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.

Oligopsony jOligopoly Power and
Factor Market Performance

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This paper is concerned with the economic performance of factor markets in an oligopsony / oligopoly setting. Firm and industry indexes are developed to measure factor market price distortions caused by exerted oligopsony /oligopoly power. These measures indicate that the elasticity of output demand, the elasticity of input supply, and the input and output conjectural elasticities determine the degree of non-competitive performance in factor markets. It is also
shown that under special conditions the firm index equals the Lerner index and the industry
index equals the Herfindahl-Hirschman index.

INTRODUCTION measure we derive an index of aggregate oligo-
psony / oligopoly power for a factor market as a
Compared to output markets, relatively little re- whole. Given familiar sets of assumptions, our firm search has been done on the economic performance index reduces to the Lerner index and our industry of factor markets under imperfect competition.! index reduces to the Herfindahl-Hirschman index. Furthermore, the research that has been done has
been primarily empirical. For example, Just and
Chern ~1980) examined the ~egr:e of oligopsony FACTOR MARKET PERFORMANCE power In the tomato-processIng Industry and re- INDEXES UNDER
jected the hypothesis that tomato processors be- OLIGOPSONY jOLIGOPOL Y
have competitively in the market for raw tomatoes.
Booton and Lane (1985) found empirical support A Form Ind x
for the hypothesis that the wages of registered I e

nurses are suppressed by the monopsony power of Consider an industry in which there are N firms hospitals. Finally, Schroeter's (1988) empirical re- (i = 1, 2, 3,..., N) producing a homogeneous suIts reveal significant input price distortions in the product. The inverse market demand function is
oligopsonistic wholesale beef market. given by
The purpose of ~his paper is to theoretically p=p(Q) (1) analyze the economIc performance of factor mar-
kets. Since, as Robinson (1934, p.227) has stated, where Q = ~qi is industry output and qi is the output 'The most important cases of monopsony will occur of the ith firm. Assume N is sufficiently small and in connection with monopoly', we consider a gen- entry is blocked so that non-competitive behavior eral model where firms can possess market power in in the output market is possible.
the input market, the output market, or both mar- On the production side each firm uses physical
kets. First, we use a conjectural variation approach capital, ki, that is purchased from a competitive
to develop a firm index of oligopsony/oligopoly capital market. In addition, each firm requires the
power that measures the extent to which an input use of a specific factor, Xi' For instance, this input price actually paid by a firm deviates from the value may represent baseball players to professional base-of the factor's marginal product.2 From this firm ball teams or cattle to beef processors. In the market

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for the specific factor, however, non-competitive Pi==(dX/dxi)(Xi/X), the ith firm's input conjec-buyer behavior is possible,3 In this case, the inverse tural elasticity with respect to the
market supply of the specific factor is given by industry's total factor demand,
w = h(X) (2) Because this index allows for non-competitive be-hx,hIIfh'fil"dhavior in both the factor and output markets, it will
were IS t e tota supp y 0 t e specI c lactor an '"
.h"fXFhd/dX' be referred to as an oligopsony/oligopoly Index. It
W IS t e per UnIt price 0 .urt er W IS ' " ,dbe' ,dN' 'dbedIrectly reflects the allocatlve InefficIency due to
assume to posItIve, an IS assume to " ,
ffi'IIIhhfi'flhmarket power by measuring the non-competItIve
su clent y sma so t at eac rm can m uence t e, ,
,fh.~F'IIh'hfi'd.rents acquIred by the firm as a proportIon of the
price f., 0 t IS lactor. ma y, t e It rm s pro uctlonva Iue 0 fthe margma 'Ipro duc. tItcomes as no
unctIon IS ' ,
surprise that the Index has two components: (Pi/e)
qi = .fi(Xi' kJ (3) reflects the non-competitive performance in the
d'db'Id' input market and (lXi/") reflects the non-competitive
an IS assume to e strict y concave an contIn- l" '
, ..perlormance m the ou tpu tmar ke,t
uously tWIce dIfferentIable.
.' Because p (MPX;):::,W:::" 0the vaue I0 f1; can
The problem of the Ith firm then IS to choose Xif0t1Whth.fil"t' .
, , , , range rom 0, en e SpeCI c lac or IS pald
and ki m order to maxImIze the firm s profit func-thIf't'Idttht'
., b e va ue 0 I S margma pro uc, a IS, W
tIon given y = p(M Px;), the factor market is allocatively efficient
1ti=p(Q)q;-h(X)xi-rki (4) and 1;=0; as the factor price is reduced and ap-h'h'hfi'fid'hIproaches 0, ceteris paribus, I; approaches 1. Thus,
were 1t. IS t e It rm s pro ts an r IS t e renta ,.". ,
, , , , greater IneffiCIency IS Implied by a hIgher value of Ii'
rate of capItal. The first-order necessary condItIonsG'thtdP't'thI'
Iven a lXi an i are pOSI Ive, e 0 Igopsony/
are: oligopoly index indicates that there will be greater
(dp/dQ)(dQ/dqJ(aqi/aX;)qi+ p(aqi/aXJ inefficiency, ceteris paribus, (1) the lower the price
-(dw/dX)(dX /dx.)x.-w=O (5a) ~Iasticit~ of dem~~d for output (,,), (2) the ~ower the
, , Input price elastICIty of supply of the speCIfic factor
(d /dQ)(dQ/d .)(a /ak,) .(e~, (3) the highe~ the firm's conjectural elasticity
p q, qi ,q, wIth respect to Industry output (IXJ, and (4) the
+p(aqi/ak;)-r=O (5b) higher the firm's conjectural elasticity with respect
, ,., to industry demand for the specific factor (PJ.
To measure Input price dls~ortlons we concen- This oligopsony/oligopoly index is quite general
trate on the market for the speCIfic factor. We define,t't'
df..d"hSInce no res rIC Ions are p ace on e conJec ura
term m ex 0 Input price Istortlons as t e ., ..d'flibehIfh'IdelastIcItIes of the firm (I.e. they may range from
I erence tween t e va ue 0 t e marglna pro -.,. .
dh' 'd' .ddbhIfhperfectly competItIve to collusIve). For example, m
uct an t e Input price IVI e y t e va ue 0 t e ' ..
'
Id4Th'hfi' 'd'd'dthe case of Cournot behavIor m both the Input and
margma fEpro ()uct. d.,e It (
rms hm Aex IS .l" erlveOU tpu tmar ke ts, dX/dXI ,=1an ddQ/dq" .=16As a
rom qn 5a an IS gIven as see t e ppendlx lor aItP.th'
f) resu , i IS e mpu tmar ke ts hare an dlXi the ou tput
proo market share of the ith firm.
1 i == [P(MPXi)- w]/[P(MPXi)] Alternatively, consider the special situation
1 where the output market is competitive and the
=(Pi/e+lXi/'1)/(+pi/e) (6) specific factor market is imperfectly competitive, In
where this case lXi=O (because dQ/dqi=O) and O<Pi~ 1.
, , The firm index derived from Eqn (6) then reduces to
MPXi==aqi/aXi, the margInal product of the m-thl"II.I'/t't"
ustry-specl c lactor 0 tel t rm,
,,== -(dQ/dp)(P/Q), the price elasticity of de-mand in the output market, IOjc=pi/(e+PJ (7)
lXi==(dQ/dq;)(qi/Q), the ith firm's output
conjectural (or perceived) elasticity with In pure monopsony where there is just one input
respect to total industry output,S buyer, Xi=X and therefore P;= 1. In this case the
e==(dX /dw)(w/ X), the input price elasticity of index equals 1/(e+ 1). When both the output mar-market supply for the specific factor, ket and the input market are competitive, lXi= p;=O

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and the index equals 0 (indicating that the factor I~/o=1:{[P(MPx;)-w]/[P(MPxi)]}Sqi
market is operating efficiently). = 1:v. S .2 12
In the case of market power in the output market ,(q,) ( )

alone, O?Xi~ 1 and Pi=O. In this competition/ where vi=(dQ/dq;)/" and Sqi=qi/Q (the output
oligopoly setting the index (I c/o) becomes market share of firm i). When all firms have con-

I -/ (8) stant and identical conjectural variations, then Vi is c/o -(Xi " the same for all firms and the industry index is
Finally, lhere is the classic case of monopsony/proportional to the Herfindahl-Hirschman index of monopoly suggested by Robinson where Pi = 1 for a the output market [1:(Sqif]. If Vi = 1, then the monopsonist (because Xi = X) and (Xi = 1 for a industry index equals the output market monopolist (because qi = Q). In this situation the Herfindahl-Hirschman index.
monopsony /monopoly index (Im/m) equals

I = (1/8+1 /")/(1+1 / 8 m/m) (9) .

" Index Implementation

Although Lerner (1943, pp. 210-11) initially dis- A. f h.. d.

b th I d h n Important use 0 t IS m ex IS to assess t he degree cusses 0 monopo y an monopsony power, e. ., It' t I tt t 't fi d th t f of oligopsony and oligopoly power m a factor U Ima e y a emp son e amoun 0 mono- , .
I th t th ' market. ThIs can be accomplished, for example, by po y revenue, , ,so a ere was no monopsony, II. h. d... I L ' f I (1) 'th co ectlng t e appropnate ata and first estimating n erner s case 0 pure monopo y (Xi = WI no ..

(a

0) th ' d . E (9) the followIng production, output market demand,
monopsony power I'i = e m ex m qn. , 9

d t th II k L ' d 1/ and Input market supply functions:

re uces 0 e we -nown erner m ex, ".

qi=/;(Xi' Zl) (13)

p=p(Q, Z2) (14) An Industry Index

w=h(X, Z3) (15) Next, an index of oligopsony /oligopoly power for
the specific factor market as a whole (1*) is de- where Zl, Z2, and Z3 are vectors of relevant veloped, This aggregate index, which is derived exogenous variables,lO These empirical results can
from Eqn (6), is defined as then be used to produce estimates of the marginal
product of input X (Oqi/ OXi)' the slope of the demand
1*=1: {[p(MPx;)-w]/[p(MPxi)]}Sxi=1:IiSxi function in the output market (op/oQ), and the

(10) slope of the supply function in the factor market

where SXi = Xii X (the input market share of firm i), (owG/.OX)'th t.

Iven e es Ima te dva Iues from a bove an dde fin- ThIs Industry measure IS a weIghted average of each... (J - (Q/) d (J - P (X/) th l' II ' h ' h d l' mg 2=(X. q.an firm's Index of power WIt Input s ares use lor ". 3 =. " X.

, e 10 owIn. g
. h rearranged versIon of Eqn (Sa) can then be estlm- welg ts. t d'
In the case of oligopsony / competition and given a e .

the definition of Pi' the industry index becomes W=(Jl [P(Oqi/OXi)] + (J2 [(op/oQ)

I:/c = 1:Ui(SX;)2 (11) X (Oqi/OX;)Q;]-(J3[(OW/OX)Xi] (16)

where Ui = (dX/dxi)/(8 +Pi)' If the input conjectural where (Jl, (J2, and (J3 are unknown parameters.ll variations are constant and the same for all firms, Because (Xi = (J2(qi/Q) and Pi=(J3(Xi/X), the degree then Ui is identical for all firms and the industry of oligopsony and oligopoly price distortions can be index is proportional to the Herfindahl-Hirschman determined. For example, the hypothesis that input index of the input market [1:(SXif], 7 In the special price distortions are present is rejected if (Jl = 1 and case where Ui= 1, the industry index equals the (J2=(J3=0. This result indicates that the market is
input market Herfindahl-Hirschman index,8 operating efficiently because the factor price equals
Finally, when the focus is on output market the value of the marginal product. Significant posit-
power as in a competition/oligopoly setting, it may ive values of (J2 and (J3 indicate the presence of
be convenient to change the weights from input to oligopoly and oligopsofly power, respectively. Fin-output market shares and define the industry ally, the degree of input price distortion at the firm
index as level can be calculated by inserting the data into the

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index in Eqn (6). This information, along with the equality in Eqn (A4) gives

data on firm market share, ca~ also b~ us~d to [p(MPxj)]/[p(MPxJ] -w/[p(MPxJ]
calculate the degree of average mput pnce dIstor-
tion at the industry level from Eqn (10). = 1-(I-tXj/,,)/(1 + (pj/e? (A5)

Simplification and rearranging terms yields

CONCLUSIONS [p(MPxJ-w]/[p(MPxJ]

..= (pj/e + tXj/,,)/(1 + Pile) (A6) ThIS paper draws on the theory of olIgopsony and
oligopoly to analyze factor market distortions which is Eqn (6). QED
caused by market power in the input market, the
output market, or both markets. Indexes capable of Acknowledgements
measuring exerted oligopsony I oligopoly power at
the firm and industry levels are developed, and The authors would like to thank David G. Hula, Joe R. em p irical implementation of the indexes is dis- Kerkvliet, James F. Ragan, Jr, Carol Horton Tremblay and an anonymous referee for helpful comments. The authors are
cussed. These measures mdIcate that the elastIcIty responsible for all remaining errors.
of output demand, the elasticity of input supply,
and the input and output conjectural elasticities
determine the degree of non-competitive per- NOTES
formance in factor markets. It is also shown that

under special conditions the firm oligopsony I oligo- 1. See Scherer and Ross (1990) for a survey and Dansby
poly index is identical to the Lerner index and the and Willig (1979), Appelbaum (1982), Kamien and
industry oligopsony loligopoly index is identical to S.chwar~z (1983), and Dau~~ety (1985) for a discus-
the Herfindahl-Hirschman index. slon of Imperfectly competitive output markets.
2. Although Schroeter developed a measure of mono-
psony power, it applies only to the special case where
the production technology is characterized by fixed
APPENDIX proportions between the quantity of output (dressed
beef carcasses in his study) and the quantity of the
A formal derivation of Eqn (6) is as follows. First monopsonistically demanded input (live beef).
, 3. Input market sellers are assumed to have no market
Eqn (5a) can be rearranged as power. This assumption is certainly realistic for many

d d

I)] [(dQld)(IQ)] [P(o l ox)] raw materials suppliers (e.g. tomato farmers and
[(pi Q)(Q p qj qj qj I cattle ranchers), but even the monopsony power in

+ [p(oqj/oXj)] = [(dw/dX)(Xlw)] labor .markets ~~s not always generated effective
collective bargaining power for labor. For example,
x [(dXldxJ(xj/X)]w+w (AI) Booton and Lane (1985, p.185) argue that mono-
.. psony power in nursing exists in the absence of
Factonng out p(oqjl oxJ from the left-hand sIde and widespread unionization. Dworkin's (1981) account
w from the right-hand side of the equality in of professional baseball in the USA indicates that
Eqh (AI) gives union power was, until recently, so weak that the
reserve clause (making each player the property of
p(oqj/oxJ{l + [(dpldQ)(Qlp)] [(dQldqJ one team) existed for almost 90 years before the first
collective bargaining contract.
x (qj/Q)]} =w{1 + [(dw/dX)(X Iw)] 4. This approach is similar to that developed by Lerner
(1932), who defined the index of monopoly price
x [(dX IdxJ(xjl X)]} (A2) distortions as the difference between the (output)

b.. h d fi.. f h price and marginal cost divided by the price. By su stItutIng t.e e mtIons rom t e text, 5. See Dickson (1981) and Appelbaum (1982) for a
Eqn (A2) can be wntten as discussion of conjectural elasticities with respect to

(M P)(1- tXI)-W (1 + PI e) (A3) output markets.

p Xj j " -j 6. Daughety (1985) has shown that the Cournot equilib-

which implies that rium is also a 'consistent conjectural variation' equi-
librium.
w/[p(MPxJ]=(I-tXj/")/(I+pj/e) (A4) 7. If, for example, all firms have the same objective
function, face the same cost function, and produce a
Multiplying both sides of the equality by -1 and homogeneous product, then in equilibrium their
adding [p(MPxJ]/[p(MPxi)] to both sides of the conjectural variations must also be the same.

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8. If the input shares are the same for all firms, the input A. F. Daughety (1985). ReconsideringCournot: the Cour-Herfindahl-Hirschman index equals 1/ N, the same not equilibrium is consistent. Rand Journal of Eco-
property that holds for the output Herfindahl- nomics 16, 3, Autumn, 368-79.
Hirschman index when output shares are equal. V. A. Dickson (1981). Conjectural variation elasticities
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10. To estimate this system, functional forms must be R. E. Just and W. S. Chern (1980). Tomatoes, technology,
chosen, the variables in Zl' Z2' and Z3 must be and oligopsony. Bell Journal of Economics 11, 2,
identified, and firm and market data must be ob- Autumn, 584-602.
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