each of its suppliers. Firms were invited to report whether they rely on single or multiple sourcing modes, across their portfolio of suppliers. This formulation reflects the concern that asking firms to report information for individual supplying relationships would have comprised both response rate and data quality.

domestic sourcing; and value 1 for firms engaged in foreign sourcing (regardless of their domestic strategies).[15]

As for the ownership decision, the categorical variable $Ownership_i$ is defined to capture firm i's make-or-buy choice: it is assigned value 0 for firms engaged exclusively in non-integration; value 1 for firms engaged in integration (regardless of their non-integration strategies); and value 2 for firms engaged in joint-venture (regardless of their non-integration and/or integration strategies). In the spirit of Antras and Helpman (2004), the three instances of ownership covered by our categorical variable $Ownership_i$ are independent alternatives and do not follow an ordering of any kind.

At this stage, it is worth mentioning that our definition of $Location_i$ is consistent with previous contributions on global sourcing (Mazzanti et al. 2009, 2011; Federico 2010). On the contrary, our categorisation of $Ownership_i$ is completely original of the present study in that it widens the make-or-buy choice to consider joint-venture adding to integration and non-integration. This marks a clear departure from previous contributions that rely on a binary rather than a categorical variable of ownership (De Ponti and Gattai 2022; Bernasconi et al. 2022).

4.1.2 Core Independent Variables

Consistent with the literature reviewed in Sect. 2, our core independent variables are TFP_lp_i, $specific\ inputs_i$, $intangible\ inputs_i$ and $spillovers_i$. In what follows, we briefly comment on these variables and their expected sign.

TFP_lp_i is our measure of productivity. It is the logarithm of total factor productivity, estimated according to the semi-parametric method of Levinsohn and Petrin (2003) to address the simultaneity and selection biases. Accordingly, we assume the production function of firm i at time t to be Cobb–Douglas. In this framework, the logarithm of firm i's output at time t can be expressed as a function of the logarithm of the freely variable input labour, the logarithm of the intermediate input, and the logarithm of the state variable capital. Following Gal (2013), we measure the firm's output in terms of value-added, the input labour as the number of employees, intermediate input as material costs, and capital stock as tangible fixed assets. The entire 2014–2019 time series for value-added, number of employees, material costs, and tangible fixed assets is exploited to implement the 'levpet' routine available in Stata. According to the *Beyond GHM: from local to global sourcing* literature, productivity is a major driver of firms' location and ownership decisions in that more productive firms are more likely to prefer foreign over domestic sourcing and integration over non-integration. (Antras and Helpman 2004). Therefore, we expect TFP_lp_i to be positive and statistically significant in explaining $Location_i$ and $Ownership_i$, meaning that the probability of engaging in foreign sourcing and integration increases in firm-level productivity.

[15] Ideally, one would like to measure the relative share of different sourcing strategies when multiple strategies are pursued and use those shares as the main dependent variables. However, our dataset does not provide information on the relative shares. We believe that sticking to a discrete characterisation of $Location_i$, as well as $Ownership_i$, is not a severe limitation here because just a handful of firms in our sample engage in multiple sourcing strategies.

Despite its widespread adoption, the *Beyond GHM: from local to global sourcing* literature neglects joint control; this deprives us of a theoretical underpinning for our investigation of the determinants of the joint-venture/non-integration choice. Nevertheless, we explore econometrically the role of productivity and provide a discussion of possible mechanisms driving our results.

Adding to TFP_lp_i, *specific inputs*$_i$ and *intangible inputs*$_i$ are core regressors in our empirical framework. As reviewed in Sect. 2, relation-specific investments are at the heart of the Grossman–Hart–Moore framework in that a combination of relation-specific investments and contract incompleteness favours integration to mitigate hold-up concerns (Hart 1995). Relation-specific investments are not directly observable in our data. However, they are likely related to the characteristics of the inputs used for production purposes, which we investigated through survey interviews. To account for the multifaceted nature of production processes, we asked our respondents to define the relevance of four types of potential inputs—denoted as tangible, intangible, standardised and specific—according to a 1–5 Likert scale with 1 (5) denoting minimal (maximal) relevance.[16] In our terminology, tangible inputs have physical substance, like components and raw materials; intangible inputs lack physical substance, like patens and know-how. Standardised inputs are untailored to a particular final good, so that they can be quickly replaced; specific inputs are tailored to a particular final product and cannot be easily employed in alternative use. Recall from Sect. 2 that GHM accounts only for investments in human capital; this suggests to investigate the relevance of intangible inputs in firm i's production process. Moreover, in the GHM framework investments are relation-specific; this points to assessing the relevance of specific inputs the most. Drawing on our data, *specific inputs*$_i$ (*intangible inputs*$_i$) is coded as a binary variable, taking value 1 for firms regarding specific (intangible) inputs as very relevant for their production processes.[17] From a theoretical point of view, we expect *specific inputs*$_i$ and *intangible inputs*$_i$ to be positive and statistically significant in explaining $Ownership_i$, when integration is compared with non-integration. The *Beyond GHM: a room for joint control* literature is silent on whether they also affect the choice of joint-venture versus non-integration and the location decision. Absent a theoretical prior on these matters, we explore econometrically the role of input characteristics and discuss potential mechanisms behind our results.

Lastly, *spillovers*$_i$ is an index capturing the magnitude of cross (footloose) spillovers between firm i and its suppliers. From a theoretical point of view, cross spillovers are of particular interest in addressing the ownership decision. According to the *Beyond GHM: a room for joint control* literature, joint-ventures can be optimal when cross spillovers are accounted for (Gattai and Natale 2016). From an empirical point of view, we consider a wide array of spillovers potentially arising between firm i and its suppliers. They range from human capital to advertising, from R&D to organisational innovation, from industry knowledge to reliability, from visibility to product quality. With the questionnaire, we asked our respondents to define the relevance on a 1–5 Likert scale of each spillover from the firm itself to its suppliers, as well as viceversa

[16] For example, our question on the relevance of specific inputs reads as follows in the questionnaire. "Define on a 1–5 Likert scale the extent to which you rely on inputs that are tailored to the final good you produce".

[17] This means that they received an evaluation equal to 4 or 5 in the 1–5 Likert scale.

(i.e. from the suppliers to the firm itself).[18] Such a two-sided perspective is key to define cross spillovers, which are computed with the following procedure. First, for each spillover, we take the average between firm *i*'s and its suppliers' evaluations, the so-called spillover-specific average; second, we take the average across spillover-specific averages to measure the overall importance of cross spillovers in the relationship involving firm *i* and its suppliers. Drawing on the *Beyond GHM: a room for joint control* literature, we expect $spillovers_i$ to be positive and statistically significant in explaining $Ownership_i$, when joint-venture is compared with non-integration.

The literature envisages no role for cross spillovers in shaping location decisions. Still, we explore this issue econometrically and provide a discussion of possible mechanisms driving our results.

At this stage, it is worth mentioning that our measure of productivity is consistent with previous contributions on the topic (Kohler and Smolka 2011; Giovannetti et al. 2013, 2015). However, the lack of firm-level data on the nature of inputs and spillovers has so far prevented proper econometric analyses on these matters. Therefore, our definition of $specific\ inputs_i$, $intangible\ inputs_i$ and $spillovers_i$ are to be considered an original contribution of the present study.

4.1.3 Control Independent Variables

Drawing on existing literature, we consider a series of additional controls to account for firm, industry, and geographical heterogeneity.

At the firm level, we control for the firm's age (age_i), group membership ($group_i$), employment ($size_i$) and profitability ($EBITDA_i$), in line with Giovannetti et al. (2013, 2015) and D'Angelo et al. (2016).

At the industry level, we control for Pavitt macro industries by means of binary variables for supplier-dominated, science-based, specialised suppliers and scale intensive industries.

At the geographical level, macro areas fixed effects take the form of binary variables for firms headquartered in the northwest, northeast, southwest and southeast of Lombardy.[19]

For expositional convenience, Table 2 provides a brief description of the variables used for econometric purposes, while summary statistics of categorical and continuous variables are available from panels (a) and (b) of Table 3, respectively.

[18] For example, our question on human capital spillovers reads as follows in the questionnaire. "Define on a 1–5 Likert scale the extent to which:—your suppliers benefit from your firm's investments in human capital;—your firm benefits from your suppliers' investments in human capital."

[19] These are the same variables used for stratification purposes.

Table 2 Variables description

Variable	Description and operationalisation
Dependent variables	
$Location_i$	Binary variable, capturing firm *i*'s *domestic-or-foreign* choice. Taking value 0 for firms engaged exclusively in domestic sourcing; value 1 for firms engaged in foreign sourcing (regardless of their domestic strategies)
$Ownership_i$	Categorical variable, capturing firm *i*'s *make-or-buy* sourcing choice. Taking value 0 for firms engaged exclusively in non-integration; value 1 for firms engaged in integration (regardless of their non-integration strategies); value 2 for firms engaged in joint-venture (regardless of their non-integration and/or integration strategies)
Independent variables	
TFP_lp_i	Continuous variable. It denotes the log of total factor productivity, estimated using the semiparametric-estimation-based approach by Levinsohn and Petrin (2003). It is a core regressor
$specificinputs_i$	Binary variable built on a 1–5 Likert scale, capturing firm *i*'s reliance on specific inputs, i.e. inputs which are specifically tailored to a particular final good. Taking value 1 for high reliance on specific inputs (i.e. values 4 or 5 on the aforementioned scale); value 0, otherwise. It is a core regressor
$intangibleinputs_i$	Binary variable built on a 1–5 Likert scale, capturing firm *i*'s reliance on intangible inputs, i.e. inputs that lack physical substance. Taking value 1 for high reliance on intangible inputs (i.e. values 4 or 5 on the aforementioned scale); value 0, otherwise. It is a core regressor
$spillovers_i$	Continuous variable. It denotes the magnitude of cross (footloose) spillovers between firm *i* and its suppliers. It is computed according to a two-step procedure. First, for each spillover, we take the average between firm *i*'s and its suppliers' evaluations, according to a 1–5 Likert scale, i.e. the spillover-specific average. Second, we take the average across spillover-specific averages to measure the overall importance of cross spillovers in the relationship involving firm *i* and its suppliers. Spillovers regard human capital, advertising, R&D, organisational innovation, industry knowledge, reliability, visibility, and product quality. It is a core regressor
age_i	Continuous variable, capturing firm *i*'s age, as years since foundation (in years). It is a control regressor
$group_i$	Binary variable, taking value 1 if firm *i* is part of a business group, value 0 otherwise. It is a control regressor
$size_i$	Continuous variable, capturing firm *i*'s sie in terms of employees (in thousand units). It is a control regressor
$EBITDA_i$	Continuous variable, capturing firm *i*'s earning before interests, taxes, depreciation and amortiation (in thousand Euro). It is a proxy for firm *i*'s profitability of the operating business. It is a control regressor
Manufacturing activity	Binary variables, capturing industrial heterogeneity. They are based on Pavitt (1984)'s taxonomy of manufacturing activities according to the source of technology and technical change: supplier-dominated, science-based, specialised suppliers and scale intensive. They are control regressors
Geographical location	Binary variables, capturing geographical heterogeneity. They are based on four macro-areas, grouping neighbouring provinces according to their productive specialisation: northwest (including Como, Lecco, Varese), northeast (including Bergamo Brescia, Sondrio), southwest (including Lodi, Milano, Mona e Briana), and southeast (including Cremona, Mantova). They are control regressors

Table 3 Descriptive statistics of categorical and continuous variables

Panel (a): categorical variables

	Freq	Perc
$Location_i$		
Domestic	416	74.02
Foreign	146	25.98
$Ownership_i$		
Non-integration	363	64.59
Integration	159	28.29
Joint-venture	40	7.12
$specificinputs_i$		
Low reliance on specific inputs	217	38.61
High reliance on specific inputs	345	61.39
$intangibleinputs_i$		
Low reliance on intangible inputs	342	60.85
High reliance on intangible inputs	220	39.15
$group_i$		
Not part of a business group	488	86.83
Part of a business group	74	13.17
Manufacturing activity		
(See Table 1)		
Geographical location		
(See Table 1)		

Panel (b): continuous variables

	Freq	Mean	Median	St dev
TFP_lp_i	562	2.93	2.85	0.70
age_i	562	40.53	36	28.85
$size_i$	562	57.91	9	264.34
$EBITDA_i$	562	1.85	0.21	8.51
$spillovers_i$	562	0.59	0.60	0.14

4.2 Empirical Methods

4.2.1 Descriptive Statistics and Mean Comparison Tests

To explain the boundaries of Italian firms, Table 4 displays comparative descriptive statistics and mean comparison tests by location and ownership decisions of our respondents.

Table 4 Comparative descriptive statistics and mean comparison tests

(1) Location decision: domestic vs. foreign	Foreign	Domestic	Avg. foreign	Avg. domestic	Diff	St. err	t value	p value
TFP_lp_i	146	416	3.139	2.855	0.284***	0.066	− 4.3	0
$specificinputs_i$	146	416	0.603	0.618	− 0.015	0.047	0.3	0.749
$intangibleinputs_i$	146	416	0.404	0.387	0.017	0.047	− 0.35	0.717
$spillovers_i$	146	416	0.577	0.595	− 0.018	0.014	1.3	0.188
(2.1) Ownership decision: joint-venture vs. non-integration	Joint-venture	Non-integration	Avg. joint-venture	Avg. non-integration	Diff	St. err	t value	p value
TFP_lp_i	40	363	3.264	2.844	0.42***	0.114	3.7	0.001
$specificinputs_i$	40	363	0.625	0.562	0.063	0.083	0.75	0.447
$intangibleinputs_i$	40	363	0.45	0.331	0.12	0.079	1.5	0.132
$spillovers_i$	40	363	0.674	0.57	0.104***	0.023	4.55	0
(2.2) Ownership decision: integration vs. non-integration	Integration	Non-integration	Avg. integration	Avg. non-integration	Diff	St. err	t value	p value
TFP_lp_i	159	363	3.037	2.844	0.193**	0.065	3	0.003
$specificinputs_i$	159	363	0.73	0.562	0.168***	0.046	3.65	0.001
$intangibleinputs_i$	159	363	0.515	0.331	0.185***	0.045	4.05	0
$spillovers_i$	159	363	0.614	0.57	0.044***	0.014	3.3	0.001

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

For every core independent variable, panel (1) of Table 4 displays the number of observations and the mean in the groups of firms engaged in domestic versus foreign sourcing, thus providing a first insight on the location decision. A preliminary investigation of the data suggests that foreign sourcing is associated with higher productivity compared with domestic sourcing. Consistent with the *Beyond GHM: from local to global sourcing* literature, firms engaged in the former exhibit higher mean values of TFP_lp_i than firms engaged in the latter, and differences in the means (foreign–domestic) are positive and statistically significant. Put another way, firms relying on foreign inputs systematically differ from firms relying on 'made in Italy' components in terms of TFP_lp_i.

Panels (2.1) and (2.2) of Table 4 focus on the ownership decision, comparing TFP_lp_i, $specific\ inputs_i$, $intangible\ inputs_i$ and $spillovers_i$ across firms engaged in joint-venture versus non-integration, and firms engaged in integration versus non-integration, respectively. Interestingly, joint-venture firms systematically differ from non-integration firms in terms of productivity and cross spillovers. Evidence reveals that differences in the means (joint-venture–non-integration) for TFP_lp_i and $spillovers_i$ are positive and statistically significant. This suggests that more productive firms prefer manufacturing the inputs themselves in joint-venture with an independent firm, rather than relying on an independent input supplier. At the same time, firms benefitting more from cross spillovers tend to prefer joint-venture over non-integration, in line with theoretical predictions of the *Beyond GHM: a room for joint control* literature. As for the comparison between integration and non-integration firms, panel (2.2) of Table 4 reveals that the former systematically differ from the latter in terms of TFP_lp_i, $specific\ inputs_i$, $intangible\ inputs_i$ and $spillovers_i$. As the most notable finding, all differences in the means (integration–non-integration) are positive and statistically significant. Put another way, firms that manufacture the inputs themselves within their own boundaries tend to be different from firms that rely on independent input suppliers. In our sample, the integration firms are characterised by higher productivity, deeper reliance on specific inputs and intangible inputs and present cross spillovers compared with non-integration firms, in line with theoretical predictions of the *Beyond GHM: from local to global sourcing* and the *Beyond GHM: a room for joint control* literatures.

4.2.2 Econometric Models and Specifications

Our econometric approach is twofold.
As a first step, we estimate Eqs. (1) and (2) separately.
Equation (1) captures the sampled firms' location decision, and it is set as follows:

$$Location_i = \alpha TFP\_lp_i + \beta specificinputs_i + \gamma intangibleinputs_i + \delta spillovers_i + \theta ctrl_i + \epsilon_i \quad (1)$$

with variables defined in Sect. 4.1. Given the binary nature of our dependent variable $Location_i$, we rely on a probit model to estimate Eq. (1). Our full model probit specification regresses $Location_i$ on the core independent variables measuring productivity,

reliance on specific inputs, intangible inputs and cross spillovers, together with additional regressors of group membership, age, size, financial performance, industrial and geographical controls.

According to the literature reviewed in Sect. 2, Eq. (2) captures the sampled firms' ownership decision, and it is set as follows:

$$Ownership_i = \alpha TFP\_lp_i + \beta specificinputs_i + \gamma intangibleinputs_i + \delta spillovers_i + \theta ctrl_i + \epsilon_i \quad (2)$$

with variables defined in Sect. 4.1. Due to the categorical nature of our dependent variable $Ownership_i$, Eq. (2) is estimated in a multinomial probit framework, using the same regressors and specifications as those in Eq. (1). Being the most represented sourcing strategy in our sample and in accordance to the theoretical model by Antras and Helpman (2004), non-integration is used as a baseline category.

As a second step in our econometric approach, we acknowledge that ownership and location decisions might be related to some extent. In our data, this is evident from the fact that the intersection between $Ownership_i$ and $Location_i$ is not empty.[20] To account for the interplay between ownership and location decisions, we estimate Eqs. (1) and (2) jointly by means of the conditional mixed process (CMP) model (Roodman 2011, 2022). Loosely speaking, the CMP framework resembles that of the Seemingly Unrelated Regressions, with the difference that dependent variables need not be continuous.[21] Therefore, it is possible to estimate our probit and multinomial probit models in a system, as shown in (3):

$$\begin{cases} Location_i = \alpha TFP_{lpi} + \beta specificinputs_i + \gamma intangibleinputs_i + \delta spillovers_i + \theta ctrl_i + \epsilon_i \\ Ownership_i = \alpha TFP_{lpi} + \beta specificinputs_i + \gamma intangibleinputs_i + \delta spillovers_i + \theta ctrl_i + \epsilon_i \end{cases} \quad (3)$$

All dependent and independent variables are as in Eqs. (1) and (2). Moreover, we retain the same specifications to facilitate comparisons with our previous results. Coherently with the multinomial probit estimated in (2), we assume errors are independent and identically distributed.

At this stage, it is worth mentioning that our probit, multinomial probit and conditional mixed process models are estimated using survey estimation methods to reduce the potential bias originating from the uneven survey response rate. We weigh each observation by the inverse of the probability of being sampled using, for every stratum, location- and industry-specific information on the total number of firms in the population and the sample (Kohler and Smolka 2011; Gattai and Trovato 2016).

On a general note, the cross-sectional nature of our data limits the empirical methods we could employ, as well as the ability of our estimates to establish causal relationships.

[20] See Sect. 3.

[21] An alternative approach could imply estimating a multinomial probit model in which the dependent variable captures all instances of sourcing in a mutually exclusive way. We prefer sticking to the CMP framework due to data constraints. Indeed, some instances of sourcing account for a very limited number of observations in our data, once we combine the ownership and location dimensions. See Sect. 3 for more details.

Although balance sheet data from AIDA cover the 2014–2019 period, our survey data refer only to 2019. Nevertheless, the different models estimated, the adoption of empirical corrective actions and the various robustness checks allow identifying recurring regularities across results, providing significant insights on the relationship of interest. In that regard, aiming to reduce the simultaneity bias which may affect our estimates, all explanatory variables are 1-year lagged (D'Angelo et al. 2016).[22]

Another concern with our data is the potentially high degree of multicollinearity among regressors. To check whether this is an issue, we present pairwise correlations between independent variables and compute the Variance Inflation Factor (VIF) coefficients. Table 5 shows that pairwise correlations between independent variables are rather weak. Moreover, Table 6 reveals that the VIF coefficients are below the critical cut-offs. Therefore, we conclude that multicollinearity does not cast doubts on the reliability of our results (Hair et al. 2010).

4.2.3 Econometric Results

Table 7 reports our probit estimates of Eq. (1).

In our data, the location decision is a matter of firm-level productivity and relevance of cross spillovers. As the most notable finding, the estimated coefficient of TFP_lp_i is positive and statistically significant at the 1% level. In line with the *Beyond GHM: from local to global sourcing* literature, the more productive the firm, the more likely it is to opt for foreign sourcing. This evidence is fully consistent with previous results from Mazzanti et al. (2009, 2011) and Federico (2010).

The coefficient of $spillovers_i$ is also negative and statistically significant at the 5% level. This seems to suggest that relevance of cross spillovers favours domestic over foreign sourcing.

As documented in Sect. 2, the effect of cross spillovers is unexplored in the literature on location decisions. Still, we may expect they play a role in orienting the domestic-or-foreign choice. Anticipating the beneficial effects of the exposure to each other's activities, final good producers and input suppliers are likely to co-locate, in order to reduce interaction costs. As long as foreign sourcing entails larger interaction costs than domestic sourcing, we expect domestic sourcing to prevail over foreign sourcing in presence of cross spillovers.[23] Therefore, our result of a negative and statistically significant coefficient of $spillovers_i$ is to be considered a novel contribution of the present study to the understanding of locations decisions.

Concerning the ownership decision, Table 8 reports our multinomial probit estimates of Eq. (2).

Consistent with the categorical nature of $Ownership_i$ and the choice of non-integration as our baseline category, Table 8 displays two columns: in (a), we estimate the probability that firm i engages in joint-venture rather than non-integration; in (b), the comparison between integration and non-integration is instead addressed.

In our data, the ownership decision is a matter of relevance of specific inputs, intangible inputs and cross spillovers. Concerning the likelihood of joint-venture versus

[22] In Sect. 4.2.4, as a robustness check, we consider a 3-year lag.

[23] Recall that in presence of contract incompleteness, exchange of information about production activities as well as market conditions between the trading partners are likely to translate into investment spillovers.

Table 5 Pairwise correlation between independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) TFP_lp_i	1							
(2) $specificinputs_i$	0.085**	1						
(3) $intangibleinputs_i$	0.206***	0.202***	1					
(4) age_i	0.199***	− 0.028	0.099**	1				
(5) $group_i$	0.313***	− 0.015	0.076*	0.078*	1			
(6) $size_i$	0.298***	− 0.049	0.043	0.217***	0.334***	1		
(7) $EBITDA_i$	0.436***	− 0.027	0.107**	0.141***	0.300***	0.301***	1	
(8) $spillovers_i$	0.188***	0.067	0.193***	0.062	0.020	0.081*	0.041	1

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

Table 6 Variance inflation factor analysis

Variables	VIF	1/VIF
TFP_lp_i	1.55	0.64
$specificinputs_i$	1.07	0.94
$intangibleinputs_i$	1.14	0.88
age_i	1.10	0.91
$group_i$	1.24	0.81
$size_i$	1.26	0.79
$EBITDA_i$	1.34	0.75
$spillovers_i$	1.08	0.93
Manufacturing activity:		
Science-based	1.47	0.68
Specialised suppliers	1.55	0.64
Supplier-dominated	1.71	0.58
Geographical location		
Northeast	1.55	0.65
Southwest	1.57	0.64
Southeast	1.22	0.82
avg. VIF	1.35	

non-integration, in panel (a) of Table 8, the estimated coefficient of $spillovers_i$ is positive and statistically significant at the 1% level. This means that the more dependent the firm is on cross spillovers, the more likely it is to opt for joint-venture. This result should be regarded as a novel contribution of the present study: to the best of our knowledge, ours is the first attempt at studying the relative attractiveness of joint-ventures in a global sourcing framework. Theoretical models belonging to the *Beyond GHM: a room for joint control* literature focus on joint-ventures and show that they are more likely to emerge when cross spillovers are accounted for. However, the absence of suitable firm-level data has so far prevented a proper test of such a theoretical prediction. In a sense, our estimates fill the gap by confirming that cross spillovers are a positive driver of joint-venture against the baseline category of non-integration.

Concerning the likelihood of integration versus non-integration, in panel (b) of Table 8, the estimated coefficients of *specific inputs*$_i$ and *intangible inputs*$_i$ are positive and statistically significant at the 1% and 5% levels, respectively, witness to the importance of relation specificity for ownership matters. These results confirm that relation specificity favours integration to mitigate hold-up concerns, consistent with the theoretical predictions of the *Beyond GHM: from local to global sourcing* literature and previous evidence from De Ponti and Gattai (2022) and Bernasconi et al. (2022). Interestingly, the estimated coefficient of $spillovers_i$ is also positive and statistically significant. This suggests that the relevance of cross spillovers affects not only the joint-venture versus non-integration but also the integration versus non-integration choice. While the former prediction was formally derived within the *Beyond GHM: a room for joint control* literature, to the best of our knowledge, the second has not

Table 7 Location decision

	Location decision: domestic vs. foreign
	(1)
TFP_lp_i	0.411***
	(0.114)
$specificinputs_i$	− 0.0524
	(0.127)
$intangibleinputs_i$	− 0.0326
	(0.129)
$spillovers_i$	− 1.127**
	(0.438)
age_i	0.00109
	(0.00211)
$group_i$	0.175
	(0.195)
$size_i$	0.760
	(0.627)
$EBITDA_i$	− 0.0201
	(0.0123)
Manufacturing activity	Yes
Geographical location	Yes
Constant	− 1.538***
	(0.411)
Pseudo R-squared	0.0652
N	562

Probit estimates of Eq. (1), with survey estimation methods. Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

been explicitly modelled yet. In this regard, a novel contribution of this paper is to show that the relevance of cross spillovers shapes the preference for integration over non-integration. From a qualitative point of view, the effect of $spillovers_i$ is consistent throughout panels (a) and (b) of Table 8, in that statistical significance and sign are preserved, regardless of the ownership regime—joint-venture or integration—compared with the baseline category of non-integration. However, from a quantitative point of view, remarkable differences emerge. In particular, the coefficient of $spillovers_i$ is much larger in panel (a) than in panel (b), witness to the key role played by cross spillovers in the joint-venture/non-integration more than integration/non-integration trade-off. Notice also that the estimated coefficient of $spillovers_i$ is significant at the

Table 8 Ownership decision

	Ownership decision	
	(a) Joint-venture vs. non-integration	(b) Integration vs. non-integration
	(1)	(2)
TFP_lp_i	0.282	− 0.00398
	(0.209)	(0.149)
$specificinputs_i$	− 0.0179	0.526***
	(0.247)	(0.179)
$intangibleinputs_i$	0.149	0.356**
	(0.256)	(0.176)
$spillovers_i$	3.706***	1.577**
	(0.915)	(0.617)
age_i	− 0.0000951	− 0.000188
	(0.00450)	(0.00313)
$group_i$	− 0.0311	0.727***
	(0.386)	(0.261)
$size_i$	0.217	− 0.272
	(0.290)	(0.380)
$EBITDA_i$	0.0176	0.0160
	(0.0108)	(0.0128)
Manufacturing activity	Yes	Yes
Geographical location	Yes	Yes
Constant	− 5.158***	− 2.455***
	(0.792)	(0.558)
N	562	562

Multinomial probit estimates of Eq. (2), with survey estimation methods. Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

1% level in panel (a), and only at the 5% level in panel (b), which seems to confirm that cross spillovers matter more for addressing the joint-venture/non-integration than the integration/non-integration choice.

Regarding additional controls, only group membership is positively related with the probability of integration, as shown in panel (b) of Table 8.

After estimating Eqs. (1) and (2) separately with the probit and multinomial probit models described above, we estimate them jointly in a CMP framework. Results are reported in Table 9, in which the left-hand side panel deals with the location decision and the right-hand side panel with the ownership decision.

A comparison among Tables 7, 8 and 9 reveals that our results are completely consistent when switching from independent to joint estimates of Eqs. (1) and (2).

Table 9 Location and ownership decisions

	Location decision	Ownership decision	
	domestic vs. foreign	Joint-venture vs. non-integration	Integration vs. non-integration
	(1)	(2)	(3)
TFP_lp_i	0.413***	0.241	0.00248
	(0.115)	(0.207)	(0.150)
$specificinputs_i$	− 0.0481	0.00856	0.514***
	(0.127)	(0.244)	(0.179)
$intangibelinputs_i$	− 0.0315	0.140	0.360**
	(0.128)	(0.256)	(0.176)
$spillovers_i$	− 1.121**	3.648***	1.599***
	(0.441)	(0.905)	(0.620)
age_i	0.00105	0.000319	− 0.000531
	(0.00213)	(0.00445)	(0.00315)
$group_i$	0.168	0.0127	0.710***
	(0.198)	(0.383)	(0.265)
$size_i$	0.702	0.228	− 0.251
	(0.622)	(0.291)	(0.361)
$EBITDA_i$	− 0.0198	0.0188*	0.0162
	(0.0125)	(0.0106)	(0.0130)
Manufacturing activity	Yes	Yes	Yes
Geographical location	Yes	Yes	Yes
Constant	− 1.543***	− 5.015***	− 2.471***
	(0.413)	(0.773)	(0.563)
Rho		0.136	− 0.256***
		(0.105)	(0.0854)
N	562	562	562

Conditional mixed process estimates of Eq. (3), with survey estimation methods. Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

Regarding location, in the left-hand panel of Table 9, foreign sourcing seems to depend on firm-level productivity and relevance of cross spillovers. From our estimates, the coefficient of TFP_lp_i is positive and statistically significant at the 1% level. This means that the probability of foreign sourcing increases in firm-level productivity, which is consistent with our results displayed in Table 7. Moreover, the coefficient of $spillovers_i$ is negative and statistically significant at the 5% level, suggesting that the relevance of cross spillovers encourages domestic over foreign sourcing. Being robust to the inclusion of firm-level controls, this result is line with our probit estimates reported in Table 7.

Table 10 Location decision, robustness check, 3-year lag

	Location decision: domestic vs. foreign
	(1)
TFP_lp_i	0.385***
	(0.108)
$specificinputs_i$	− 0.0603
	(0.127)
$intangibleinputs_i$	− 0.0262
	(0.129)
$spillovers_i$	− 1.086**
	(0.437)
age_i	0.00117
	(0.00216)
$group_i$	0.0966
	(0.196)
$size_i$	0.861
	(0.654)
$EBITDA_i$	− 0.0183
	(0.0117)
Manufacturing activity	Yes
Geographical location	Yes
Constant	− 1.459***
	(0.382)
Pseudo R-squared	0.0633
N	562

Location decision: Probit estimates of Eq. (1). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

Regarding ownership, in the right-hand panel of Table 9, we focus on the joint-venture versus non-integration and integration versus non-integration choices. Notably, the coefficients of *specific inputs*$_i$ and *intangible inputs*$_i$ turn out to be positive and statistically significant drivers in the integration/non-integration trade-off, whereas they play no role in orienting the choice of joint-venture versus non-integration. This result, witness to the importance of relation specificity, is fully consistent with our evidence displayed in Table 8. Lastly, the estimated coefficient of *spillovers*$_i$ is positive and statistically significant no matter the ownership regime compared with the baseline category. Nevertheless, the effect of cross spillovers is more pronounced when dealing with joint-ventures. Indeed, the magnitude of the coefficient is much larger

Table 11 Ownership decision, robustness check, 3-year lag

	Ownership decision	
	(a) Joint-venture vs. non-integration	(b) Integration vs. non-integration
	(1)	(2)
TFP_lp_i	0.364*	0.0750
	(0.204)	(0.156)
$specificinputs_i$	− 0.0516	0.519***
	(0.248)	(0.180)
$intangibleinputs_i$	0.159	0.348**
	(0.256)	(0.176)
$spillovers_i$	3.656***	1.541**
	(0.900)	(0.621)
age_i	− 0.0000435	− 0.000212
	(0.00443)	(0.00317)
$group_i$	− 0.0376	0.697***
	(0.379)	(0.268)
$size_i$	0.190	− 0.440
	(0.289)	(0.659)
$EBITDA_i$	0.0152	0.0178
	(0.00968)	(0.0146)
Manufacturing activity	Yes	Yes
Geographical location	Yes	Yes
Constant	− 5.283***	− 2.634***
	(0.838)	(0.560)
N	562	562

Ownership decision: Multinomial probit estimates of Eq. (2). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

and statistical significance is stronger in column (2) compared with column (3). Put another way, from both Tables 8 and 9, cross spillovers matter more for choosing joint-venture than integration over non-integration.

4.2.4 Robustness Checks

To verify the consistency of our findings, we introduce several robustness checks.

First, we re-run the regressions allowing for a 3-year rather than a 1-year lag in our continuous firm-level variables. This helps addressing the simultaneity bias despite the cross-sectional design of our data (D'Angelo et al. 2016). Results displayed in Tables 10, 11 and 12 are highly consistent with those reported in Tables 7, 8, and 9.

Table 12 Location and ownership decisions, robustness check, 3-year lag

	Location decision	Ownership decision	
	Domestic vs. foreign	Joint-venture vs. non-integration	Integration vs. non-integration
	(1)	(2)	(3)
TFP_lp_i	0.392***	0.337*	0.0745
	(0.110)	(0.205)	(0.156)
$specificinputs_i$	− 0.0581	− 0.0241	0.509***
	(0.127)	(0.244)	(0.180)
$intangibelinputs_i$	− 0.0231	0.150	0.353**
	(0.128)	(0.256)	(0.176)
$spillovers_i$	− 1.090**	3.602***	1.566**
	(0.441)	(0.890)	(0.624)
age_i	0.00106	0.000331	− 0.000530
	(0.00219)	(0.00438)	(0.00320)
$group_i$	0.0877	− 0.00461	0.681**
	(0.199)	(0.374)	(0.271)
$size_i$	0.806	0.206	− 0.400
	(0.663)	(0.290)	(0.621)
$EBITDA_i$	− 0.0181	0.0163*	0.0179
	(0.0120)	(0.00953)	(0.0148)
Manufacturing activity	Yes	Yes	Yes
Geographical location	Yes	Yes	Yes
Constant	− 1.474***	− 5.188***	− 2.633***
	(0.385)	(0.831)	(0.560)
Rho		0.131	− 0.262***
		(0.106)	(0.0862)
N	562	562	562

Location and ownership decisions: conditional mixed process estimates of Eq. (3). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

Second, we consider an alternative measure of productivity (TFP_w_i) computed according to the estimation-based approach due to Wooldridge (2009). Such method overcomes collinearity issues in the input choice, that might depend on the simultaneous selection of materials and labour, as well as assuming no frictions in the labour market (Gal 2013). Results are robust and fully aligned with those summarised in Sect. 4.2.3 (see Tables 13, 14, 15).

Table 13 Location decision, robustness check, TFP *à la* Wooldridge

	Location decision: domestic vs. foreign
	(1)
TFP_w_i	0.411***
	(0.116)
$specificinputs_i$	− 0.0517
	(0.127)
$intangibleinputs_i$	− 0.0322
	(0.129)
$spillovers_i$	− 1.120**
	(0.438)
age_i	0.00114
	(0.00210)
$group_i$	0.182
	(0.194)
$size_i$	0.786
	(0.631)
$EBITDA_i$	− 0.0201
	(0.0123)
Manufacturing activity	Yes
Geographical location	Yes
Constant	− 1.583***
	(0.422)
Pseudo R-squared	0.0648
N	562

Location decision: probit estimates of Eq. (1). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

Table 14 Ownership decision, robustness check, TFP *à la* Wooldridge

	Ownership decision	
	(a) Joint-venture vs. non-integration	(b) Integration vs. non-integration
	(1)	(2)
TFP_lp_i	0.280	− 0.0124
	(0.210)	(0.150)
$specificinputs_i$	− 0.0173	0.527***
	(0.247)	(0.179)
$intangibleinputs_i$	0.150	0.357**
	(0.256)	(0.176)
$spillovers_i$	3.711***	1.583**
	(0.914)	(0.617)
age_i	− 0.0000554	− 0.000170
	(0.00449)	(0.00313)
$group_i$	− 0.0247	0.730***
	(0.386)	(0.260)
$size_i$	0.224	− 0.272
	(0.290)	(0.383)
$EBITDA_i$	0.0178*	0.0163
	(0.0108)	(0.0128)
Manufacturing activity	Yes	Yes
Geographical location	Yes	Yes
Constant	− 5.185***	− 2.434***
	(0.802)	(0.571)
N	562	562

Ownership decision: Multinomial probit estimates of Eq. (2). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

Table 15 Location and ownership decisions, robustness check, TFP *à la* Wooldridge

	Location decision:	Ownership decision	
	Domestic vs. foreign	Joint-venture vs. non-integration	Integration vs. non-integration
	(1)	(2)	(3)
TFP_lp_i	0.412***	0.239	− 0.00601
	(0.116)	(0.208)	(0.151)
$specificinputs_i$	− 0.0473	0.00892	0.515***
	(0.127)	(0.244)	(0.179)
$intangibelinputs_i$	− 0.0311	0.140	0.361**
	(0.128)	(0.256)	(0.176)
$spillovers_i$	− 1.113**	3.653***	1.605***
	(0.440)	(0.905)	(0.620)
age_i	0.00111	0.000354	− 0.000510
	(0.00213)	(0.00444)	(0.00315)
$group_i$	0.176	0.0180	0.713***
	(0.197)	(0.382)	(0.264)
$size_i$	0.727	0.235	− 0.251
	(0.626)	(0.291)	(0.364)
$EBITDA_i$	− 0.0198	0.0190*	0.0165
	(0.0125)	(0.0106)	(0.0131)
Manufacturing activity	Yes	Yes	Yes
Geographical location	Yes	Yes	Yes
Constant	− 1.588***	− 5.038***	− 2.451***
	(0.424)	(0.785)	(0.576)
Rho		0.136	− 0.255***
		(0.105)	(0.0853)
N	562	562	562

Location and ownership decisions: conditional mixed process estimates of Eq. (3). Coefficients and standard errors (in parentheses) are displayed
*p < 0.1, **p < 0.05, ***p < 0.01

5 Concluding Remarks

With this paper, Grossman–Hart–Moore goes to Italy. Drawing on the GHM framework, we provide new evidence on the boundaries of the firm investigating the role of input characteristics, investment spillovers and productivity in ownership and location decisions.

We believe that robust evidence on the above is essential for our understanding of the medium and long-term responses of GVCs to recent changes and emerging trends in the global economy.

Lack of reliable data has so far prevented similar investigations. To fill this gap, we conducted survey interviews between April and July 2020 of a sample of 718 Italian manufacturing firms headquartered in Lombardy, one of the most industrialised European regions. Stratified by size, manufacturing activity, and geographical location and with a response rate of 70%, our sample provides direct information on many aspects of firms' production processes, including input characteristics and investment spillovers that our study emphasizes as relevant in explaining the boundaries of the firm.

Our probit, multinomial probit and conditional mixed process estimations suggest a number of robust regularities. As for ownership, we go beyond the standard taxonomy of Antras and Helpman (2004) and widen the make-or-buy choice as to consider three ownership regimes—non-integration, integration and joint-venture. Our estimates suggest that reliance on specific inputs and intangible inputs fosters integration over non-integration; moreover, firms acknowledging cross spillover effects are more likely to opt for joint-venture than for non-integration. As for location, we stick to the standard taxonomy of Antras and Helpman (2004) and compare domestic versus foreign sourcing. In our sample, the former prevails over the latter in presence of cross spillovers, whereas input characteristics seem to play no role. Lastly, productivity is a major driver of the boundaries of the firm in that productive firms are more likely to source abroad than domestically.

Holding across different econometric models and a number of robustness checks, our results contribute to the PRT and its recent developments. In particular, our contribution to the literature is twofold. On one hand, our detailed survey data provide new evidence on the predictions of the PRT. Put another way, some results from our econometric analysis confirm so far unexplored theoretical propositions from the GHM framework. On the other hand, taking advantage of our rich database, we unveil regularities on which the PRT is silent. This suggests further investigation and may open new developments in the GHM framework.

Our empirical findings leave room for a few policy-making and corporate practice remarks. In light of the relevant role played by productivity in firms' international engagement decisions, its enhancement might be crucial, should internationalisation be a corporate objective. As far as the ownership decision is concerned, our results illustrate integration is highly positively correlated to firm's reliance on specific and intangible inputs. Hence, firms might benefit from a proper assessment of their production processes to steer their ownership decisions on sourcing.

Nevertheless, we acknowledge limitations to our analysis. First, due to the survey design, our data have a cross-sectional nature. Unfortunately, this prevents a proper

causal analysis and poses endogeneity concerns. A second wave of interviews to the same sample could eventually mitigate this issue. Second, external validity can be a concern. Albeit our sample is highly representative of the Lombard population of firms, it provides evidence on a single region within a single country in a single year. To improve on external validity, our survey could be extended as to collect cross-region and/or cross-country firm-level data. Third, there is a measurement issue. Survey interviews provide us with detailed information on the variables of interest, otherwise not available. However, this comes at the cost of relying on firms' self-reported measures of inputs characteristics and investment spillovers. Integrating self-reported with objective firm-level measures, if available, would provide an appropriate robustness check. Lastly, data constraints prevent us from relying on a continuous rather than discrete categorisation of ownership and location decisions. Developing the survey design as to collect granular information on the exact percentage of ownership of the foreign affiliates and the relative share of different sourcing strategies in case of multiple strategies would allow for a better understanding of the boundaries of the firm.

Improving on these limitations is a suggestion for future research.

Author contributions PDeP: methodology, formal analysis, writing—review and editing. VG: conceptualisation, methodology, formal analysis, writing—original draft, writing—review and editing. PN: conceptualisation, writing—review and editing.

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Data availability The work elaborates survey interview data and Orbis data. Survey interview data were obtained under a confidentiality agreement and cannot be shared with third party. Orbis data are covered by a proprietary agreement between Bureau van Dijk and Università degli Studi di Milano-Bicocca.

Code availability Code is available from the authors upon request.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethics approval It does not apply.

Informed consent The work elaborates survey interview data. Participants to the survey interviews were informed that the data were collected for scientific purposes and consented to their use in scientific publications. All data presented in the work are anonymised.

References

Alfaro L, Antràs P, Chor D, Conconi P (2019) Internalizing global value chains: a firm-level analysis. J Polit Econ 127:509–559

Annen K (2009) Efficiency out of disorder: contested ownership in incomplete contracts. RAND J Econ 40:597–610

Antras P (2003) Firms, contracts, and trade structure. Quart J Econ 118:1375–1418

Antras P (2014) Grossman-Hart (1986) goes global: incomplete contracts, property rights, and the international organization of production. J Law Econ Organ 30:118–175

Antras P (2020) De-globalisation? Global value chains in the post-COVID-19 age. NBER working papers: 28115

Antras P, Chor D (2022) Global value chains. Handbook of international economics, vol 5. Elsevier, New York

Antras P, de Gortari A (2020) On the geography of global value chains. Econometrica 84:1553–1598

Antràs P, Helpman E (2008) Contractual frictions and global sourcing. In: Helpman E, Verdier T, Marin D (eds) The organization of firms in a global economy. Harvard University Press, Cambridge, MA, pp 9–54

Antras P, Helpman E (2004) Global sourcing. J Polit Econ 112:552–580

Arora A, Fosfuri A (2000) Wholly owned subsidiary versus technology licensing in the worldwide chemical industry. J Int Bus Stud 31:555–572

ASR (2021) Annuario statistico regionale Lombardia. Arti Grafiche Colombo, Milan

Assolombarda (2019) The performance of European firms: a benchmark analysis #10/2019. https://www.assolombarda.it/centro-studi/the-performances-of-european-firms-a-benchmark-analysis-report-2019. Accessed 01 Mar 2023

Bai C, Tao Z, Wu C (2004) Revenue sharing and control rights in team production: theories and evidence from joint ventures. RAND J Econ 35:277–305

Baldwin R, Venables AJ (2013) Spiders and snakes: offshoring and agglomeration in the global economy. J Int Econ 90:245–254

Bel R (2013) Access, veto, and ownership in the theory of the firm. J Law Econ Organ 29:871–897

Bernasconi M, Galetti S, Gattai V, Natale P (2022) Contract incompleteness and the boundaries of the firm in times of COVID-19. J Ind Compet Trade 22:371–409

Cai H (2003) A theory of joint asset ownership. RAND J Econ 34:63–77

Chiu YS (1998) Noncooperative bargaining, hostages, and optimal asset ownership. Am Econ Rev 88:882–901

Corcos G, Irac DM, Mion G, Verdier T (2013) The determinants of intrafirm trade: evidence from French firms. Rev Econ Stat 95:825–838

D'Angelo A, Majocchi A, Buck T (2016) External managers, family ownership and the scope of SME internationaliation. J World Bus 51:534–547

de Meza D, Lockwood B (1998) Does asset ownership always motivate managers? Outside options and property rights theory of the firm. Quart J Econ 113:361–386

De Ponti P, Gattai V (2022) Family firms, productivity and input specificity: an empirical assessment of Italian firms' sourcing. Appl Econ. https://doi.org/10.1080/00036846.2022.2141458

Defever F, Toubal F (2013) Productivity, relationship-specific inputs and the sourcing modes of multinationals. J Econ Behav Organ 94:345–357

Desai MA, Foley CF, Hines JR (2002) The costs of shared ownership: evidence from international joint ventures. SSRN Electron J. https://doi.org/10.2139/ssrn.324123

Eurostat Homepage (2023) https://ec.europa.eu/eurostat/web/main/data/database. Accessed 28 Mar 2023

Federico S (2010) Outsourcing versus integration at home or abroad and firm heterogeneity. Empirica 37(1):47–63

Filatotchev I, Strange R, Piesse J, Lien Y (2007) FDI by firms from newly industrialised economies in emerging markets: Corporate governance, entry mode and location. J Int Bus Stud 38:556–572

Gal PN (2013) Measuring total factor productivity at the firm level using OECD-ORBIS. OECD Economics Department working papers: 1049

Gans JS (2005) Markets for ownership. RAND J Econ 36:433–445

Gattai V (2006) From the theory of the firm to FDI and internalisation: a survey. Giornale Degli Econ Ann Econ 65:225–261

Gattai V, Natale P (2013) What makes a joint venture: micro-evidence from Sino-Italian contracts. Rev Financ Econ 22:194–205
Gattai V, Natale P (2016) Investment spillovers and the allocation of property rights. Econ Lett 145:109–113
Gattai V, Natale P (2017) A new Cinderella story: joint ventures and the property rights theory of the firm. J Econ Surv 31:281–302
Gattai V, Trovato V (2016) Estimating sourcing premia using Italian regional data. J Econ Anal Policy 16:1029–1067
Gibbons R (2005) Four formal(izable) theories of the firm? BE J Econ Behav Organ 58:200–245
Giovannetti G, Ricchiuti G, Velucchi M (2013) Location, internationalization and performance of firms in Italy: a multilevel approach. Appl Econ 45:2665–2673
Giovannetti G, Marvasi E, Sanfilippo M (2015) Supply chains and the internationalization of small firms. Small Bus Econ 44:845–865
Grossman S, Hart O (1986) The costs and benefits of ownership: a theory of vertical and lateral integration. J Polit Econ 94:691–719
Grossman GM, Helpman E (2002) Integration versus outsourcing in industry equilibrium. Quart J Econ 117:85–120
Grossman GM, Helpman E (2003) Outsourcing versus FDI in industry equilibrium. J Eur Econ Assoc 1:317–327
Grossman GM, Helpman E (2005) Outsourcing in a global economy. Rev Econ Stud 72:135–159
Hair JF, Black WC, Babin BJ, Anderson RE (2010) Confirmatory factor analysis. Multivariate data analysis, 7th edn. Pearson Education Inc., Upper Saddle River, pp 600–638
Halonen M (2002) Reputation and the allocation of ownership. Econ J 112:539–558
Hart O (1995) Firms contracts and financial structure. Oxford University Press, Oxford
Hart O (2009) Hold-up, asset ownership, and reference points. Quart J Econ 124:267–300
Hart O, Moore J (1990) Property rights and the nature of the firm. J Polit Econ 98:1119–1158
Iammarino S, Rodriguez-Pose A, Storper M (2019) Regional inequality in Europe: evidence, theory and policy implications. J Econ Geogr 19:273–298
Ito B, Tomiura E, Wakasugi R (2011) Offshore outsourcing and productivity: evidence from Japanese firm-level data disaggregated by tasks. Rev Int Econ 19:555–567
Javorcik B (2020) Global supply chains will not be the same in the post COVID-19 world. In: Baldwin R, Evenet S (eds) Covid 19 and trade policy: why turning inward won't work. CEPR Press, London
Kano L, Tsang EW, Yeung HWC (2020) Global value chains: a review of the multi-disciplinary literature. J Int Bus Stud 51:1–46
Kohler WK, Smolka M (2011) Sourcing premia with incomplete contracts: theory and evidence. BE J Econ Anal Policy Contrib Econ Anal Policy 11:1–37
Kohler WK, Smolka M (2021) Productivity and firm boundaries. Eur Econ Rev 135:103724
Levinsohn J, Petrin A (2003) Estimating production functions using inputs to control for unobservables. Rev Econ Stud 70:317–342
Mazzanti M, Montresor S, Pini P (2009) What drives (or hampers) outsourcing? Evidence for a local production system in Emilia Romagna. Ind Innov 16:331–365
Mazzanti M, Montresor S, Pini P (2011) Outsourcing, delocalization and firm organization: transaction costs versus industrial relations in a local production system of Emilia Romagna. Entrep Reg Dev 23:419–447
Manzini P, Mariotti M (2004) Going alone together: joint outside options in bilateral negotiations. Econ J 114:943–960
Maskin E, Tirole J (1999) Two remarks on the property-rights literature. Rev Econ Stud 66:139–149
Matouschek N (2004) Ex-post inefficiencies in a property rights theory of the firm. J Law Econ Organ 20:125–147
McLaren J (2000) "Globalization" and vertical structure. Am Econ Rev 90:1239–1254
Melitz MJ (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71:1695–1725
Muller D, Schmitz PW (2014) Transaction costs and the property rights approach to the theory of the firm. CEPR Discussion Papers: 10207
Noldeke G, Schmidt KM (1998) Sequential investments and options to own. RAND J Econ 29:633–653
Ottaviano GIP, Turrini A (2007) Distance and foreign direct investment when contracts are incomplete. J Eur Econ Assoc 5:796–822

Pavitt K (1984) Sectoral patterns of technical change: Towards a taxonomy and a theory. Res Policy 13:343–373
Raff H, Ryan M, Stahler F (2012) Firm productivity and the foreign-market entry decision. J Econ Manag Strategy 21:849–871
Rajan RG, Zingales L (1998) Power in the theory of the firm. Quart J Econ 113:361–386
Roodman D (2011) Fitting fully observed recursive mixed-process models with CMP. Stand Genom Sci 11:159–206
Roodman D (2022) CMP: Stata module to implement conditional (recursive) mixed process estimator. Statistical Software Components S456882, Boston College Department of Economics
Rosenkranz S, Schmitz PW (1999) Know-how disclosure and incomplete contracts. Econ Lett 63:181–185
Rosenkranz S, Schmitz PW (2003) Optimal allocation of ownership rights in dynamic R&D alliances. Games Econ Behav 43:153–173
Rosenkranz S, Schmitz PW (2004) Joint ownership and incomplete contracts: the case of perfectly substitutable investments. Schmalenbach Bus Rev 56:72–89
Salaniè B (1997) The economics of contracts: a primer translation. MIT Press, Cambridge
Schmitz PW (2008) Joint ownership and the hold-up problem under asymmetric information. Econ Lett 99:577–580
Schmitz PW (2013) Bargaining position, bargaining power, and the property rights approach. Econ Lett 119:28–31
Schwartz A (1992) Legal contract theories and incomplete contracts. In: Werin L, Wijkander H (eds) Contract economics. Blackwell Publisher, Oxford, pp 76–108
Spencer BJ (2005) International outsourcing and incomplete contracts. Can J Econ 38:1107–1135
Tirole J (1999) Incomplete contracts: where do we stand? Econometrica 67:741–781
Tomiura E (2005) Foreign outsourcing and firm-level characteristics: evidence from Japanese manufacturers. J Jpn Int Econ 19:255–271
Tomiura E (2007a) Foreign outsourcing, exporting, and FDI: a productivity comparison at the firm level. J Int Econ 72:113–127
Tomiura E (2007b) Global sourcing, technology, and factor intensity: firm-level relationships. RIETI Discussion paper series: 24
Tomiura E (2009) Foreign versus domestic outsourcing: Firm-level evidence on the role of technology. Int Rev Econ Finance 18:219–226
von Lilienfeld-Toal U (2003) Asset ownership and the threat to sell. J Econ (Zeitschrift Fur Nationalokonomie) 80:1–25
Wang S, Zhu T (2005) Control allocation, revenue sharing, and joint ownership. Int Econ Rev 46:895–915
Wooldridge JM (2009) On estimating firm-level production functions using proxy variables to control for unobservables. Econ Lett 104:112–114