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SOCIAL COSTS OF OLIGOPOLY AND THE VALUE OF COMPETITION*

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In this study we present a new methodology for estimating welfare losses caused by market power. We depart from past studies by explicitly taking into account different levels of market power. We provide estimates of: (*a*) *actual* social costs arising from existing market structures and (*b*) expected *monopoly* social costs that would occur if there were no competition – actual or potential. The difference between actual and monopoly welfare losses represents the value of competition in existing markets. We further estimate the separate contributions of *actual* and *potential* competition to this value.

Our methodology is based upon an empirical model of oligopoly behaviour and limit pricing. From this model we estimate the markup which would occur were there no competition. We use this markup in turn to estimate industry demand elasticity at the monopoly price. With this elasticity and the assumption of linear demand we can characterise demand, cost, and welfare conditions at each equilibrium: monopoly, actual, and competitive.

With this new methodology and some other modifications of earlier techniques we provide not only new estimates of welfare losses, but also estimates of the value of competition under existing conditions. We find that the actual deadweight loss triangle averages 2·9 % of value of shipments for a sample of 37 industries. We also estimate that were these industries to maximise joint profits with no threat of entry, the welfare loss would be 11·6 %. The difference, 8·7 %, we attribute to the beneficial effects of potential competition (4·9 %) and actual competition (3·8 %). Our monopoly benchmark thus yields additional understanding of the value of competition.

We cannot represent our study as having solved all of the problems associated with social cost estimation of monopoly power. Indeed, given general equilibrium problems associated with horizontal, vertical, and cross-industry aggregation interacting with the 'second best' problem, we doubt that all the problems can be solved, although we can point out some of the potentials for bias. After presenting our estimates we discuss the implications of sampling methodology and aggregation problems, demonstrating that potentially strong, but possibly offsetting, biases exist in all studies, including ours.

I. INDUSTRY OR FIRM ELASTICITIES

One key difference in our approach concerns the way we measure demand elasticity. Most social cost studies have simply assumed a uniform demand elasticity for all industries, and additionally made the assumption that the

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appropriate competitive benchmark was the average manufacturing firm (e.g. Harberger, 1954; Schwartzman, 1960; Bell, 1968; Worcester, 1973; Siegfried and Tiemann, 1974). The shortcomings of this approach are now well known (see Needham, 1978, and Scherer, 1980). Two later studies followed a different approach based upon a price-cost-margin (*PCM*) or Lerner index (Kamerschen, 1966, and Cowling and Mueller, 1978).

If $PCM \equiv (P-AC)/P$ and $AC \simeq MC$, then the profit-maximising firm sets $PCM = 1/\eta$ where η is the elasticity of demand faced by that firm. Kamerschen looked at industry *PCMs* and derived industry demand elasticities using this formula. If industries have prices below the joint profit maximising level then this method overstates industry demand elasticity (and industry deadweight loss). Cowling and Mueller also use the *PCM* formula, but they use it to estimate the elasticity of demand as perceived by individual firms. Using a firm by firm approach they can adapt to the heterogeneity of firms within industries. They note, of course, that there are difficulties which arise in aggregating welfare costs across firms.

Cowling and Mueller present a compelling argument that firm heterogeneity should be explicitly modelled and welfare calculated at this level. We on the other hand believe that an industry demand approach is more useful despite the costs of losing individual firm differences. Most competition policy both in the United Kingdom and the United States is oriented more towards achieving workable competition than breaking up any individual firm or forcing it to price at marginal cost. The industry approach is more suitable for dealing with the former task, while Cowling and Mueller's methodology may be more appropriate for the latter task. Their measure, as they note, cannot simply be summed across firms to obtain an industry measure. The reason for this relates to the role of oligopolistic conjectures. Their welfare derivation for a firm is predicated upon 'an assumption of perfect competition elsewhere'. Specifically, if a dominant firm maximises profits while all others are 'fringe' competitors and act as price takers, then the firm's (residual) demand curve can be used to obtain the marginal social value of an additional unit of output. For example, one may calculate the partial equilibrium social gains of output expansion by the area *between firm demand* and *firm marginal* costs if all other firms *in that industry* and elsewhere are perfectly competitive. In this case, the firm and industry demand approaches yield identical welfare results, although the area under a firm demand curve represents a hybrid of changes in fringe firm producer surplus along with consumer surplus. For an oligopoly the problem is more complex. Consider a Cournot (zero marginal cost) mineral spring with linear demand. If price is zero at output OA, then each firm in longrun equilibrium produces $OA/(n+1)$. The firm *PCM* approach would measure the area under the demand curve between $(OA)n/(n+1)$ and OA as social costs *for each firm*. Accordingly, the sum of measured welfare losses of the n firms will incorrectly equal n times the welfare loss in the industry. The problems are more complex and the aggregation biases potentially larger when we move from the Cournot assumption.

For these reasons we prefer using an industry approach to welfare estimation.

To avoid the problems that arise in using the *PCM* formula for industry demand elasticity when prices are below the jointly maximising level we first estimate the joint maximising level of *PCM* and start the analysis from there.

II. ESTIMATION OF MONOPOLY *PCM*S

Traditional microeconomic theory predicts that excess profits serve as a signal for entry of new firms. The literature on limit pricing suggests that incumbent firms may exploit this signal to retard or forestall entry. The limit pricing models by Kamien and Schwartz (1971) and Baron (1973) are based upon dynamic maximisation with stochastic entry. These models suggest a simultaneity between entry rates and profit rates. In Masson and Shaanan (1982) we derived a simultaneous equations approach for testing the limit pricing hypothesis. Using this approach, we estimated previously unobserved entry-forestalling profit levels, optimal limit-pricing profit levels and monopoly profit levels as functions of industry structure and growth. We currently adopt the same general approach, but with *PCM*s in place of profit rates on equity. From this we can estimate a monopoly *PCM* from which we may derive monopoly demand elasticities and, by assuming linearity, derive the demand curve.

The methodology used in estimation is explained in detail in our earlier paper (1982) so we provide here only a summary. The only substantive changes are the use of *PCM* as a profit variable (leading to somewhat weaker statistical results) and the use of OLS regression rather than Tobit (the results were not very sensitive to this change).

(A) *Methodology*

We assume that incumbent firms take potential entry into account in their pricing decisions and that potential entrants respond to *PCM* (price) levels. If firms attempt to deter entry by limit pricing, *PCM*s will reflect this. The testing model has two separate equations, one for incumbent firms and the other for potential entrant firms.

Specifically, for any industry our two primary equations are

$$PCM^a_{t-1} = PCM^a(G_{t-1}, B_s, B_k, B_a, C_{t-1}), \tag{1}$$

$$E_t = E(PCM^a_{t-1}, G_{t-1}, B_s, B_k, B_a), \tag{2}$$

where

E_t is the cumulative market share of entrants into the industry at the end of period t,

PCM^a_{t-1} is the 'actual' price-cost margin in the industry in period $t-1$,

C_{t-1} is the industry 4 firm concentration ratio in period $t-1$,

G_{t-1} is the industry growth in period $t-1$,

B_s is the industry economies-of-scale entry barrier,

B_k is the industry capital-cost entry barrier (cost of a plant of minimum efficient scale in millions of dollars),

B_a is the industry advertising-induced product differentiation entry barrier.

(i) *The Entry Equation.* For testing, we need to solve for the nonobservable entry-forestalling *PCM*. The entry-forestalling price, following Bain, is the highest price attainable without attracting entry. Similarly, there will be an entry-forestalling *PCM*, noted as PCM^f_{t-1}. Although PCM^f_{t-1} cannot be directly observed, it can be derived from the entry equation as the solution to the implicit function:

$$0 = E(PCM^f_{t-1}, G_{t-1}, B_s, B_k, B_a). \quad (3)$$

For simplicity of exposition only the linear model is presented. It is assumed that entry is a positive function of the amount by which actual *PCM*s exceed the entry-forestalling *PCM*:

$$E_t = c(PCM^a_{t-1} - PCM^f_{t-1}) \quad (4)$$

and

$$PCM^f_{t-1} = a_0 + a_1 G_{t-1} + a_2 B_s + a_3 B_k + a_4 B_a, \quad (5)$$

thus

$$E_t = -ca_0 + cPCM^a_{t-1} - ca_1 G_{t-1} - ca_2 B_s - ca_3 B_k - ca_4 B_a. \quad (6)$$

This equation is recursively identified (given a condition on error terms), and can be estimated by ordinary least squares. The coefficient c should be positive if expected post-entry profits are a positive function of pre-entry profits. Once the entry equation is estimated, the estimated PCM^f function can be derived by setting $E = 0$ and solving for PCM^f. *PCM* should be a rising function of the cost of entry, so it is expected that a_2, a_3 and $a_4 > 0$. The sign of a_1, the effect of growth, is less clear *a priori*, depending mainly upon potential entrants' conjectures of incumbents' reactions to entry. (For a complete discussion, see our earlier paper.) We hypothesise that $a_1 < 0$.

(ii) *The PCM Equation.* The incumbent firms' *PCM*s are affected by two forces: what they would charge to maximise joint value given the threat of potential competition, and what they can charge given the existing state of competition. We look first at joint maximisation. PCM^o is defined as the level of *PCM* chosen by incumbents when they choose a jointly optimal limit price considering the threat of entry. The recent stochastic-dynamic pricing literature generally predicts $PCM^o > PCM^f$.

Fig. 1 depicts a relationship close to those predicted by Kamien and Schwartz or Baron in their stochastic-dynamic models. Intuitively, $PCM^o > PCM^f$ follows from assuming that the probability of entry rises smoothly from zero as the incumbents' *PCM*s rise above PCM^f. Then as *PCM*s are raised by a small finite amount above PCM^f, the expected costs of entry rise by an infinitesimal amount whereas profits generally rise by a finite amount. Hence, incumbents never absolutely forestall entry when barriers are below the 'blockaded level', or B^b in Fig. 1. At the blockaded level of barrier, $PCM^f = PCM^o$ at the monopoly level PCM^m. These models predict that PCM^o converges to PCM^m with a positive slope (although PCM^o need not be monotonically rising).

Our estimation is based on the assumption that the shape of PCM^o is that implied by a linear version of this model (we support this in our earlier paper). This is

$$PCM^o_\tau = b_0 + b_1 G_\tau + b_2 B_s + b_3 B_k + b_4 B_a. \quad (7)$$

Since PCM^o must converge on PCM^f from above as barriers increase, the vertical intercept of PCM^o must be greater than that for PCM^f, but its slope must be less. This may be written:

$$a_0 - b_0 < 0; \quad a_2 - b_2 > 0; \quad a_3 - b_3 > 0; \quad \text{and} \quad a_4 - b_4 > 0.$$

(b_1 cannot be signed without strong assumption about a_1.)

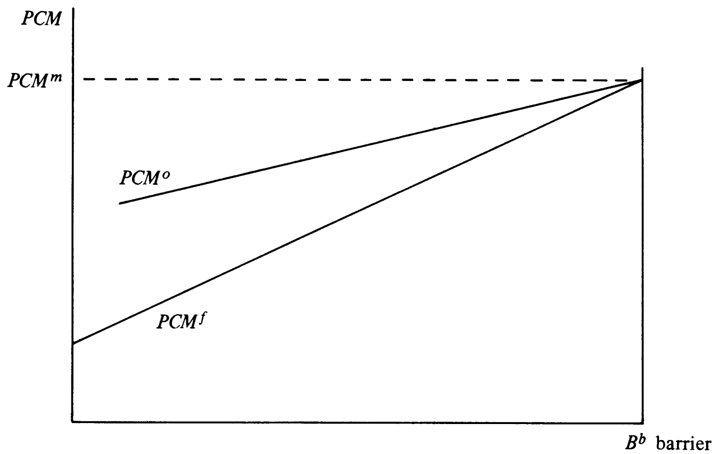

Fig. 1

We shall assume that PCM^a will be determined by what PCM^o would be if it were attainable and by the ability of incumbents to act jointly to attain PCM^o. We assume that the ability to arrive at PCM^o is a positive linear function of concentration, C_T. By further assuming that PCM^o will be reached only when concentration reaches 100 %, we are able to estimate the unobservable PCM^o. By assuming

$$PCM_T^a = PCM_T^o + b_5 (C_T - 100), \quad \text{where} \quad b_5 > 0, \tag{8}$$

we may combine with (7) to arrive at

$$PCM_T^a = b_0' + b_1 G_T + b_2 B_s + b_3 B_k + b_4 B_a + b_5 C_T, \tag{9}$$

where $b_0' = b_0 - 100\, b_5$.

Given conditions on the error terms, this will be recursively identified and estimated using ordinary least squares. (For a complete discussion on simultaneity and identification see our earlier paper.)

The model's predictions can be summarised as:

$$(a)\ a_0 - b_0 < 0, \quad (b)\ a_1 < 0, \quad (c)\ a_i - b_i > 0 \quad (i = 2, 3, 4), \quad (d)\ b_5 > 0.$$

(B) *Estimation*

The estimates were based upon US data from Harris (1973), and adjusted concentration ratios from Shepherd (1970). Where necessary, revisions were made using census data. We employ 4-digit SIC data on 37 manufacturing industries for 1950–66. This is a pre-entry period, $t-1$, of approximately 1950–7; an entry-initiation period, t, of approximately 1958–62; and an entry-completion period of 1962–6.

All the data except for the PCM were described in our earlier paper. From our PCM data we subtract more costs (e.g. advertising and depreciation) than to arrive at PCM, the traditional measure, because entry should respond to excess profits, not price above variable costs. See the appendix for details.

In Table 1 we present the regression results, PCM and growth induced entry, while economies of scale and advertising served as barriers to entry. The capital requirements barrier has the correct sign but is insignificant. In the PCM

Table 1

The estimating equations (coefficients and t statistics)

Dependent variable	Constant	C_{t-1}	G_{t-1}	B_s	B_k	B_a	PCM_{t-1}	R^2
E_t	0·31	n.a.	3·45*	−0·279†	−0·006	−0·253*	0·157†	0·25
	(0·2)		(1·43)	(1·75)	(0·66)	(1·64)	(1·88)	
PCM_{t-1}	−2·59	0·183†	0·905†	0·30	−0·019	0·815†	n.a.	0·55
	(0·59)	(3·23)	(2·14)	(1·02)	(1·06)	(3·24)		

* Significant at the 10% level. † Significant at the 5% level. n.a. Not applicable.

Table 2

The coefficients of PCM^f, PCM^o and $(PCM^f - PCM^o)$

Dependent variable	Constant	G_{t-1}	B_s	B_k	B_a
PCM^f	−1·974	−2·194*	1·788†	0·0396	1·611*
PCM^o	15·67†	0·905†	0·30	−0·019	0·815†
	(4·90)	(2·14)	(1·02)	(1·06)	(3·24)
$PCM^f - PCM^o$	−17·644*	−3·099*	1·478	0·059	0·796
	(1·645)	(1·37)	(1·13)	(0·88)	(0·799)

* Significant at the 10% level. † Significant at the 5% level.

equation, concentration and growth enhanced the PCM, as did the economies of scale and advertising barriers. Once again, capital requirements are insignificant, now with the wrong sign. Accordingly, we examined the sensitivity of our welfare estimates to B_k and report these results below.

In Table 2 the PCM^f estimates are presented as well as levels of significance based on a Zerbe (1978) test for ratios. Economies of scale and advertising are significant. The PCM^o equation is also presented and, by construction, growth and barriers have identical effects as in the PCM^a equation above. As predicted, the intercept of PCM^o is significantly above that of PCM^f. The three entry-barrier coefficients of PCM^f are also all larger than the corresponding variables of PCM^o, although not significantly.

We can now derive PCM^m, the monopoly PCM which would be selected by a joint profit-maximising oligopoly facing no threat of potential entry. To obtain PCM^m we set $PCM^o = PCM^f$ for each industry and solve for the price cost margin corresponding to the intersection of these two functions at B^b, as shown in Fig. 1. With these estimates we turn to the social cost modelling.

III. SOCIAL COST ESTIMATION

We assume that joint profit-maximising firms would face an objective function of

$$\Pi(Q, A) = [P(Q, A) - m]\, Q - A, \tag{10}$$

where Π is industry profits, Q is industry quantity, A is industry expenditure on advertising which shifts the demand curve, and m is industry marginal cost. Solving the first order conditions gives

$$\begin{aligned}\eta_m &= 1/[(P_m - m)/P_m] \\ &= 1/PCM_m.\end{aligned} \tag{11}$$

The monopoly elasticity, η_m, is a function of the margin of the monopoly price above marginal production costs, PCM_m. The entry and limit-pricing results in the last section were based upon the margin of price above average total costs PCM^m. Notationally, superscripts will denote PCM markups over total costs and subscripts will denote PCM markups over production costs.

We use the following conventions. We assume that average and marginal production costs are constant at level m as implied by equation (10). We also assume that the endogenously determined level of advertising costs, A, happens to yield a constant per unit advertising cost of $a = A/Q$. This in effect assumes that advertising per unit is endogenously solved for, but invariant to the level of competition.[1] (Later we assume that a falls as markets become more competitive.) Then average total costs are $m + a$, so

$$(P_m - m - a)/P_m = PCM^m < PCM_m = (P_m - m)/P_m. \tag{12}$$

We assume that the same advertising per unit occurs in all market structures of any industry. So strictly speaking our competitive benchmark is one of 'workable competition' in which entry drives profits to zero, but price exceeds marginal production costs. This is expressed graphically in Fig. 2.

The industry demand curve, DD, is assumed to be constant, regardless of market structure. Strictly speaking, the constant demand assumption is inconsistent with profit maximisation and a constant per unit advertising cost unless the relationships are endogenous, and the form of the endogeneity is given more structure.[2]

Our task is to derive (indices for) the necessary prices, quantities, and costs, P_m, Q_m, $P_c = m + a$, Q_c, m, a, P_a, and Q_a, where P_a and Q_a are actual price and

[1] Clearly, from any oligopoly starting point, a could rise or fall as the industry is made atomisitic. It would fall if a reflected non-price competition or expenditures on entry deterrence. It might rise if advertising were purely informative and increasing firm numbers made the consumers' search process more complex. It might also rise locally if a very tight oligopoly, which had suppressed advertising competition, became somewhat looser and channelled competition into non-price competition.

[2] Clearly $\delta P/\delta A = 0$ is inconsistent with the first order conditions of (10) for $A > 0$. With non-price competition firm $\delta P/\delta A$ may be positive while industry $\delta P/\delta A$ is zero. As market structures change a might rise or fall and so might demand. We allow for some other effects later.

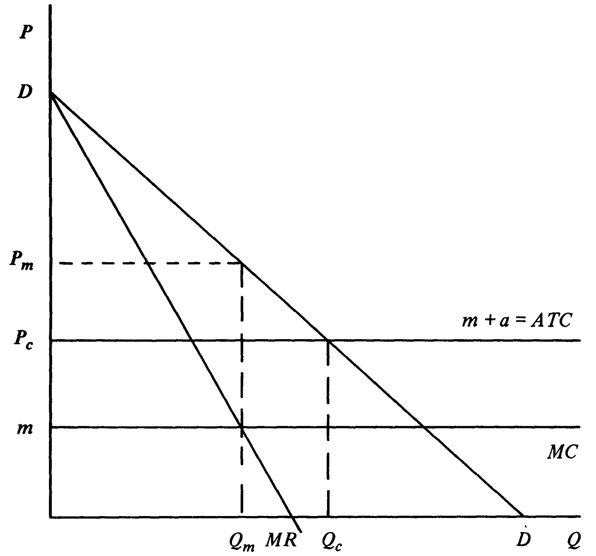

Fig. 2

quantity. As we continue, we also define η_a, the elasticity of demand at the actual price in addition to η_m; and W_m and W_a, the welfare losses at these two prices.

(A) *Deriving Values*

To obtain estimates of deadweight loss, we use the formula $W = |\Delta Q|\Delta P/2$ where deviations are from zero profit equilibrium. This formula can be used for any hypothetical welfare loss (e.g. monopoly or actual) as long as price and quantity are those pertaining to the case under examination.

The data set includes values of *PCM* (the actual margin over average total cost) for each industry. In Section II we demonstrated our method of derivation for PCM^m, the joint maximising margin over average total costs. Conversion to price units depends upon quantity units. We use an index of $P_m \equiv 1$.

Starting with $P_c \equiv m+a \equiv ATC$, $P_m \equiv 1$, and $PCM^m \equiv (P_m - ATC)/P_m$, several unknowns as functions of raw data or calculated values may be solved for sequentially as:

$$P_c = 1 - PCM^m, \tag{13}$$

$$P_a = P_c/(1 - PCM^a), \tag{14}$$

$$Q_a \equiv VS/P_a, \text{ where } VS \text{ is value of shipments,} \tag{15}$$

$$a \equiv A/Q_a, \tag{16}$$

$$PCM_m = PCM^m + a, \tag{17}$$

$$m = 1 - PCM_m, \tag{18}$$

and

$$\eta_m = 1/(PCM_m). \tag{19}$$

For linear demand, elasticity is the ratio of the length of the demand curve below a price to its length above the price. Defining the vertical intercept of the demand curve as D, and projecting to the vertical axis, we have $\eta_m = 1/(D-1)$ (as $P_m \equiv 1$) and we can solve sequentially

$$D = (1+\eta_m)/\eta_m, \tag{20}$$

and

$$\eta_a = P_a/(D-P_a). \tag{21}$$

Following the same procedure, but projecting to the horizontal axis, we similarly derive sequentially

$$Q_m/Q_i = (D-P_m)/(D-P_i) \quad (i = a, c), \tag{22}$$

$$Q_m = [(D-P_m)/(D-P_a)]\,Q_a, \tag{23}$$

$$Q_c = [(D-P_c)/(D-P_m)]\,Q_m, \tag{24}$$

$$W_a = (P_a-P_c)\,(Q_c-Q_a)/2, \tag{25}$$

and

$$W_m = (P_m-P_c)\,(Q_c-Q_m)/2. \tag{26}$$

We follow parallel procedures to find W_0, the welfare loss asscciated with suppressing actual competition, but with firms setting their optimal limit prices given the threat of potential entry.

With the relationships outlined above, we can calculate welfare losses for the 37 industries for which we estimated PCM^m in Section II.

(B) *Welfare Estimates*

In Table 3 we present the estimates for the 37 industries in our sample. The first two columns are based upon the actual *PCM*s observed for each industry. The implied demand elasticity, η_a, is presented first[1] and then the actual welfare loss as a percent of industry value of shipments, W_a.[2] The next two columns present the 'monopoly' values of elasticity, η_m, and welfare loss, W_m, based upon our estimates of the *PCM* which would have evolved were the industry jointly maximising and facing no entry threat. The final two columns are, for comparison, estimates for this data set using elasticity estimates based upon assuming $\eta_{cm} = 1/PCM_a$. This estimate represents a Cowling and Mueller[3] estimate for each industry's 'typical firm' which has the industry average level of PCM_a.

The weighted average welfare loss for our sample is 2·9 % of value of shipments for these industries at their actual prices. We further estimate that if all of these same industries were maximising joint profits and, additionally, were not facing potential entry, their welfare losses would rise to an average of

[1] If consumers react to price changes with lags, then present value maximisation conditions determine a price such that the implied elasticity is between the shortrun and longrun demand elasticities.

[2] These are flow costs of a system which is, by hypothesis, not in a steady state if $PCM^a > PCM^f$. If the economy ceased experiencing technological change and exogenous shocks, the present values of welfare losses could rise above or fall below the present value of the current flow costs evaluated over an infinite horizon. For example, cost may rise (if firms with higher costs enter) or fall (if entry of equally efficient firms occurs, reducing concentration and prices).

[3] Cowling and Mueller (1981) believe that their most accurate measurements are based upon the welfare triangle between production costs, m, and demand. Thus, even if we had the same elasticities, their ΔQ and W would be greater.

Table 3

Demand elasticities and welfare losses in 37 industries

	Estimates at P_a		Estimates at P_m		Estimates using C & M methods	
Industry name	Industry η_a	W_a (% of VS_a)	Industry η_m	W_m (% of VS_m)	Typical firm* η_{cm}	W_{cm} (% of VS_a)
Meat packing	1·23	0·05	3·27	14·86	34·89	1·73
Canned fruit and vegetables	1·25	1·23	2·72	16·29	7·15	8·40
Flour	1·47	0·45	3·34	13·69	12·73	4·78
Cereal preparations	1·57	5·26	2·28	13·83	3·86	18·09
Wet corn milling	3·61	9·16	3·92	11·14	4·44	12·11
Bread	1·91	1·72	3·43	12·05	7·47	8·24
Biscuits	1·80	6·06	2·68	16·00	3·86	14·51
Cane-sugar refining	2·35	1·11	4·43	11·11	10·29	4·96
Chewing gum	2·12	10·13	2·42	13·67	3·24	19·44
Beer	1·02	0·91	2·25	15·14	7·50	11·97
Distilled liquor	1·96	5·92	2·62	12·54	4·07	16·23
Bottled soft drinks	0·92	0·60	2·31	17·62	8·78	8·79
Cigarettes	1·69	7·36	2·21	14·02	3·39	19·98
Greeting cards	2·35	4·85	3·49	13·85	4·92	10·41
Alkalies and chlorine	2·37	2·71	3·88	12·02	6·61	8·06
Rayon	5·76	13·38	4·80	8·84	4·64	11·57
Pharmaceutical preparations	1·14	7·66	1·74	19·07	2·73	24·59
Soap and other detergents	0·75	1·62	1·70	17·97	4·82	19·72
Perfumes	0·44	3·13	1·34	29·53	2·66	26·41
Petroleum refining	2·79	0·55	5·26	8·41	15·96	3·78
Tyres and inner tubes	1·80	2·22	3·18	13·20	6·36	9·41
Footwear, except rubber	1·05	1·04	2·53	18·65	7·11	7·83
Flat glass	1·88	2·30	3·35	13·62	6·38	8·63
Glass containers	1·59	3·26	2·84	16·22	4·94	10·98
Cement, hydraulic	1·58	5·63	2·31	17·36	3·75	14·89
Gypsum products	1·73	7·85	2·40	16·60	3·32	17·55
Blast furnaces and steel mills	6·40	6·11	6·55	6·48	7·24	7·51
Primary copper	2·06	0·74	4·15	11·47	11·81	4·58
Primary zinc	2·15	0·02	5·03	9·38	69·53	1·07
Primary aluminium	2·36	4·69	3·52	13·56	5·02	10·30
Metal cans	1·83	1·48	3·57	13·67	7·88	6·54
Farm machinery	1·67	1·89	3·10	13·68	6·65	9·07
Typewriters	2·87	10·63	3·24	13·94	3·67	14·41
Radio and TV receiving sets	0·82	0·57	2·27	20·65	8·49	6·99
Cars	4·57	3·42	6·02	7·74	8·17	6·42
Photographic equipment	1·58	4·58	2·65	17·20	4·15	13·04
Watches and clocks	1·27	0·21	2·96	12·94	17·49	5·66
Weighted average		2·9%		11·6%		7·8%

* If there are no firms with negative profits, then the welfare loss as a percentage of value of shipments of these 'typical firms' is identical to an industry welfare loss percentage computed as the average of each firm's losses weighted by value of shipments, i.e. $[\Sigma(\pi_i + A_i)]/2 = [\Sigma(\pi_i + A_i)/2VS_i]\ VS_i$. Of course, Cowling and Mueller warn against aggregation.

11·6 % of their value of shipments.[1] If we re-specify the empirical model to drop the B_k measure (which had a perverse sign in one equation), estimated elasticities generally fall: W_a falls to 1·7 %, and W_m rises to 15·8 %.[2] Although not included in the table, we also calculated the average W_0 (based on PCM^o) as a percentage of sales. This was 6·7 %, meaning that if actual competition were suppressed (e.g. through collusion) but the firms still faced the threat of entry, then an optimal limit price given the threat of potential entry would yield these costs.[3]

Although our techniques are not strictly comparable, it is interesting to compare our industry results with those of a Cowling and Mueller representative firm. As expected, their firm level implied demand elasticities are far higher than our industry demand elasticities. Similarly, their welfare estimates as a percentage of value of shipments exceed ours. If we recall that even for a symmetric oligopoly one cannot sum the Cowling and Mueller firm estimates to arrive at industry estimates, their results are not necessarily inconsistent with ours. We think our results give a better gauge of the magnitude of the potential gains from establishing workable competition; theirs are more applicable to computing the gain from breaking up a single firm or forcing it to set its price at marginal production costs.

We do not claim that our estimates are precise; in fact we devote Section D to a discussion of potential biases. However, we find, for example, that the elasticities implied by our approach often appear to be reasonable[3] and in our view the methodology employed is a good one if the object is to estimate welfare losses based upon endogenously derived elasticities. Additionally, we consider that additional insight is available from the contrasts between the actual and monopoly estimates. The monopoly estimates are not only interesting in their own right, but the differences between them and the actual estimates can also be interpreted as a measure of the social benefits accruing from competition (actual and potential) in these industries.

The social value of competition, actual plus potential, competition, is estimated as 8·7 % (the difference between W_m and W_a). Potential competition, even without actual competition, yields a social gain of 4·9 % ($W_m - W_0$).

[1] Since fixed depreciable assets are used to adjust PCM, we also tried an approximation technique for calculating total assets. The results, from this adjustment, point to small changes in the welfare estimates (See the appendix for details).

[2] Only a few elasticities change by very much. Showing the pairs of elasticities estimated with and without B_k in the model, the larger changes are: Meat packing (1·23, 0·86); beer (1·02, 0·81); perfumes (0·44, 0·24); petroleum refining (2·79, 1·11); cement (1·58, 1·02); steel (6·40, 2·08); aluminium (2·36, 1·92); and cars (4·57, 1·92). The largest shifts are in industries with high values of B_k (steel and cars). Most of the elasticities appear more reasonable when B_k is deleted (e.g. Comanor and Wilson (1967) estimate short-run and long-run elasticities for meat packing of (0·36, 0·36); beer (0·56, 1·39), and perfumes (0·24, 0·29).

[3] Many of our reported elasticities appear to be quite reasonable, others do not. The estimating technique is better for giving average tendencies than individual industry elasticities.

(C) *Monopoly Power and Socially Wasteful Expenditures*

Finally, without detailed analysis, we present one additional set of welfare loss estimates. As argued by Posner (1975), firms spend resources to gain and maintain market power, and consumers and others expend resources to avoid the effects of market power. One convention, extending a conjecture of Posner's, is to include in social costs the sum of profits and advertising. Advertising may be designed to protect incumbent firms' market power rather than providing useful information to consumers. It part, profits earned by monopolists reflect only the profits of successful monopolists. If there is competition amongst entrepreneurs to gain monopoly power, then a competitive entrepreneurial equilibrium evolves when the losses from unsuccessful attempts for market power are equal to the gains from successful attempts; expected profit is zero. Hence for any profits observed for 'winners' there must, on average, be losses by some losers not measured in the sample. An additional claim is that consumers and others spend resources to avoid monopoly power, so to the extent that on average entrepreneurial competition does not drive expected profits to zero, these other costs drive social costs up to the full level of monopoly profits.

Three features of this concept of the social costs of securing market power should be mentioned. Posner notes that these costs are not potentially cancelled out by general equilibrium second-best factors, whereas deadweight loss triangle costs may be cancelled out across industries as suggested by familiar arguments involving the second best. Stated simply, social resources expended to produce market protection are diverted from the production possibilities frontier for all final goods with social value in consumption. As such they cannot cancel, and are a robust social cost even in a general equilibrium world.

The two other points concern the dangers inherent in adopting this measure: (*a*) the magnitudes of loss are arbitrarily assumed, and (*b*) in dynamic competition some expenditures for securing market power may entail social gains. Certainly, some advertising is socially beneficial and some profits reflect scarcity rents which are not wasteful. It is unclear what proportion of profits or advertising should be used for measuring social costs. Further, some expenditure on monopoly enhancement is socially beneficial in a dynamic world. Under the patent system, for example, R & D expenditures made to achieve patent protection result in the development of new and useful inventions, thus providing social benefits. Similarly, expenditures on maintaining goodwill through maintaining product quality (and maintaining market power) are at least partly beneficial. Further, advertising may be informative, shifting demand and leading to social gains. In dynamic competition many of these costs may have partially or fully offsetting welfare gains.

Cowling and Mueller are the only previous authors to provide estimates based upon this theory and estimating technique. Their estimates demonstrate the additional costs involved if 'all advertising' or 'all advertising plus profits' reflect social costs. We present a slightly finer grid, letting the reader select different percentages measuring the contribution of these two potential elements for social cost estimation.

Our technique for profits is simply to add to social costs some percentage of calculated profits. For advertising the hypothetical case is more complex. If all advertising is caused by monopoly, then the workably competitive price, P_c, would fall to marginal production costs, m, were the industry to be made workably competitive. If, however, only a proportion of advertising, α, is caused by monopoly, then the workably competitive price should be $P_c = m + (1-\alpha)a$. By looking at the relationship for advertising we can also examine the sensitivity of our results to our previous assumption that the advertising rate would be constant so $P_c = m + a$.

Table 4

Social Costs Including Some Costs of Securing Market Power

	Total social costs if social costs are reflected by adding a fraction of:									
	No. additional cost of securing market power	Profits only (% social cost)			Advertising only (% social cost)			Profits plus advertising (% social cost		
		25%	50%	100%	25%	50%	100%	25%	50%	100%
W_a^*	2·9%	6%	9%	16%	4%	5%	6%	7%	11%	19%
W_m^*	11·6%	18%	24%	37%	13%	14%	16%	19%	26%	41%

In Table 4 we present estimates of the weighted average of social cost W_a and W_m based upon assuming some fraction of profits, advertising, or profits plus advertising to be socially costly. Given the *ad hoc* nature of such estimates we leave the interpretation to the reader.

(D) *Potential Biases*

There are many possible sources of bias inherent in any social cost estimation, especially for aggregate estimates (Littlechild, 1981, discusses several of these elements of bias). We note here only a few potentially important sources of bias, over and beyond those which may be associated with using the limit-pricing hypothesis which is not universally accepted.

(i) *Sample Bias*. Our sample of 37 industries consists primarily of national industries with a high average four-firm concentration ratio of 68%. It would be risky to project our average results to all manufacturing industries, much less to services, retailing (small town, large town, or aggregate), etc.

In particular, it is worth noting that welfare loss for our sample based upon the Cowling and Mueller measure is $W_{cm} = 7{\cdot}8\%$, whereas when they use a broad-based sample of manufacturing firms, they attained a comparably calculated value of 2·3%.[1] Our measure of W_{cm} is three times larger. This may reflect numerous factors including the sample industries, differing sample years, and differing data (especially the use of plant *PCM* data rather than firm profit data).

[1] They do not report this figure. They report 6·5%, a value adjusted for vertical effects by multiplying 2·3 by a factor of 2·8. We explain below why we do not use this approach.

(ii) *Measurement of PCM^m.* Our PCM^m is based upon an estimate which is sensitive to slope coefficients on entry barrier terms and to the assumption that industries with four-firm concentration of 100 will achieve the joint profit-maximising level of profits. This estimate clearly affects W_m, and in turn through elasticity affects W_a. If firms in an industry with this level of concentration are unable to achieve a maximising PCM^m, then W_m is biased down and W_a is biased up.[1] Biases due to slope coefficients on the barriers terms could be in either direction.

(iii) *Horizontal Aggregation.* Cowling and Mueller correctly point out that welfare estimates are biased downward by aggregation of profit data to the industry level. If two identical firms, one Eastern and one Western, sold at different markups in the East and West, then a welfare triangle based on national sales and the average price would be smaller than the true sum of two triangles (because of the quadratic relation between social cost and margin). Another bias results if some firms with higher costs survive under a monopoly umbrella. Welfare triangles should be based upon efficient firm costs, and the costs stemming from inefficiency in production should be added to the measure of socially wasteful expenditures.

(iv) *Cross-Industry Aggregation.* This aggregation generally presents the opposite bias to the previous aggregation. In a general equilibrium world, monopoly pricing for one product (even without externalities) can be socially offset to an efficient solution by the right degree of monopoly pricing for all other products. One may, with the right conditions, have a world in which industries have monopoly markups but there is a Pareto-efficient equilibrium. If, however, there is a competitive sector (such as the labour-leisure sector) then the monopoly welfare loss effects cannot be completely cancelled out (see Scherer, 1980). Furthermore, wasteful expenditures to secure market power can never be cancelled out by other such expenditures.

(v) *Final Thoughts.* Given these potentials for bias, especially the aggregation biases which would affect all of the analyses, we are not sanguine about reaching a definitive measure. Although these potential biases leave considerable room for debate, we think that the approach used in our study sheds light on some biases in earlier studies, and illustrates a methodology for attaining more reliable estimates of social costs. It also yields insights into the value of competition – both actual and potential.

IV. SUMMARY AND CONCLUSION

One major deficiency of past studies of the deadweight loss attributable to monopoly pricing is the inability to disentangle actual and monopoly values. Consequently, it was impossible to assess separately the actual losses stemming from an oligopolistic industry structure and the potential welfare losses that might arise from a monopoly. It is our hope that the present study has contributed to an understanding of this problem, providing estimates for both actual

[1] Conceptually, if m were indexed to 1 (rather than P_m), this bias reduces P_m (lowering W_m) and flattens the demand curve, enlarging the triangle between P_a (which is fixed if m is the index) and m (raising W_a).

and monopoly deadweight losses, thus evaluating the benefits of existing levels of competition.

Our estimate of actual oligopoly deadweight loss – 2·9 % of industry value of shipments – is considerably higher than Harberger's finding of 0·1 % or 0·06 %. Yet when compared to our estimate of potential monopoly deadweight loss of 11·6 %, it would appear that manufacturing industries are closer to a competitive outcome than to an outright monopoly solution. It has become generally accepted that Harberger's study found a 'very small' welfare loss, while Kamerschen and Cowling and Mueller found 'large' welfare losses. It is our contention that in order to attain a better understanding of, and a proper perspective on welfare losses, the actual figures should be contrasted with the monopoly extreme as well as with the competitive outcome of zero deadweight loss.

Since our finding is that actual losses are substantially different from the potential monopoly welfare losses, one may well speculate on the reasons for this large divergence (aside from any statistical and other biases). Two possible answers may be that this is due to (*a*) natural market forces, or (*b*) strict anti-trust enforcement. Which of the foregoing, with their weighty and differing policy implications, is the correct answer, we leave for future research.

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APPENDIX: *PCM* DATA

$PCM(t-1)$ comes from Harris (1973), who, in turn, adopted Collins and Preston's (1968) measures while supplementing his own estimates for industries missing from their sample. Collins and Preston started with [(Value added) – (payroll)]/(value of shipments). They then subtracted from the numerator supplemental employee benefits, the cost of repairs and maintenance (not included in payroll), rental payments, insurance, and property taxes. We made additional subtractions which include advertising costs, depreciation costs (based on the 1958 US Census of Manufactures), and a risk-free opportunity cost of capital (estimated to be 5 % for 1958 multiplied by the ratio (Fixed Depreciable Assets)/(Value of Shipments)).

Since total assets were not reported on a 4-digit SIC basis by the US Census we could only use fixed depreciable assets. However, in order to obtain a rough idea of what the results would have been with total assets, we used the following approximation technique. We estimated the average ratio of (total assets)/(fixed depreciable assets) for non-financial corporations in 1958. We then multiplied each industry's fixed depreciable assets by this ratio and adjusted the price-cost margins accordingly. The results obtained from re-estimation pointed to a 10 % decline in the weighted average of W_a/VS_a and an 8 % decline in W_m/VS_m. (The t values for these regressions were relatively insensitive to the above change; the coefficients were slightly more significant in the *PCM* equation and a little weaker in the entry equation.)

PCM measures have been criticised by Liebowitz. Part of his criticism is that depreciation and advertising are not deducted. In our measure they are. Another criticism is that they do not correlate well with profits on sales, adjusted for opportunity cost on capital. In our work they did. Our *PCM* was correlated 0·49 with profits on sales and 0·59 with profits on equity calculated for roughly the same years. Unadjusted *PCM* correlated respectively at 0·55 and 0·63 with these measures. The two *PCM* measures correlated at 0·95 and the two accounting measures at 0·74.

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