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Market Concentration and International Outsourcing

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Abstract

This paper shows that market concentration is positively related to outsourcing activities in a framework of Cournot competition with strategic outsourcing in a first stage. The theoretical priors are confirmed by rank correlation coefficients between the intermediate goods import intensity and market concentration in the EU12 countries.

Key words: International outsourcing; Oligopolistic competition

JEL classification: F12; F15; F40; L13.

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1 Introduction

The theoretical literature on outsourcing (fragmentation of production across borders) is predominantly organized around the traditional Heckscher-Ohlin, Ricardo and Ricardo-Viner general equilibrium models of international trade with perfectly competitive goods markets (compare Arndt, 1997; Deardorff, 2001a, 2001b; Egger & Egger, 2001; Jones & Kierzkowski, 2000; Kohler, 2001a, 2001b; etc.). There is a consensus that shrinking trade costs for intermediate goods in a broad sense¹ are an important incentive for outsourcing. In general equilibrium models, industry-specific trade costs, technologies and factor costs typically explain the differences in outsourcing activities across industries (compare the discussion in Egger & Egger, 2001.)

This paper demonstrates that the observed differences in the outsourcing engagement across industries may also be due to market concentration. It takes a partial equilibrium (short-run) point of view and sets out a simple model of Cournot competition in two stages. In a first stage, firms strategically choose their outsourcing intensity. This decision is based on the following trade-off. On the one hand, outsourcing generates additional costs in the form of *search costs* to find a suitable supplier of the imported intermediate (compare Grossman & Helpman, 2001), *production adjustment costs* and *communication* and *coordination costs*.² These costs depend on the degree of outsourcing. On the other hand, outsourcing also implies access to cheaper intermediate goods imported from abroad.³ Thus, (marginal) production costs (net of search, adjustment, communication and coordination costs) are declining in the outsourcing intensity. In the second stage, we assume that firms serve markets under Cournot competition.

In our theoretical model, it turns out that a higher market concentration is associated

¹"... the costs of linking such fragments across borders,..." (Kohler, 2001b).

²Jones (2000, p. 117) stresses the importance of service links. "*The costs of service links include (...) cost of communication, and the costs of planning and the coordination to match the quality and quantity of output flows.*"

³It is typically argued in the literature that the driving force behind international outsourcing are differences in factor prices. Compare among others Arndt (1997) and Kohler (2001a).

with a higher outsourcing intensity at the industry level. This result is confirmed by the rank correlation coefficients of market concentration in the EU and the outsourcing intensity (intermediate goods imports as percent of gross production) within the EU12 area. Hence, market structure is indeed one reason, why outsourcing activities are so different across industries.

2 A Cournot Model With Outsourcing

Consider a model, where a given number of firms (n) sells a homogeneous good under Cournot competition facing the inverse demand function

$$p = a - bQ, \quad (1)$$

with Q being the aggregate output. Then, profits of firm i are given by

$$\pi_i = (A - bQ) q_i - c(a_O^i) q_i - \tau a_O^i. \quad (2)$$

Thereby, q_i is the output of firm i and $a_O^i \in [0, 1]$ denotes the degree of international outsourcing of firm i (i.e. the outsourcing intensity). The amount of imported intermediate goods of firm i is then given by $a_O^i q_i$. τa_O^i describes output-independent outsourcing costs (as for example search, coordination and communication costs), which are increasing in the outsourcing intensity a_O^i . Unit production costs, given by $c(a_O^i)$, are strictly decreasing in a_O^i , with $c'(a_O^i) < 0$ and $c''(a_O^i) > 0$.

We suggest a two stage model, where firms choose the outsourcing intensity (and therefore the production technology) in a first stage and compete in quantities at the goods market thereafter (second stage). Profits are by assumption strictly positive, i.e. $\pi_i > 0$. The first order conditions in a symmetric equilibrium with identical firms (suppressing i) can be written as

$$A - c(a_0) - b(n + 1)q = 0 \quad (3)$$

for the second stage and

$$c'(a_0)q + \tau = 0 \quad (4)$$

for the first stage. Using the implicit function theorem in (4), the following impact of the number output on the outsourcing intensity can be derived:

$$\frac{da_O}{dq} = -\frac{c'(a_O)}{c''(a_O)q} > 0. \quad (5)$$

Moreover, use $a_O(q)$ in (3) to obtain

$$\frac{dq}{dn} = -\frac{bq}{b(n+1) + c'(a_O)\frac{da_O}{dq}}. \quad (6)$$

Thus, $\frac{dq}{dn} \geq 0$ iff $b(n+1) \leq |c'(a_O)|\frac{da_O}{dq}$. Now, solve (4) for $c'(a_O)$ and use $\frac{da_O}{dq}$, according to (5) to derive

$$\frac{dq}{dn} \geq 0 \quad \text{iff} \quad [A - c(a_O)]q \leq -\tau\frac{c'(a_O)}{c''(a_O)}. \quad (7)$$

For an explicit solution, assume $c(a_O) = ca_O^\alpha$, with $\alpha < 0$. Then, $\frac{c'(a_O)}{c''(a_O)}$ gives $\frac{1}{\alpha-1}a_O$. Finally, we obtain

$$\frac{dq}{dn} \geq 0 \quad \text{iff} \quad [A - c(a_O)]q \leq \frac{1}{1+|\alpha|}\tau a_O. \quad (8)$$

$\frac{dq}{dn} < 0$ follows directly from the requirement of positive profits. Noteworthy, this result holds for all $c(a_O)$ functions which are homogenous of degree $k < 0$. Accordingly,

$$\frac{da_O}{dn} = \frac{da_O}{dq} \frac{dq}{dn} < 0. \quad (9)$$

Hence, the outsourcing intensity is negatively related to the number of firms and therefore positively related to the market concentration.

3 Empirical Evidence

We compute rank correlation coefficients between the intermediate goods imports intensity as a broad measure of outsourcing and market concentration. Our data base contains intermediate goods imports (UNO) in terms of gross production (New Cronos, EURO-STAT) and market concentration of the largest five firms on the EU12 market (Davies & Lyons, 1996; Sleuwaegen & Veugelers, 2001). We calculate averages over the period 1993-97, since market concentration is only available for 1993 and 1997. The data are

in an aggregated form of Nace-3-digit, due to the availability of data on concentration (compare Sleuwaegen & Veugelers, 2001). In sum, we come up with 66 industries and 11 countries.⁴

> Table 1 <

Table 1 displays the results for EU outsourcing to different regions. Intermediate goods imports in general as well as from the EU12 area and from the rest of the world (ROW) in terms of gross production are positively correlated with the industry-specific market concentration in the EU12 area as suggested by the model above.

4 Conclusions

This paper takes a partial equilibrium Cournot competition perspective and looks at the relationship between market concentration and the outsourcing intensity at the industry level. The results complement the insights from the previous literature on fragmentation. Market concentration may be seen as an important source of the difference in outsourcing activities across industries. We provide evidence that the intermediate goods import intensity in the EU12 countries and market concentration at the EU12 market are positively correlated. This confirms our theoretical priors.

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⁴The EU15 countries less the joining countries of 1995 (Austria, Finland and Sweden). Belgium and Luxembourg are treated as a single economy, due to the availability of trade data.

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*Table 1 - Rank Correlation Coefficients
Market Concentration and Outsourcing in the EU12*

Statistics	EU12 intermediate goods imports from		
	World	EU12	RoW
Correlation coefficient	0.0866 ^{**)}	0.0684 ^{*)}	0.1306 ^{***)}
P-value	0.0201	0.0663	0.0004
Observations	721	721	721

Spearman rank correlation coefficients on time averages (1993-97) of industry-specific intermediate goods imports (UNO) from different regions in terms of gross production and the concentration rate of the five largest firms at the EU12 market (Davies & Lyons, 1996; Sleuwaegen & Veugelers, 2001).

***) significant at 1%; **) significant at 5%; *) significant at 10%.

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