

Supplier-Buyer Networks in International Trade: Firm-Level Evidence from Italy

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Overview

Overview of the lecture

Reading list

The Unicredit dataset

Offshoring

Production to order

The decision of the firm

Estimation results

Conclusions

- In this lecture we are going to analyze some firm-level evidence dealing with supplier-buyer networks in international trade
- **First**, we are going to evaluate firms' performance, for a number of measures, according to the type of foreign activity they are involved in
- In particular, we will focus on offshoring firms
- **Second**, we are going to study some determinants concerning firms' organizational choices
- In particular, we will focus on the production to order choice (*commessa* in Italian)

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- Casaburi L., Gattai V., Minerva G.A. (2007) Firms' International Status and Heterogeneity in Performance: Evidence from Italy. *Rivista di Politica Economica* 97, 151-187.
- Casaburi L., Gattai V., Minerva G.A. (2008) Are offshoring firms superstar? Evidence from Italy. <http://www.voxeu.org/index.php?q=node/1038>
- Casaburi L., Minerva G.A. (2008) Supplier-Buyer Proximity and Production to Order Choice. *Centro Studi Luca d'Agliano Working Papers*, no. 241.

Background:

Mayer T., Ottaviano G.I.P. (2007) *The Happy Few: The internationalisation of European firms. New facts based on firm-level evidence.* Bruegel Reprint 3, Brussels.

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- To test our predictions or to simply assess firms' performance we use firm level data
- Cross-Section for 4,178 Italian manufacturing firms for 2001-2003 (~3,400 after trimming)
- Most questions refer to the three-year period.
- Detailed data for size, labor force composition, balance sheet data, R&D activities, ownership
⇒ We can estimate TFP using as a fixed effect from a panel data approach.

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- **Offshoring** refers to the purchase from companies in locations outside the country of goods and services previously produced inside the purchasing company. Thus it includes not only international outsourcing, but also international insourcing, with the foreign affiliates of domestic parent companies exporting to their parents.
- In the Unicredit dataset firms are asked to report whether they offshore production, and the type of product that is offshored
- The types of offshored products are:
 - Final goods (horizontal offshoring)
 - Inputs or Components (vertical offshoring)
 - Both of them

Descriptive statistics about offshoring firms

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- Firms involved in offshoring are just 7% of the sample, and account for 12% of sales
- While there is considerable variation across industries, firms belonging to traditional sectors (such as textiles, clothing and leather) are more strongly involved in vertical offshoring and firms operating in high-tech sectors (such as office equipment and PCs, and medical, precision, and optical instruments) show a clear preference for horizontal offshoring
- Offshoring firms turn out to be "better" along several dimensions, as summarized in the table below.

Offshoring firms' performance

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	Average for Non- Offshoring Firms	Offshoring Premia	Final Goods Offshoring Premia	Inputs Offshoring Premia
Sales	34,000	170%	218%	94%
Employment	122	122%	124%	105%
Capital per worker	62	37%	53%	9%
Value added per worker	8	16%	28%	2%
Average wage	32	5%	9%	-2%

- Note: Data are from 2003. Monetary measures are in thousands of euros. The offshoring premia are computed from a model that includes industry fixed effects.
- The overall "offshoring premia" are clearly driven by firms involved in horizontal offshoring, while evidence is weaker when looking at vertical offshoring

Total factor productivity comparisons

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- As you have seen in the previous lectures, internationalized firms exhibit superior performance
- Specifically, you have seen that FDI makers perform better than exporters, and these perform better than non exporters
- A similar exercise can be conducted on offshoring firms
- To do so, one has to focus on a finer measure of successful firms' performance, called total factor productivity
- Total factor productivity is the portion of a firm's value-added that cannot be explained by the stock of assets held or the number of skilled or unskilled workers employed
- For this part of the analysis, we compare the productivity of inputs' and final goods' offshorers with that of purely domestic producers, that is firms that neither export nor offshore

Productivity comparisons: cdf

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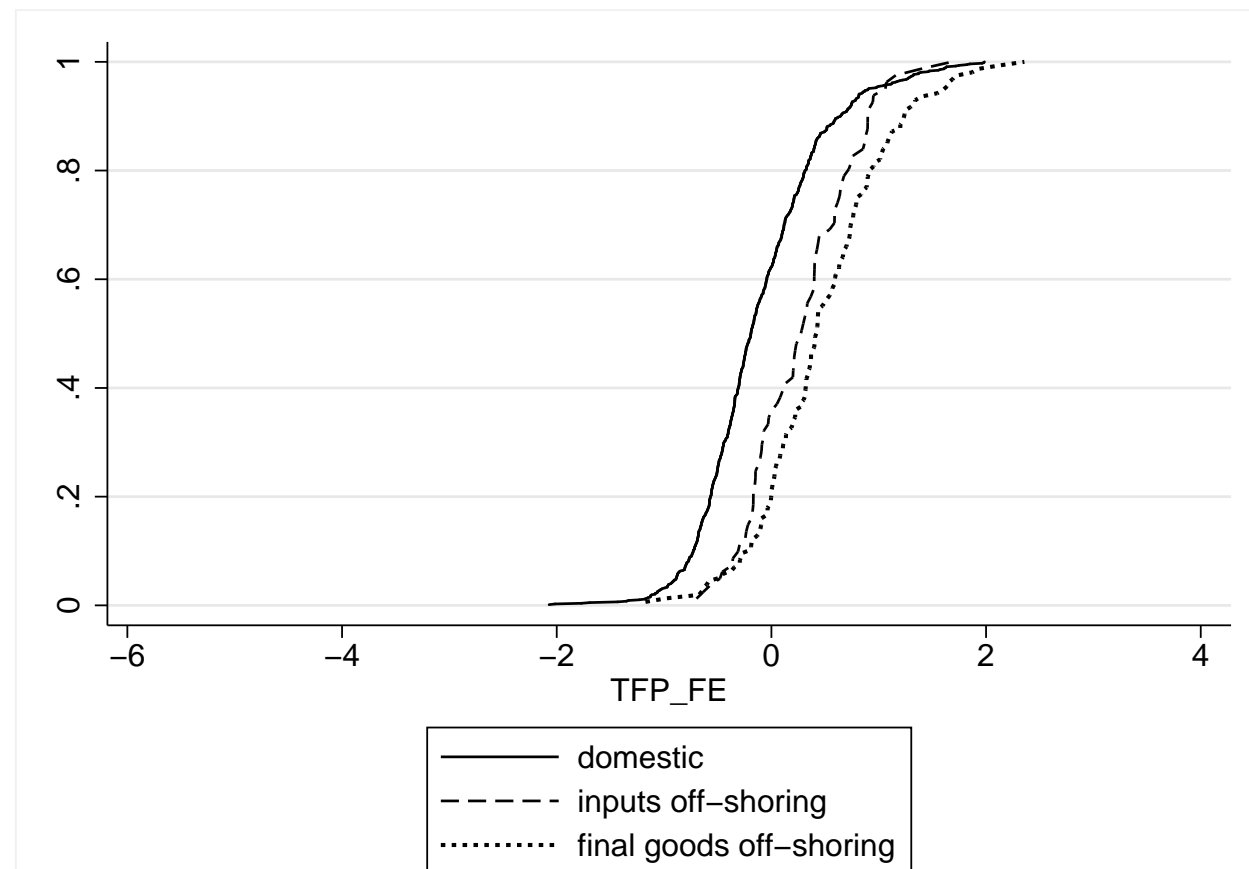
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In the figure below, we draw graphs of the empirical (estimated) cumulative distribution functions of productivity for the three categories of firms we are interested in: the higher is the estimated average productivity for a particular category of firms, the lower is the corresponding graph of the distribution function.



Productivity comparisons: comments on results (I)

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- Purely domestic firms are the least productive.
- Firms involved in inputs offshoring are at an intermediate productivity level
- Firms involved in final goods offshoring are the most productive.
- The first explanation is:
 1. Since offshoring involves fixed costs (such as finding a foreign partner and/or setting up a foreign plant, fixing the details of the production process offshore in terms of technical and legal requirements, etc.) only more productive firms are able to afford it.
Moreover, fixed costs associated with horizontal offshoring turn out to be higher than those associated to vertical offshoring since specific marketing activities are needed in the former case (such as advertising, searching local sales representatives abroad, etc.). The existence of these fixed costs then drives the offshoring decision.

Productivity comparisons: comments on results (II)

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- The second explanation is:
 2. Firms beginning to offshore at some point in time may then improve their efficiency as a consequence of this strategy. The exposure to international operations may actually benefit them, so that a process of learning by offshoring sets in. This process is stronger for firms that offshore final goods and weaker for firms that offshore inputs.
- These two explanations of the link between productivity and offshoring could both be relevant. A rigorous assessment of this issue needs data with multiple observations of the same firms over time.

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- Our research is related to the current debate in European trade policy.
- Knowing which firms are likely to gain and which are likely to lose from protectionist (or non-protectionist) measures is an important piece of information for the current policy-making debate
- As you know by now, the distinction between winners and losers from globalisation also applies to firms, not just workers
- In a world where offshoring strategies are becoming more pervasive, the political economy of trade liberalization is also becoming more complex
- Trade policy is no longer just a matter of seeking a balance between the interests of consumers and producers, but it necessarily involves the interests of consumers, offshorers, and domestic producers
- Example: Trade dispute on anti-dumping duties against light bulbs manufactured in China

Production to order vs. production in advance

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Production to order vs.
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- We focus on the firm's choice of producing to order vs. producing in advance
- **Production in advance:** firm faces the risk of not selling the product
- **Production to order:** pre-production contractual arrangement with a downstream firm
 - Ex-ante costs of arranging the details of the contract (search and matching frictions)
 - Ex-post costs: classical hold-up situation
- We study how this choice is determined by:
 - Degree of **sectoral product differentiation**
 - Proximity** between supplier and destination market (e.g., local vs. foreign market)
- Main result: The role of proximity depends on the degree of sectoral product differentiation

Relation with previous literature (I)

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- Wide literature focuses on the choice of the firm who commits the order (buyer).
- Instead, we focus on the determinants of the choice of the upstream firm (supplier)
- Limited work so far on this topic. Razzolini-Vannoni (2007) study the relation between production to order and TFP in Italy
- Most part of production to order takes place between firms and concerns intermediate goods \Rightarrow explaining this decision is important to better understand the determinants of intermediate inputs trade

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■ Relevance of other areas of research for our study:

- Networks and Trade (Rauch (1999)): proximity has a bigger role in differentiated sectors.
In these industries, trade occurs through the creation of networks/matching (rather than by organized markets)
⇒ Our focus is on the creation of these supplier-buyers networks
- Urban Economics: Matouschek & Robert-Nicoud (2005), Duranton & Puga (2004), and Helsley & Strange (2007):
co-location of firms and proximity between buyers and sellers lower transaction costs.
⇒ How does this affect the creation of networks?

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- Firms take as given the degree of sectoral product differentiation
- The choice concerns production for a given destination market (e.g. the firm has to decide which type of production - to order vs. in advance - to undertake to sell its product in a foreign market)
- They have to decide whether to produce in advance or to produce to order for a certain destination market
- Production in advance:
 - Production occurs before finding a buyer
 - After producing (or while producing) the firm undertakes market search activities
- Production to order:
 - First, the firm writes a contract with the buyer
 - After the contract is signed, the firm undertakes production

The role of proximity and product differentiation (I)

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- Both choices entails specific risks.
- Production in advance scenario:
 - The firm faces uncertainty in demand \Rightarrow risk of not finding a buyer
 - If destination market is "far": more uncertainty, market search activities are less effective (more costly)
 - Thus the closer a firm is to its potential destination market, the lower the risk faced if it undertakes production in advance
- Production to order scenario:
 - The firm faces the cost of writing a contract and in addition deals with the classical hold up risk
 - This hold-up risk is higher the higher the degree of product differentiation
 - Proximity reduces the risk of hold-up. The role of proximity in reducing this risk is more relevant in highly differentiated sectors

The role of proximity and product differentiation (II)

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- Consider the case of a firm operating in a **homogeneous sector**
 - Hold-up risk is not relevant
 - Proximity reduces demand uncertainty if the firm chooses to produce in advance
 - ⇒ In homogeneous sectors, proximity pushes toward production to advance

- Consider the case of a firm operating in a **differentiated sector**
 - Both the demand uncertainty and the hold-up risk are reduced by proximity
 - If high differentiation: proximity primarily works in reducing hold up risk
 - ⇒ In highly differentiated sectors proximity pushes toward production to order

Plots of the profit differential $\Delta\pi = \pi_{\text{order}} - \pi_{\text{advance}}$

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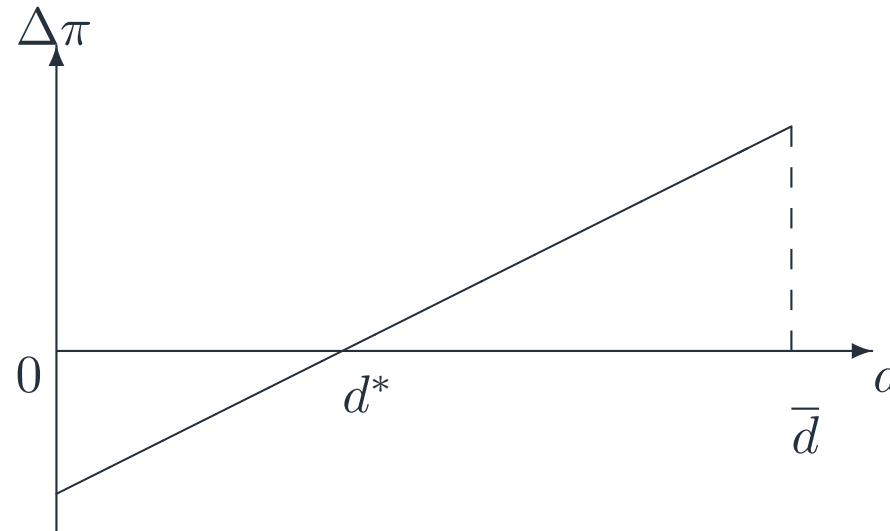
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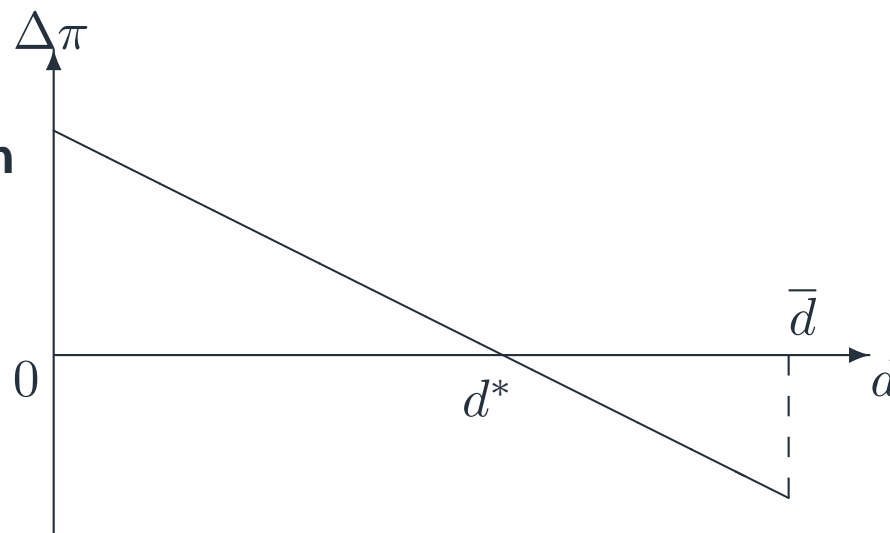
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Prod. Differ. is **low**



Prod. Differ. is **high**



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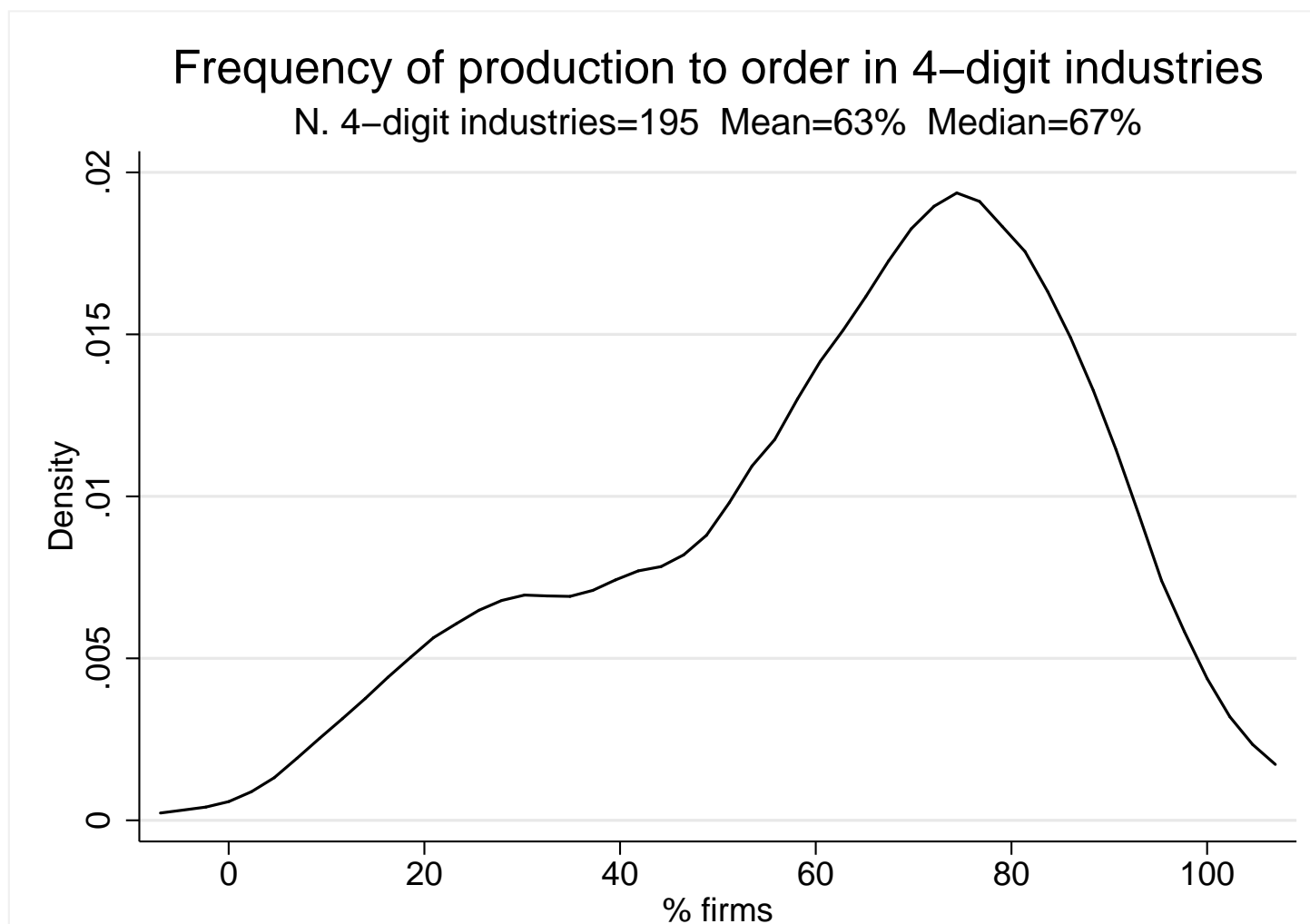
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■ Testable hypotheses:

- In homogeneous sectors, firms that are located closer to the potential buyers should be more likely to produce in advance
- In differentiated sectors, firms that are located closer to the potential buyers should be more likely to produce to order

The production to order variable

- *ord*: indicator for whether firm undertakes production to order
- Lots of variation within narrowly defined sectors (4 digit NACE):



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- We define a measure of product differentiation in the transaction between the supplier and the buyer
- Rauch (1999) classifies each of the 1,189 industries of the 4-digit SITC classification as:
 1. sold on an organized exchange market;
 2. having a reference price (e.g., price quotations published in trade journals);
 3. neither of the two (differentiated commodities; e.g., shoes).
- We employ UK Input-Output **Use** tables to retrieve weights for downstream industries (roughly 3 digit, 75 sectors).
- We develop an *ad hoc* concordance to match firm-level, Input-Output, and Rauch's industrial classifications

An example of UK I-O tables: Glass industry

3

Demand for products in 2002 The 'Combined Use' matrix

£ million

		18	19	49	76	77
	Product (for full titles see Annex A)	Alcoholic beverages	Soft drinks & mineral waters	Glass & glass products	Medical & precision instruments	Motor vehicles
49	Glass & glass products	333	56	462	5	476

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- We follow a procedure similar to Nunn (2007)
- For each supplying industry, we compute a weighted measure of product differentiation that takes into account the characteristics of downstream markets: $z_j = \sum_k \theta_{jk} \cdot R_k$.
 - R_k is the share of *differentiated products* in each I-O industry
 - θ_{jk} is the fraction of output produced by industry j that is consumed by industry k ,
- **Result:** A measure of downstream product differentiation at 3-digit industry level.
- Important assumption: the product differentiation in the buyer's industry is a good proxy for the differentiation that characterize the transaction between the buyer and the supplier.

Production to order and product differentiation

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	All	Production to order (%)	Production to order mainly from abroad (%)
Industries			
<i>Least contractual intensive</i>			
Production, processing, preserving of meat (.192)	64	13 (20.3%)	0
Alcoholic beverages, alcohol and malt (.260)	53	15 (28.3%)	3 (5.7%)
Vegetable and animal oils and fats (.287)	15	4 (26.7%)	0
<i>Most contractual intensive</i>			
Electronic valves and tubes, other components (.999)	33	26 (78.8%)	8 (24.2%)
Insulated wire and cable (.997)	15	9 (60.0%)	2 (13.3%)
TV and radio receivers, recorders (.994)	2	1 (50.0%)	1 (50.0%)

- Pairwise connections are more likely if downstream markets are contractual intensive but the relation is not one-to-one.
- The firm, taking as given the sectoral characteristics, has a degree of choice
- Recall: high variability even in narrowly defined sectors

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- Ideally, we would have distance between supplier and buyer for each transaction...
 - ...but we don't \Rightarrow Quest for proxies of proximity
- **Location in a district:**
 - Firms located in an industrial district sell most of their output to downstream firms located nearby (broad evidence on this)
 - \Rightarrow Proxy for high proximity between supplier and typical buyer
- **Export status:**
 - Exporting firms sell part of their output in distant (i.e foreign) markets
 - \Rightarrow Proxy for high distance between supplier and typical
- Main assumption: district location and export status are taken as exogenous

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	Firm Located in a district	Exporters
Homogeneous Sectors	PRODUCTION IN ADVANCE	PRODUCTION TO ORDER
Differentiated Sectors	PRODUCTION TO ORDER	PRODUCTION IN ADVANCE

■ Intuition:

- Homogenous sectors: production to order as a way to "secure" a buyer in distant markets
- Differentiated sectors, hold-up and matching frictions prevail \Rightarrow firms decide to serve a distant market through production in advance
- The converse hold for "close" markets, proxied by district location

■ We use a simple probit:

$$\text{Prob}(ord_{ijp} = 1) = \Phi(\beta_0 + \beta_1 * Proximity_i + \beta_2 * Proximity_i * z_j + X'_i \beta_3 + \eta_j + \eta_p)$$

- firm i , sector j , province p ,
- Industry and Province fixed effects,
- Firm level controls: size, TFP, capital intensity, skill intensity, R&D activities, group dummy.

■ Expected signs of the coefficients:

- When the (inverse) proxy for proximity is exporter status :
 $\beta_1 > 0, \beta_2 < 0$
- When the (direct) proxy for proximity is district location:
 $\beta_1 < 0, \beta_2 > 0$

Baseline results

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Dependent Variable: Share of production to order						
Proximity as:	[Both] [1]	[Export status] [2]	[3]	[District location] [4]	[5]	[Both] [6]
Exporter	-.018 (.023)	.291*** (.089)	.332*** (.092)			.352*** (.092)
Exp * z_j		-.456*** (.107)	-.440*** (.110)***			-.462*** (.110)
District	.017 (.026)			-.402** (.131)	-.353** (.140)	-.415*** (.134)
Distr * z_j		.		.464* (.154)	.415*** (.157)	.482*** (.156)
Firm level controls	Yes	No	Yes	No	Yes	Yes
Spatial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R-squared	.18	.16	.18	.15	.18	.18
N. obs.	3,290	3,325	3,290	3,353	3,318	3,308

Marginal effects reported. Standard error in parentheses

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Exporter	-.018 (.023)	.291*** (.089)	.332*** (.092)			.352*** (.092)
Exp * z_j		-.456*** (.107)	-.440*** (.110)***			-.462*** (.110)
District	.017 (.026)			-.402** (.131)	-.353** (.140)	-.415*** (.134)
Distr * z_j				.464* (.154)	.415*** (.157)	.482*** (.156)
Firm level controls	Yes	No	Yes	No	Yes	Yes
Spatial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R-squared	.18	.16	.18	.15	.18	.18
N. obs.	3,290	3,325	3,290	3,353	3,318	3,308

Marginal effects reported. Standard error in parentheses

Overview

Offshoring

Production to order

The decision of the firm

Estimation results

Conclusions

Conclusions

- This lecture has considered two rather distinct aspects of firms networks in international trade:
 - **First**, we have documented performance heterogeneity among domestic and offshoring firms, and among offshoring firms themselves
 - We have argued what could be driving such results, and also why this is a relevant policy issue
 - **Second**, we have picked up a precise organizational choice (production to order) and proved how the determinants of this choice can be theoretically rationalized, and how the success of the theory in explaining reality can be tested against firm-level data
 - Aspects such as contractual incompleteness and marketing costs seem to play an important role in the decision about how to sell the product