Market power and welfare loss

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MARKET POWER AND WELFARE LOSS

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Abstract

I estimate welfare loss of market power using consumer loss variation. I estimate demand elasticity of certain goods known to suffer monopolistic power. Based in Urzúa's study I employ data from household expenditure survey of Spain and Deaton's methodology to estimate elasticities of demand using expenditure of households. We finally obtain distributive effects of market power in selected sectors.

1.- Introduction

The economic literature has studied the negative effect of monopoly power on the allocation of resources and welfare of consumers, but there scarce literature on whether these effects may impact the distribution of wealth of consumers. Exceptions include some contributions on the effects of monopoly power on the distribution of wealth in the United States (Urzúa 2008, Creedy, Dixon 1998, Comanor, Smiley 1975), while other authors point out the importance of the distributional effects of monopolies (McKenzie 1983). More interesting is the study on the distributional impact of monopoly power applied to the case of Australia (Creedy, Dixon 1998) replicated for Mexico, using the same methodology (Urzúa 2008) which not only analyzes the distributional impact of monopoly power but also regional[2]impact.

This latter study divides the population in income strata according to their income and then estimates the loss of welfare caused in each stratum by monopoly or oligopolic powers. To do this, they first estimate the loss of consumer welfare using loss of consumer's surplus (although Creedy and Dixon use several methodologies in addition to the consumer's surplus which guarantees the robustness of their results) estimating for this the elasticity-price of the demands of each object monopoly power. The study focuses on a set of goods for which companies are presumed to have high market power and uses quantity and spending data per family recorded in a Mexican Family Budget Survey (from PresupFamily Requirements, INE Survey). The next step is to estimate the elasticities of the demand for the goods under study using Deaton methodology that allows to estimate the elasticities from the expenditure per family without using prices. Finally, the distributional and spatial effects of the market power of some companies are presented. In this note we apply the same methodology developed by Urzúa to the case of Spain but using the data obtained from the INE Household Expenditure Survey (EPF).

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[2] It has recently been applied to the case of South Africa (Njisane, Mann et al.) and Kenya (Argent, Begazo 2015)

2.- How to measure social welfare loss

As we have mentioned, we assume that the loss of social welfare is proportional to the loss of consumer surplus and this proportionality factor is the same for all households. The estimation method based on the equivalent variation also used by Creedy and Dixon, requires the estimation of an indirect utility function, but because of its complexity we will not estimate it here.

We consider the demand function to be linear, so that the net loss of consumer surplus, B, corresponds to half of the price difference multiplied by the reduction in the amount demanded. So:

$$(1)\ B = \frac{(p^m - p^c)(q^c - q^m)}{2}\ ,$$

Where m and c on prices and quantities refer to price and amounts of imperfect competition and perfect competition. We assume that the prices in perfect competition are equal to marginal cost.

The above equation can be approximated as:

(2) $\eta = \dfrac{(q^m - q^c)p^m}{(p^m - p^c)q^m}$ where η the demand elasticity is. Reordering the above equation we obtain,

$$(3)\ q_m - q_c = \eta\left(\frac{p_m - p_c}{p_m}\right)q_m$$

Replacing in (1) we get

$$(3)\ B = \left(\frac{p^m - p^c}{p^m}\right)^2 \frac{p^m q^m(-\eta)}{2}.$$

To calculate (3) we need not only an estimate of elasticity but also the amount spent of each good (can be obtained from the EPF) and the estimated increase in relative prices due to market power (which depends on the particular industrial structure of each market). Following Creedy and Dixon, we assume that in each market there are identical K companies with constant marginal costs, c, which behave using a Cournot guess.

Under these assumptions in the Cournot [3] equality:

$$(4)\ p^m\left(1 + \frac{1}{K\eta}\right) = c.$$

[3] see p. 219 (Tirole, 1988)

So if $p^c - c$, then

$$(5)\ \frac{p^m - p^c}{p^m} = -\frac{1}{K\eta}.$$

It can now be replaced (5) in (3) to estimate welfare loss:

$$(6)\ B = \frac{p^m q^m}{2K^2\eta}\ ,$$

In this way we need an estimate of elasticity-price, the expenditure of each good and the number of oligopolistic companies in that marketis required for each good. This formula is applied for each good and then the losses of the *assets* are added to obtain the total loss of well-being relative to the total expense of each household (*and*) as:

$$(7)\ L = \sum_{j=1}^{n} \frac{B_j}{y}\ ,$$

(7) can be used to calculate the distributional impact of market power across the country as follows: first, for each household, the total relative loss is calculated and then the average loss essay relative to total expenditure is calculated among all households in each stratum. Subsequently, once the stratum with lower relative losses is identified, all losses are again expressed relatively, but now with respect to the stratum less impaired.

3.- Distributional impact of market power on affected markets

In order to estimate the loss of well-being we need estimates of demand elasticities relative to their prices. Expenditure Household Survey of Spanish National Statistics Institute (EPF) reflects both household expenditure and volume so that the unit value of the goods used by each household can be indirectly established. However, following Urzúa, it must be borne in mind that unit value cannot necessarily be taken as the price that all households would face. Due to differences in qualities consumed by each household, it is not possible to equate unit values with prices.

As an alternative one can use expenditure methodology (Deaton 1987) where household expenditure is used to estimate demand elasticities[4]. I use two markets assumed to be oligopolistic. I calibrate demand elasticities using several studies (Gálvez, Mariel et al. 2016, Santiago lvarez-García, Desiderio Romero-Jordán, Marta Jorge-García 2016) that

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[4] Expenditure proportion of each good, w_i, is a function of prices, p_i and real disposable income:

$$w_{iht} = \alpha_{iht} + \sum_j \gamma_{ij} \log p_{jht} + \beta_i \log(X_{ht} / P_t)$$

i=1,..., n

X is total expenditure and P is a Price index expressed as:

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_j \sum_k \gamma_{jk} \log p_k \log p_j$$

estimate both elasticities and that we use here, in the case of fuel would be 0.5361 and in the case of electricity of 0.907 both with a negative sign. The other variable that requires a specification is K, which is the number of companies on the market, and we assume for fuel that K=4 and in the case of electricity k=5.

With K values and elasticities obtained in the previous studies, the loss of surplus consumer surplus is obtained using equation (6) for each market of goods and services. In the case of an oligopoly of K companies using Cournot conjecture, the existence of an optimal requires that:

(7) $\eta < -1/K$.

In case of monopoly ($\eta < -1$).

I now classify households by income strata, the average income per stratum is obtained as well as the corresponding share of the good in total household expenditure. The total relative loss due to the market power for each market is then calculated for each household using equation (7) and subsequently an average has been calculated for each stratum. Finally, once the stratum with lower relative losses (the highest income) has been identified, these have been expressed again relatively, but with respect to the welfare losses suffered by the least affected stratum. The results appear like this in the last column.

Intervalo de ingresos mensuales netos totales del hogar	gasto medio por hogar total	gasto medio por hogar en gasolina	Gasto medio por hogar en electricidad	proporcion gasto gasolina sobre el total	proporción gasto en electricidad sobre el total	pérdida de bienestar absoluta gasolina (L)	pérdida de bienestar absoluta electricidad (L)	Perdida total bienestar	perdida de bienestar relativa (I)
1 Menos de 500 €	11.038,39	658,20	358,47	0,0596	0,0017	0,0511416	0,0009391	0,0520807	1,300323828
2 De 500 a menos de 1000 €	12.136,26	620,60	510,11	0,0511	0,0014	0,0438365	0,0007586	0,0446151	1,113926611
3 De 1000 a menos de 1500 €	16.770,19	957,58	514,49	0,0571	0,0009	0,0489707	0,0005137	0,0494844	1,23550076
4 De 1500 a menos de 2000 €	21.547,41	1.239,02	606,99	0,0575	0,0009	0,0493157	0,0004956	0,0498113	1,243667623
5 De 2000 a menos de 2500 €	25.388,42	1.513,62	510,04	0,0596	0,0005	0,0511307	0,000267	0,0513977	1,283271039
6 De 2500 a menos de 3000 €	29.613,92	1.730,53	645,49	0,0584	0,0005	0,0501169	0,0001903	0,0503072	1,256044003
7 3000 a menos de 5000 €	36.624,96	2.084,45	556,33	0,0569	0,0005	0,0488109	0,0001776	0,0489885	1,22311689
8. 5000 a menos de 7000 €	50.738,82	2.469,64	789	0,0487	0,0002	0,0417481	0,0001186	0,0418668	1,045153687
9. De 7000 a menos de 9000 €	44.937,89	2.118,84	951,24	0,0472	0,0001	0,0404578	0,0000302	0,040488	1,010883324
10. 9000 o más €	63.705,66	2.975,10	0	0,0467	0	0,0400521	0	0,0400521	1

We see that the loss of well-being decreases as income increases. Therefore, the loss of well-being caused by the concentration of the market, has the greatest impact on those lower income strata. The relative loss of stratum with fewer resources is about 30% greater than the richest stratum.

4.- Conclusions

In this note we have examined the distributional effects of imperfect competition in the case of Spain using a methodology developed by Creedy and Dixon and applied by Urzua. The methodology used estimates the loss of consumer welfare based on the difference between the competitive hypothetical price and in the case of market power. Assuming that companies compete in quantities and linear demand, the welfare loss depends only on expenditure, price elasticity and the number of companies on the market. If we divide by income strata, the loss of well-being will be proportionally greater for lower income levels, which comes to accentuate social inequality.

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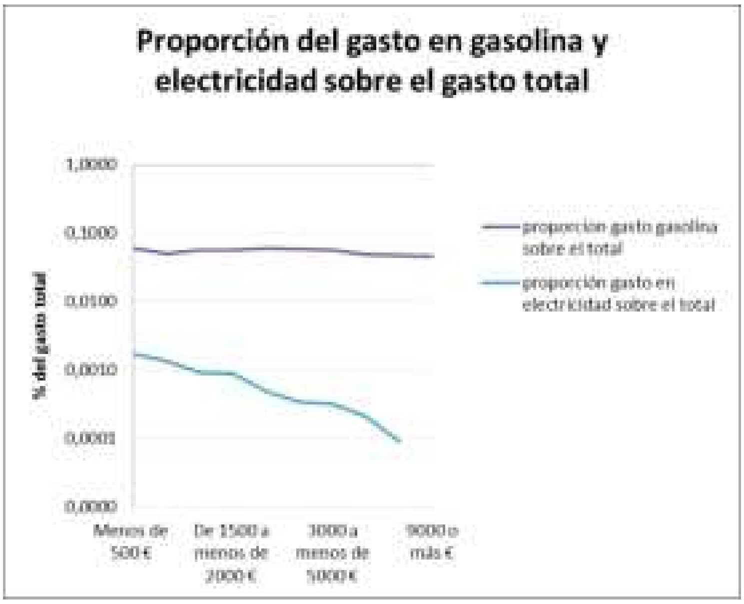
Annex I.

Perdida de bienestar relativa
1,4
1,3
1,2
1,1
1
0,9
0,8
perdida de bienestar relativa (I)
1 Menos de 500 €
2 De 500 a menos de 1000 €
3 De 1000 a menos de 1500 €
4 De 1500 a menos de 2000 €
5 De 2000 a menos de 2500 €
6 De 2500 a menos de 3000 €
7 3000 a menos de 5000 €
8. 5000 a menos de 7000 €
9. De 7000 a menos de 9000 €
10. 9000 o más €



Proporción del gasto en gasolina y electricidad sobre el gasto total
1,0000
0,1000
0,0100
0,0010
0,0001
0,0000
% del gasto total
Menos de 500 €
De 1500 a menos de 2000 €
3000 a menos de 5000 €
9000 o más €
proporcion gasto gasolina sobre el total
proporción gasto en electricidad sobre el total

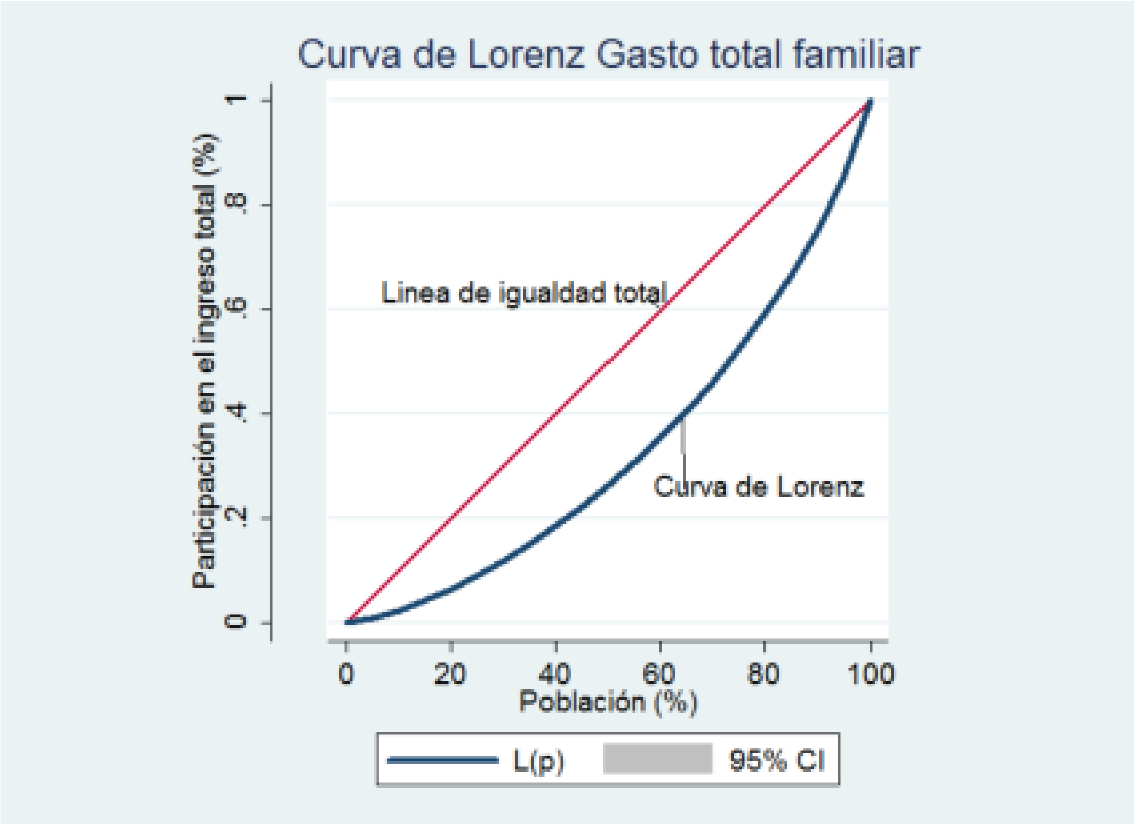
Annex II: Inequality coefficient

1: Lorenz Curve: This is the most basic approach for assessing inequality of income distributions. It is based on comparing the percentages of total income and the percentages of the population corresponding to those incomes. Lorenz curve is a key reference for the analysis of inequality since it incorporates a very intuitive graph, and its analytical definition.

The construction of the Lorenz curve $y = (y_1, y_2, ..., y_n)$ is as follows: be an orderly distribution of rent, where $y_1 \leq ... \leq y_n$. First we sort the accumulated population shares, from the poorest individual to the richest, on the horizontal axis and their corresponding income percentages on the vertical axis. This produces a one dimension box that contains a curve that describes the distribution of the rent. The diagonal line represents exact equality (each proportion of the population receives the same share of total income), so the difference between this line and the actual distribution is a measure of inequality.

Formally for an orderly income vector from lowest to highest, $[p_i, L(p_i)]$ the Lorenz curve is defined as a set of points, where $p_i = \frac{i}{n}$ is the share of the population with income equal to or less than y_i, and $L(p_i)$ can be defined as:

$$L(p_i) = \frac{\sum_{j=1}^{i} y_j}{n\mu}, \qquad \text{with} \qquad L(0) = 0, L(1) = 1.$$



Household Exp.	Coef.	Std. Dev.	[95%	confidence interval]
0	0			
5	.0094179	.0000131	.0093921	.0094436
10	.0245255	.000026	.0244746	.0245763
15	.0435237	.0000386	.043448	.0435994
20	.065763	.0000502	.0656645	.0658614
25	.0911084	.0000626	.0909857	.091231
30	.1193576	.0000744	.1192118	.1195033
35	.1506756	.0000868	.1505054	.1508457
40	.1851354	.0000987	.1849419	.1853289
45	.2226721	.0001099	.2224568	.2228874
50	.263311	.0001205	.2630748	.2635471
55	.3073042	.0001309	.3070476	.3075607
60	.3548825	.0001406	.354607	.355158
65	.4062984	.0001494	.4060056	.4065912
70	.4622915	.0001572	.4619833	.4625997
75	.523582	.0001637	.5232612	.5239028
80	.5909459	.0001679	.5906169	.5912749
85	.6657701	.0001686	.6654396	.6661006
90	.7509119	.0001639	.7505907	.7512331
95	.8520598	.000146	.8517737	.852346
100	1	.	.	.

The slope of the Lorenz curve between two consecutive points $[p_{i-1}, L(p_{i-1})], [p_i, L(p_i)]$, corresponds to the relative income, $\frac{y_i / n\mu}{y_i/n} = \frac{y_i}{\mu}$, which implies that the slope increases as we move to the right (the part of the richest population). You can compare income distributions from an ordinal point of view: if the Lorenz curve of one distribution is above another then the first is more egalitarian than the second, as it is closer to the total equality line. However, such comparisons are difficult when Lorenz's two curves are cut and when there is no way to measure the inequality of one distribution relative to the other. Therefore, a cardinal measurement is necessary and the most common is the Gini index that we analyze below. However, it should be noted that the Lorenz curve provides very interesting information, for example, for $L(0.5)=0.26$ which means that 50% of the poorest population gets 26% of the total income. The lower the value of $L(p)$ the higher the inequality of the distribution.

2.- The Gini index (Gini,1921), is the most commonly used inequality index probably because it can be easily interpreted using the Lorenz curve. This is the ratio between the area between the Lorenz curve and the 45% line between the entire area below that line:

$G = \frac{A}{A+B}$, being $A+B=0,5$:

And $G=2A$.

$G = \frac{2}{n}\sum_{i=1}^{n}(p_i - L_i)$ coefficient is equal to half of the relative mean difference. In our case the index would be 0,3428986