

# The nature of buyer-supplier relationships: Lessons from the Central European Supplier Survey

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## Abstract

The increasing importance of global value chains has created both scientific and policy interest in supplier-buyer relationships. Data availability is often a key constraint for such research. The few firm-to-firm datasets that exist contain little information on how relationships form and operate. This study introduces the Central European Supplier Survey, a new data source, which merges survey information with financial statements for a large sample of manufacturing firms from Hungary, Romania and Slovakia. The first part of the paper describes the data collection process and the different issues and dilemmas it brought about, while the second part highlights key features of firm connections. These results show that (i) buyer/supplier portfolios are correlated with productivity, (ii) key relationships are as often initiated by the buyer as the supplier and (iii) many of these relationships start with both product and process innovation. These patterns indicate that many key relationships are of long-term and relational. Such patterns can be of key interest for policymakers aiming at supporting firms in creating high-value relationships.

**keywords:** supplier-buyer relationships, supplier survey, relationship formation, innovation, data handling and cleaning, Hungary, Romania, Slovakia

**JEL-codes:** C83, D22, D23

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## 1. Introduction

The new wave of globalization in the 1990s brought about the formation of Global Value Chains (GVCs). GVCs are made of by companies linked by ownership and trade connections, and are among the most important production structures of the global economy. The scale and importance of GVCs has multiplied during the last three decades.<sup>1</sup> Linking their countries' companies to GVCs is also high on the agenda of governments, as integration into international production chains is considered to be among the most effective ways of improving the competitiveness of firms.

Despite their importance, we know surprisingly little about how relationships between companies form and operate. Most existing studies on GVCs rely on industry-level input-output tables to identify potential upstream-downstream connections between firms (Johnson and Noguera, 2012; Hummels et al., 2001). Although this line of research has yielded a number of important conclusions, the use of industry-level data has some shortcomings (Johnson, 2018). Most obviously, it is hard to describe the heterogeneity of connections or draw conclusions about the nexus between supplier-buyer relationships and firm performance without information on the supplier-buyer connections themselves.

More recently, a few studies have relied on administrative firm-to-firm information, such as data from value added tax (VAT) filings. This kind of data expanded greatly the type of questions that can be addressed including such issues as 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). However, this type of data is scarce, and even if available, the it only informs us on the amount of trade between firms, and, therefore, does not provide much information on how relationships develop and operate.

Our paper describes the Central European Supplier Survey, which collected information on the formation and operation of buyer-supplier relationships and linked it to financial statements. This survey covers information on the buyers and suppliers of manufacturing firms in three countries, Hungary, Romania and Slovakia. Besides questions about all buyers and suppliers, the survey asked detailed questions about the most important suppliers and customers of the firm, including when and how the relationship formed,

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<sup>1</sup>Lund et al. (2019), for example, identify 23 GVCs and find that they account for 69 percent of global output and 96 percent of international trade.

what is the share of the partner in the firm’s purchases or sales and how closely the firms cooperate. An important feature of the survey data is that it can be linked to financial information from the AMADEUS/ORBIS database, and, therefore, to financial measures of firm performance.

As any survey, this one also has its limitations. Most importantly, it can only cover a small subset of the full buyer-supplier network of a country. Still, methodologies combining qualitative data with financial information appear to be a promising approach for understanding GVCs and the importance of buyer-supplier relationships in firm performance.<sup>2</sup> The aim of this paper is to describe our approach in detail, compare it to other approaches used in the literature, and to describe a number of relevant patterns identified from the data.

In what follows, Section 2 describes and compares the various approaches used in the literature to understand buyer-supplier relationships. Section 3 details our approach and the process of conducting the survey. Section 4 describes the main variables from the questionnaire while Section 5 discusses how we cleaned and handled the data. Section 6 describes the first results from the survey while 7 concludes.

## **2. Approaches to understand GVCs and supplier-buyer relationships**

### *2.1. Types of data and key results*

To understand the importance of GVCs and their effect on countries, early research relied on industry-level input-output tables which originated from international trade data. Researchers used this type of data to study the magnitude of trade flows between industries and countries; the share of domestic value added in gross value added (Johnson and Noguera, 2012; Hummels et al., 2001); and the propagation and amplification of small shocks in the economy (Acemoglu et al., 2016). A key finding of this literature is that intermediate inputs played an ever increasing role in international trade since the 1970s, with an acceleration in the 1990s.

An emerging literature studies business linkages and their effects on firm behavior at the firm level. These papers rely on two types of datasets: those of administrative origin and surveys.<sup>3</sup>

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<sup>2</sup>A similar approach was followed in industry studies (see Section 2), where survey data were combined with industry-level information.

<sup>3</sup>A common feature of all these data are that information on linkages and on firm performance (in form of balance sheet and income statement) are from different sources, and the performance data usually is of administrative origin.

In Europe, administrative data on buyer-supplier links are mainly derived from VAT filings. [Dhyne et al. \(2015\)](#) describe a dataset that covers Belgian companies. In addition to its extensive coverage (about 400 thousand firms), the data also follow firms for an extended period of 11 years. Papers using these data have studied the effects of international trade on firms' costs ([Tintelnot et al., 2018](#)) and the sources of firm size heterogeneity ([Bernard et al., 2019](#)).

In the U.S., a limited set of business relationships are identifiable from Security and Exchange Commission filings of publicly listed firms ([Barrot and Sauvagnat, 2016](#)). In this dataset shipments are recorded only if the buyer is a major partner of the supplier firm, defined as having at least 10 percent share in revenue. In Japan, data collected for credit risk analysis purposes enables the analyses of buyer-supplier linkages. These data cover almost the whole Japanese private sector (800 thousand firms). [Bernard et al. \(2019\)](#) test a model of outsourcing using these data.

The second type of data source is survey data. A major survey on within-firm business relationships is the Commodity Flow Survey [U.S. Bureau of the Census \(2007\)](#), which is based on a random sample of bills of lading for domestic and export shipments of U.S. firms. Even though the identity of the destination firm is not recorded in the survey, the ZIP code of the buyer is available, allowing researchers to identify internal within-firm shipments given the precise locations of firm establishments. [Atalay et al. \(2014\)](#) link this Survey to the Economic Census study in order to study reasons for vertical integration of U.S. firms.

Among smaller-scale, more qualitative surveys, [Minetti et al. \(2018\)](#) investigates the relationship between financial constraints and participation in local and global supply chains. The data cover about 7,500 Italian firms and include rich information on many aspects of firm behavior: the financial structure of the firm, outsourcing, participation in supply chains and the propensity to innovate. [Newman et al. \(forthcoming\)](#) uses data on 102 multinational enterprises and 226 domestically-owned firms from 5 African and 2 South Asian countries to estimate knowledge spillovers resulting from Foreign Direct Investment (FDI). In addition to the usual set of variables, the data include information on ownership structure and R&D activity.

The main advantage of administrative data relative to surveys is its larger coverage. As shown above, administrative datasets usually cover most firms in an economy, if not the whole population. Some of these datasets also have a panel dimension. The information available, nonetheless, is usually restricted to the existence of the trade link and the value exchanged between firms. While survey data tend to have much smaller coverage (a few hundred or several thousand firms), they can inform one about the specificity of the relationships at the firm level.

## 2.2. Typologies of supplier-buyer relationships

The design our survey was also motivated by the theoretical literature on the typologies of supplier-buyer relationships. Gereffi et al. (2005) provide a typology of relationships in global value chains. The authors identify four types of trade relations between firms:<sup>4</sup>

**Market partners.** The commodity is simple and does not require any specific investment. Both the supplier and the buyer have many alternative partners. The cost of switching to a new partner is low both for the supplier and the buyer.

**Modular partners.** The commodity is complex and it requires exchange of information between the two parties. At the same time, the supplier does not have to rely on relationship-specific assets for the production.

**Relational partners.** The efficient production of the exchanged good requires relationship-specific investments. At the same time, both parties have a vested interest in maintaining the relationship. This interest may result either from the high cost of replacing the partner or from some institutional arrangement, such as family ties between companies. Thus, none of the parties will be held up by the other.<sup>5</sup>

**Captive partners.** In this relation not only relationship-specific investment is necessary, but one of the parties is also able to extract part of the value of this investment. This may result from, for example, the sheer size difference between the parties. For example, small local suppliers can be completely dependent on large international buyers and thus have little bargaining power in the relation.

As shown in the typology, the relation between two firms may lie between a simple market relation and a long-term, relational contract. The type of relation is shaped predominantly by the specificity of the product exchanged and the investment needed. There is a key distinction between specific and non-specific products in this respect. Supplying standardized and simple-to-produce goods usually does not require specific investments, and, therefore, it can be simply *procured from the market*, even if it is a crucial input in the buyer's production process.<sup>6</sup>

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<sup>4</sup>The 5<sup>th</sup> relation is that of vertical integration, but we are interested in market transactions.

<sup>5</sup>The hold up problem originates from the opportunistic behavior of a party in a relation (Williamson, 2007) and was formally analyzed by Grossman and Hart (1986) in the context of vertical integration. It consists of the possibility of expropriation of the other party's specific investment in a relationship.

<sup>6</sup>Note that if the timing of the arrival of the product is crucial even a simple intermediate good may become specific.

When goods are specific, the nature of the relationship will depend on two factors: (i) whether there is need for a specific investment to produce the good and (ii) how concentrated the supply and demand of the good is. If there is no need for a relation-specific investment, the relation will be modular and only information will be exchanged between the parties. If producing the intermediate product requires specific investments and there are few firms on the seller side, the relationship will be *relational*.<sup>7</sup> If specific investments are required but there are multiple similar potential suppliers, the relationship is likely to become *captive*.

One aim of the survey was to distinguish between these various types of relationships. One key dimension we were able to study is the length of the relationship. Often changing, short-term relationships are likely to be market relationships, while longer term relations are likely to involve specific products. We also attempt to measure specific investments by asking about the need for innovation and other changes at the start and during the relationship. Finally, questions about the support each party received for their innovative investments from the other party investigate whether the relationship requires mutual investment and extensive cooperation or it is one-sided in terms of investments.

### 3. The survey

This section first describes our main aims and approach, followed by a number of practical questions and dilemmas which arose during the execution of the survey.

#### 3.1. Our aim and approach

A limitation of the reviewed literature is that relatively little is known about linkage formation between firms and the way linkages operate. Administrative data typically do not include such information and most of the surveys we have reviewed focus on other questions.

Our aim was to design a method which would be informative along this dimension. The literature on supplier-buyer relationships suggests that both firm fundamentals (productivity, size, etc), type of the product (specific or not) and strategic choices matter. Therefore, qualitative data on links and administrative balance sheet data strongly complement each other. In order to access both types of information, we have

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<sup>7</sup>This is similar to firm-specific human capital of workers. If a worker has to develop skills that are costly and she cannot use them in other firms, the cost of this human capital investment should be shared between the employer and the employee so both have a vested interest in maintaining the employment relation (Becker, 1962).

designed a procedure that allows us to link survey answers to key financial, industry and ownership information at the firm level.

Another key decision was to conduct a multi-country survey. One motivation was to strengthen the external validity of the analysis with multi-country research. A more practical motivation was that given the typical response rate for such surveys – 10-15% – it was unlikely that we will be able to 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 Global Supply Chains is prevalent in Central and Eastern Europe (OECD, 2017). Many multinational firms have manufacturing affiliates in these countries that are assembling parts or making 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 to EU value chains but are also part of many global operations.

A key practical constraint was to keep the survey at a manageable length 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.

### *3.2. Available expertise*

Conducting a survey involves many tasks: designing the questionnaire, collecting data—executing the survey itself— and managing the resulting datasets. All these activities require expertise and experience in many areas. In this project we have built on several different resources.

First, formulating good survey questions is a skill which can be learned by doing. Multi-country surveys raise a number of additional issues including a number of legal and accounting principles. In this respect, our previous involvement in international surveys—we were partners and team leaders in [EFIGE](#), one of the earliest and most successful cross-country survey projects on firms—was an important asset. Some of the team members also participated in surveys of firm restructuring and privatization in central and eastern European countries in the 1990's (Hungary, Romania and the Czech Republic).

Second, such a project also needs capacity for and expertise in actually conducting the survey in multiple countries. This involves designing the platform to collect answers, digitize them, and co-ordinate an array of people visiting firms as well as providing

quality control during the whole process. Surveyors need the expertise to convince high-level managers to participate in the survey and to build trust with the managers so they would share sensitive information about their company. Lacking this capacity, we decided to involve a partner with international experience and capacity. We set up an open call for tenders, in which previous experience in cooperating with researchers and strong presence in our target countries were key criteria. After a two-round selection procedure, *GfK Hungária Piackutató Kft.* (a subsidiary of the global GfK group) emerged as the winner. GfK Hungária helped in designing the survey, ran the data collection in Hungary and coordinated with the Slovak and Romanian GfK affiliates during data collection there.

Finally, after the survey is conducted, it is critical to have the capability to store and handle the data securely and have the capabilities for cleaning, linking and analyzing the data. We relied on [CEU MicroData](#), a research center of the Central European University, with many years of expertise in micro data handling and analysis.

### *3.3. Computer assisted personal interview*

While it was clear from the beginning, that we need to collect qualitative data and link them to quantitative information to reach our aims, we considered many options to conduct the survey – from internet-based surveys to face-to-face interviews. Finally, we opted for a computer assisted personal interview, assuming that this provides a good balance between depth and response rate. The survey instrument itself was programmed into an application. The surveyors could use application on their tablets to ask the questions from the managers and to type in the answers.

Surveyors were experienced with conducting surveys with managers and were from the network of GfK. We provided training sessions for these interviewers ensure that they understand the questions in depth. Similar events were organized in each participant country. All definitions were explained clearly to the interviewers in order to make them confident when using these business terms. We also conducted numerous calls with project managers from all countries to make sure that they understand the questions as we did, and ensure that the answers would be comparable across countries.

GfK had a number of surveyors in various regions of each country. This had an advantage both in terms of low travel cost and familiarity with the region. However, this feature of the data collection process also constituted a constraint because there was no way to randomize surveyors across respondents. Both the survey design and the training of the surveyors aimed at minimizing differences in the interpretations of the questions. In section [5.4](#) we write briefly about the checks we conducted to see whether surveyor heterogeneity affects the answers and the patterns we find.

### 3.4. Designing the survey instrument

We started the process of designing the survey instrument with a number of brainstorming sessions. During these occasions, we collected a number of topics and possible types of questions based on our review of the economics and business literature. Some of these initial questions were novel and some of them were adapted from already existing surveys (e.g. from the EU standard Community Innovation Survey).

A key limitation for such a survey is the amount of questions that can be covered in a time frame which managers are willing to allow for the surveyors. We decided that the survey should last no longer than 45 minutes. Given the breadth of topics we wanted to include, we faced significant length constraints on our questionnaire.

Another constraint that came up early on was the importance of finding the right balance between well-structured (and easier to analyze) close-ended questions and potentially more informative open-ended questions. We decided that most questions should be of the formal type, with few, but important exceptions. For example, we asked managers to briefly describe their firm, as this may contain useful information that helps understanding the context of their answers.

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.<sup>8</sup> 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.

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 Amadeus 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 (Bloom et al., 2014), we included very few questions on firm finances, especially if that

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<sup>8</sup>In case the firm did not have three partners above the 10% threshold, we asked for the three with the highest shares.

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.

### *3.5. Finding the right terms and formulating the actual questions*

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. Besides reading management texts, we also attended the [2015 Supplier Conference](#) organized for Hungarian suppliers and potential suppliers. This event helped us understanding the different roles a firm can play in a value chain (e.g. based on the nature of products supplied), the most important challenges they face (for example we got a deep understanding of the audit process before receiving ISO certificate) and the reasons firms opt to have foreign partners instead of Hungarians.

Another step of making sure that our questions will yield relevant answers was conducting three preliminary interviews with managers who also had some interest in research. During these interviews we learned extensively about what topics to cover and how to ask the right questions. We learned about different ways of establishing partnerships that we have not thought before. One of these ways was meeting at a trade fair, which came up many times later on. It also became clear that we need a strategy to ask the relevant information about partners within corporate groups. It proved to be a sensible idea to classify these partners into a separate category.

Another challenge was to find the right questions about the topic of branding in the manufacturing sector. Many of our preliminary interviewees did not use branding in the way we had assumed. For instance, they often used identifiers to mark their products in order to make maintenance easier. Even though the manufacturer of such products can be identified, this does not constitute branding in our framework.

These preliminary interviews played an essential role in designing the first draft of the survey. After the draft was ready, we conducted 10 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 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.

### *3.6. Building trust*

Response rates to surveys have been falling over time (Bloom et al., 2014). In line with this observation, managers claimed that they receive more than one survey call a week and so they have to be very selective when accepting such requests. We applied many different approaches to build trust and convince managers that our survey is one they should answer.

First, we promised the participants an analytic report and industry level summary from the results. These outputs can help them understand the general trends in their industry and compare their firms to industry averages.

Second, the survey was managed by respected institutions (Central European University and the Institute of Economics of the Hungarian Academy of Sciences) and also received professional support from other associations (such as the Hungarian Association of Logistics, the Slovak Economic Association and the Faculty of Economics and Business of Babeş-Bolyai University). We asked these institutions to endorse our survey among among their members or network.

Third, to make the survey more visible, we created a [website](#), available in four languages: English, Hungarian, Romanian, and Slovakian. We advertised the survey on related business events. When contacting firms, we have also supplied a concise letter of introduction on our aims and the survey. We found this extremely important as managers are likely to make decisions based on this limited amount of information.

Fourth, we took data security very seriously and also emphasized it to the managers. We prepared a Data Protection and Privacy Policy document which we published at the survey web site. This contains the exact details about what kind of data are collected and the purpose of data gathering as well as technical and personnel restrictions on data access. As part of writing this policy, we consulted with lawyers about legal constraints and also with industry participants to understand their needs and concerns. Our research was also approved by the Ethical Research Committee of Central European University and underwent an ethics self-review for the European Research Council. These assurances notwithstanding, some of the interviewees refused to reveal private, business sensitive information such as the name of business partners.

Another issue was to find the appropriate person in the firms. It was not always clear who has all the information that we need. Our questionnaire required information about

suppliers, which could have implied that the target person is the Procurement Officer. However, in many cases partnership decisions require higher level authorization. The questions are related to strategic decisions which can have a strong impact on the overall operation of the firm.<sup>9</sup> It was the responsibility of the interviewers to find the right person within the company, and we recorded the position of the interviewed person to improve precision of the estimation.

### *3.7. Target population and sampling frame*

We constructed a sampling frame based on the 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 GfK's estimates, 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.

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<sup>9</sup>For example, ISO certificates are often preconditions of joining a global value chain. Gaining such certificated often requires the review of the entire operation and the adoption of pre-defined standards at many levels.

#### 4. The questionnaire

In this section, we present some key questions from the questionnaire to illustrate the type of information available from the survey.

The questionnaire starts with questions about the firm itself. Table 1 includes a number of examples. These questions were typically answered by most firms, with some of them unable or unwilling to provide basic financial information. Questions here include basic information about the partners, including the number of buyers and suppliers.

Table 1: Firm specific questions

Question	Resp.rate	Question	Resp.rate
Number of employees	100%	Owner nationality	100%
Total sales in 2015	75%	High-value machines/equipment in the production process?	100%
How many buyers did your company have in 2015?	100%	Who decides typically on a new, large contract with a buyer?	100%

The table displays a sample of questions with their respective response rates. *Source: Central European Supplier Survey.*

After asking this basic information and learning about all partners, the questionnaire focused on *key partners*, as described in Subsection 3.4. Some of these questions are reported in Table 2. The basic questions, such as the location and industry of the partner and the age of the relationship were symmetric for buyers and suppliers. As the table shows, response rates were very high for these basic information questions. We measured the importance of suppliers relative to total purchase costs and that of buyers relative to the sales of the respondent. To make the questions less sensitive, we asked about ratios rather than the absolute values of sales and purchases. The response rate for this question was somewhat lower than for the basic questions, but still above 85%. If the manager was willing to specify a partner, in most cases she was also willing to supply us with this basic information about the relationship.

Table 2: Basic buyer/supplier questions

Buyer	Resp.rate	Supplier	Resp.rate
Where is the headquarters of the buyer located?	100%	Where is the headquarters of the supplier located?	100%
What is the buyer's main business activity?	100%	What is the supplier's main business activity?	100%
Number of years selling products to this buyer?	96%	How long have you been making purchases from this supplier?	95%
What share of your sales comes from this buyer?	89%	Share of overall purchase costs goes to this supplier?	87%

The table displays a sample of questions with their respective response rates. *Source: Central European Supplier Survey.*

When asking more detailed questions, in line with the typology discussed in Subsection 2.2, we focused on the nature of collaboration and types of products they trade. A few examples are shown in Table 3. Again, the response rate for describing the product and the substitutability of the product was high, with a somewhat lower response rate about cooperation and whether the product is critical. The lower response rate may partly be due to the sensitivity of these questions, but most likely the interviewees did not have the necessary information to answer these questions.

Table 3: Detailed questions on the relationship

Buyer	Resp.rate	Supplier	Resp.rate
Name the most important product sold to this buyer?	100%	Name the most important product bought from the supplier?	100%
Buyer performed regular checking in the last two years?	88%	Product of the sup. critical in your production process?	79%
Easy to sell an almost identical product to buyer?	100%	Easy to buy an almost identical product from an. supp.?	100%

The table displays a sample of questions with their respective response rates. *Source: Central European Supplier Survey.*

Beyond buyers and suppliers, a part of the questionnaire was devoted to understanding high valued machinery use as shown in Table 4. Again, the response rates were very high, with the exception of the age of the machine. Most likely the reason for not answering was the lack of information rather than the sensitivity of this question.

Table 4: Questions on high value machinery

Question	Resp.rate	Question	Resp.rate
Where is the headquarters of the manufacturer located?	100%	Quality of the machine on a 5 point scale	100%
The name of the machine	94%	Train existing emp. to successf. operate this machine?	99%
When was the machine produced?	81%	Received any assistance from the producer to operate this machine?	100%

The table displays a sample of questions with their respective response rates. *Source: Central European Supplier Survey.*

To sum up, response rates were reasonably high thanks to the large number of iterations during the development of the questionnaire. An important factor was to link the surveys to existing financial information rather than asking managers about about finances. Asking questions about all partners first and then focusing on key partners proved to be a good compromise. Asking questions perceived to be less sensitive — for example asking about ratios rather than absolute numbers — also helped achieving a higher response rate.

## 5. 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.

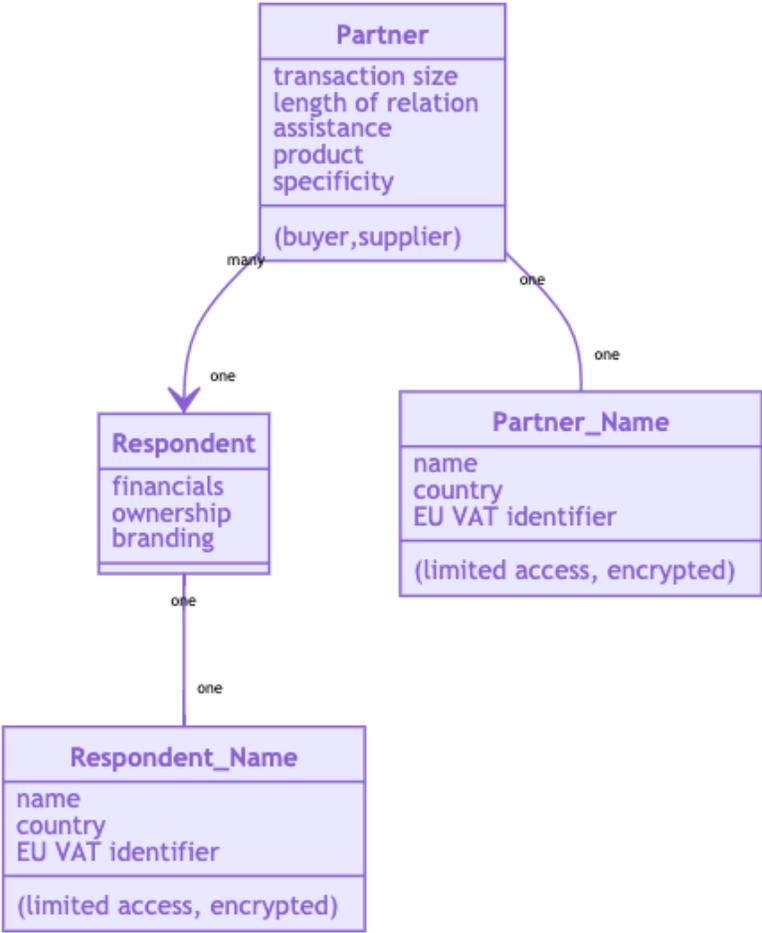
### 5.1. Data structure

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 1 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.<sup>10</sup>

Figure 1: Logical Model of the Supplier 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.

<sup>10</sup>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.

### *5.2. Data security*

As we have discussed in Subsection 3.6, data protection and security is key when conducting a survey about sensitive business information. In line with our Data Protection and Privacy Policy, we developed a work flow accordingly. In particular, as we discussed in Subsection 5.1, all information on company names and other identifiable information were masked. In addition, we checked the answers to open-ended questions and cleared company names, as sometimes firm names were mentioned in the free texts.

Complying with our security policy and to protect against accidental data leakage, all privately identifiable information resides on encrypted media on electronically and physically protected servers. Only designated researchers have access to the privately identifiable data when it is necessary (e.g., when cleaning the data). All other researchers have access only to the anonymized data, also stored on encrypted devices.

### *5.3. Harmonization*

Thanks to the efforts described in Subsections 3.5 and 3.6, 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.

#### *5.4. Survey quality test*

A key concern with these kind of surveys is whether some surveyors make less effort to gather reliable answers. 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 nonresponse. 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.

## **6. Results of the survey**

In this section, we present key results on buyer and supplier relationships. To conserve space, we mostly present results solely for buyers and note if the patterns are substantially different in the case of suppliers. When possible, we report the numbers separately for each country. We also show differences between different types of firms. When constructing firm groups, there is a clear trade-off between presenting a large number of groups and having a decent number of observations within each group. As a compromise, we classify firms into three groups: (i) Small domestic (below 51 employees), (ii) Large domestic and (iii) Foreign.

### *6.1. Sample*

A first view of the data is presented by Table 5, which shows the number of observations along several dimensions. There are 1535 firms in the final sample: 556 from Hungary, 584 from Romania and 395 from Slovakia. The majority of firms are small, with almost

two thirds having less than 50 employees. This distribution is similar across countries, with a somewhat greater share of large firms in Slovakia.

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 5: Summary of firms by number of employees, ownership and industry

Country	Hungary	Romania	Slovakia
<u>Number of employees</u>			
Less than 20 (38.7%)	203	213	179
Between 21 and 50 (25.7%)	134	167	93
Between 51 and 250 (28.1%)	184	167	80
More than 250 (7.5%)	35	37	43
<u>Ownership</u>			
Domestic (71.7%)	409	443	249
Foreign (28.3%)	147	141	146
<u>Manufacturing sector</u>			
Chemicals (4%)	19	25	17
Pharmaceuticals (0.8%)	3	6	4
Rubber and plastic (12.8%)	67	79	50
Non-metallic mineral (9.1%)	37	68	35
Basic metals (2.5%)	13	19	7
Fabricated metals (39.4%)	249	235	121
Computer, electronic and optical (4.8%)	24	23	27
Electrical equipment (6.9%)	36	28	42
Machinery (11.9%)	77	60	46
Motor vehicles (4.6%)	26	24	26
Other transport equip. (2.7%)	5	17	20
Total (100%)	556	584	395

Source: Central European Supplier Survey. Manufacturing sectors are NACE 1.1 2-digit categories. Ownership is based on majority owner. Number of employees is based on survey response

## 6.2. Portfolios of buyers and suppliers

Let us start with providing a picture about the number and distribution of suppliers and buyers (Table 6).

Consider first the median number of partners, presented in the third column. A robust insight is that the typical manufacturing firm has significantly more buyers (30 in all three countries) than suppliers (between 10 and 20). This likely reflects that many of the smaller buyers are outside manufacturing, and clearly suggest an important asymmetry in the structure of the network.

Table 6: Buyer and supplier portfolios (medians)

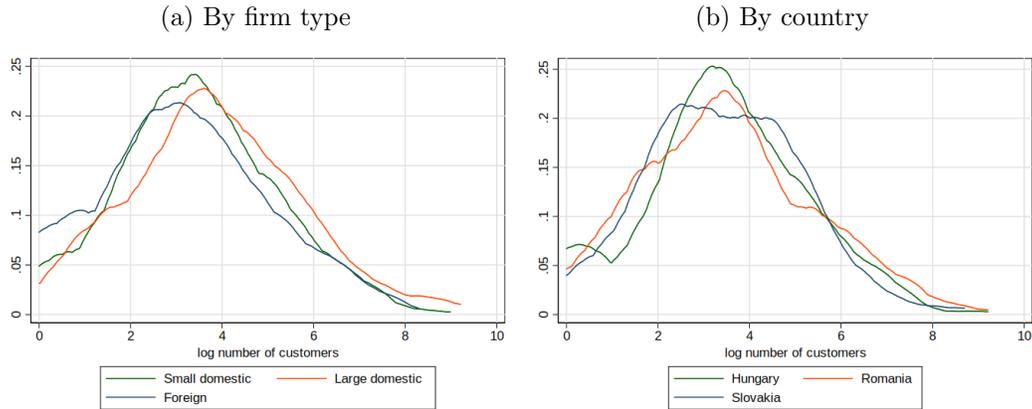
Country	Buyer/Supplier	Number	From which		Length
			Returning (number share)	TOP3 (value share)	
Hungary	buyer	30	67%	47%	10
	supplier	18	83%	40%	10
Romania	buyer	30	67%	60%	7
	supplier	20	75%	59%	8
Slovakia	buyer	30	40%	40%	6
	supplier	10	100%	44%	7

*Notes:* This table shows firm-level median for the number of buyers, suppliers, the share of returning partners, the share of the TOP3 partners in sales/material costs, and the average length of key relationships. *Source:* Central European Supplier Survey.

Figure 2 zooms in by showing the full distribution of the number of customers. The shape of these log-transformed distributions suggest that the original distribution is fat-tailed, with few firms having a very large number of partners while many firms supplying only a small number of partners. Panel A of the Figure distinguishes between small domestic (less than 51 employees), larger domestic and foreign firms. While the shape of the distribution is similar for the three groups of firms, larger firms clearly tend to have more customers. Panel B shows the distribution for the three countries separately. The figure shows that not only the central tendencies of the distributions (as Table 6 has already shown), but also their whole shapes are very similar across countries.

The fourth column of Table 6 shows the median share of returning partners (“had bought from /sold to your company previously?”). Repeated or longer term relationships seem to be the norm rather than the exception. In Hungary, for example, two thirds of buyers and more than 80% of suppliers are returning for the typical firm. This

Figure 2: Kernel densities of the number of buyers



*Notes:* This Figure shows kernel densities of the natural logarithm of the number of buyers. Small: < 51 employees, large otherwise. Foreign: foreign controlled. *Source:* Central European Supplier Survey.

also implies that manufacturing firms’ relationships with their suppliers are slightly more likely to be repeated than with their buyers.

The fifth column of Table 6 shows that the supplier and buyer portfolios are quite concentrated. The largest three partners represent between 40% and 60% of sales or purchases for the typical firm. This concentration is high when compared to the typical number of partners. We do not find pronounced differences between the concentration of buyers and suppliers, and these shares are similar across countries.

Finally, the last column of Table 6 shows the median length of key relationships.<sup>11</sup> We find that key relationships tend to be long-lasting, between 6 and 10 years old when the survey took place. The longevity of key supplier and buyer relationships appear to be similar. There are pronounced country differences in this respect, with relationships being about 3 years longer in Hungary compared to the other two countries.

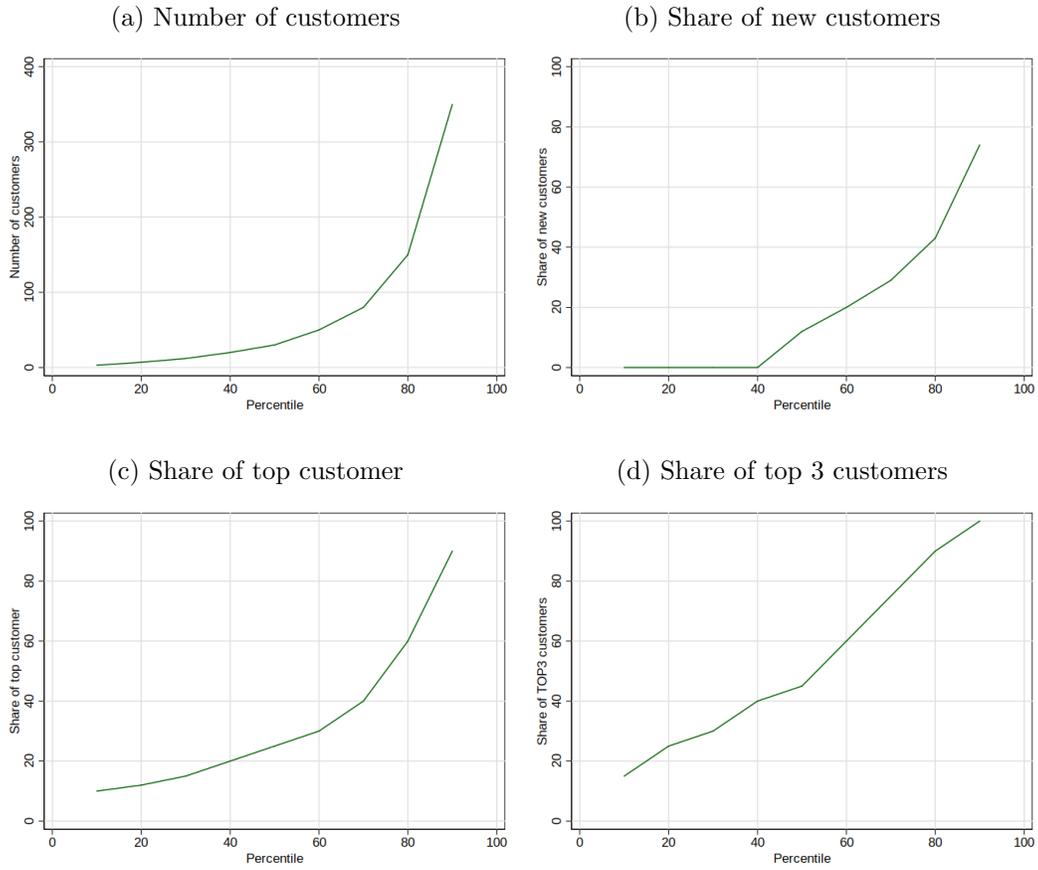
While Table 6 presented the central tendencies of the variables, the survey data also allows us to analyze firm heterogeneity along these dimensions. Figure 3 shows the inverse cumulative distribution functions of several variables. Panel A illustrates the distribution of the number of customers. In line with the patterns in Figure 2, the distribution is skewed, the median firm having 30 customers and the 99th percentile firm supplying 400.

<sup>11</sup>Recall that this question was only asked for key relationships.

There is also substantial heterogeneity across firms in terms of the share of their new (non-returning) customers (Figure 3, Panel B). 40% of firms served only returning customers in 2015, while 20% of firms had a share of new customers above 50%. This pattern reinforces our earlier conclusion that long-term relationships are the rule rather than the exception. It also adds to the picture by showing that different firms face large differences in the share of their longer-term relationships.

The heterogeneous strategic situation of firms is even more pronounced when we consider the concentration of their buyers (Figure 3, Panel C). The top 3 buyers of the median firm are responsible for about half of the sales, but the share of top 3 buyers is above 80% for 23.5% of firms. This suggests that most firms face at least some buyers with a large buyer/supplier power, but a substantial share of firms depend strongly on decisions of a few firms.

Figure 3: Differences between customer portfolios



Notes: This Figure shows the percentages (1-99) of the distribution of the above variables. Source: Central European Supplier Survey.

To sum up, we find that the supplier-buyer relationships of manufacturing firms are far from being atomized and short-term. A large share of partners are returning and the length of key relationships can easily be above 8-10 years. Buyer and supplier power seem to be substantial, with the top 3 partners typically responsible for more than half of sales or purchases. The survey also shows that there is a substantial amount of heterogeneity across firms in terms of how long-term their relationships are and how concentrated their buyer and supplier portfolios are. These facts imply that building supplier/buyer relationships are long-term strategic choices and may be strongly related to competitiveness, to which we turn now.

### 6.3. Supplier and buyer portfolios and performance

In this subsection we conduct a simple analysis to see whether the quantity and quality of suppliers is associated with firm performance. To do so, we run regressions at the firm level with labor productivity as the dependent variable and some characteristics of the buyer/supplier portfolio as explanatory variables. In particular, we run the following regression

$$LP_{icjs} = \beta' X_i + \gamma \ln \text{employees}_i + \eta_c + \theta_j + \delta_s + u_i, \quad (1)$$

where  $i$  denotes firms,  $c$  countries,  $j$  2-digit industries and  $s$  size categories,  $X_i$  is the vector of the variables of interest, and  $\eta_c$ ,  $\theta_j$  and  $\delta_s$  are sets of country, industry and size category dummies, respectively.

This strategy identifies the estimated coefficients from comparing firms in the same country, industry and size category but with different buyer and supplier structure. Naturally, in this cross sectional regression many key firm variables remain unobserved, therefore the results should be interpreted as suggestive correlations rather than causal effects. Although we focused on variables with good coverage, some buyer/supplier information is not available for all the firms in our sample. As a result, the sample for this exercise is 1129 firms (73% of the 1535 firms in the survey).

Table 7 presents the results of these regressions. In column (1), only the  $\ln$  number of buyers and suppliers are included in addition to the base firm controls. We find that the number of suppliers (but not that of buyers) is strongly correlated with labor productivity. A firm having twice as many suppliers will have a 4.2 log % higher productivity level. This does not merely captures price effects: when comparing two firms of similar size, the one with more suppliers tend to be more productive. The sign of the controls variables are as expected: larger firms and members of business groups are more productive.

In column (2) we start to control for the type of partners the firm has. First, we ask whether having at least one buyer and/or supplier from the firm's business group matters for productivity. We find a strong relationship between productivity and the

presence of *buyers* from the business group: firms having at least one such buyer tend to be more productive by 13%.<sup>12</sup> Column (2) does not show evidence for an association between having foreign buyers or sellers and productivity. In column (3) we also include the average length of the relationship with key buyers and suppliers.<sup>13</sup> These variables are not significant.

To sum up, the portfolio of buyers and suppliers is correlated with firm performance. In particular, labor productivity is associated with the number of suppliers a firm has and also whether some of the buyers are from the same business group. These results underline that partner portfolios are related to performance and therefore being more successful in building such portfolios may generate a competitive advantage.

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<sup>12</sup>Note that we already control for whether the firm itself is a member of the business groups, therefore this coefficient captures the additional effect of having buyers from the same group.

<sup>13</sup>Note that this reduces the sample to firms which have named key partners and also reported the duration of those relationships.

Table 7: Labor productivity and supplier/buyer characteristics

VARIABLES	(1) LP	(2) LP	(3) LP
ln(Number of buyers)	0.014 (0.013)	0.021 (0.014)	0.016 (0.015)
ln(Number of suppliers)	0.059*** (0.017)	0.057*** (0.017)	0.069*** (0.019)
Has buyer from business group		0.137** (0.057)	0.155** (0.061)
Has supplier from business group		-0.073 (0.060)	-0.050 (0.064)
Has foreign buyer		0.023 (0.051)	0.035 (0.057)
Has foreign supplier		-0.081 (0.050)	-0.056 (0.058)
Mean relationship length, buyers			0.007 (0.005)
Mean relationship length, sellers			-0.005 (0.005)
ln(Employment)	0.110*** (0.025)	0.104*** (0.026)	0.097*** (0.028)
Group member	0.161*** (0.049)	0.140*** (0.052)	0.136** (0.057)
Country, sector, size dummies	YES	YES	YES
Observations	1,129	1,129	996
R-squared	0.325	0.330	0.339

*Notes:* The table shows OLS regressions when the dependent variable is ln(labor productivity). One observation is one respondent. Business group and foreign refers to whether the firm has at least one such partner, while length is the average length of key relationships. Standard errors in parentheses\*\*\* $p$ |0.01, \*\* $p$ |0.05, \* $p$ |0.1. *Source:* Central European Supplier Survey.

#### 6.4. Forming relationships

After showing that performance is related to the number and type of buyers of the firm, we ask how these relationships form. What do firms do to build a portfolio which can support their performance more effectively?

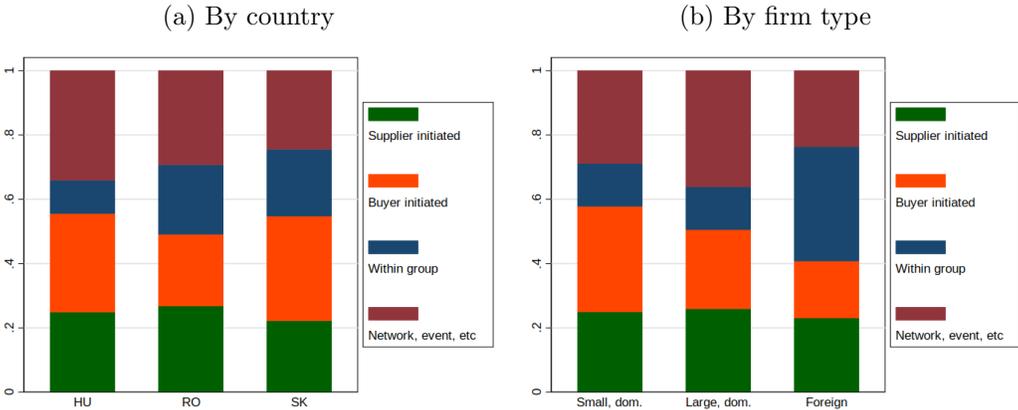
In our questionnaire we asked how each key relationship had formed. Based on the answers to this question we can distinguish between four main types of relationship formation: (i) supplier initiated; (ii) buyer initiated; (iii) within groups and (iv) other ways (including professional events and networking).

The results are presented in Figure 4. Buyer and supplier initiated relationships are similarly prevalent, representing more than half of all relationships. Intra-group relationships are especially important in the case of foreign-owned firms, where 36% of key buyers are from the same business group. Slightly more than 30% of key relationships formed via networking, professional events and in other ways.

These patterns are similar across countries, with within-group relationships playing a somewhat smaller role in Hungary compared to the other two countries. Another difference is that supplier-initiated key relationships substantially outnumber buyer initiated ones in Romania, while the two sides initiate to a more similar extent in Hungary and Slovakia.

A number of conclusions can be drawn from these patterns. First, the searching process is clearly two-sided, and presumably many relationships require substantial efforts from both sides. Second, within-group relationships represent a substantial share of key relationships, especially for foreign firms. Understanding multinational groups is important when describing the empirically observed supplier-buyer networks. Third, while a substantial number of relationships are created by networking and at professional events, the majority of relationships form besides these platforms. Policymakers aiming at promoting the creation of high-value relationships may use policy instruments that go beyond organizing such events.

Figure 4: How do firms find customers?



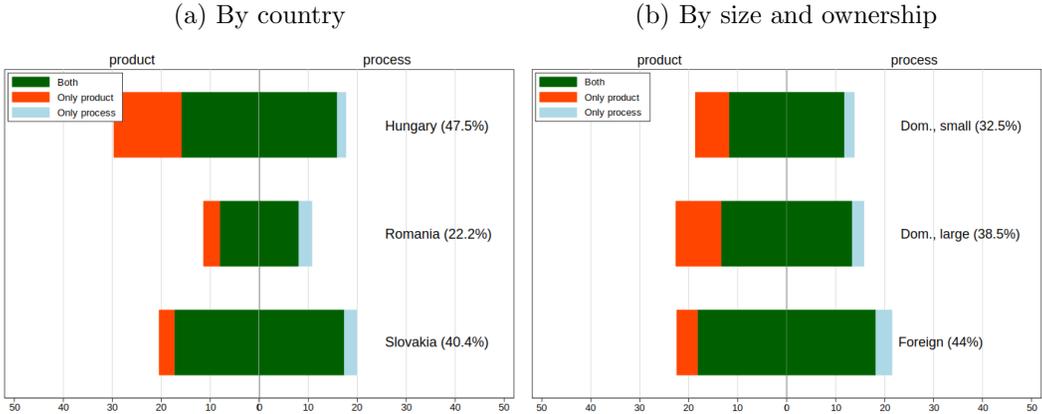
*Notes:* The figure shows the distribution of the answers to “How did the relationship start?” for key relationships (each such relationship when respondent is supplier is one observation).

While search is clearly a key element of new relationship formation, establishing the relationship often requires even more substantial investments. The survey captured these efforts by asking about innovation necessary at the beginning of a relationship. Figure 5 shows the share of key relationships which started with product innovation,

process innovation or both. We find that a large share of relationships indeed begin with innovation, though differences across countries are also substantial and reflect differences in general innovation activity: 47.5% in Hungary, 22.2% in Romania and 40.4% in Slovakia. Interestingly, product and process innovation appear to be strongly complementary: the majority of innovators conduct both types of innovation. Only modifying the product for the demands of the buyer may not be enough - the revamping of the production process is often necessary.

Panel B of Figure 5 distinguishes between firm types. We find that larger and foreign owned firms are more likely to innovate when starting key relationships compared to small domestically owned ones. This interesting pattern suggests that most of these innovations do not represent an effort by less productive firms to upgrade their technological level when starting to supply an important partner, but they represent an activity which allows more productive firms to customize their processes and products to fit better their important potential buyers. The 'innovation gap' between SMEs and larger firms may be an additional reason for smaller firms being less able to serve large and productive partners. Not only SMEs' technology level but also their innovation capabilities may lag behind that of larger and globally integrated firms.

Figure 5: Innovation when relationship starts



*Notes:* The figure shows the distribution of the answers to 'did the firm have to improve its product/process for the relationship at the beginning' for key relationships (each such relationship when respondent is supplier is one observation). *Source:* Central European Supplier Survey.

Investing into a relationship, however, is not necessarily a lonely activity. The data shows that suppliers' innovation is often supported by the buyer. Table 8 shows the type of support the buyer provides to the supplier at the start of the relationship (according to the supplier). The table distinguishes between different types of suppliers and buyers. The questionnaire differentiates between three types of support: (i) technology transfer, (ii) asset transfer and (iii) regular consulting, meeting.

The most frequent type of support involves regular meetings (28.2%), followed by technology transfer (17.5%) and asset transfer (7.8%). Buyers, especially domestic ones, often provide assistance for product development: consulting in 1/4, technology transfer in 1/8 and asset transfer in 1/16 of key relationships.

Table 8: Support for product innovation from customers at the start of the relationship

Partner (buyer)	Respondent (seller)			Total
	Domestic SME	Domestic large	Foreign-owned	
Technology transfer				
Domestic SME	18.1	100.0	63.6	21.0
Domestic large	25.2	25.9	25.7	25.3
Abroad	13.0	27.1	20.7	13.7
Total	16.4	27.8	26.2	17.5
Asset transfer				
Domestic SME	6.9	0.0	63.6	9.6
Domestic large	15.0	11.1	15.8	14.9
Abroad	4.2	8.6	10.3	4.5
Total	7.1	9.5	16.7	7.8
Regular meetings, consulting				
Domestic SME	24.5	50.0	54.5	26.2
Domestic large	39.0	27.8	34.5	37.6
Abroad	23.9	31.4	29.3	24.3
Total	27.7	30.2	34.2	28.2

*Notes:* The table shows the fraction of firms who responded having received a specific type of assistance from its buyer for product development at the start of the relationship. Buyer-supplier relationships are grouped by firm type. Only key relationships included. SME:  $\leq 50$  employees, large otherwise. *Source:* Central European Supplier Survey.

Our main findings about relationship formation can be summarized as follows. First, searching and starting relationships is a two-sided process: often both parties invest heavily into searching for partners and establishing relationships. Second, starting key relationships requires innovation, often both by modifying products and processes. Such innovations are more likely to be undertaken by more productive firms, showing that these are specific investments rather than general technology upgrades for firms with low productivity levels. The innovations often involve some form of cooperation between the buyer and supplier, suggesting that co-innovation plays an important part. All these patterns, together with the longevity of these relationships, suggest that many of the key supplier-buyer contacts are relational rather than simply market-based.

## 7. Summary and discussion

We conducted a survey of buyer-supplier linkages in a sample of manufacturing firms in Hungary, Romania and Slovakia. We discussed the key design and implementation choices for the Central European Supplier Survey and provided explorative analysis of firm responses about their business partners.

There are broad patterns of business link formation that are similar across countries and industries. Most firms have more buyers than suppliers and bigger firms have more of each type of partner. A very small fraction of business partners capture a large share of revenue and cost for most firms. This degree of concentration suggests that buyer-seller networks provide an important structural constraint to firm strategy. Many firms have a potentially unbalanced power relation with much larger business partners. It hence seems important to study how firms can diversify the portfolio of their buyers and sellers.

Regarding the formation of relationships we found that this is a two-sided process. Buyers and suppliers are similarly likely to initiate the relationship, suggesting a two-way search process. On the supplier side, starting the relationship requires an innovation effort, often involving both product and process innovation. This, however, is often supported by the buyer, mostly by technical advice, but also with technology or asset transfer in a number of cases.

The most important benefit of our survey is that it can tease out qualitative information about business relationships, which are difficult to collect in observational data. We hence view this methodology complementary to collecting large-scale administrative datasets about business-to-business transactions (such as from VAT filings). To understand the long-term stability and success of business relationships, we need to have much more information than just the volume of transactions, which is typically the only metric available in transactional data. Well-designed surveys can elicit information about the length of the relationship, the steps each party has taken to form and maintain the relationship, the flow of information and assistance in the relationship and other qualitative indicators measuring the relative market power of each partner.

We see a number of direct applications of the Central European Supplier Survey and the methodology we accumulated. First, we can study the role of geography and other frictions in forming buyer-supplier links. Our preliminary analysis suggests that suppliers are located closer to buyers than random firms in the same industry. This may be natural, but the exact ways in which geography affects link formation is not known. Second, given the collected information about the formation of a business link, we can ask what it takes for domestic firms to join GVCs. What are the characteristics of firms that sell to multinational business groups and what steps did they take to link up with their buyer? Third, it is interesting how communication and the flow of knowledge and

technology can maintain the relation in the long run. Many suppliers receive assistance from their buyers, but the exact nature of this assistance and its role in the longevity of the buyer-supplier relation should be studied further. Fourth, our survey and similar studies can inform about the power balance in GVCs and the transmission of economic shocks. For example, our previous survey (Békés et al. (2011)) found that local firms at the bottom of a GVC were hit harder by the great recession than headquarter firms at the top of the GVC. Studying the buyer-supplier relationship more directly can shed light on this question and other policy debates.

## 8. References

### References

- Acemoglu, D., Akcigit, U. and Kerr, W. (2016), ‘Networks and the macroeconomy: An empirical exploration’, *NBER Macroeconomics Annual* **30**(1), 273–335.
- Atalay, E., Hortaçsu, A. and Syverson, C. (2014), ‘Vertical integration and input flows’, *American Economic Review* **104**(4), 1120–48.
- Barrot, J.-N. and Sauvagnat, J. (2016), ‘Input specificity and the propagation of idiosyncratic shocks in production networks’, *Q. J. Econ.* **131**(3), 1543–1592.
- Becker, G. S. (1962), ‘Investment in human capital: A theoretical analysis’, *Journal of political economy* **70**(5, Part 2), 9–49.
- Békés, G., Halpern, L., Koren, M. and Muraközy, B. (2011), ‘Still standing: how european firms weathered the crisis - the third EFIGE policy report’, *Blueprints* **15**.
- Bernard, A. B., Moxnes, A. and Saito, Y. U. (2019), ‘Production networks, geography, and firm performance’, *Journal of Political Economy* **127**(2), 639–688.
- 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.
- Bureau van Dijk (2015), ‘Amadeus: A database of comparable financial information for public and private companies across europe’.
- Dhyne, E., Magerman, G. and Rubínová, S. (2015), The belgian production network 2002-2012, Technical report, NBB Working Paper.
- Gereffi, G., Humphrey, J. and Sturgeon, T. (2005), ‘The governance of global value chains’, *Review of international political economy* **12**(1), 78–104.
- Grossman, S. J. and Hart, O. D. (1986), ‘The costs and benefits of ownership: A theory of vertical and lateral integration’, *Journal of political economy* **94**(4), 691–719.

- Hummels, D., Ishii, J. and Yi, K.-M. (2001), ‘The nature and growth of vertical specialization in world trade’, *Journal of international Economics* **54**(1), 75–96.
- Johnson, R. C. (2018), ‘Measuring global value chains’, *Annual Review of Economics* **10**, 207–236.
- Johnson, R. C. and Noguera, G. (2012), ‘Accounting for intermediates: Production sharing and trade in value added’, *Journal of international Economics* **86**(2), 224–236.
- 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.
- 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.
- 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*.
- OECD (2017), Participation in global value chains, in ‘OECD Science, Technology and Industry Scoreboard 2017: The digital transformation’, OECD Publishing.
- Tintelnot, F., Kikkawa, A. K., Mogstad, M. and Dhyne, E. (2018), Trade and domestic production networks, Technical report, National Bureau of Economic Research.
- U.S. Bureau of the Census (2007), ‘Commodity flow survey’.
- Williamson, O. E. (2007), The economic institutions of capitalism. firms, markets, relational contracting, in ‘Das Summa Summarum des Management’, Springer, pp. 61–75.