Supplier-buyer relationships in global value chains

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Abstract

Relational contracting is an important feature of global value chains because it can facilitate investment into and sharing of intangible assets between buyers and suppliers. Existing measurements focus on several key implications of relational contracting, such as long-lived buyer-supplier relationships and the trading of complex products. But there is little direct evidence on intangible investments in buyer-supplier relationships, their economic determinants and effect on firm performance. This paper uses the novel Business Relations Survey, covering the key buyers and suppliers of 1,500 manufacturing firms in three countries, to measure relational links. We define a link as relational if the supplier produces a product specific to the buyer or has modified the product or process at the buyer's request. Vertically integrated links are identified based on ownership information. We find that only a third of links are market based, while more than half are relational and 17% are vertically integrated. Relational links are more likely to form between more productive firms, between firms in different countries, especially when the buyer is outside the EU, and when the product is complex. Suppliers with many relational links expand their sales and improve their total factor productivity faster. Our results are relevant for the extent and heterogeneity of shock propagation and also for policies which aim at promoting firms integration into global value chains.

keywords: SMEs, global value chain, supplier-buyer relationship, supplier survey, relationship strength, innovation

JEL-codes: C83, D22, D23

DRAFT VERSION: June 2021. See latest version.

1. Introduction

Global value chains (GVCs) are key features of modern international production (Haltiwanger et al., 2013; Neumark et al., 2011)[1] and mapping the governance of buyer-supplier links in these production networks is essential to understand their operation (Gereffi et al., 2005; Acemoglu et al., 2010; Nunn and Trefler, 2013; Schmitt and Van Biesebroeck, 2020). A key institutional feature of GVCs is the relational nature of many of the links between independent firms, which facilitate the exchange of customized products by promoting relationship-specific investments even when contracts are incomplete (Baker et al., 2002; Antras, 2020). The relational and long-term nature of contracts can significantly affect many key economic outcomes. At the firm-level, by facilitating relationship-specific investments and knowledge flows, such links can result in growth and technology upgrading. At a more macroeconomic level, relational governance of buyer-supplier links help create trade and technology flows and promote larger specialization. At the same time, they also affect the way economies react to economic shocks, and may contribute to an increase in uncertainty (Martin et al., 2018).

Even though the significance of relational contracting has been established in the literature, its prevalence, determinants and effects have mostly been studied via case studies of specific industries in specific countries (e.g. Gereffi, 1999; Sturgeon et al., 2008; Bamber and Gereffi, 2013; Macchiavello et al., 2015; Macchiavello and Morjaria, 2021). Our paper contributes to this literature by providing evidence based on a new Business Relations Survey of 1,500 manufacturing firms in Hungary, Romania and Slovakia. The detailed questions in the survey not only allow us to identify the most important buyers for each supplier—both domestic and abroad—, but also to understand the type and extent of the interaction between each of supplier-buyer pair. We propose a novel way of identifying relational links based on survey information on relationship-specific investments—proxied by innovation conducted by the supplier specifically for the buyer–, and the specificity of the product. We match our survey with Orbis, an international company database, and identify vertically integrated links based on the detailed ownership information registered in Orbis.

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**The authors gratefully acknowledge funding from the European Research Council (ERC Starting Grant agreement number 313164) and the European Union's Horizon 2020 research and innovation programme (Microprod project under grant agreement No 822390). We thank Kinga Ritter, Imola Csóka, Gergely Kiss, Krisztián Fekete and András Vereckei for excellent research assistance. The views expressed in this paper are those of the authors and do not necessary reflect the official view of the National Bank of Hungary.

[1] Lund et al. (2019), for example, identifies 23 GVCs and find that they account for 69 percent of global output and 96 percent of international trade.

The detailed firm- and relationship-level information we collected in the survey and matched from company financials allow us to investigate the factors affecting GVC governance. Our primary interest lies in buyer and supplier productivity, buyer country and the contractibility and complexity of the product. Finally, we study how the type of links is associated with subsequent firm performance in terms of sales and productivity growth.

The Business Relations Survey was conducted in 2016 and early 2017 and we asked firms to describe their operation and identify their most important suppliers and buyers and characterize their relationship with them. We use the information provided by the suppliers to classify the governance mode of their relationships with each of their buyers. We consider the relationship governance of a supplier-buyer link *relational* if the supplier considered the product specific to the buyer or said that it modified the product and production process specifically at the buyer's request. By linking the buyers and suppliers to firm-level information from Orbis, we can identify if the two firms are in the same business group, in which case we consider the link *vertically integrated*. Other links are considered as having *market-based* governance mode.[2]

Our approach complements existing approaches to quantify relationship-specificity of products. Nunn (2007) builds on the classification by Rauch (1999), who manually classifies products based on the degree of their differentiation to identify products which need relationship specific inputs. Our method goes beyond the physical features of products by observing actual relationship-specific innovation and also being able to identify the heterogeneity across firms within industries and product categories. More similar to our approach is Martin et al. (2018), who classify products based on the typical length of firm-to-firm relationships using administrative trade data from France.[3] As we show below, both of these measures (product contractibility and relationship length) are correlated with relational links, but there is substantial variation left to explain. Therefore observing actual cooperation is more closely linked to the theoretical concept of relational contracting.[4]

Importantly, with being able to distinguish between within-business group and arms-length relational links, we can also study the decision between these solutions for the

[2]These categories are based on Gereffi et al. (2005), but that paper also distinguishes between modular and captive relationships. Our vertically integrated mode is equivalent with the hierarchy mode in that structure.

[3]Administrative data on firm-to-firm links from VAT filings have also been used to study related questions, including the pass-through of trade shocks via the firm-to-firm network (Tintelnot et al., 2018) or the network sources of firm heterogeneity (Bernard et al., 2019).

[4]A few recent papers have used survey data on firm-level transactions to study such questions as financial constraints and participation in GVCs (Minetti et al., 2018), knowledge spillovers from FDI (Newman et al., forthcoming; Javorcik, 2008) and inter-firm relationships in automobile industry (Schmitt and Van Biesebroeck, 2020).

contractual problem the parties face. This contributes to the literature on global sourcing (Alfaro et al., 2019, 2018; Johnson and Moxnes, 2019) by providing more information about the types of arms-length links. Our first finding is that only 33% of the links we observe has market-based relationship governance mode, while 50% has relational and 17% vertically integrated modes. The share of market based links in terms of transaction values is even lower, with 24.5%. This shows that, indeed, relationship-specific products and investments are key in GVCs.

We also investigate what factors are related to the governance mode choice by running regressions at link-level with governance mode as the dependent variable. First, we study productivity sorting between the modes. We find that both buyer and supplier productivity are positively related to choosing a relational mode instead of market based one. This is in line with increasing returns and a fixed cost of operating relational contracts but can also be explained by more productive buyers buying more customized products. A governance mode is also more likely to be relational if the two firms are in different countries and especially if the buyer is outside the EU.[5] This is in line with international transactions and especially transactions spanning through the EU border raising more contractual problems. Finally, in line with Nunn (2007), we find that more contract-intensive products are more often traded in relational links. In contrast, we do not find evidence for more complex products (measured with the Hausmann et al., 2014, index) being traded more frequently in links with a relational mode.

When investigating the choice between vertically integrated and relational links, we do not find a clear ordering between the two. While vertical integration is more frequent when the relationship is international, it is less likely when the product is more contract-intensive and when the buyer is less productive relative to the supplier. This last observation reflects the importance of the suppliers specific investment for such products.

Following on, we investigate whether suppliers with more relational and vertically integrated links perform better subsequently. Both types of links can provide efficient channels for vertical knowledge spillover and facilitate relationship-specific investments. In line with this hypothesis, we find that having more links with relational mode is positively associated with subsequent sales and TFP growth, even when controlling for a number of firm-level attributes typically used in firm growth regressions.

The firm-level research on the governance of contracts in GVCs is of high policy interest. One reason is that understanding the extent to which relationships are relational will help predict how firms will adjust to economic shocks, such as an increase in uncertainty (Martin et al., 2018). But it can also inform policies which aim at promoting firms'

[5]Note that the suppliers are all in the EU.

integration into GVCs. If the firm-level benefits and outcomes of such integration depend on the relational nature of the newly formed link, policies may aim at promoting links which are likely to be governed by specific mechanisms, for examples ones that are more likely to be relational rather than market-based.

The structure of the paper is the following. First, in Section 2, we discuss the determinants of governance mode choice that motivates our empirical work. Then, we present the Business Relations Survey in Section 3, briefly introducing the methodology, key variables, and offer some basic descriptive statistics on some key variables of interest. Using the survey, we can now define and describe our three relationship governance modes in Section 4. To understand choice, we look at which firms choose relational and vertically integrated modes in Section 5. Conditioning on key selection variables, we finally look at how the buyer portfolio in terms of modes is correlated with growth and TFP improvement in Section 6. The conclusion compares our findings with existing evidence on relationships in Section 7.

2. Determinants of governance mode choice

In this section we describe the theoretical background which underlies our definition and the key factors we investigate. Given that the suppliers (reporters) we investigate are from countries which are similar in terms of their institutions and factor endowments, we focus on the role of firm and buyer-country characteristics.

Definition

Our starting point is Antras (2020), who describes the emergence of "relational supply chains". These involve the exchange of customized products, high matching costs, relationship-specific investments, flow of goods, technology and credit, and they are governed by incomplete contractual arrangements. We build on this definition when classifying the links based on our survey. One feature we measure and take into account in our definition is whether the product is customized. The second component of our definition is whether the supplier conducted relationship-specific investments; this is captured by process and product innovation which had been implemented in order to operate the relationship. We argue that this measure captures the essence of the relational governance mode better than existing proxies based on product characteristics or relationship length.

Non-market links

The global sourcing literature has primarily focused on the distinctions between transactions between arms-length and vertically integrated firms. In these setups, arms-length firms were assumed to operate essentially with a market-based mode. As vertical inte-

gration typically has similar functions to relational contracts—to facilitate cooperation and therefore relationship-specific investments even under incomplete contracting—the drivers identified in the global sourcing decision are mostly also relevant for the decision between market and relational governance modes.

Thanks to the combination of fixed costs and economies of scale, productivity sorting have been demonstrated to have a substantial effect in firm-level internalization choices in general and global sourcing decisions in particular (Antras and Helpman, 2004; Halpern et al., 2015; Antras et al., 2017). If organizing relational and vertically integrated sourcing requires higher fixed costs (similarly to the FDI decision in Helpman et al., 2004), we can expect positive productivity sorting into these arrangements. Furthermore—to the extent that multinationals' and other productive firms' technology edge results from distinctive products or specialized technologies (see e.g. Syverson, 2011), innovation (Bøler et al., 2015) and higher quality (Kugler and Verhoogen, 2009; Blaum et al., 2018)—customized inputs and relationship-specific investments by suppliers may have larger marginal returns and hence, provide stronger incentives for relational contracts. These considerations motivate us to investigate the role of productivity sorting in these cases.

Two key factors studied in the global sourcing decision are the rule of law and trade costs. Global value chains are likely to be especially sensitive to these costs, making sourcing less likely from countries with weaker institutions and higher fixed cost. However, a key function of vertical integration and relational contracting is exactly to mitigate these consequences. Therefore, conditional on sourcing from a country, these governance mechanisms may be more prevalent when the rule of law is weaker or trade costs are higher. We investigate this relationship with two variables. First, trade costs and rule-of-law issues are likely to be much smaller in domestic than in international transactions. Second, we distinguish within-EU and extra-EU trade. Trade costs are likely to be smaller within regional trade agreements thanks to low barriers to trade (Antras, 2020). Common policies within the EU may also enhance the effectiveness of legal proceedings.

The GVC literature has also identified product attributes as a determinant of governance choice. Given the contracting problems in GVCs, Nunn (2007) has shown that products which require more contract-intensive inputs are more likely be traded within vertically integrated relationships. In addition, more complex goods may allow for more customization and require more intensive communication and knowledge transfer between the two firms, making it more likely that they are traded via non-market governance mechanisms. We proxy this product feature based on the Hausmann et al. (2014) index of product complexity.

Relational vs. Vertical integration

The forces mentioned so far are likely to have similar effects on vertical integration and relational arrangements. There are some differences though: vertical integration, for example, may be more efficient in substituting for weak rule of law than relational contracts.

According to the property rights theory of the firm, the most important drawback of vertical integration is that the acquired supplier will commit less resources into relationship-specific investments compared to arms-length contracts. This argument suggests that relational contracting will be more likely when the suppliers' specific investment is more important. Empirically, we proxy the importance of suppliers' relationship-specific investments with two variables. First, these investments may be more important when the product is more customized, which is proxied by the Nunn (2007) index of contractibility. Second, a higher supplier productivity – relative to that of the buyer – may also suggest that the suppliers' investments are more important.

Another feature documented is that links tend to become larger in value and potentially more likely to have relational governance over time (Macchiavello et al., 2015; Brugués, 2020). We include the age of the relationship – for how many years the seller has been in contact with the buyer – into our regressions to control for this effect[6].

Relational links and performance

GVC participation in general has been shown to be enhance firm-level productivity (see e.g. Amiti and Konings, 2007; Goldberg et al., 2010; De Loecker et al., 2016). Less evidence is available, however, about the relationship between the way firm participate in GVCs and their performance.

In terms of theoretical mechanisms, there may be opposing forces at play. One the one hand, by facilitating relationship-specific investments, relational links will generate more surplus, thereby generating resources for the firm to grow faster and invest into productivity improvements. The knowledge and financial flows characteristic of relational contracts can also help firms to upgrade their technology and potentially acquire other demanding buyers. On the other hand, the non-market prices in relational links can be diverted by the larger partner and thus, reduce the surplus acquired by a smaller supplier (Antras, 2020), even though there is empirical evidence that in some situations the relational buyer will pay higher prices for similar products (Grossi, 2020).

[6]A few papers model relational contracts as repeated games, which emphasize the role of long-term orientation (Kukharskyy, 2016) and the possibility to switch partners (Defever et al., 2016).

3. Business Relations Survey

This section describes the Business Relations Survey we used to classify and model supplier-buyer relationships. Our main aim with this survey was to complement the existing literature with learning about the interactions taking place within firm-to-firm links in a relatively large sample. Compared to administrative datasets on firm-to-firm trade, our survey produces more information about the interactions, and also, unlike most such data sources, includes both domestic and international transactions. Compared to other surveys, our dataset has a greater external validity, as we cover a large part of the economy from three countries.

The survey was conducted in Hungary, Slovakia and Romania. We conducted a multi-country survey for two main reasons: first, partly to strengthen the external validity of the analysis, second, to increase the sample size. As the typical response rate for such surveys is of the magnitude of 30 percent, it was unlikely that we could collect a large enough sample from a single small-sized country. When choosing the group of countries, an important decision was whether to conduct the survey in relatively similar or rather different countries. We opted to choose similar countries to maximize the power of the statistical analysis. Our choice of the countries was mainly motivated by the fact that participation in GVCs is prevalent in Central and Eastern Europe (OECD, 2017). Many multinational firms have manufacturing affiliates in these countries that assemble parts or make consumer products from white goods to cars. Many local firms produce parts used in assembly lines all over Europe and beyond. These countries are fully integrated not only into EU value chains but are also part of many global operations.

In particular, the survey targeted manufacturing firms with at least 10 employees in 2015 in a variety of industries. Within industries, it was aimed to be representative in terms of size category and foreign vs domestic ownership. Due to the small sample size in some industries, it may eventually be a bit biased to domestic or foreign firms. An explicit goal was to combine quantitative information on partners (such as the number of buyers, share of key buyers) and qualitative information on co-operation, such as buyer specific investments. We also aimed at being able to link the survey information to the financial data from Orbis in order to include a variety of firm specific measures such as ownership structures, growth rates and TFP. To make sure that we can link the survey with Orbis, we formulated the sampling frame based on that database. After dropping non-producers, the final sample consists of 1,501 firms (for details, see B.12 in the Appendix A.)

The survey consists of two parts. The first is short and asks questions about the respondent firm itself, such as its main activity, owner's nationality, number of employees and the total number of buyers. The second part is about buyers and suppliers. First, we asked some basic questions about all partners and asked a set of detailed questions

only about a limited set of *key partners*, defined as having at least 10 percent share in sales/material costs in 2015.[7]

In terms of practical details, we used a computer-assisted personal interview, assuming that this provides a good balance between depth and response rate. We trained surveyors, ran pilots and also conducted meetings with company managers to make sure that questions were clear and comparable across countries. The survey was carried out in 2016-2017 over several months.

A key task after conducting the survey was entity resolution of respondents' buyers. Some respondents supplied the tax identifier of their partners but in most cases they only reported the buyers' name. We used internet search and the batch search function in Orbis, to identify the Orbis id of these firms. All matches were checked afterwards by hand. We were able to identify the buyers in 72.5% of the 3,469 supplier-buyers links. Thus, when we use detailed financial information, we use this smaller sample.

Another similar problem was coding the main product exchanged between the two firms. We asked for a verbal description of the product from the reporter firm, and mapped these descriptions to Harmonized System (HS) categories based on HS names and internet search[8]. This procedure allowed us to merge the main traded product codes in a supplier-buyer link with product-specific categories, such as the Nunn (2007) and Hausmann et al. (2014) measures. We managed to link 87% of observations to these measures, and the rest were imputed with the industry mean.

We used financial and employment variables from Orbis[9] for both the respondents and the buyers. As firms reported regarding their 2015 activities we matched financial information for the year 2015. A key variable of relevance is Total Factor Productivity (TFP), which is calculated using country- industry level coefficients for K and L estimates from the full Orbis dataset based on coefficients derived from CompNet, a collaboration project of EU central banks[10].

The resulting data is a link-level ("dyadic") dataset that collects information from three sources. The first is about the producers - respondents we surveyed, the second is about the buyers they reported, while the third is about supplier-buyer links, observed only for each respondent's key partners. This will be the unit of observation in our link-level

[7]More details about the survey are presented in Appendix A. Please see the survey instrument here.

[8]Descriptions included "Steel structural elements", "Drill bits, steel dowels", "Creams, cosmetics, shower gels, make-up removers, etc." We took these texts along with information on the main industry of the firm to find a HS match.

[9]For information on Orbis, see https://www.bvdinfo.com/en-gb/our-products/data/international/orbis.

[10]For details on the project, see https://www.comp-net.org/. These coefficients were calculated using the Wooldridge (2009) method. Coefficients used are available on request.

regressions. Table 1 summarizes key information about these types of observations.

Table 1: Types of information in the dataset

	N	source	key variables (examples)
Suppliers (respondents)	1,501	Survey, Orbis	Ownership, industry, sales, TFP, N. of buyers
Buyers	2,831	Survey, Orbis	Country, industry cat, sales, TFP
Supplier-buyer link	3,469	Survey	Length, share in respondent sale, innovation, buyer specificity, main product

3.1. Descriptive statistics

In this subsection we present some key descriptive information on the dataset.

Let us start presenting information on the respondents in the survey. The number of surveyed firms is 550 for Hungary, 570 for Romania, and 381 in Slovakia. Most of the firms from the sample are small and medium-sized enterprises (SMEs), only 8.3% firms have more than 250 employees. The average firm has 105 employees, with firms in Slovakia being almost 50% larger on average than their counterparts in Hungary and Romania. The detailed distribution of firms by country is presented in Table B.11 in the Appendix.

Figure 1 shows the breakdown by 2-digit manufacturing sectors. Our focus was on heavy industries, and machinery, components, equipment makers in particular.

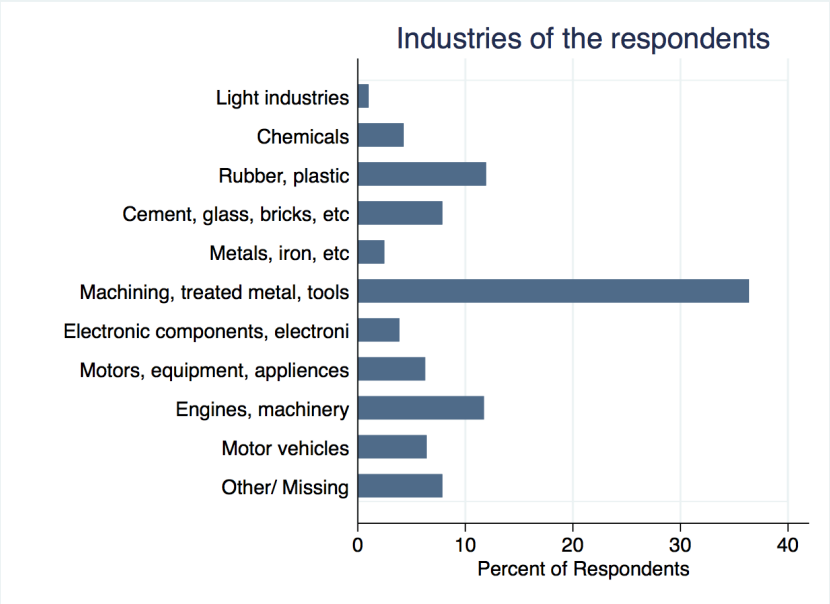
As we noted earlier, respondents were asked to report their key buyers, and on average, respondents reported 2.3 of buyers. Table 2 shows more detailed information: 28.2% of firms named just one buyer, three partners named was the most frequent case, and 3.6% of firms named 5 or more buyers.

Table 2: Number of key buyers

	Share(%)
1	28.2
2	27.8
3	31.4
4	9.0
5+	3.6

Respondent sample, N=1,501. Number of key buyers in the survey.

Figure 1: Distribution of survey respondents by industry

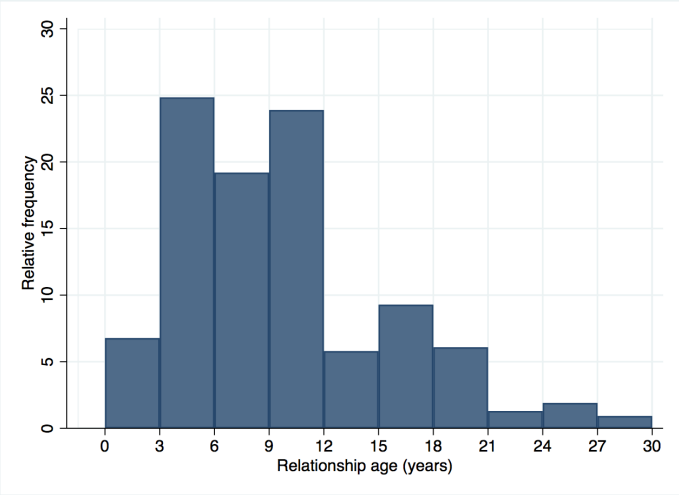


Respondent sample, N=1501. Percent values

Most of these buyers are in manufacturing but a quarter of them are in commerce, while 14.9% are in services (Table B.15 in the Appendix). In terms of location, over 74.6% of buyers are domestic, 22.4% are in the European Union and just 3% are outside of the EU.

Regarding links, we can observe that the age of relationships with key buyers is rather long. As Figure 2 documents, about 70 percent of all relationships had been established 3-15 years before the survey was conducted and only 7 percent were only 1 or 2 years old. Relations with key trade partners, therefore, tend to be sticky and last for a long time.

Figure 2: Age of buyer-seller relationship



Respondent-buyer dyads, N=3469. The age of relationship is measured in years.

4. Quantifying relational governance

In this section, we describe our measurement of the GVC relationship governance mode, and its relation to key firm-level variables.

4.1. Defining relational transactions

We classify supplier-buyer links into three governance modes.

In **vertical integration**, the seller and buyer are in the same business group. For those who are not in the same group, we define the governance mode **relational** when the seller (the respondent) considered the product specific to the buyer's needs, or they modified products or processes at this buyer's request. **Market based** governance mode constitute the rest, neither carried out between vertically integrated firms, nor involving buyer specific effort.

To be more specific, the vertically integrated relationship governance mode is defined on the basis of the seller and the buyer being in the same *business group* according to the survey. This may be because the respondent owns the buyer, the buyer owns the respondent or they have the same ultimate owner. Such cases make up 17% of all relationships.

The link is considered relational if the two firms are not in the same business group and at least one of the following three is true: a) a *partner-specific product* is exchanged,

proxied by the respondent's answer to the question "Considering the main product sold to the buyer, it is impossible/hard to sell to someone else this product"; the respondent reported *partner-specific innovation* by answering either that b) "The company had to modify its product or the production process *recently* (in the past two years) to satisfy the needs of this buyer" or c) "The company had to modify its product or the production process *at the start* of the relationship to satisfy the needs of this buyer".[11] All other links are considered market-based.[12]

Let us describe the prevalence of the different governance modes (Table 3) for the 3,469 key supplier-buyer links in our sample. We found that 50.6% of these links have a relational governance modes, 17% is vertically integrated, and 32.6% is market-based. This means that when we look at the key buyers of our respondents, two-thirds of these relationship governance modes involve a stronger relationship than what is involved in market based link. Furthermore, these non-market based links tend to carry more value - especially between vertically integrated companies. Taking into account the dollar value of annual sales, market based relationships account for only 24.5% of the observed volume.[13]

Table 3: Share of governance modes (%)

	Count	Values
Market	32.4	24.5
Relational	50.6	30.9
Vertical	17.0	44.6
Total	100	100

This table shows the number (in terms of supplier-buyer links) and value share of the three governance modes among key buyers of the respondents in the Survey, N=3,469. Values are calculated as the sums of each key buyer's share × respondent turnover in 2015 by relation type, measured in 1,000 EURs.

Do suppliers mix different types of relationship governance modes when they have multiple key buyers? To answer this, let us consider firms with at least 2 key buyers, and

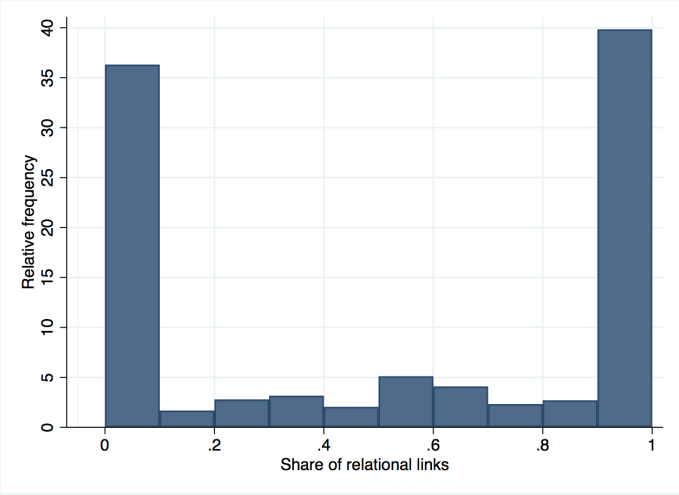
[11]Note that these latter questions and definitions come from the Community Innovation Survey and the EFIGE survey.

[12]Considering relational links, 80.6% of them involved buyer-specific products, while 62% involved relationship-specific innovation. The two variables clearly correlate strongly, and 42% of relational links were characterized both by specific products and innovation.

[13]We shall note that this reflects important partners only and may be biased. It may be upward biased: as we do not observe relatively smaller sales to less important buyers, and these transactions are more likely to be market based. But it may also be downward biased: our sample does not include the largest companies like Audi Hungaria, that are mostly likely to have relational and vertically integrated transactions.

look at the share of buyers with relational modes in Figure 3. We find that respondents typically have one or the other type - only 20% of them interact with different key buyers with different governance modes. This result suggests that supplier-level variables should have a strong explanatory choice in governance mode choice.[14]

Figure 3: Share of buyers with relational modes

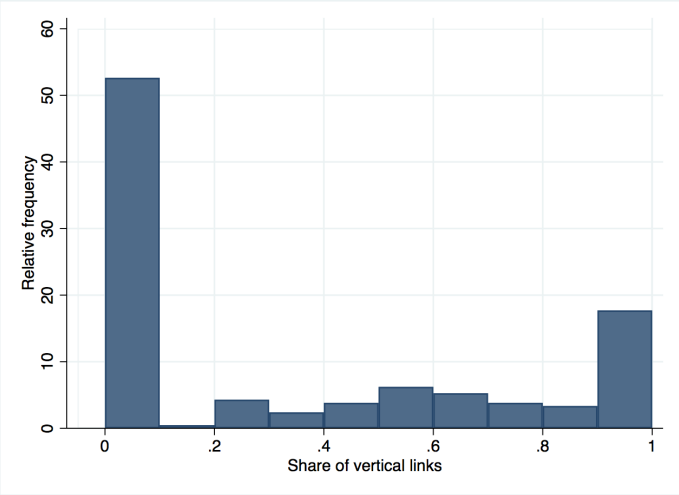


This figure is a histogram of the (unweighted) share of relational mode buyers among the key buyers of each respondent. Respondents with at least two buyers named, N=1,077.

Next, we look at vertically integrated links and consider firms that have named at least 2 key buyers *and* are part of a business group. In Figure 4 we now look at the share of buyers in a vertically integrated relationship. Compared to the share of relational buyers, here we find more variation: half of the firms sell nothing within the business group. The rest is fairly mixed. Thus, firms that are part of a business group and have at least one buyer from the this very group, may have other key buyers from the same business group or outside, too.

[14]Note that an important empirical consequence of this finding is that, because of this small within-supplier variation in governance modes, within-supplier identification strategies to identify the factors affecting mode choice are unlikely to yield precise estimates.

Figure 4: Share of links with vertically integrated key buyers



This figure is a histogram of the (unweighted) share of vertically integrated buyers among the key buyers of each respondent. Firms with a same business group buyer, at least two buyers, N=209.

4.2. Key characteristics of various governance modes

First we investigate how large is the share of buyers served via different governance modes in the supplier's sales (column (1), Table 4). Market and relational type links tend to be equally important for the seller - with such links representing 19% of their sales on average. In contrast, the sales share of vertically integrated buyers is 34%, on average. As columns (2) and (3) of Table 4 show, firm size is not very characteristically correlated with governance mode choice. Respondents with relational and vertically integrated links tend to be 0.2 log points (22%) and 0.7 log points (101%) larger in terms of turnover. Buyers in a relational governance mode are much larger than links with market based governance. Interestingly, vertically integrated buyers are a bit smaller on average than their peers in market based links.

Table 4: Governance relationship modes and firm size

	(1) Share(%)	(2) Respondent Sales (log)	(3) Buyer Sales (log)
Market	19	7.4	9.6
Relational	19	7.6	10.6
Vertical	34	8.1	9.4
Total	22	7.6	10.1

This Table shows how average supplier and buyer size varies across governance modes. The average is calculated from Respondent-buyer dyads, N=3,469. Column (1) shows the average share of buyers in suppliers' sales in percent. Column (2) shows the average log sales of the supplier whiles Column (3) shows the average log sales of the buyer.

Internationalization is an important aspect for these firms, many respondents are foreign-owned, and many buyers are located abroad. As Table 5 shows, firms with relational links tend to be slightly more likely to be foreign-owned than those with market links (25% vs 19%). Their buyers are also more likely to be abroad (41% vs 32%). Vertically integrated links are the most likely to cross borders, 50% with a foreign buyer, and 47% with a foreign owned seller. These patterns are in line with the hypothesis that non-market relationships are more prevalent when trade costs or rule of law problems are larger. Both of this is potentially more relevant between partners from different countries.

Table 5: Governance relationship modes by internationalization (share, %)

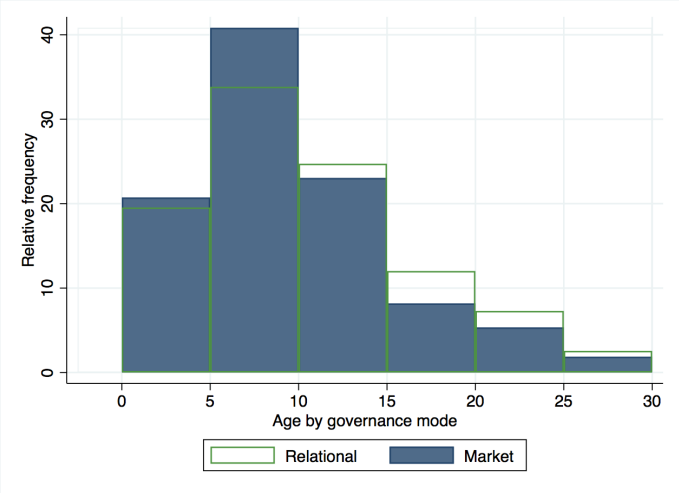
	(1) Foreign-owned respondent	(2) Buyer abroad
Market	19	32
Relational	25	41
Vertical	47	50
Total	27	40

This table shows the share of links in which the supplier is foreign-owned (column (1)) and the share of links when the two firms are in different countries (column (2)) by relationship governance mode. Respondent-buyer dyads, N=3469.

Finally, we compare the age of these relationships. Vertical and relational types are on average 9.5 years old, while market types are slightly less at 8.7 years. Figure

5 compares the distribution of relationship age for the market and relational types. The key difference is the above 10-year range - this is where relational types are more frequent. Note that this result is in line with Macchiavello et al. (2015); Brugués (2020), who find that links tend to become governed in more relational fashion as they age. The relatively low correlation between the two variables, however, shows that there is a large variation in governance mode even between links of the same age, underlying the relevance of going beyond relationship length when measuring relational links.

Figure 5: Age by governance relationship modes



Respondent-buyer dyads, N=3469.

5. Governance mode choice

In this section, we discuss how relationship types vary along some key observable dimensions related to what we discussed in 4.

We answer this question in two steps. First, we look at the choice to have a relational link between our respondents and their buyers versus a market one. Second, we analyze when firms choose vertical integration.[15]

For a respondent i and buyer b, we model the choice between relational and market relationship with a binary dependent variable, and estimate a linear probability model as:

$$Relational_{i,b} = \alpha + \beta_1 x_i + \beta_2 z_{i,b} + \beta_3 w_b + \epsilon_{i,b}, \quad (1)$$

[15]Due to missing observations and some cleaning measures, our sample for the regression is smaller.

where $Relational_{i,b}$ is a binary variable at respondent-buyer link level, with 1 denoting relational, and 0 market links; x_i are respondent-level variables such as ownership and industry; $z_{i,b}$ are link level variables such as the age of the relationship; and x_b are at the buyer level: such as their country of headquarter.

Vertically integrated links are dropped from the sample. In terms of our variables, total factor productivity (TFP) for both respondents and buyers come from Orbis, along with the 2-digit industry codes of respondents, included into all our regressions (see Section 3). We control for a number of variables in different specifications that have been documented to also affect relationship choice and may also be correlated with our variables of interest. First, we control for the sector of the buyer, as the logic of governance mode choice may differ when a buyer is in services or wholesale/retail trade. Second, we include relationship age as links can become more relational as time passes (Macchiavello et al., 2015; Brugués, 2020). Third, we control for the ownership of the supplier as foreign-owned firms, which are also often members of business groups, may operate differently in GVCs. Finally, we include the share of the buyer in the supplier's sales by categorical variables—relational governance may involve economies of scale for example if it requires a fixed cost (details are in Appendix B).

Note that some of these controls may be part of the mechanism we are after, and thus, should have been excluded. In particular, relationship age and the buyer share may be caused by the relationship choice, rather than confound the causal link from governance mode to performance growth. Still, our main results are similar with and without these controls, making our confidence in the results stronger.

Regression results are shown in Table 6. Our first observation is that a link is more likely to be relational between more productive firms - both for the respondent and the buyer. A 10% higher TFP is associated with 0.3-0.4% higher chance of a link being relational. This is in line with our expectation based on either relational governance requiring a high cost (in combination with increasing returns to scale) and/or higher productivity buyers requiring more customized products.

Second, the location of the buyer matters. A key advantage of our survey is learning about both domestic and foreign buyers. In terms of country of the buyer, the base is domestic. Our first result here is that international (export) links are more likely to be relational, in line with the idea that international links involve higher trade costs and more contractual incompleteness, which are handled better with relational arrangements. Second, we see that relational links are somewhat more likely with foreign partners who are, nevertheless, in the same free trade area, the European Union. For buyers outside the EU, relational links are substantially more likely, in line with relational contracts being able to solve problems resulting from rule-of-law issues or

higher trade costs.[16]

Third, let us look at the role of the main product sold to the buyer. Note that our regression includes industry dummies, so we compare products with different characteristics between firms operating within the same 2-digit industry. We find that, in line with the hypothesis that relational governance yielding larger benefits when the products are contract intensive, the Nunn (2007) measure is positively associated with choosing a relational link. If we compare products in the lowest quartile (0.3 in our sample) to the highest one (0.8 in our sample), we find a 10% higher chance of relational ties. In contrast, we find no evidence for an association between product complexity based on the Hausmann et al. (2014) measure and relational links; the coefficient is a relatively precisely estimated zero. Firms seem to be able to exchange complex products via market links unless they need to be customized.

Finally, note that in terms of the age of the link, we see a U-shaped pattern. Older ties are more likely to be relational (one year longer tie is associated with a 1.1% higher likelihood of being a relational link), but very new ties (formed in the past 2 years, 6% of the sample) are quite likely to be relational, too. While the downward-sloping part may be a result of selection—links which are large even at the start may tend to be relational—the upward sloping part may reflect links becoming larger and more relational with time (Macchiavello et al., 2015; Brugués, 2020) or relational links being stickier Martin et al. (2018).

[16]For more detailed results on the role of buyers' country, see Table B.17 in the Appendix B.

Table 6: Relationship governance choice: Relational vs Market.

Dep var: relational	(1)	(2)	(3)
Respondent TFP in 2015	0.0518***	0.0480***	0.0389**
	(0.0150)	(0.0149)	(0.0156)
Buyer TFP in 2015	0.0351***	0.0312***	0.0275***
	(0.00749)	(0.00753)	(0.00749)
Buyer country: EU		0.0845***	0.0799***
		(0.0299)	(0.0304)
Buyer country: Non-EU		0.244***	0.252***
		(0.0709)	(0.0661)
Nunn contractibility index		0.194**	0.182**
		(0.0873)	(0.0834)
HH Product Complexity Index		0.00453	0.000922
		(0.0272)	(0.0267)
Link age (ys)			0.0112***
			(0.00252)
Link age < 2 yr (D)			0.105*
			(0.0581)
Additional controls:			
Resp. industry D	NACE 2-digit	NACE 2-digit	NACE 2-digit
Buyer sector	YES	YES	YES
Respondent owner	NO	NO	YES
Buyer importance	NO	NO	YES
Sample	Market+ Relational	Market+ Relational	Market+ Relational
Observations	1,809	1,809	1,809
R-squared	0.105	0.117	0.154

This table reports regressions investigating the determinants of choosing a relational governance rather than a market-based. A link is considered relational if the respondent (supplier) reported that it would be hard to sell the product to another buyer or that it had conducted innovation specifically to serve this buyer. The coefficients are from supplier-buyer link-level linear probability regressions where the dependent variable shows whether the link is relational. Vertically integrated links are excluded. Respondent (supplier) and buyer TFP are estimated from Orbis data. Nunn contractibility measure is based on the Nunn (2007) classification of the specific product exchanged between the two firms. HH Product Complexity Index is from Hausmann et al. (2014). All regressions include 2-digit respondent industry dummies. Additional controls are: Buyer industry dummies (manufacturing, service, commerce), Respondent owner: foreign/business group, Buyer importance: share of buyer in sales categories. Details in Appendix B. Robust standard errors, clustered at the firm level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Our second question is about the choice of vertical integration. In Table 7 we compare

vertically integrated links both with relational links (columns (1)-(2)) and with market links (columns (3)-(4)).

Table 7: Relationship governance choice: Vertically integrated

Dep var: vertically integrated	(1)	(2)	(3)	(4)
Respondent TFP in 2015	0.0138	-0.00459	0.0428**	0.0183
	(0.0161)	(0.0166)	(0.0172)	(0.0182)
Buyer TFP in 2015	-0.0339***	-0.0374***	-0.0162	-0.0266***
	(0.00793)	(0.00765)	(0.0106)	(0.0103)
Buyer country: EU	0.168***	0.0505*	0.310***	0.143***
	(0.0305)	(0.0291)	(0.0434)	(0.0447)
Buyer country: Non-EU	0.236***	0.113	0.527***	0.327***
	(0.0912)	(0.0760)	(0.0911)	(0.0785)
Nunn contractibility index	-0.168**	-0.205***	-0.0662	-0.0850
	(0.0800)	(0.0715)	(0.115)	(0.105)
HH Product Complexity Index	-0.0441	-0.0274	-0.0595*	-0.0605**
	(0.0271)	(0.0251)	(0.0317)	(0.0301)
Link age (ys)		-0.00547**		0.000238
		(0.00220)		(0.00312)
Link age < 2 (D)		-0.253***		-0.202***
		(0.0486)		(0.0519)
Additional controls:				
Resp. industry D	NACE 2-digit	NACE 2-digit	NACE 2-digit	NACE 2-digit
Buyer sector	NO	YES	NO	YES
Respondent owner	NO	YES	NO	YES
Buyer importance	NO	YES	NO	YES
Sample	Vert. int.+ Relational	Vert. int.+ Relational	Vert. int.+ Market	Vert. int.+ Market
Observations	1,471	1,471	1,118	1,118
R-squared	0.129	0.236	0.134	0.236

This table reports regressions investigating the determinants of choosing a vertically integrated governance rather than a relational (columns 1 and 2) or market-based (columns 3,4). A link is considered vertically integrated if the respondent (supplier) is in the same business group as the buyer. The coefficients are from supplier-buyer link-level linear probability regressions where the dependent variable shows whether the link is vertical. Respondent (supplier) and buyer TFP are estimated from Orbis data. Nunn contractibility measure is based on the Nunn (2007) classification of the specific product exchanged between the two firms. HH Product Complexity Index is from Hausmann et al. (2014). All regressions include 2-digit respondent industry dummies. Additional controls are: Buyer industry dummies (manufacturing, service, commerce, Respondent owner: foreign/business group, Buyer importance: share of buyer in sales categories. Robust standard errors, clustered at the firm level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Results look very different to the previous table.

First, firms in vertically integrated relationship are not more productive than those in market or relational ties, if anything, buyers are less productive. This finding does not support a simple extension of the Helpman et al. (2004) model to governance mode choice in which there is a clear ordering between market, relational and vertically integrated links both in terms of fixed and marginal costs. This pattern may be more in line with the predictions of the property rights model of the firm, reflecting that buyers with more important specific investments—proxied by their relative productivity—trade in relational links.

Second, vertically integrated relationships are much less likely in contract intensive products, which may again reflect that supplier-specific investment is more important relative to the buyers' investment when products are more contract intensive.

Third, in terms of buyer location, we see that vertically integrated links are more frequent outside the EU even relative to relational ones, suggesting that vertical integration is even more effective in governing links with high fixed costs and rule-of-law issues.

In terms of relationship age, vertically integrated links are much less likely to be new than market or relational ties, and also about as likely to be long as market ones. Thus, integrated ties tend to be somewhat shorter than relational ties.

Let us make two additional observations. First, relational links are not equivalent to long ones. Relational ties tend to be longer, but many other factors—some of them unobserved[17]—seem to be relevant in governance mode choice. This underlines the importance of measuring the specific interactions within each relationship, as our measure does.

Comparing these two tables, we do not find that vertical relationships 'dominate' relational ones in every dimension. While we find such an ordering in terms of geography, we actually find that when suppliers have a higher relative productivity and the products are more contract intensive, firms tend to choose relational governance more frequently. This underlines that, for this choice, property-rights arguments emphasizing the relative importance of the supplier's specific investments provide a relevant point of view.

[17]Note that the R-squared is below 25% in all our regressions

6. Performance and governance mode

In this section, we turn our attention to study how governance mode choice is related to subsequent size and productivity growth. The promise of technology transfer and higher growth is often what motivates individual suppliers to join GVCs.

Our empirical strategy is to calculate the cumulative sales growth and TFP growth rate of the reporter (supplier) over three years (2018 vs 2015) for each link (between supplier i and buyer b), and investigate how this is related to the governance mode of the link at the time of the survey, 2015.[18]

Table 8: Growth rates and governance modes

	Sales (ln) growth	TFP growth
Market	-.072	.047
Relational	.040	.105
Vertical integration	.015	.116

This table compares respondent (supplier) sales and TFP growth rates in 2018 vs 2015 depending on the governance mode of the relationship in 2015. Based on respondent-buyer dyads, weighted by relative sales share. Respondent (supplier) and buyer Turnover and growth rates come from Orbis data.

Let us first make a simple unconditional comparison (Table 8). For suppliers with market-based (key) links only, revenues actually fell during this period, on average by 7%.[19] For firms with both relational and vertical links, however, sales have increased instead. Firms with only relational links would grow by 4%, and those with only vertical links, by 1.5% percent. Another way to put it is that having 10 percentage points higher share of relational (vertically integrated) key buyers is correlated with a 1.1% (0.85%) higher subsequent growth rate.

To estimate conditional differences, we run the following model. For a link between respondent i and buyer b, we model subsequent sales- and productivity growth on the governance mode of the relationship.

$$outcome_i = \alpha + \beta \times governance_{i,b} + \gamma_1 x_i + \gamma_2 z_{i,b} + \gamma_3 w_b + \epsilon_{i,b}, \tag{2}$$

[18] We use the difference in log sales and TFP to capture percentage growth rates. We picked three years to avoid short term noise, and the year 2018 is before the pandemic. We also weight these link-level observations with the share of each relationship compared to total share of key buyers in the respondent's sales, to produce results which characterize patterns at the firm level.

[19] Here the average is not weighted by firm size, i.e., not true on the aggregate.

where $outcome_i$ is first the growth rate of (ln) sales followed by growth rate of TFP between 2015-2018; $governance_{i,b}$ is a categorical variable with the base being market-type relationship, x_i are respondent-level, $z_{i,b}$ are link-level, and x_b are buyer-level control variables. In particular, we include the variables which proved to be important in the governance choice regressions as they are correlated with mode choice and most of them can have a direct effect on growth. In addition, we condition on both the current level and the past growth rate by including current and past (in 2012) level of sales (TFP).[20] Note that we run the regression at the link-level, but the outcome variable only varies among sellers, not among buyers.[21]

Let us first present results regarding the growth rate of sales in Table 9, followed by the growth rate of TFP in Table 10.

[20] In the spirit of macro growth regressions, these controls can account for "conditional convergence."

[21] Again, we weight the links with their share within suppliers' sales to key partners to make the results representative at the firm level.

Table 9: Sales growth and governance modes

Dep var: Sales growth	(1)	(2)	(3)	(4)
Relational link	0.100**	0.0898*	0.0773	0.0684
	(0.0482)	(0.0480)	(0.0495)	(0.0599)
Vertical link	0.0701	0.0649	0.0611	0.0782
	(0.0607)	(0.0601)	(0.0633)	(0.0733)
Respondent Sales in 2015 (log)		0.0991**	0.0953*	0.0948
		(0.0504)	(0.0496)	(0.0594)
Respondent Sales in 2012 (log)		-0.0922*	-0.102**	-0.106*
		(0.0516)	(0.0510)	(0.0598)
Nunn contractibility index				0.314**
				(0.134)
Buyer TFP				0.0254*
				(0.0132)
Buyer abroad (export)			0.0857**	0.0872*
			(0.0367)	(0.0454)
Respondent foreign owned			0.0647	0.0737
			(0.0543)	(0.0643)
Link age (ys)			-0.00398	-0.00626
			(0.00355)	(0.00415)
Link age <2 (D)			-0.121	-0.107
			(0.102)	(0.134)
Additional controls:				
Resp. industry D	NACE 2-digit	NACE 2-digit	NACE 2-digit	NACE 2-digit
Buyer sector	NO	NO	YES	YES
Buyer importance	NO	NO	YES	YES
Weight	rel.share	rel.share	rel.share	rel.share
Observations	2,851	2,798	2,788	2,115
R-squared	0.017	0.024	0.038	0.048
Cluster	resp. ID	resp. ID	resp. ID	resp. ID

This table reports regressions investigating the determinants of growth, comparing respondent sales (Turnover in EUR) in 2018 vs 2015. The OLS regression is based on respondent-buyer dyads, weighted by relative sales share. Includes respondent's 2-digit industry dummies. Respondent (supplier) and buyer Turnover comes from Orbis data. Nunn contractility measure is based on the Nunn (2007) classification of the specific product exchanged between the two firms. All regressions include 2-digit respondent industry dummies. Additional controls are: Buyer industry dummies (manufacturing, service, commerce, Buyer importance: share of buyer in sales categories. Robust standard errors, clustered at respondent level, in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: TFP growth and governance modes

Dep var: TFP growth	(1)	(2)	(3)	(4)
Relational link	0.0631**	0.0920***	0.0953***	0.0835**
	(0.0310)	(0.0306)	(0.0319)	(0.0370)
Vertical link	0.0765**	0.114***	0.113***	0.112***
	(0.0374)	(0.0369)	(0.0391)	(0.0415)
Respondent TFP in 2015		-0.106***	-0.111***	-0.124***
		(0.0234)	(0.0240)	(0.0275)
Respondent TFP in 2012		0.0222	0.0151	0.0307
		(0.0318)	(0.0320)	(0.0354)
Buyer TFP				0.0103
				(0.00773)
Nunn contractibility index				0.179**
				(0.0864)
Buyer abroad (export)			0.00977	0.0189
			(0.0238)	(0.0300)
Respondent foreign owned			0.0530	0.0689*
			(0.0354)	(0.0394)
Link age length (ys)			-0.00302	-0.00405*
			(0.00213)	(0.00218)
Link age <2 (D)			-0.0716	-0.0498
			(0.0611)	(0.0689)
Additional controls:				
Resp. industry D	NACE 2-digit	NACE 2-digit	NACE 2-digit	NACE 2-digit
Buyer sector	NO	NO	YES	YES
Buyer importance	NO	NO	YES	YES
Weight	rel.share	rel.share	rel.share	rel.share
Observations	2,621	2,525	2,516	1,901
R-squared	0.008	0.056	0.063	0.078
Cluster	resp. ID	resp. ID	resp. ID	resp. ID

This table reports regressions investigating the determinants of growth, comparing respondent TFP in 2018 vs 2015. The OLS regression is based on respondent-buyer dyads, weighted by relative sales share. Includes respondent's 2-digit industry dummies. Respondent (supplier) and buyer TFP are estimated from Orbis data. Nunn contractility measure is based on the Nunn (2007) classification of the specific product exchanged between the two firms. All regressions include 2-digit respondent industry dummies. Additional controls are: Buyer industry dummies (manufacturing, service, commerce, Buyer importance: share of buyer in sales categories. Robust standard errors, clustered at respondent level, in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In the first columns of these regressions, we show that the main finding Table 8 does not change when we control for industry dummies. We find that firms with a higher share of relational and vertical relationships tend to grow faster (in terms of sales) and tend to improve their productivity faster as well. This finding does not change

when we condition on past level and growth rates. It also stands as we add other link characteristics, such as destination (export), relationship age, the total number of suppliers' buyers or the respondent ownership.[22]

In the last columns we add product contractibility and buyer TFP, which proved to be important determinants of relationship choice, and, therefore, potential omitted variables in this regression. Indeed, selling contractible products is positively associated with subsequent growth.

As we condition on more and more variables, the governance mode coefficients shrink marginally in the sales growth regressions and become not significantly different from zero, while the coefficients in the TFP growth regressions even rise in magnitude.

Interestingly, we see no difference between the role of relational and vertically integrated relationships: both outperform market type ones, while there is no statistically significant difference between them.

The positive relationship between non-market governance modes and subsequent growth support our hypothesis that the intangible flows and specific investments actually help firms in upgrading their productivity and in expanding.

7. Conclusions

Relational contracting is thought to be an important feature of global value chains because it can facilitate investment into and sharing of intangible assets between buyers and suppliers. Existing measurements focus on several key implications of relational contracting, such as long-lived buyer-supplier relationships and the trading of complex products.

We used the novel Business Relations Survey, covering the key buyers and suppliers of 1,500 manufacturing firms in three countries, to measure relational links. We found that only a third of links are market based, while more than half are relational and 17% are vertically integrated. Relational links are more likely to form between more productive firms, between firms in different countries, especially when the buyer is outside the EU, and when the product is complex. Suppliers with many relational links expand their sales and improve their total factor productivity faster.

Our measure directly captures the key aspect of relational links: investment into and sharing of intangible assets. Buyer-specific products and product modifications are

[22]The motivation for including these variables is the extensive literature in international trade which documents how exporting and foreign ownership is related to performance.

associated with several economic benefits, as explained above. Consistently with earlier measures, older links and those trading contract-intensive products are more likely to be relational. Even conditional on these observables, however, there is substantial variation in which pair of firms engage in relational trading.

If relational links generate (quasi) rents to buyers and sellers, then the protection and sharing of these rents are of paramount importance. This poses two interrelated questions. First, external shocks may destroy the links and associated rents, inviting risk averse agents to diversify their relationship across many partners (Martin et al., 2018; Caselli et al., 2020). Such risk aversion can then lead to an imbalance in bargaining powers and rent sharing. We plan to study the longevity of relational links and their power imbalance, especially in the context of the Covid-19 shocks.

Second, policymakers often encourage small and medium enterprises to join GVCs without an explicit cost-benefit analysis. Our survey can help identify the investments necessary to join a GVC, as well as the private and public returns on these investments.

References

Acemoglu, D., Griffith, R., Aghion, P. and Zilibotti, F. (2010), 'Vertical integration and technology: theory and evidence', *Journal of the european economic Association* **8**(5), 989–1033.

Alfaro, L., Antràs, P., Chor, D. and Conconi, P. (2019), 'Internalizing Global Value Chains: A Firm-Level Analysis', *Journal of Political Economy* **127**(2), 508–559.

Alfaro, L., Bloom, N., Conconi, P., Fadinger, H., Legros, P., Newman, J., Sadun, R. and Reenen, J. V. (2018), Come Together: Firm Boundaries and Delegation, Working Papers ECARES 2018-11, ULB – Universite Libre de Bruxelles.

Amiti, M. and Konings, J. (2007), 'Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia', *American Economic Review* **97**(5), 1611–1638.

Antras, P. (2020), 'Conceptual Aspects of Global Value Chains', *The World Bank Economic Review* **34**(3), 551–574.

Antras, P., Fort, T. C. and Tintelnot, F. (2017), 'The margins of global sourcing: Theory and evidence from us firms', *American Economic Review* **107**(9), 2514–64.

Antras, P. and Helpman, E. (2004), 'Global sourcing', *Journal of political Economy* **112**(3), 552–580.

Baker, G., Gibbons, R. and Murphy, K. J. (2002), 'Relational contracts and the theory of the firm', *The Quarterly Journal of Economics* **117**(1), 39–84.

Bamber, P. and Gereffi, G. (2013), 'Costa rica in the medical devices global value chain', *Durham: Duke University, Center on Globalization, Governance and Competitiveness* .

Bernard, A. B., Moxnes, A. and Saito, Y. U. (2019), 'Production networks, geography, and firm performance', *Journal of Political Economy* **127**(2), 639–688.

Blaum, J., Lelarge, C. and Peters, M. (2018), 'The gains from input trade with heterogeneous importers', *American Economic Journal: Macroeconomics* **10**(4), 77–127.

Bloom, N., Lemos, R., Sadun, R., Scur, D. and Van Reenen, J. (2014), 'The new empirical economics of management', *J. Eur. Econ. Assoc.* **12**(4), 835–876.

Bøler, E. A., Moxnes, A. and Ulltveit-Moe, K. H. (2015), 'R&d, international sourcing, and the joint impact on firm performance', *American Economic Review* **105**(12), 3704–39.

Brugués, F. (2020), Take the goods and run: Contracting frictions and market power in supply chains, Technical report, Working Paper.

Bureau van Dijk (2015), 'Amadeus: A database of comparable financial information for public and private companies across europe'.

Caselli, F., Koren, M., Lisicky, M. and Tenreyro, S. (2020), 'Diversification through trade', *Q. J. Econ.* **135**(1), 449–502.

De Loecker, J., Goldberg, P. K., Khandelwal, A. K. and Pavcnik, N. (2016), 'Prices, markups, and trade reform', *Econometrica* **84**(2), 445–510.

Defever, F., Fischer, C. and Suedekum, J. (2016), 'Relational contracts and supplier turnover in the global economy', *Journal of International Economics* **103**, 147–165. **URL:** *https://www.sciencedirect.com/science/article/pii/S0022199616301064*

Gereffi, G. (1999), 'International trade and industrial upgrading in the apparel commodity chain', *Journal of international economics* **48**(1), 37–70.

Gereffi, G., Humphrey, J. and Sturgeon, T. (2005), 'The governance of global value chains', *Review of international political economy* **12**(1), 78–104.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N. and Topalova, P. (2010), 'Imported intermediate inputs and domestic product growth: Evidence from india', *The Quarterly journal of economics* **125**(4), 1727–1767.

Grossi, J. C. (2020), 'Interacting and sharing the gains in buyer-seller relationships: Garment in bangladesh', *Policy* .

Halpern, L., Koren, M. and Szeidl, A. (2015), 'Imported inputs and productivity', *American Economic Review* **105**(12), 3660–3703.

Haltiwanger, J., Jarmin, R. S. and Miranda, J. (2013), 'Who creates jobs? small versus large versus young', *Review of Economics and Statistics* **95**(2), 347–361.

Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M. and Simoes, A. (2014), *The atlas of economic complexity: Mapping paths to prosperity*, Mit Press.

Helpman, E., Melitz, M. J. and Yeaple, S. R. (2004), 'Export versus fdi with heterogeneous firms', *American economic review* **94**(1), 300–316.

Javorcik, B. S. (2008), 'Can survey evidence shed light on spillovers from foreign direct investment?', *World Bank Res. Obs.* .

Johnson, R. C. and Moxnes, A. (2019), Gvcs and trade elasticities with multistage production, Working Paper 26018, National Bureau of Economic Research.

Kugler, M. and Verhoogen, E. (2009), 'Plants and imported inputs: New facts and an interpretation', *American Economic Review* **99**(2), 501–07.

Kukharskyy, B. (2016), 'Relational contracts and global sourcing', *Journal of International Economics* **101**, 123–147.
URL: *https://www.sciencedirect.com/science/article/pii/S0022199616300496*

Lund, S., Manyika, J., Woetzel, J., Bughin, J., Krishnan, M., Seong, J. and Muir, M. (2019), *Globalization in Transition: The Future of Trade and Value Chains*, McKinsey&Company.

Macchiavello, R. and Morjaria, A. (2021), 'Competition and relational contracts in the rwanda coffee chain', *The Quarterly Journal of Economics* **136**(2), 1089–1143.

Macchiavello, R., Morjaria, A. et al. (2015), Competition and relational contracts: Evidence from rwanda's coffee mills, *in* '2015 Meeting Papers', Vol. 431, Society for Economic Dynamics.

Martin, J., Méjean, I. and Parenti, M. (2018), 'Relationship stickiness: Measurement and applications to international economics', *Unpublished Working Paper* .

Minetti, R., Murro, P., Rotondi, Z. and Zhu, S. C. (2018), 'Financial constraints, firms' supply chains, and internationalization', *Journal of the European Economic Association* **17**(2), 327–375.

Neumark, D., Wall, B. and Zhang, J. (2011), 'Do small businesses create more jobs? new evidence for the united states from the national establishment time series', *The Review of Economics and Statistics* **93**(1), 16–29.

Newman, C. C., Page, J., Rand, J., Shimeles, A., Söderbom, M. and Tarp, F. (forthcoming), 'Linked in by foreign direct investment', *Journal of Development Studies* .

Nunn, N. (2007), 'Relationship-specificity, incomplete contracts, and the pattern of trade', *The Quarterly Journal of Economics* **122**(2), 569–600.

Nunn, N. and Trefler, D. (2013), 'Incomplete contracts and the boundaries of the multinational firm', *Journal of Economic Behavior & Organization* **94**, 330–344.

OECD (2017), Participation in global value chains, *in* 'OECD Science, Technology and Industry Scoreboard 2017: The digital transformation', OECD Publishing.

Rauch, J. E. (1999), 'Networks versus markets in international trade', *Journal of international Economics* **48**(1), 7–35.

Schmitt, A. and Van Biesebroeck, J. (2020), 'Testing predictions on supplier governance from the global value chains literature'.

Sturgeon, T., Van Biesebroeck, J. and Gereffi, G. (2008), 'Value chains, networks and clusters: reframing the global automotive industry', *Journal of economic geography* **8**(3), 297–321.

Syverson, C. (2011), 'What determines productivity?', *Journal of Economic literature* **49**(2), 326–65.

Tintelnot, F., Kikkawa, A. K., Mogstad, M. and Dhyne, E. (2018), Trade and domestic production networks, Technical report, National Bureau of Economic Research.

Wooldridge, J. M. (2009), 'On estimating firm-level production functions using proxy variables to control for unobservables', *Economics letters* **104**(3), 112–114.

Appendix A. The survey process

This section describes The Business Relations Survey [23], which aimed at measuring the nature of supplier-buyer relationships including their number, share and strength.

Appendix A.1. The survey process

In terms of practical details, we used a computer assisted personal interview, assuming that this provides a good balance between depth and response rate. The survey was run by Gfk, a multinational market research company, with offices in Budapest, Bratislava and Bucharest being in charge of local surveys.

We trained surveyors, run pilots and had also conducted meetings with company managers to make sure questions are clear and comparable across countries. We limited questions to ensure that the survey should last no longer than 45 minutes as a key practical constraint was to make sure that managers are willing to answer our questions.

As a compromise between depth and length, we asked some basic questions about all partners and asked a set of detailed questions only about a limited set of key partners. Indeed, the most substantial trade-off proved to be between the number of suppliers and buyers we learn about and the depth of the information about each of them. As a compromise, we asked a few questions about all suppliers and buyers and asked the details only about *key partners*, defined as having at least 10% share in sales/material costs. In case the firm did not have three partners above the 10% threshold, we asked for the three with the highest shares. This definition worked very well and firms could easily identify these partners. We also allowed the managers to name a special supplier/buyer, even if that partner was not among the largest ones. Such special partner can be the oldest partner, a firm that is a good reference, or a foreign partner. Special buyers represented some 6% of all buyer links.

The most significant question regarding key partners was the identity of these firms. To maximize the accuracy of data we asked the firms to provide the EU VAT number of their partners. We needed this to merge the information with the Orbis dataset for further analysis involving financial data. As this information is usually not available on the spot, we asked managers to supply this information after the survey. Unfortunately, few managers were ready to supply the EU VAT number either during or after the interview. Consequently, we got very sparse coverage here. We will hence have to complete name-based matching of partner firms.

Given the time constraints and managers' reluctance to supply financial information

[23] Note that earlier it was called Central European Supplier Survey

(Bloom et al., 2014), we included very few questions on firm finances, especially if that was available from other sources. One of the exceptions was asking about total and export revenue. We compared this information to data available from the balance sheet information to double check whether the interviewee belongs to the firm we think.

Another challenge we faced was the different jargon – and to some extent logic – used by researchers and managers. We had to make sure that the interviewees understood the questions the same way as we did. We started with a few longer open-ended interviews. These preliminary interviews played an essential role in designing the first draft of the survey. After the draft was ready, we conducted pilot interviews with a diverse set of firms in two rounds, testing two versions of the questionnaire. Pilots were essential in the design of the final version of the questions. Based on feedback from the pilot, we simplified some questions. For example, managers typically were able to name the main industry of the partner, but could not provide much detail in this respect. We also added explanations to questions and answers to make sure respondents understand the them equally well. This was especially important for questions on innovation and learning.

A specific concern with the multi-country study was making sure that the questions are similarly interpreted by the managers in different countries. It was essential to provide a chance for the managers to answer in their native language. In order to do so, we relied on translators with an extensive knowledge of this type of work and their work was reviewed both by the Gfk and by other academics. We also conducted the interviews in English when that was the main language of the manager.

Appendix A.2. Data handling and cleaning

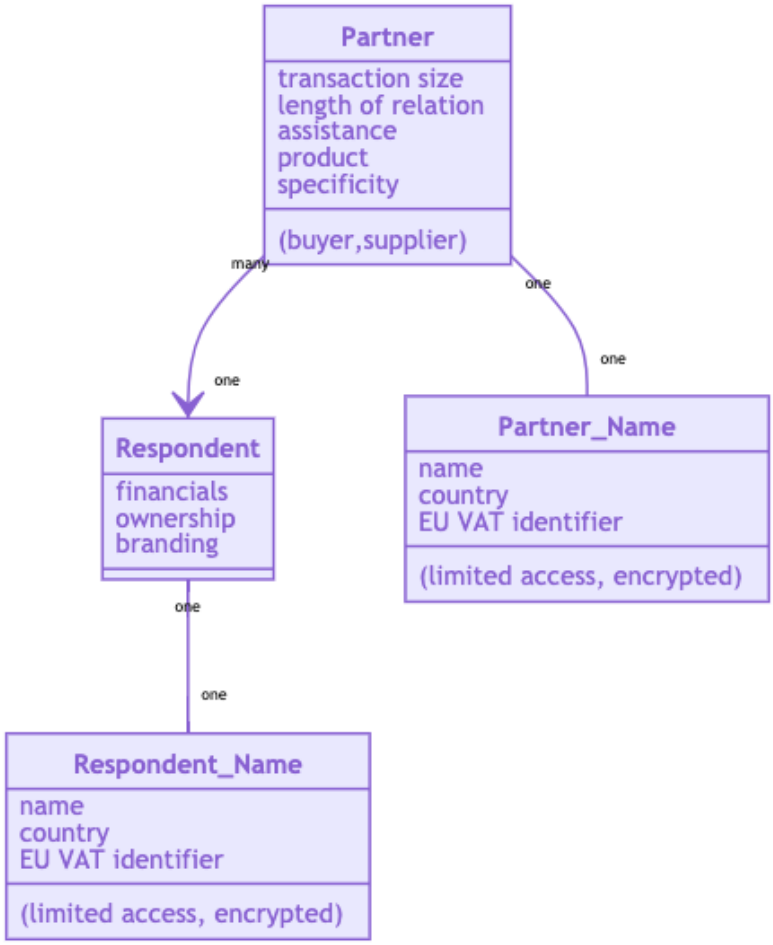
This section explains the basic structure of the dataset we created from the survey. First it describes our measures to guarantee data security followed by the cleaning process we implemented.

Owing to the many levels of questions, the Survey yields a somewhat complex data structure. Most importantly, we have one questionnaire for each respondent, but each respondent could name a number of suppliers and buyers, also generating information at the respondent-partner pair level. To increase efficiency, we separated these two types of information into separate files. For security reasons, we also store company identifiers separately from our main datasets. Figure A.6 illustrates the logical model of our dataset with an Entity-Relation Diagram.

The first two files include respondent-level information. The "Respondent" file contains the anonymized respondent-level information from the questionnaire and the balance sheet data, while the "Respondent name" file includes the name and the identifier of the respondent. The latter file is limited access and encrypted.

The other two files include information at the respondent-partner level. The file named "Partner" includes the respondent-partner specific answers from the questionnaire and "Partner name" includes the name and identifier of the partner.[24]

Figure A.6: Logical Model of the Business Relations Survey Dataset



Notes: This figure shows the Entity-Relation Diagram of our analysis dataset. Each respondent can have multiple partners reported. The names of respondents and partners have been separated out in tables and handled separately to preserve anonymity. The graph gives a sample of information known about each entity, not a full list of variables.

[24]Note that one partner can belong to several respondents in principle. This information is critical when drawing the network. We are currently working on identifying firms which were reported by multiple respondents as partners.

Appendix A.3. Harmonization

Thanks to the efforts described earlier, questionnaires were remarkably consistent across countries and answers were clear so relatively little data cleaning was necessary. The main steps were the following:

1. All values were given in national currency or a currency the company used (e.g., USD). To harmonize this information across countries and firms, all such variables were converted to 1,000 Euros.

2. We corrected partner index numbering to ensure that the largest customer is indeed the one with the largest share (as some respondents mentioned their second or third largest customer first). We created a new variable named "share rank" containing the actual ordering for partners for which the share was available. We added a flag when the share was missing. This change affected about 3-4% of rankings (both for buyers and sellers).

3. We checked if shares satisfied basic algebraic constraints, such as being less than 100% and summing up to less than 100%. There were only few such mistakes and they did not appear to be systematic.

4. We corrected every type of duplication in the list of partners. Most importantly, in a number of cases the "special" buyer/supplier mentioned by the respondent had already been mentioned among the most important partners. We cleaned this information by deleting the duplicates. We used both the name and share information to identify these instances, mainly in an automated way, but also checked some suspicious cases manually. This affected less than 5% of observations.

Appendix A.4. Survey quality test

A key concern with these kind of surveys is whether some surveyors make less effort to gather reliable answers, and thus, surveyor features affect the results. As important as it is, such an effect is actually not easy to verify. As regions and firms in these countries vary, replies to questions may also vary across respondents. Furthermore, surveyors are different in experience and hence response time may vary for completely honest reasons, too.

Nevertheless, we conducted several checks to investigate this and related issues. We looked for correlations between the quality of the response data and metadata. A simple measure of quality is item non-response: how many questions remain unanswered in the questionnaire. Survey metadata includes an anonymous identifier of the surveyor and the precise time stamp of starting and finishing the survey. These were recorded automatically in the interview software.

We identified several surveyors who were very different from the vast majority in terms of the number of interviews conducted (too many), the time gap between surveys (too short), or the length of the interview (too short). However, interviews conducted by these surveyors did not differ significantly in terms of data quality indicators such as the prevalence of item non-response. We could not rule out that these interviews were, in fact, conducted in the same fashion as others, with data entry into the survey application happening at a later stage.

Appendix A.5. Target population and sampling frame and additional data

We constructed a sampling frame based on the Orbis Europe (earlier called AMADEUS) database (Bureau van Dijk, 2015) to make sure that we can link survey responses to financial information. The target population included manufacturing firms in the industries with a NACE code between 20 and 30 (Revision 2) with at least 10 employees in the 3 countries.

We selected firms with non-missing basic financial information for 2012 and 2013. Based on the estimate of our surveyor partner, GfK, we anticipated a response rate of 15%, therefore our sampling frame included 6-7 times more firms than the actual sample. We used stratified sampling within countries based on two dimensions: size (10-50, 50-250 and over 250 employees) and ownership. In terms of ownership, we distinguished between foreign- and domestically-owned firms. All companies with at least one non-domestic owner were considered foreign. Both the size and the ownership variables were extracted from the Amadeus dataset. We created inverse probability weights to restore the representativity of our sample with respect to the target population.

Our survey partner received basic identifying information for each firm in our sampling frame (name, industry, address of the headquarters), randomly ordered within each stratum. We also assigned target sample sizes to reach within each size-ownership stratum. These targets implied oversampling of smaller hard-to-reach groups like large foreign firms. The country-level targets were proportional to the number of firms in each country: it was 500 firms in Slovakia, 600 in Hungary and 700 in Romania.

Given our sampling frame, we could link our survey data with Amadeus and extract financial information such as sales or assets. At this stage, all financial variables refer to 2013. Eventually we have financial information (such as total sales in 2013) for 82% of firms in the sample.

Appendix B. Additional results

Appendix B.1. Additional descriptive statistics

In our sample, after some minor cleaning, we have 1501 observations. A first view of the data is presented by Table B.11, which shows the number of observations along several dimensions. This distribution is similar across countries, with a somewhat greater share of large firms in Slovakia.

Table B.11: Distribution of Survey Respondents by Employment Size and Country

	Hungary	Romania	Slovakia	Full sample
less than 20	11.0	12.3	7.7	31.0
21-50	10.5	11.3	4.8	26.6
51-250	12.3	10.7	6.6	29.6
more than 250	2.6	3.1	2.6	8.3
Total	36.6	38.0	25.4	100
Total No.	550	570	381	1501
Avg. emp	92.9	93.4	146.6	105.3

Respondent sample, N=1501. Percent values. Employment categories are based on Orbis reported employment in 2015, Countries are from the survey.

The vast majority (72%) of the firms in our sample are domestically owned and the remaining 28% are foreign owned. These shares are also similar in the three countries, with a somewhat higher share of foreign-owned firms (37%) in Slovakia. In terms of industry, the largest share of firms operate in the fabricated metals industry, followed by rubber/plastic and machinery. Table B.12 shows that the share of foreign firms is somewhat higher in Slovakia.

Table B.12: Respondents by ownership and country

	Hungary	Romania	Slovakia	Total
	4cShare(%)			
Domestic	27.4	29.7	15.4	72.5
Have foreign	9.3	8.3	10.0	27.5
Total	36.6	38.0	25.4	100.0

Respondent sample, N=1501. Both variables are from the survey

We measure two dimensions of ownership: whether the firm's ultimate owner is of domestic or foreign origin, and whether the respondent belongs to a business group. As Table B.13 demonstrates, 71 percent of our respondents are domestically owned and a minority of them (5.8 percent) also belongs to a business group. The remaining 27 percent are foreign-owned, and half of them also belong to a business group. Adding up domestic and foreign owned business groups, one fifth of the sampled firms are part of business groups.[25] A small fraction (2 percent) has a owners that cannot be classified simply as domestic of foreign, such as banks, venture capitalists, or diverse owners of listed on the stock market.[26]

Table B.13: Respondents by owner type

	Share(%)	Count
Independent: Only domestic owner	63.3	950
Independent: Has foreign owner	13.8	207
Group: Domestic	6.2	93
Group: Foreign	14.4	216
No direct holder	2.3	35
Total	100.0	1,501

Respondent sample, N=1501. Based on survey owner variables.

Next, we show the total number of buyers in Table B.14. Quite a large part of the respondents have a rather limited set of buyers: 30 percent have less than 10 out of which half have less than 5 buyers. On the other side of the distribution of buyers, only 23 percent of respondents report more than 100 buyers.

Table B.14: Number of buyers

	Share(%)
Very few of buyers (1 to 5)	17.9
A couple buyers (6 to 10)	11.9
Many buyers (11-100)	46.9
Great many buyers (100-8000)	23.1

Respondent sample, N=1501. Based on respondent reported buyer number in the survey

[25]Note that these firms may be owned by a central firm or be the head of the group, or the major company in a smaller group.

[26]The distribution of ownership by country is presented in Appendix Table B.12.

Table B.15: Main activity of buyers

	Share(%)
Industry (agriculture)	59.6
Commerce	25.5
Services	14.9

Respondent-buyer sample, N=3469. NB: Industry includes mining.

Table B.16 has the aggregate share of the important buyers in respondent's sales. There are some firms with even their most important buyers having a share of less than 10 percent in their sales, but for more than half of the respondents this figure is between 10 and 25 percent and for an additional 19 percent it is between 25 and 50 percent. Firms with buyers having more than 50 percent share in their sales are not common, but neither are they negligible as 8 percent of all respondents have such trade partners.

Table B.16: Share of Buyers in Respondent Sales

	Share(%)
Not important (<10%)	20.8
Important (10-24%)	51.9
Essential (25-50%)	19.1
Single majority buyer (>50%)	8.3

Respondent-buyer dyads, N=3469. The table shows the aggregate share of the important buyers in respondent sales. Categorized by the percent of share given by respondents.

Appendix B.2. Additional regressions

In this subsection we show the extended version of the results presented in Table 6. The first column of Table B.17 is extended version of the one in Table 6. Further columns are extended buyer country categories.

Table B.17: Relationship governance choice: Relational vs Market - extended.

Dep var: relational vs market	(1)	(2)	(3)
Respondent TFP in 2015	0.0389**	0.0469***	0.0386**
	(0.0156)	(0.0164)	(0.0155)
Buyer: TFP	0.0275***	0.0205**	0.0278***
	(0.00749)	(0.00824)	(0.00749)
Nunn contractibility index (0-1)	0.182**	0.161*	0.180**
	(0.0834)	(0.0890)	(0.0834)
HH Product Complexity Index	0.000922	0.0124	0.000421
	(0.0267)	(0.0284)	(0.0267)
Buyer country: EU	0.0799***		
	(0.0304)		
Buyer country: Non-EU	0.252***		
	(0.0661)		
Buyer country: RoL: Good		0.162***	
		(0.0446)	
Buyer country: RoL: Mediocre		0.139	
		(0.0932)	
Buyer country: RoL: Poor		0.367***	
		(0.0967)	
Buyer: distance (log)		-0.0325**	
		(0.0133)	
Buyer country gr: Austria, Italy, Germany			0.0939***
			(0.0352)
Buyer country gr: Other CEE			0.107
			(0.0702)
Buyer country gr:EU(Other) + EFTA +UK			0.0202
			(0.0557)
Buyer country gr: Eastern Europe, eg Russia			0.276***
			(0.0920)
Buyer country gr: Overseas, e.g. Americas, Asia			0.239***
			(0.0855)
Buyer: relation length (ys)	0.0112***	0.0116***	0.0112***
	(0.00252)	(0.00259)	(0.00254)
Buyer: relation length: new (D)	0.105*	0.124*	0.107*
	(0.0581)	(0.0661)	(0.0579)
Buyer commerce	-0.103***	-0.0985***	-0.102***
	(0.0330)	(0.0352)	(0.0330)
Buyer service	-0.0797**	-0.0619	-0.0794*
	(0.0405)	(0.0441)	(0.0405)
Important buyer (10-24%)	0.0688*	0.0389	0.0686*
	(0.0375)	(0.0403)	(0.0375)
Essential buyer (25-50%)	-0.00422	-0.0353	-0.00424
	(0.0450)	(0.0481)	(0.0450)
Single majority buyer (50%+)	0.118**	0.0664	0.120**
	(0.0547)	(0.0602)	(0.0547)
Respondent: = 2, Foreign Private	-0.0323	-0.0110	-0.0338
	(0.0465)	(0.0485)	(0.0469)
Respondent: = 3, Group: Domestic	-0.266***	-0.232***	-0.266***
	(0.0561)	(0.0602)	(0.0560)
Respondent: = 4, Group: Foreign	-0.00882	-0.0193	-0.00753
	(0.0519)	(0.0535)	(0.0521)
Respondent: = 5, No direct	-0.0631	-0.0490	-0.0596
	(0.104)	(0.114)	(0.104)
Constant	0.0661	0.0973	0.0664
	(0.0834)	(0.0927)	(0.0835)
Observations	1,809	1,510	1,809
R-squared	0.154	0.142	0.155
Industry D	NACE 2-digit	NACE 2-digit	NACE 2-digit

This table reports regressions investigating the determinants of choosing a relational governance rather than a market-based. A link is considered relational if the respondent (supplier) reported that it would be hard to sell the product to another buyer or that it had conducted innovation specifically to serve this buyer. The coefficients are from supplier-buyer link-level linear probability regressions where the dependent variable shows whether the link is relational. Vertically integrated links are excluded. Respondent (supplier) and buyer TFP are estimated from ORBIS data. Nunn contractibility measure is based on the Nunn (2007) classification of the specific product exchanged between the two firms. HH Product Complexity Index is from Hausmann et al. (2014). Rule of law is three categories: Good, Medicore and Poor based on worldjusticeproject.org/rule-of-law-index/

In addition to results discussed in the main text, we find that buyers those that constitute the majority of sales for the producers (9% of ties) are the ones most likely being of relational nature.

In terms of ownership of the producer, once we condition on TFP and other variables, all that makes a difference is belonging to a domestic group - it reduces the chances of relational by 24%. (NB maybe another member, eg parent could be the one with relational tie). Foreign ownership makes no difference.

Finally,these relationships are about 10% more likely when the buyer is in manufacturing rather than services or commerce.