Discussion of “O-Ring Production Networks”
by Demir, Fieler, Xu, Yang

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Firms that pay high wages have suppliers that pay high wages

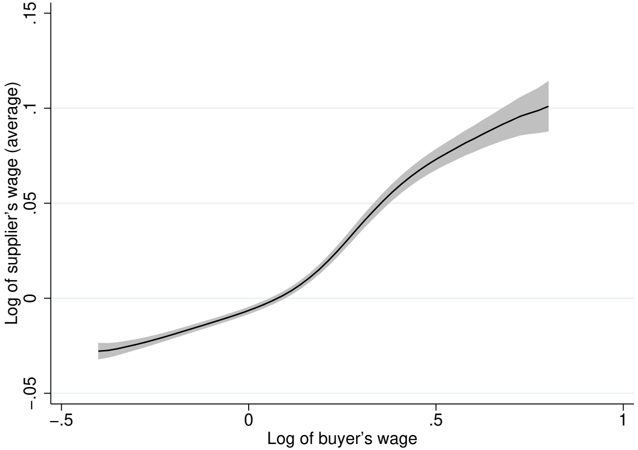

Figure: Turkish manufacturing firm-to-firm (VAT) data, 2011-2015

DFXY empirical facts

- strong positive assortative matching: high-wage firms have high-wage suppliers
- decomposition: extensive margin $\sim 60\%$, intensive margin $\sim 40\%$
- shift-share regressions: increase in foreign demand for high quality goods (from rich foreign country)
  - exporting firm's own wage increases
  - suppliers' wages increase
- in DFXY quantitative model: firm's wage reflects latent variable "quality"
  - positive assortative matching in quality: extensive & intensive
  - increase in foreign demand for high quality goods $\rightarrow$ exporting firms upgrade quality

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Extremely stripped-down version of DFXY model

Firms

- mass of firms $i \in [0,1]$ with qualities

$$q_i \in Q \subseteq \mathbb{R}_+$$

- distribution of firms over qualities

$$j(q)$$

- production function

$$X_i = z_i F(L_i, Y(q_i))$$

- input bundle CES over supplier qualities q'

$$Y(q_i) = \left[\int y(q')^{\frac{\sigma-1}{\sigma}} \phi_y(q_i, q')^{1/\sigma} dq' \right]^{\sigma/(\sigma-1)}$$

Firm Problem: intensive margin

- cost minimization

$$C(q_i) = \min \int p(q')y(q')dq'$$

  subject to

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- FOC implies CES demand for firm of quality q_i

$$\frac{y(q_1')}{y(q_2')} = \left[\frac{p(q_1')}{p(q_2')} \right]^{-\sigma} \underbrace{\frac{\phi_y(q_i, q_1')}{\phi_y(q_i, q_2')}}_{\text{intensive}}$$

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Intensive margin

- intensive margin governed by

$$\frac{\phi_y(q_i, q_1')}{\phi_y(q_i, q_2')}$$

  - increasing in quality of firm q_i iff $q_1' > q_2'$
  - a.k.a. ϕ_y is log-supermodular

- quality complementarity: high quality firms buy more from high quality suppliers

Intensive Margin

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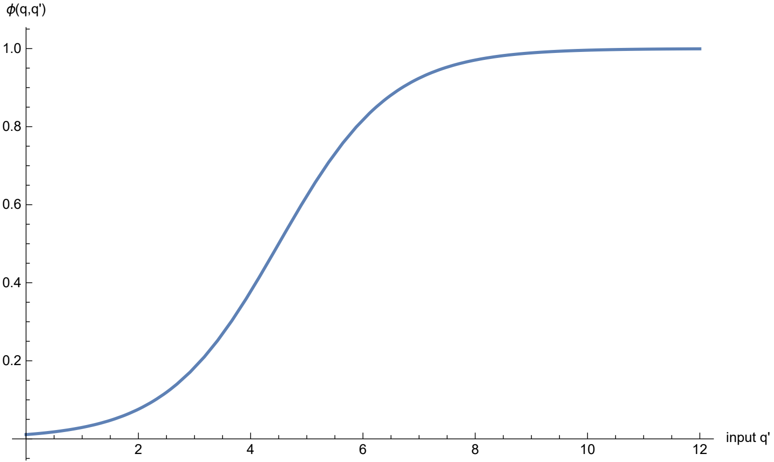

Figure: $\phi_y(q, q')$

High q firms buy more from high q suppliers

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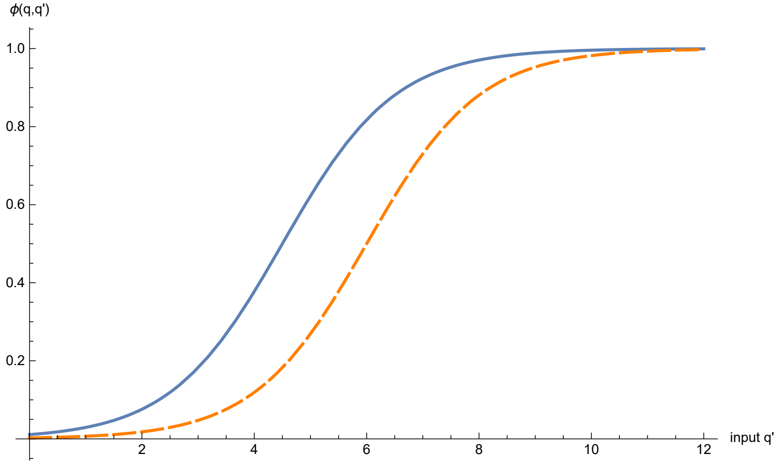

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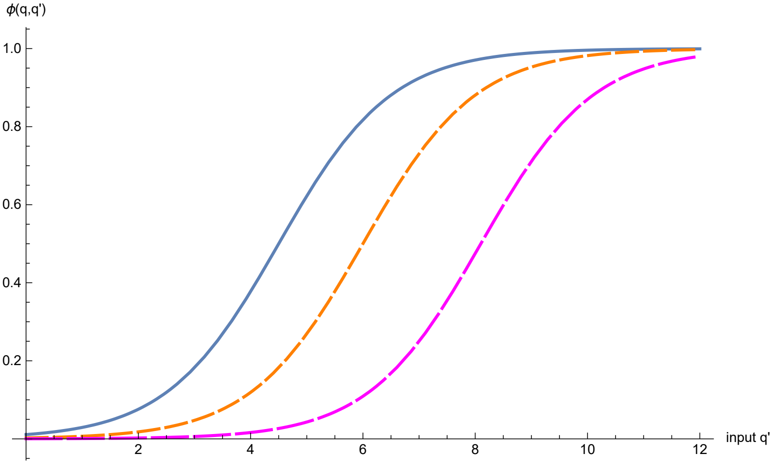

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Firm Problem: extensive margin

- firms must post mass of ads in order to attract suppliers (m) and buyers (v)

$$\max_{v,m} \pi(q_i, v, m) - c^m(m) - c^v(v)$$

- determines optimal mass of ads

$$m(q_i) \qquad \text{and} \qquad v(q_i)$$

One-sided directed search

- buyers of quality q: passive, just posts ads $m(q)$
- sellers of quality q': posts ads $v(q')$ directed towards buyers of quality q according to

$$\phi_v(q,q') \qquad \text{pdf of} \quad \mathcal{N}(q',\sigma_v^2)$$

Search & Matching

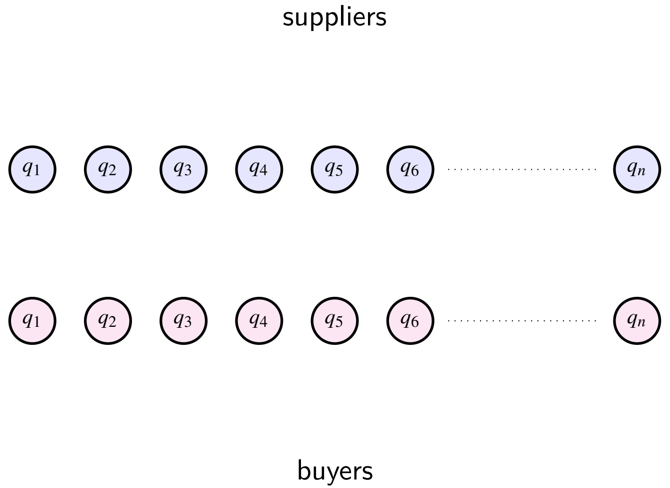
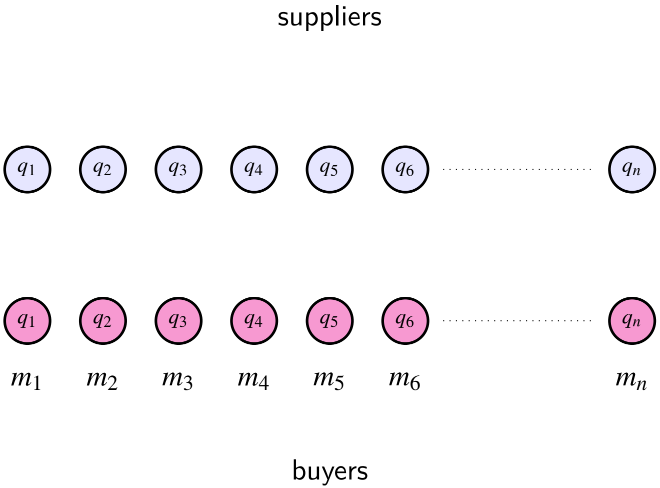


Figure: supplier network formation

Search & Matching



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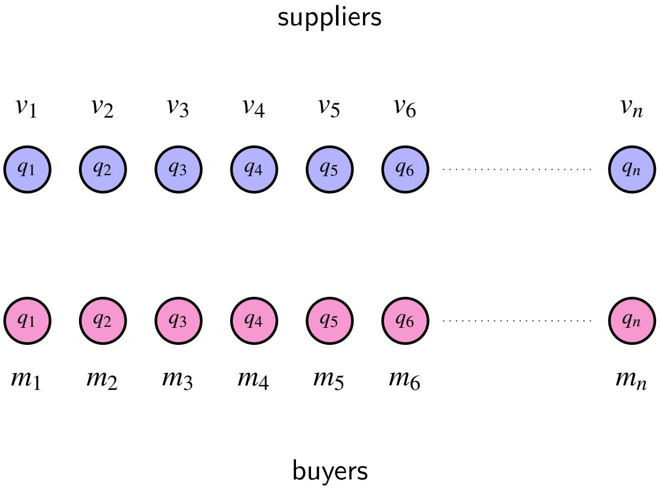

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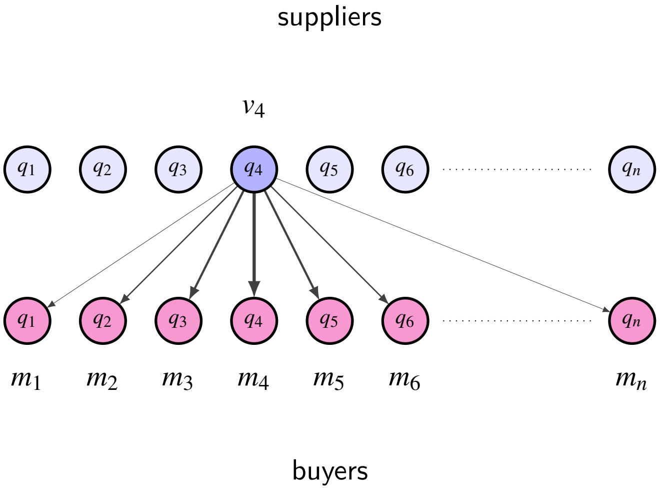

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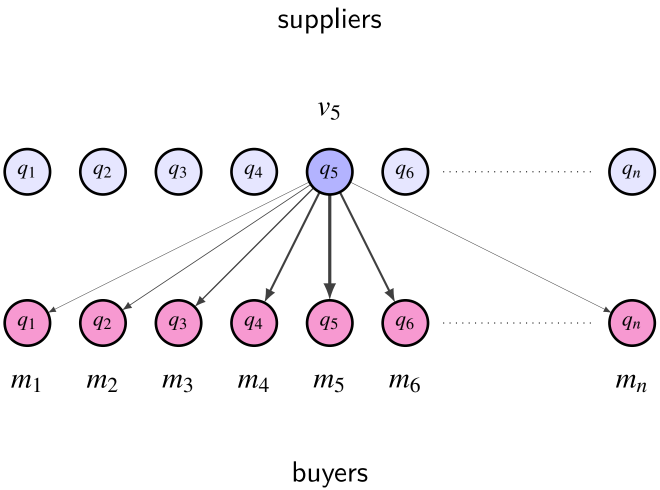


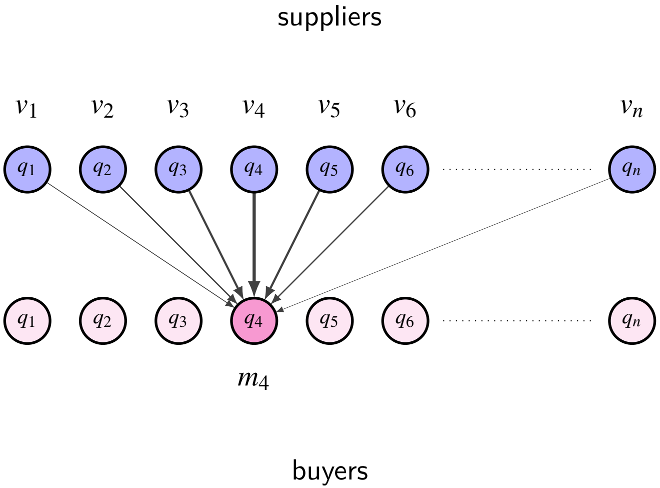
Figure: supplier network formation

Consider a buyer of quality q_i

- buyer's ratio of matches with suppliers of quality q'_1 and q'_2

$$\frac{j(q'_1)v(q'_1)}{j(q'_2)v(q'_2)} \underbrace{\frac{\phi_v(q_i, q'_1)}{\phi_v(q_i, q'_2)}}_{\text{extensive}}$$

Extensive margin



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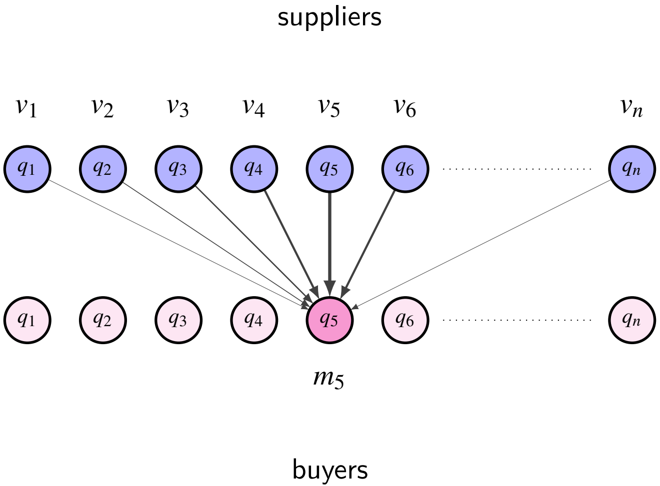

Figure: supplier network formation

High q firms have relatively more matches with high q suppliers

- extensive margin governed by

$$\frac{\phi_v(q_i, q_1')}{\phi_v(q_i, q_2')}$$

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- one-sided directed search leads to positive assortative matching

Endogenous Quality Choice

- firm's quality q is actually endogenous:

$$\max_{q \in Q} \Pi(q, z(q), \delta)$$

  - $z(q)$ is Hicks-neutral productivity (recall production function $X_i = z_i F(L_i, Y_i)$)

- let δ parameterize foreign demand shock

Endogenous Quality Choice

$$\max_{q \in Q} \Pi(q, z(q), \delta)$$

- FOC

$$\frac{\partial \Pi(\cdot)}{\partial q} + \frac{\partial \Pi(\cdot)}{\partial z} \frac{\partial z(q)}{\partial q} = 0$$

- why an interior $q^* \in Q$?
- trade-off between quality q and productivity z

$$\exists \tilde{Q} \subseteq Q \qquad \text{s.t.} \qquad \frac{\partial z(q)}{\partial q} < 0, \quad \forall q \in \tilde{Q}$$

  - intuition: as quality increases, could become difficult to produce high quantity

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How does firm's quality choice respond to foreign demand shock?

- Let $q^*(\delta)$ denote firm's optimal quality choice for given foreign demand δ

Proposition

The firm's optimal choice $q^*(\delta)$ is strictly increasing in δ if and only if

$$\frac{\partial^2 \Pi(\cdot)}{\partial \delta \partial q} > 0,$$

i.e. foreign demand shock increases demand more for high quality goods than for low quality.

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Sketch of proof/intuition

- firm's optimal choice of $q^*(\delta)$ determined implicitly by FOC

$$\frac{\partial \Pi(\cdot)}{\partial q} + z^{\gamma(\sigma-1)-1}\frac{\partial z(q)}{\partial q} = 0$$

- by the implicit function theorem,

$$\frac{dq^*}{d\delta} = -\frac{\partial^2 \Pi(\cdot)}{\partial \delta \partial q} \Big/ \frac{\partial^2 \Pi(\cdot)}{\partial q^2}$$

- as long as profits are concave in quality,

$$\frac{dq^*}{d\delta} > 0 \qquad \text{iff} \qquad \frac{\partial^2 \Pi(\cdot)}{\partial \delta \partial q} > 0$$

- firm upgrades quality in response to demand shock iff demand shock is complementary to quality

Conclusion

- Very impressive paper
  - novel and rich data set, interesting new empirical facts
  - quantitative model that fits facts/can be used for counterfactual exercises
- Comments on theory exposition:
  - intuition and theory for the trade-off firm faces when choosing quality
  - intuition and theory for upgrading quality in response to demand
  - intuition for why earnings-per-worker are increasing in quality
- I really enjoyed reading and thinking about this paper, and I learned a lot!