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Distributive and Regional Effects of Monopoly Power

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DISTRIBUTIVE AND REGIONAL EFFECTS

OF MONOPOLY POWER

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Abstract

This paper estimates the distributive and regional effects of firms with market power in the case of Mexico. It presents evidence that the welfare losses due to the exercise of monopoly power are not only significant, but also regressive. Moreover, the losses are different for the urban and rural sectors, as well as for each of the states of Mexico, being the inhabitants of the poorest ones the most affected by firms with market power.

"Despite the primary concern of economists with the resource allocation effects of market arrangements, political officials are more often concerned with distributive effects". Comanor and Smiley (1975, p. 194).

At first glance it would seem natural to surmise that the welfare effects caused by firms with a significant market power would vary according to the consumers' income, or even according to the regions where the firms sell their products; the latter especially in the case of developing countries, where transportation costs tend to be high and consumers are typically poorly informed. Nevertheless, there have been very few studies that explore in detail the distributional consequences of monopoly power in any economy, whether developed or underdeveloped. Among the general studies known to us are those of Comanor and Smiley (1975), McKenzie (1983), and Creedy and Dixon (1998 and 1999); while Hausman and Sidak (2004) explore the same issue for the particular case of long-distance phone calls. In all those studies the verdict is the same: market power has a significant distributive impact. In the case of Australia, for instance, Creedy and Dixon (1998, p. 285) conclude that "whatever the size of the absolute welfare loss arising from monopoly, there may be a substantial effect on the distribution of welfare".

Our work not only follows those authors in analyzing the distributive impact of firms with a significant market power, this time in the case of Mexico, but it also deals with their regional effects. In order to accomplish this last task, we distinguish between households living in urban and rural areas, and we calculate afterwards the welfare losses due to market power for each of the thirty two Mexican states. Section 1 presents the theoretical model to be used to estimate those welfare losses, which is based on the assumption of oligopolies with conjectural variations. Section 2 details the household

expenditure survey that is used in the paper, as well as the markets under study. These are chosen according to two criteria: a presumption, from the part of the Mexican Federal Competition Commission, that there could be market power from the part of the sellers, and the availability of data on, both, households' spending and unit values.

Since the expenditure surveys that are officially made in Mexico are not longitudinal, it is not permissible to regard the reported unit values as prices. Strictly speaking, those values reflect not only commodity prices but also the quality of them. Thus, Section 3 uses the ingenious model of spatial variations proposed by Deaton (1987 and 1990) to circumvent that problem. Once the price elasticities of the demand for the goods are estimated for both the urban and the rural sectors, the distributional and spatial effects on social welfare are finally estimated in Section 4.

I. MEASURING WELFARE LOSSES DUE TO MARKET POWER

In this part we present the theoretical model that is used in a later section to estimate the distributional consequences of market power. It is assumed from the beginning that the social welfare cost of market power can be represented by the loss of consumers' surplus. Although it is well known that welfare losses are much better estimated using utility-based measures, such as equivalent variations, these measures cannot be calculated here. This is so because, as explained in Section 3 below, the econometric model that is used in this paper to estimate the own-price elasticities is not a *bona fide* demand system, since it is not derived from a utility function.

Given a particular good, let p^m be the price charged to households by the firms with market power. We assume that the marginal cost of the supplier, *cm*, is constant and equal to the competitive price that would prevail under perfect competition, p^c. As in Creedy and Dixon (1998), we further assume that the demand curve can be approximated by a linear demand function, in such a way that the loss of consumers' surplus, *B*, can be calculated as:

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

Denoting by η the elasticity of the demand for the good relative to its own price, then

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

and so, using (2) in (1), the welfare loss can be rewritten as:

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

In order to calculate (3), we require not only an estimate of the elasticity, but also of the amount spent on the good, which can be obtained from a survey, and the estimated

increase in relative prices due to market power, which depends on the particular industrial structure prevailing in the market. Following Creedy and Dixon (1999), we assume here that the industries under study are made of oligopolies with conjectural variations.

More formally, consider an oligopoly that is constituted by K firms, all of them producing the same homogeneous good. Let Q be the total production of the industry, which is the sum of the production by firm k, denoted by q_k, and the aggregate production from the rest of the firms, denoted by q_{-k}. Assuming that all the firms base their decisions according to the conjectural variations hypothesis, the optimality condition for each firm k is given by:

$$
(4) \qquad cm_k = p^m \left(1 + \frac{1}{\eta_k} \right),
$$

where cm_k is the marginal cost for firm k, which is assumed to be constant, while η_k is the demand elasticity as perceived by the firm. The following expressions establish the relationship between this last elasticity and the market elasticity:

$$
(5) \qquad \eta_k \equiv \frac{dq_k / q_k}{dp / p} = \frac{dq_k / q_k}{dQ / Q} \frac{dQ / Q}{dp / p} = \frac{dq_k / q_k}{dQ / Q} \eta .
$$

The denominator on the right-hand side of (5) can be written as

$$
(6) \qquad \frac{dQ}{Q} = \frac{q_k}{Q}\frac{dq_k}{q_k} + \frac{q_{-k}}{Q}\frac{dq_{-k}}{q_{-k}},
$$

which, if we denote the market share of firm k as s_k, can be rewritten as

$$
(7) \qquad \frac{dQ}{Q} = s_k\frac{dq_k}{q_k} + (1 - s_k)\frac{dq_{-k}}{q_{-k}}.
$$

Let us define the conjectural elasticity $\alpha_k \equiv (dq_{-k}/q_{-k})/(dq_k/q_k)$, which measures the degree to which firm k takes into account its rivals' reactions to its own changes in production. Using α_k, and inserting (7) in (5), we can obtain the firm's perceived conjectural elasticity in terms of the elasticity of market demand and the market share as:

$$
(8) \qquad \eta_k = \theta_k\eta \quad \text{where} \quad \theta_k \equiv \frac{1}{s_k + (1 - s_k)\alpha_k}.
$$

Assuming now that, for all firms, $\theta_k = \theta$ and $cm_k = p^c$ (conditions that would be fulfilled in particular if all firms were identical), then, after substituting (8) in (4), we can find that the price margin due to market power can be expressed as:

(9)
$$\frac{p^m - p^c}{p^m} = -\frac{1}{\theta \eta}.$$

Thus, using (9) in (3), the total consumers' loss due to market power can be approximated as

(10)
$$B = -\frac{p^m q^m}{2\theta \eta}.$$

Note that this last equation just requires an estimate of the price elasticity and the spending on each good, once the value of θ is established. It equals one in the case of a monopoly, but the value depends in general on both the market shares and the conjectural elasticities. If we further assume that the conjectural responses correspond to the Cournot model, as we do in a later section, then $\alpha = 0$ and, by (8), θ is simply equal to K. Also note that for the optimality condition in (4) to make sense, it is necessary that $\eta_k < -1$, since the marginal cost is always positive. This requires that $\eta < -1/\theta_k$, which, in the case of identical firms in a Cournot game, implies in turn that $\eta < -1/K$.

Finally, in order to be able to establish comparisons across groups of individuals, it is convenient to rescale the welfare loss given in (10). Let M be the number of goods purchased by the consumers from firms with market power. A measure of the total welfare loss in relative terms can be found after dividing the welfare loss on each item by the total expenditure on the M goods:

(11)
$$L = -\frac{1}{2} \sum_{i=1}^{M} \frac{w_i}{\theta_i \eta_i},$$

where w_i is the share of good i in total expenditure.

II. DATA AND MARKETS UNDER STUDY

The household income and expenditure survey to be used here is known in Mexico as the *Encuesta Nacional de Ingresos y Gastos de los Hogares*, ENIGH for short. The most recent ENIGH that was available at the moment of this writing was made in August-November 2006 (INEGI, 2007). The sample consisted of 20,875 housing units, and it was designed to provide reliable estimates at the national level, as well as at the urban and rural levels (the urban sector consists of all localities with 2,500 or more inhabitants, and the rural sector of the rest); furthermore, the 2006 survey was also representative for some, but not all, of the 32 Mexican states. For reasons to be given in a later section, it is important to add that the sampling process was stratified and multi-staged. Each primary sampling unit was made of one or several "basic geostatistical areas" (these are similar to the census tracts employed in other countries). The resulting 2,785 primary sampling units were subject to a stratification based on socio-demographic variables to finally produce 392 strata from which the sample was drawn.

Turning now to the markets to be studied, their selection is facilitated by the fact that in 2008 the Federal Competition Commission listed a number of sectors that it wanted to examine closely (CFC, 2008). The goods mentioned by the Commission that are also contemplated in the ENIGH are the following: corn tortilla; processed meats; carbonated soft drinks; cow milk; chicken and eggs; beer; medicines; electricity; liquefied gas; natural gas; and gasoline. On the other hand, the services included in that list that are also recorded in the expenditure survey are: foreign bus transportation; air transportation; private primary schools; private high schools; private universities; long-distance phone calls; local phone calls; cell phones; internet; medical fees; hospital fees; and credit card payments.

Even though all the goods and services mentioned above are reported in the ENIGH, for most of them there is only information on household spending, not on unit values. This is the case for both the services and the energy consumption goods. Since this fact prevents us from a direct estimation of their corresponding price elasticities, in this paper we focus solely on the following seven consumption goods for which unit values are indeed reported: corn tortilla; processed meats (ham, bacon, sausage, etc.); carbonated soft drinks (together with juices and bottled water); cow milk; chicken and eggs; beer; and medicines (whether purchased with or without a prescription).

Having selected the goods markets, it remains to be decided whether or not each of them can be treated as a single national market. In our context, this would be so if there were no presumption of differing non-competitive practices across all regions in Mexico. Although in the case of urban areas there is no such presumption, in the case of rural

areas there is evidence of distinctive non-competitive practices. For instance, it is common for firms to deliver directly their products to stores in remote areas, but only if no other competing brands are offered to the consumers. There are even documented cases (CFC, 1998) in which firms have bribed the leaders of communal lands to eject competitors from the entire locality. If we add to that evidence the fact that in most rural areas there are no shopping outlets nearby that can impose some price discipline, then it would seem important to distinguish between the urban and the rural sectors in what follows.

III. PRICE AND QUALITY

Since the ENIGH is not a longitudinal survey, but rather a cross-sectional one, we should resist the temptation of treating the unit values reported by each household as the goods prices faced by the rest of them. This is so because variations in unit values across households may be due to changes in the quality of goods purchased; for instance, the price difference between two cuts of beef can be quite significant. Furthermore, even if the goods are identical, the perceived quality may differ; for example, the lettuce sold in a supermarket may be perceived to be cleaner than the one sold in a market street.

Although the above comments might be thought to imply that there is no way to estimate the own-price elasticities needed in this paper, there is however an indirect procedure that can be implemented for that end. The model of spatial variations due to Deaton (1987 and 1990) can be used, provided that the unobserved prices do not vary

within the clusters used in the sampling process. In the case of the ENIGH this is a reasonable assumption, since, as noted earlier, each of its 2,785 primary sampling units correspond to a simple geostatistical area, a neighborhood so to speak. Following the notation in Deaton (1997), the statistical model to be used is of the form:

$$(12) \qquad w_{Ghc} = \alpha_G^0 + \beta_G^0 \ln x_{hc} + \gamma_G^0 \cdot z_{hc} + \sum_{H=1}^{M} \theta_{GH} \ln \pi_{Hc} + (f_{Gc} + u_{Ghc}^0)$$

$$(13) \qquad \ln v_{Ghc} = \alpha_G^1 + \beta_G^1 \ln x_{hc} + \gamma_G^1 \cdot z_{hc} + \sum_{H=1}^{M} \psi_{GH} \ln \pi_{Hc} + u_{Ghc}^1 ,$$

where: M is the number of goods; w_{Ghc} is the share of good G in the budget of household h located in cluster c; x_{hc} is the household's total spending; z_{hc} is a vector of socio-demographic variables (and '$\cdot$' is the inner product); π_{Hc} is the price of good H in cluster c; f_{Gc} is a cluster-level effect (fixed or random) that is uncorrelated with the prices; v_{Ghc} is the unit value of good G as reported by the household h located in cluster c; and u_{Ghc}^0 and u_{Ghc}^1 are the correlated stochastic residuals.

It is worth noting that the apparent similarity between the model (12)-(13) and the popular Almost Ideal Demand system is illusory. At best the model may be viewed as an aggregate demand system where "the averaging over agents almost never permits an interpretation in terms of a representative agent" (Deaton, 1997, p. 305). An implication of this fact is that, as already noted in Section 1, we cannot use in this paper utility-based

measures to estimate welfare losses. Another consequence is that a special econometric procedure has to be used to estimate the model.

Since Deaton (1997, pp. 293-305) has a very detailed exposition of his methodology, here we limit ourselves to a short comment. The estimation procedure can be divided into two steps. In the first, the within-cluster stage, the two equations (12)-(13) are run using ordinary least squares after demeaning, by their cluster means, the budget shares, the logarithms of the unit values and of the expenditures, and the socio-demographic variables. Since prices are constant in each cluster, then, as is well known from the literature, that demeaning removes prices and fixed effects, and allows consistent estimation of the alphas, betas and gammas. The second step, the between-cluster stage, is less canonical. First, the consistent estimates of the parameters are used to compute averages by cluster of shares and unit values purged of the effects of expenditures and socio-demographic characteristics. Second, the first-stage regressions are also used to estimate the variance-covariance matrix of the theoretical averages, as well as of the variance-covariance matrix of u_{Ghc}^0 and u_{Ghc}^1. Finally, the elasticity matrix is estimated using between-cluster ordinary least squares regressions of average shares on average unit values.

Our model is estimated along those lines for the seven goods under consideration, after adding a number of socio-demographic variables. The first three are the age of the head of the household, her years of education, and the number of members of the household. The next ten variables are made of the following proportions: of men and women in the household that are under 12 years of age; of men and women aged 12 years

or older, but under 25 years of age; of men and women aged 25 years or older, but under 45 years of age; of men and women aged 45 years or older, but under 65 years of age; and of men and women aged 65 years or older. Finally, binary variables were also included to capture diverse consumption patterns across regions. For that end, the 32 Mexican states were divided into four regions: Baja California, Baja California Sur, Coahuila, Chihuahua, Durango, Nuevo León, Sinaloa, Sonora and Tamaulipas; Aguascalientes, Colima, Guanajuato, Jalisco, Nayarit, San Luis Potosí and Zacatecas; Campeche, Chiapas, Guerrero, Oaxaca, Tabasco, Quintana Roo and Yucatán; and Distrito Federal, Hidalgo, México, Michoacán, Morelos, Puebla, Querétaro, Tlaxcala and Veracruz.

The estimation results, for both urban and rural households, are presented in Table 1. As can be appreciated, the point estimates of the own-price elasticities seem to be reasonable in both sectors. Only the demand for milk is inelastic, at a level of significance of 5%, for all

TABLE 1
OWN-PRICE ELASTICITIES

	Elasticity	Standard error
Urban households		
Corn tortilla	-1.389	0.623
Processed meats	-0.507	0.103
Chicken and eggs	-1.087	0.324
Milk	-0.327	0.143
Carbonated soft drinks	-1.023	0.215
Beer	-1.082	0.120
Medicines	-1.842	0.472
Rural households		
Corn tortilla	-0.311	0.105
Processed meat	-0.456	0.295
Chicken and eggs	-1.559	0.500
Milk	-0.394	0.128
Carbonated soft drinks	-1.142	0.529
Beer	-1.462	0.204
Medicines	-1.117	0.438

households, while the demand for corn tortilla is also so for rural households (whose diet crucially depends on tortilla consumption). Although income elasticities are not included in the table, it may also be noted that only beer seems to be a luxury good in both sectors.[1]

IV. DISTRIBUTIONAL AND REGIONAL IMPACTS

This part integrates the theoretical results developed in the first section of the paper with the empirical results that have just been presented. As noted earlier, if for each of the markets we assume that firms produce a homogeneous product, have identical cost functions, and behave as in a Cournot game, then the measure of the total welfare loss in relative terms given in (11) can be rewritten as

(12)
$$L = -\frac{1}{2}\sum_{i=1}^{M}\frac{w_i}{K_i\eta_i},$$

where, it is useful to repeat it here, w_i is the share of good i in the budget, K_i is the number of firms in the market for good i, and η_i is the own-price elasticity of market demand. It is also worth remembering that the existence of an optimum requires that the

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[1]Using the same ordering as in the table, the income elasticities are estimated to be 0.467, 0.498, 0.365, 0.639, 0.687, 2.107 and 0.606 for the urban sector, and 0.648, 0.761, 0.440, 0.769, 0.729, 2.019 and 0.835 for the rural sector.

elasticity itself is not only negative but also that $\eta_i < -1/K_i$ (this condition collapses in the case of a monopoly to the classical condition that $\eta_i < -1$).

In order to compute (12) we have to specify the number of firms participating in each of the seven Cournot oligopolies. In the case of the market for corn tortilla, about half of its production is made after treating the corn kernels using an ancient technique called "nixtamalization", while the other half is made using corn flour. The first production process is practiced by myriads of small producers and households across the country, while 70 percent of the supply of corn flour comes from a single company.[2] To represent that fact in our model, we assume that those two inputs are perfect substitutes, and that the firm faces a competition from the rest, so that $K_1 = 2$. It may be noted that, as implied by Table 1, the necessary condition $\eta_1 < -1/2$ is not rejected at a 5% level of significance in the case of both the urban and the rural sectors.

Turning now to the processed meat market, we assume that $K_2 = 3$ given that there are three companies relatively equal in size that clearly control it. Another three firms used to control the chicken and eggs markets until very recently, when imports have brought some price discipline. Yet, in 2006, when the ENIGH was made, $K_3 = 3$ would still seem to be the most adequate value. It may also be noted that in the case of both processed meats and chicken and eggs the corresponding condition $\eta_i < -1/3$ cannot be rejected.

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[2]Since the names of the firms that have market power are irrelevant for the purposes of this paper, they have been omitted entirely. Nevertheless, they are available upon request from the author.

In the case of milk, two companies control about 80% of the market, while the other 20% is geographically fragmented. Thus, for the simulation we take $K_4 = 2$ (note that the condition $\eta_4 < -1/2$ also cannot be rejected, although barely in the urban sector, at a 5% level of significance). Regarding soft drinks, there is a firm that controls about two thirds of the Mexican market, and it has also been fined twice by the Mexican Federal Competition Commission for monopolic practices. Thus we set $K_5 = 1$, a value that is theoretically admissible, since, as shown in Table 1, the point estimates of the elasticities in both sectors are smaller than -1.

It would seem at first sight that the market for beer in Mexico constitutes the classical case of a duopoly since there are only two producers. However, the market is segmented geographically and prices are curiously identical among competing brands (from light beer to dark beer). For many observers of the industry this is a case of conscious parallelism; that is, it is an instance of tacit price-fixing between the two competitors. Thus, we choose $K_6 = 1$ for the simulation below (a value that is admissible according to Table 1). The final case, the market for medicines, is the most complex since there are several producers. Yet, except for the case of generic drugs, medicine prices in Mexico are considerably high according to international standards. Since the most favoured hypothesis to explain that phenomenon is once again conscious parallelism, we set $K_7 = 1$ (which is also admissible).

Using the values determined above, the own-price elasticities given in Table 1, and data on households' income and spending, Table 2 presents estimates of the

distributive effects of market power. The results in the table are calculated after ordering, by deciles, urban or rural households according to their total monetary income (the lower the decile, the poorer the group). Next, using (12), it is estimated for each household the relative welfare loss due to market power in the seven markets, and after that it is computed an average of the losses among all households in each decile. Finally, those averages are expressed relative to the average of the decile that is affected the least by the market power of the firms.

TABLE 2
WELFARE LOSS DUE TO MARKET POWER

Urban households		Rural households	
Decile	Relative loss	Decile	Relative loss
I	1.198	I	1.264
II	1.176	II	1.219
III	1.158	III	1.236
IV	1.134	IV	1.214
V	1.128	V	1.211
VI	1.109	VI	1.150
VII	1.073	VII	1.148
VIII	1.052	VIII	1.043
IX	1.036	IX	1.000
X	1.000	X	1.030

The estimates thus obtained are presented in the second and fourth columns of Table 2. The results suggest that in the urban sector the negative impact of monopoly power grows (in relative terms) as households become poorer. In the limit, the poorest households have a relative welfare loss about 19.8% higher than the one suffered by the richest. For the rural sector the redistributive impact is even more serious, since the first decile has a relative welfare loss of about 26.4% compared to the ninth decile, and of 22.7% compared to the tenth decile.[3]

Given the substantial redistributive effects arising from monopoly power, one could also wonder about its regional impacts across the 32 Mexican states. This can be accomplished using a similar procedure as the one mentioned earlier, except that now urban and rural households are classified by their home states, not by their incomes. Figure 1 illustrates the results thus obtained. The state with the smallest relative welfare loss turns out to be Baja California, which lies at the farthest north, while the state with the largest loss is Chiapas, at the farthest south. In fact, Chiapas' relative welfare loss is 2.77 times larger than Baja California's. More generally, the southern states, many of which are Mexico's poorest, are those with the greatest welfare losses. What factors might explain these results? There are essentially two: the percentage of households that live in the rural sector in the case of each state, as well as the very diverse consumption patterns that exist in Mexico. For instance, a majority of rural households live in the south, and for them the most important component of their diet is corn tortilla. As a final point, it should

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[3]As one would expect, the bootstrapped standard errors for the estimates in both columns turn out to be larger in the case of the rural sector. Furthermore, the null hypothesis that the relative welfare loss of rural households in the ninth decile is greater than the ones in the tenth decile can be rejected at a 5% level of significance.

be recalled that the ENIGH is representative only for some states, so that our last results

are   less   precise   than   the   ones

FIGURE 1

RELATIVE WELFARE LOSSES IN THE STATES OF MEXICO

High (> 2.5)

Medium

Low (<2.0)
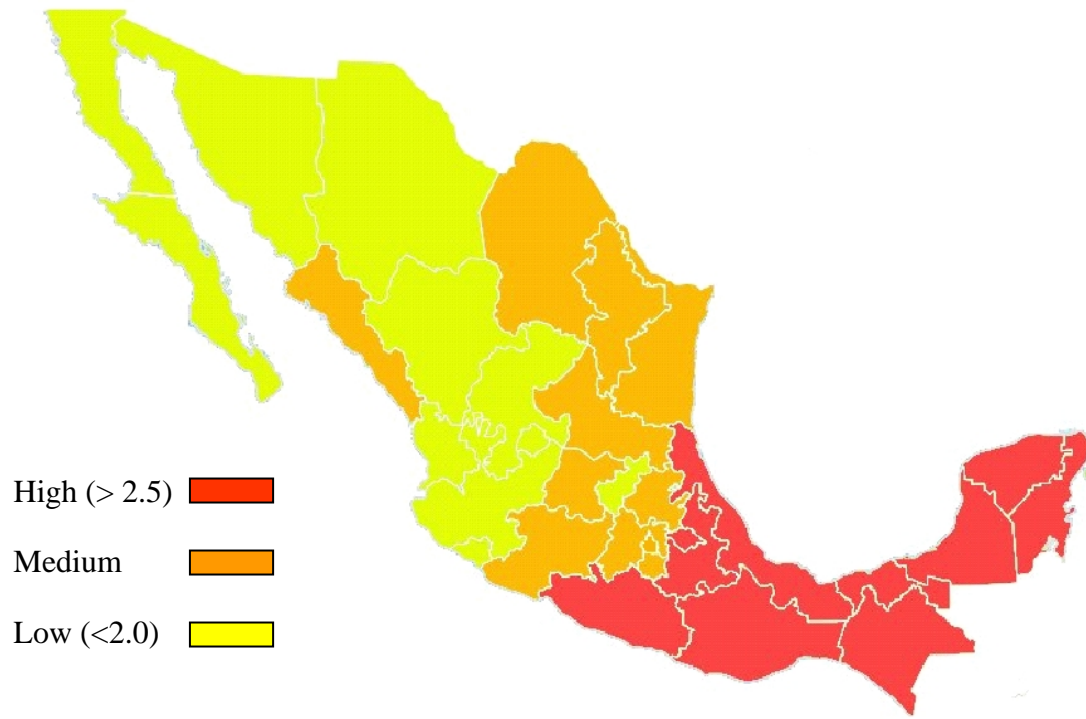
obtained earlier. Yet, we think that this last exercise is worth presenting it, since a legislator would be even more concerned about the redistributive effects of market power if it just happened that her represented constituency were one of the most affected.

CONCLUSION AND EXTENSIONS

This work has presented evidence that the social losses due to the exercise of monopoly power in Mexico are not only significant, but also regressive, both across households and across Mexican states. It should be recalled that those results are based only on the study of goods markets, not of markets for services. These later markets are also interesting to examine, since, as opposed to the case of consumption goods, one would expect that the largest welfare losses due to market power would be suffered this time by the more affluent. Such an examination could be accomplished if one were willing to make two drastic assumptions: that the ENIGH could be treated as a longitudinal survey and that, following Frisch (1959), the underlying utility function could be deemed to be additive. Then, as illustrated in Urzúa (2009), one could obtain rough estimates of the price elasticities of services.

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