MARKET STRUCTURE: CONCENTRATION AND IMPORTS AS DETERMINANTS OF INDUSTRY MARGINS

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Resumen: Se analizan los determinantes de los márgenes de precio costo de acuerdo con el enfoque tradicional de organización industrial. Los márgenes de precio costo se hacen función de los índices de concentración y el grado de penetración de importaciones. Los resultados indican que las importaciones reducen los márgenes de precio-costo de la industria doméstica. En el periodo posterior a la liberalización comercial el impacto de la concentración disminuye. Con ajustes por comportamiento cíclico de los márgenes de precio costo, se muestra que los estudios de sección cruzada tienden a sesgar las estimaciones. Se distingue entre bienes durables y no-durables y se encuentra que la concentración afecta el márgen de precio costo de los durables.

Abstract: The paper analyzes the determinants of price-cost margins following traditional industrial organization approaches. The price-cost margins are made function of the concentration index, and the degree of import penetration. We find that imports act as a market disciplining device that reduces the price-cost margins of the domestic industry. After trade liberalization, the impact of concentration diminishes. Controlling for cyclical behavior of the price-cost margins the paper shows that cross-section studies tend to bias the estimates. A distinction between durables and non-durables is made, finding strong evidence for concentration to affect the price-cost margins of durables.

Clasificación JEL: L00, L11, L60.

Palabras clave: price-cost margins, import penetration, concentration, cyclical effects, márgenes de precio-costo, penetración de importaciones, concentración, efectos cíclicos.

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1. Introduction

In 1986, the Mexican government initiated an aggressive liberalization process. In 1985, the average tariff was 23.5 percent, and 92.2 percent of national production was protected by import license requirements. By the end of 1987, the average tariff was reduced to 11.8 percent and import license requirements covered only 25.4 percent of national production with a maximum rate of 20 percent. This process should have had an impact on the competitive regime experienced by the Mexican manufacturing sector. This paper estimates a model that studies the impact of trade liberalization and the impact of other variables on price cost margins.[1]

Before the advent of the new empirical industrial organization approach as surveyed in Bresnahan (1989), empirical industrial organization literature applied most of its resources to learn from industry behavior. A seminal study in this tradition is the one published by Bain in 1951. The typical study in this vein of research put a set of industries together for a single period of time and analyzed, with regression techniques, the determinants of profitability or price margins. Schmalensee argued in favor of this approach. In his 1985 paper he defended the industry as unit of analysis.[2]

A problem with cross section studies lies in that they do not allow for industry specific characteristics. In this study we have assembled the data of 63 industries that runs from 1980-1998.[3] The pooling of time series and cross sections allows us to study the determinants of price margins, while allowing for unobservable individual industry effects, thereby solving potential biases shown in OLS estimates.

In this paper, we investigate the determinants of industry margins for the Mexican manufacturing sector. We analyze the impact of trade liberalization on price cost margins and study the impact of the business-cycle on the determinants of price-cost margins. This last topic is important because, as some oligopoly models have predicted (Rotemberg and Saloner, 1986; Haltiwanger and Harrington, 1991; Green and Porter, 1984; and Athey, Bagwell, and Sanchirico, 2002) price-cost margins may change across the cycle. Rotemberg and Saloner (1986) and Haltiwanger and Harrington (1991) have pre-

[1] See Domowitz, Hubbard, and Petersen (1986 a, b) for similar studies in other countries.

[2] McGahan (1999) argues that very recently some others have turned back to the industry as unit of analysis.

[3] See the appendix for details.

dieted that concentrated industries tend to collude less during booms to prevent defections. Athey Bagwell and Sanchirico (2002) showed that the prediction of countercyclical pricing made by Rotemberg *et al.* is robust to schemes with private cost information. This cyclical variation may also interact with the import penetration ratio and the capital output ratio. We investigate these possibilities.

The use of concentration as an explanatory variable started early in the cross section studies (see for example Collins and Preston, 1969). It emerges also naturally from one stage non-cooperative quantity games. The prediction from these models states that, other things being equal, a higher degree of concentration in an industry should lead to a larger (average) Lerner index. It is this prediction that leads competition commissions to calculate concentration index as an indication of the presence of substantial market power (*poder sustancial de mercado*) exerted by a firm or by a whole industry.

Imports act as a market power disciplining device. Again, non-cooperative one stage games can be used to analyze the impact of imports on the Lerner index. The results depend upon the assumed behavior of the importing sector. If imports are inelastically supplied then non-cooperative quantity games predict that the Lerner index is affected through an adjustment of the concentration index. If imports have some degree of elasticity, a change in the elasticity of import supply changes the Lerner index of domestic firms. This approach assumes that the importing sector behaves competitively. If information is disaggregated enough so that it allows for calculation of the shares of large firms on imports and we can obtain data on stocks, hours for this sector, etc., then we could, in principle, model part of the importing sector as oligopolist and the other part as competitive. However, that information is not available for this study and we model this sector as competitive.

The main results are as follows. The change in the trade regime affects the impact of concentration on the Lerner index. The size of the coefficient of the concentration variable diminishes as we move from the pre-liberalization period to the post-liberalization period. Competition from international products changes the residual demand faced by domestic firms generating a lower price margin for a given level of concentration. The signs of the impact of the variables are fairly robust towards changes in the specification of the equations. After the liberalization period, we find for the whole manufacturing sector that concentration has, in a boom, a lower impact on the price-cost margin. Apparently, concentrated industries have less collusive agreements in booms. There is a difference in the im-

pact of explanatory variables according to the type of good (durable or non-durable).

2. Methodology

Consider a one stage Cournot model and foreign competition from abroad. We consider the foreign sector as behaving competitively. As explained by Tirole (1988), a Cournot oligopolist is a monopolist over its residual demand. Thus it can be easily proved that its Lerner index is equal to the following:

$$\frac{P - C'}{P} = \frac{1}{\varepsilon_i^{cd}},$$

with P denoting price, C' marginal cost and ε_i^{cd} the residual demand elasticity of a Cournot competitor. If we incorporate the supply of foreign imports, then the residual demand of a national Cournot oligopolist is equal to the following:

$$q_i^d = q_i^{cd} - q_f^s$$

With q_i^d representing the residual demand that firm i faces after taking into account the behavior of the (domestic) oligopolies and the foreign competition; q_i^{cd} denotes the residual demand firm i faces after taking into account the oligopolistic behavior of the domestic competitors; q_f^s is the supply of the foreign firms. Differentiating both sides with respect to price, rearranging, and using the equation[4]

$$\varepsilon_i^{cd} = \frac{\varepsilon_m}{S_i(1 - \alpha_f)},$$

we get the following expression:

$$\varepsilon_i^d = \varepsilon_m \frac{1}{S_i(1 - \alpha_f)} + \varepsilon_f^s \frac{\alpha_f}{S_i(1 - \alpha_f)}$$

ε_i^d is the residual demand elasticity that faces the domestic oligopolist firm, ε_m is the market elasticity of demand, S_i is the share of firm i in domestic production, α_f is the share of the foreign firms in the

[4] This is a standard residual demand model of a Cournot competitor with fixed foreign imports.

domestic market, ε_f^s is the supply elasticity of imports. Given that the Lerner index of a firm is equal to the inverse of its residual elasticity of demand, the Lerner index of a domestic oligopoly that faces foreign competition through competitive imports is given by:

$$\frac{P - C'}{P} = \frac{S_i(1 - \alpha_f)}{\varepsilon^m + \alpha_f \varepsilon_f^s}$$

As the literature traditionally proceeds we can weight the Lerner index by the share of firm i, adding over all firms and assuming linearity in marginal cost for each firm. We obtain the following:

$$\overline{L} = \frac{H(1 - \alpha_f)}{\varepsilon^m + \alpha_f \varepsilon_f^s} \tag{0}$$

$\overline{L}$ is the weighted (by shares) Lerner index. If there is no elasticity of supply of foreign imports, $\varepsilon_f^s = 0$, then the formula states that the impact of imports is just an adjustment of the Herfindahl index.

The estimating equations are influenced by the last equation. According to this, concentration has a positive impact on the average Lerner index and the imports to market ratio affects the average Lerner index negatively.

The paper estimates a model in which the price cost margin (PCM=Lerner Index) is made a function of several variables, among them, the $C4$ concentration index,[5] the import penetration ratio (usually defined as M/VA, imports over value added) and the capital-output ratio. The first two variables are suggested by economic principles as illustrated in equation (0). The third is used to control for technological heterogeneity among industries.[6] We also investigate the cyclical properties of the markup. We use four digit data for the Mexican manufacturing sector obtained from the *Encuesta industrial* published by INEGI. The data runs from 1975 to 1998. We will be estimating regression equations of the following sort:

[5] We use the four firm concentration ratio as there is no information for the Herfindahl index. However, there is evidence that both indexes are highly correlated (Nelson, 1963). The four firm concentration ratio corresponds in this case to the sales of the largest four plants in the industry over total sales of the industry. The information that *Instituto Nacional de Estadística Geografía e Informática*, INEGI, gathers is at the plant level, which is the reason for calculating this index.

[6] We should expect a positive relation between the capital-output ratio and the markup.

$$PCM = f(C4, M^*, K/Q) \tag{1}$$

Where $C4$ corresponds to the $C4$ concentration ratio, M^* corresponds to the import penetration ratio and K/Q refers to the capital/output ratio. The inclusion of $C4$ corresponds to the intuition that highly concentrated industries may have a larger price cost margin.[7] Besides the explanation advanced in equation (0), traditional folk theorems in the repeated game literature could be consistent with this prediction. M^*, which corresponds to the import penetration ratio,[8] is usually a reflection of the degree of protection of the economy. As indicated in (0), a reduction of protection in the economy has an impact on the competitive regime of the industry, changing the Lerner index of domestic firms set.[9] Finally, K/Q is the degree of capital intensity in the industry. We should expect the price cost margin to vary across industries in accordance with the degree of capital intensity. The aim of including this variable is to pick up technological heterogeneity.[10] These explanatory variables are later combined with cyclical variables that interact with them to analyze the behavior of price cost margins. If the interaction of the cyclical variables with our standard variables appears to be statistically significant, it will imply that cross-section studies do not reflect accurately the impact of these explanatory variables on price cost margins. Depending upon the year of comparison, good or bad, we may get a different impact of

[7] The paper follows the literature assuming that the concentration ratio is not endogenous. See Domowitz, Hubbard and Petersen (1986 a, b). Furthermore, we tested for endogeneity of the concentration index and found no evidence of it. The instruments used are lagged values of concentration measures and lagged values of the capital-output variable. See footnote 10.

[8] This variable is measured in several ways by the literature: it could be equal to the ratio of imports to total sales or to the ratio of imports to value added. In some cases the variable corresponds to the ratio of the trade balance with respect to total sales or value added. The import penetration rate is modeled as exogenous, because hausman tests do not reject the hypothesis of no-endogeneity. Domowitz, Hubbard, and Petersen (1986 b); and Pugel (1980) report OLS results. Grether (1996) also reports the OLS results for the Mexican case.

[9] A change in protection, for example a reduction in quotas, changes the elasticity of supply of foreign firms.

[10] To test for robustness we estimated the model with the inclusion of a labor productivity variable. The inclusion of this variable did not change most of the results of the paper. We decided to exclude the variable given that there is no a priori theoretical justification to include it.

the four firm concentration ratio, the capital intensity variable and the import-penetration ratio on price cost margin. The sole use of cross section studies may give us a bad measurement of industry variables on price setting behavior. Thus, to account for cyclical interactions we estimate the following system:

$$PCM = f(C4, M/TS, K/Q, C4^*D, M/TS^*D, K/Q^*D) \quad (2)$$

with D reflecting the cyclical variable.

The PCM variable was calculated, using standard formulas

$$PCM = \frac{\text{TOTAL SALES}-\text{WAGES}-\text{INTERMEDIATE INPUTS}}{\text{TOTAL SALES}} \quad (3)$$

There are several arguments that highlight the biases inherent in these measurements; however we are mostly interested in viewing the variability of these margins across time, rather than their variability across industries.[11]

Regarding the concentration index, we only have observations for the following years: 1970, 1975, 1980, 1985, 1988, 1993, and 1999. For the remaining years we used interpolation techniques, basically polynomial interpolation (splines) to get the other observations. We use the four firm concentration ratio as it is the only index available.[12]

We run regressions for the whole manufacturing sectors for the durables industries pooled together and for non-durables; all regressions are run with fixed effects.

3. Results

In table 1 we show the concentration index divided by quintile and the corresponding price cost margin. The calculation is made for each year from 1980-1998. We have 63 industries included in the sample. See the appendix for details.

For all years, there is a positive correlation between the index of concentration and the markup. For several years there are cases in which concentration increases are not accompanied with corresponding increases in the price cost margin. Although for some theories,

[11] The price cost margin is equal to the Lerner index if variable cost is an appropriate surrogate for marginal costs.

[12] The index is obtained from INEGI, the index is calculated based only upon domestic sales. Thus it is perfectly consistent with the theoretical model developed above in which the foreign sector is modeled as perfectly competitive.

Table 1

Price - Cost Margin by Quintile of Concentration

Año	Total (63)*	$0 \leq C4 \leq 20$ (4)*	$21 \leq C4 \leq 40$ (17)*	$41 \leq C4 \leq 60$ (14)*	$61 \leq C4 \leq 80$ (14)*	$80 \leq C4 \leq 100$ (14)*
1980	0.24	0.17	0.31	0.22	0.26	0.27
1981	0.25	0.03	0.31	0.28	0.24	0.30
1982	0.27	0.21	0.32	0.26	0.27	0.33
1983	0.28	0.27	0.39	0.27	0.23	0.26
1984	0.34	0.30	0.38	0.31	0.32	0.39
1985	0.35	0.32	0.39	0.33	0.35	0.38
1986	0.36	0.28	0.34	0.35	0.35	0.44
1987	0.38	0.26	0.40	0.32	0.44	0.43
1988	0.38	0.16	0.47	0.36	0.40	0.38
1989	0.35	0.24	0.32	0.37	0.39	0.34
1990	0.36	0.26	0.38	0.39	0.41	0.30
1991	0.32	0.27	0.31	0.33	0.37	0.31
1992	0.29	0.23	0.27	0.31	0.42	0.20
1993	0.28	0.21	0.27	0.31	0.35	0.25
1994	0.28	0.32	0.21	0.32	0.36	0.28
1995	0.36	0.36	0.23	0.38	0.44	0.36
1996	0.31	0.31	0.22	0.39	0.34	0.31
1997	0.29	0.30	0.30	0.36	0.26	0.30
1998	0.27	0.22	0.28	0.23	0.27	0.29

*The number in parenthesis show the number of industries for the first period of observation.

there is a correlation between the concentration margin and industry profitability,[13] there are some other variables that affect this latter variable. Besides, the potential impact of concentration, price cost margins should depend on other variables such as the openness of the industry and the impact of capital intensity. When considering all these potential effects we will see later in the regression results that concentration does affect the markup positively.

Before going into the results we present in graph 1 the measure of price cost-margin obtained from the data for the whole manufacturing sector by using the formula stated in equation (3), and the same measurement with the use of the Hall approach (1988) to the estimation of price-markups. Briefly, the Hall approach suggests the implementation of instrumental variables into Solow equation (Solow, 1957). The rate of growth of the labor-capital ratio is projected on the space spanned by pro-cyclical instruments. The identification assumption states that the Solow residual in levels follows a random walk with drift. By projecting the rate of growth of the labor-capital ratio in the space spanned by the instruments, Hall finds the estimated coefficient (the level of market power) that makes the Solow residual orthogonal to business cycle fluctuations. However, due to the criticisms of Nelson and Starz (1988), the literature has also made use of estimates with traditional OLS techniques. Graph 1 was made by running Hall's equation with an OLS technique in the cross section of industries included for this study. So, we have one estimate for the markup for each year for the whole manufacturing sector. The PCM was calculated as stated in equation (3) by adding each individual piece of data needed, across the whole manufacturing sector.

Graph 1 shows a similar trend of the PCM calculated according to Hall and the PCM from equation (3).

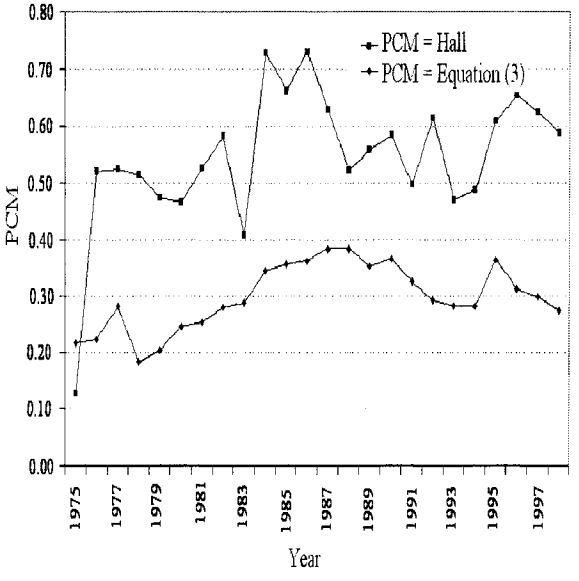
3.1. *Equation 1 Results*

First, we estimate equation (1) under the assumption of linearity in the functional form (linear in parameters). The results are shown for the period 1980-1998 and then by sub-periods, 1980-1985 and 1986-1998. In table 2 we show the estimates for equation (1). We pooled together all industries to obtain an estimate for the whole manufacturing sector. To control for industry specific factors, we

[13] As illustrated in equation (0), under Cournot competition the sum of the firms profits is proportional to the Herfindahl concentration index.

estimate a fixed effects model.[14] Standard errors are in parenthesis. In this table, the variable M^* is defined as the ratio of imports to value added. As shown in the table 2, the coefficients on K/Q and $C4$ are highly significant, and the result on M^* also yields a highly significant estimate.

Graph 1
PCMS According to Hall and Equation (3)



We can see in the results from table 2 that the ratio of imports to value added becomes significant in the period in which Mexico changes its trade regime to implement a liberalization process. As mentioned previously, in 1985, the average tariff was 23.5 percent and 92.2 percent of national production was protected by import license

[14] The fixed effect method allows us to control for industry specific characteristics, thus allowing us to avoid potential biases in the estimation that might occur if we were to follow a pure OLS approach. Random effects estimates do not differ substantially in most of the results of this paper. Given that we are more concerned about the potential omission of industry specific variables, and that fixed effects are robust to this omission we would rather stay with fixed effects.

requirements. By the end of 1987, the average tariff was reduced to 11.8 percent and the import license requirements covered only 25.4 percent of national production with a maximum rate of 20 percent. The sign of the coefficient for the import penetration ratio, M^*, is negative, showing that import competition diminishes domestic price-margins. The coefficient on K/Q is positive for the whole period and for the sub-period 1986-1998. We should expect that capital intensive industries experience larger markup due to the sunkness of the investment and the need to recover fixed costs. The literature has found this coefficient to be positive (Collins and Preston, 1969; and Domowitz, Hubbard, and Peterson, 1986a).

Table 2
Pooled Regressions - Standard Measure of Import Penetration

	$C4$	K/Q	M^*	$ADJ.R2$
Whole Manufacturing Sector				
1980-1998	0.07*	0.0037	-0.42*	0.52
	(0.03)	(0.02)	(0.12)	
1980-1985	0.45*	-0.07**	-0.12	0.57
	(0.10)	(0.04)	(0.26)	
1986-1998	0.162*	0.072**	-0.543*	0.68
	(0.04)	(0.04)	(0.14)	
*Significant at 5% **Significant at 10%				
M^* is calculated as the ratio of imports to value added.				

When we pass from the 1980-1985 period (pre-liberalization period), to the post-liberalization period (1986-1998), we see a significant reduction in the impact of the concentration index on the price-cost margin. As the economy became more open, the pro-competitive impact of imports reduced the impact of concentration on price-cost margins. We should expect this behavior from standard oligopoly models. Although domestic concentration persists, the competition of imports makes more elastic the residual demand faced by each firm, thereby generating a lower price-cost margin for a given level of concentration.[15]

[15] See Geroski and Jacquemin (1981) and equation (0).

We ran specification tests to test for the endogeneity of M^*. The results show that imports are not endogenous when we used as instruments two lagged values of the import penetration rate and two lagged observations of the capital-output ratio. For 1980-1985, the test does not reject the hypothesis of no endogeneity. A similar outcome occurred from the 1986-1998 period.[16] For 1986-1998, the test did not reject the hypothesis of no endogeneity.[17]

For concentration we followed a similar procedure. The tests for the period 1980-1985 and the period 1986-1998 do not reject the hypothesis of no endogeneity.[18] We used as instruments the two lagged values of concentration and the two lagged values of the capital output ratio. For both M^* and the concentration index, the instruments used are well correlated with the explanatory variables.

In table 3 we include an alternative measure of import penetration: instead of looking at the ratio of imports to value-added, we look at the ratio of imports to total sales. As before, we should expect that more open industries have reduced price-cost margins.

Table **3**
Pooled Regressions - An Alternative Measure of Import Penetration

	$C4$	K/Q	M/TS	$ADJ.R2$
Whole Manufacturing Sector				
1980-1998	0.06**	-0.039**	-3.49*	0.52
	(0.03)	(0.02)	(0.09)	
1980-1985	0.42*	-0.089*	-15.7*	0.58
	(0.09)	(0.03)	(4.64)	
1986-1998	0.158*	0.06	-5.45*	0.69
	(0.04)	(0.04)	(0.94)	
*Significant at 5%		**Significant at 10%		

The external competition variable affects negatively and significantly the price-cost margins of the manufacturing sector for the

[16] See the tables in appendix 2.

[17] Domowitz, Hubbard, and Petersen (1986 b), were aware of potential endogeneity of this variable. However, they reported the OLS results.

[18] See appendix 2 for the results.

three periods studied, including the 1980-1985 period. This last result is different from the previous table. In table 3, the $C4$ index is significant for all periods considered. In contrast with the previous table, the sign of the coefficient for the capital-output ratio is negative and significant for the whole period, a surprising result. However, the last period (after liberalization) shows a positive coefficient for this variable (although non-significant). As before, the concentration coefficient is lower for the post-liberalization period, showing the disciplining impact of imports.

3.2. *Equation 2 Results (Cyclical Effects)*

We include pro-cyclical variables to account for the possibility of variations in the markup across the business cycle. We included the measurement of unemployment as defined in INEGI. The basic equation to be estimated is the one defined in (2) above. The variable D in that equation is the unemployment rate as defined in INEGI (U in table 4). The results are reported in table 4.

Table 4
Pooled Regressions with the Inclusion of Anti-cyclical Variables (Unemployment)

	1980-1998	*1980-1985*	*1986-1998*
M	-0.385*	-0.116	-0.459*
	0.120	0.275	0.144
UM	-0.051*	-0.052*	-0.095*
	0.019	0.025	0.032
K	-0.035	-0.09	0.004
	0.059	0.074	0.074
UK	0.0058	0.002	0.013
	0.009	0.011	0.012
$C4$	0.045	0.333*	0.145*
	0.042	0.116	0.047
$UC4$	0.0056	0.019*	0.007
	0.006	0.01	0.006
ADJ.R2	0.52	0.58	0.68
*Significant at 5%		**Significant at 10%	

The inclusion of anti-cyclical variables in the regression does appear to have a significant impact on the behavior of the price-cost margins. For the period 1986-1998, the coefficient on $C4$ still has a significant impact on the price-cost margin and the anti-cyclical variable U, interacted with $C4$ does not appear statistically significant. However, the cyclical variable does affect the import-penetration rate. Whenever there is a recession in the economy (the unemployment rate is high) the disciplining impact of imports is increased. Thus, industries with a great import-penetration ratio experience a stronger competitive impact from imports whenever there is a recession in the economy. This fact is also observed for the whole period (1980-1998). As the import-penetration rate increases, the price-cost margin becomes more pro-cyclical. Business cycles appear to affect the impact of concentration for the 1980-1985 period. As the economy went into a recession, the impact of concentration on the price-cost margin increased. More concentrated industries tend to have a larger price-cost margin in the downturns. For this period of time, more concentrated industries lead to more anti-cyclical behavior on the part of price-cost margins. This fact is consistent with the period of observation in which the relative closedness of the Mexican economy isolated concentrated industries from competition.[19] The inclusion of the unemployment rate as a single regressor did not render a significant estimate.

We also considered the potential impact of business cycles by including a dummy variable that has the value of one whenever the economy is growing and a zero value if the economy is experiencing a recession (D in table 5). We report the results in table 5.

Table 5
Pooled Regressions with the Inclusion of Pro-Cyclical Variables (Dummy)

	1980-1998	*1980-1985*	*1986-1998*
M	-0.628*	-0.119	-0.95*
	0.186	0.296	0.33

[19] The result that shows that concentration affeets in an anti-cyclical way the price-cost margins is not robust to a change in the definition of the cyclical variable. In the following table, we will incorporate another measure that gives us a different prediction. A possible explanation for the divergence in predictions might come from the fact that the unemployment rate in Mexico is not too responsive to cyclical fluctuations (due to the absence of unemployment insurance).

Table 5
(continued)

	1980-1998	*1980-1985*	*1986-1998*
DM	0.29	-0.09	0.46
	0.19	0.271	0.30
K	0.025	-0.07	0.08**
	0.0298	0.05	0.04
DK	-0.018	-0.01	-0.027
	0.025	0.028	0.036
$C4$	0.086*	0.421*	0.22*
	0.036	0.104	0.044
$DC4$	-0.019	0.041*	-0.076*
	0.016	0.02	0.02
ADJ.R2	0.52	0.57	0.69
*Significant at 5%		**Significant at 10%	

As we observe in the last table, only the dummy that multiplies the concentration index appears significant. This happens only for the 1980-1985 period and for the 1986-1998 period. For the 1980-1985 sub-period, we see that as the economy goes into a recession, the impact of concentration on price cost margins decreases, while the opposite occurs in a boom. For the 1986-1998 period, the opposite occurs, as the economy goes into a recession, the impact of concentration on price cost margin is increased and the impact is reduced in a boom. We notice also that for the 1986-1998 period, the coefficient of M and K are significant and have the expected signs. However, there is no apparent significant impact of the pro-cyclical variable for these variables. Booms and recessions do not appear to generate a different impact from these variables when we measure the change of regime with the dummy. The change in the impact of concentration across booms and recessions (for the 1986-1998 period) is consistent with the story about price wars in booms and collusive agreement in recessions (See Rotemberg and Saloner, 1986; Haltiwanger and Harrington, 1991; and Athey, Bagwell, and Sanchirico, 2002).[20] As the

[20] Haltiwanger and Harrington modify the Rotemberg and Saloner model to allow for models in which the current demand generates expectations about future

economy moves into a boom, the impact of concentration on price-cost margins is diminished, because firms (rationally) sustain less collusive agreements to avoid defections and the opposite occurs in a recession.

A comparison between table 4 and 5 show that, regardless of the interacting variable, we have almost the same inferences found before in table 2. The signs of the coefficients for M, $C4$ and K are similar between them and with those shown in table 2.[21] Also, the significance of the impact of the variable (the coefficient of $C4$, K and M) is not affected by the inclusion of the additional variables (the interacted terms, $C4^*U, K^*U, U^*M$ in the first regression and $C4^*D, K^*D, M^*D$ in the second). This is an indication of the robustness of the results.[22]

This inference related to the impact of the business cycle enhances the approach used in this paper. The pooling of cross section and time series allows us to study the impact of the business cycle on the estimated coefficients. The simple cross-section approach cannot account for these variations; thus, estimates obtained with cross-section studies -similar to those used in traditional industrial organization approaches- will vary depending upon our year of choice (good or bad).[23]

3.3. *Analysis by Type of Good*

Next, we study the impact of these variables by dividing by type of good –durables and non-durables–. Table 6 reports the results for these categories.

The table shows that concentration impacts the price cost margins of durable goods for all periods considered. For non-durable goods, this occurs only for the 1980-1985 period. These results are

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demand. They also find out that collusion is difficult to sustain during expansions. However they modify slightly the Rotemberg and Saloner conclusion to show that even during recessions collusion is difficult to sustain. They also find counter-cyclical pricing. Athey, Bagwell, and Sanchirico found similar results to Rotemberg and Saloner in an imperfect information environment.

[21] When we talk about the signs we talk about the value of the coefficients in a recession and in a boom. The value given by the interacting coefficients do not change the sign of the coefficient of M, K and $C4$ when added to them.

[22] Here we refer to robustness with regard to a change in the specification of the equation by the addition of cyclical variables.

[23] See Domowitz, Hubbard, and Petersen (1986 a, b).

consistent with those found in studies of other countries. In a study for the US, Domowitz, Hubbard, and Petersen (1988) found also that concentration does not appear to impact the price cost margins of non-durable goods. Imports have a significant impact for both types of goods for the period after trade liberalization (1986-1998) and, in both cases, imports reduce the price-cost margins of domestic industries. The capital-output ratio affects significantly the price cost margins of non-durables for the after trade liberalization period. For this period and for durable goods, there is no significant impact of the capital-output ratio. However, this variable affects in a significant manner and negatively, the price-cost margins of durables for the whole period.

Table 6
Pooled Regressions bye Type of Good
(Durables and Non-durables)

	$C4$	K/Q	M^*	$ADJ.R2$
Durables				
1980-1998	0.118*	-0.096*	-0.184	0.56
	(0.04)	(0.04)	(0.156)	
1980-1985	0.29*	-0.27*	0.783**	0.52
	(0.15)	(0.09)	(0.47)	
1986-1998	0.299*	-0.39	-0.46*	0.69
	(0.06)	(0.3)	(0.173)	
Non-Durables				
1980-1998	0.04	0.05	-0.29	0.44
	(0.05)	(0.03)	(0.31)	
1980-1985	0.55*	-0.02	-1.1	0.62
	(0.14)	(0.05)	(1.74)	
1986-1998	0.05	0.09*	-0.49**	0.64
	(0.06)	(0.04)	(0.28)	
*Significant at 5%		**Significant at 10%		
M^* is calculated as the ratio of imports to value added.				

The variation of the sign of the capital-output ratio in the different regressions analyzed so far demands an intuitive explanation. One potential explanation is related with the sunkness of the stocks

of capital and the different periods of crisis and expansions observed throughout this period of analysis coupled with liberalization. One should expect that in normal times the capital-output ratio should be positively related to price cost margins; however, in times of recession, the capital is sometimes sunk and the price cost margins may be affected by other variables, thus affecting the positive relation between the two. Economic theory suggests that when capital is sunk, firms will still operate even if they cannot recover the sunk costs. We should point out also that, for almost all tables shown, this variable is positive for the after-trade liberalization period.

We also analyze the potential cyclical behavior of the coefficients for these two types of goods.

Table 7
Pooled Regressions: Non-durable Goods, Controlling for Cyclical Effects

	1980-1998	*1980-1985*	*1986-1998*
M	-3.34*	-6.45*	-3.42*
	1.64	2.93	1.57
DM	3.156**	6.41*	3.04*
	1.62	2.899	1.54
K	0.05	-0.012	0.08**
	0.03	0.053	0.047
DK	-0.01	-0.016	-0.007
	0.028	0.029	0.036
$C4$	0.086	0.513*	0.159*
	0.054	0.14	0.064
$DC4$	-0.068*	-0.006	-0.129*
	0.028	0.034	0.031
ADJ.R2	0.45	0.62	0.65
*Significant at 5%		**Significant at 10%	

For the case of non-durables, these coefficients are affected by business cycles. For all three periods considered, the disciplining impact of imports is considerably less important in periods of economic growth. In fact, the impact of imports for all three periods considered

vanishes (statistically) in a boom.[24] Also, for these types of goods, the coefficients of $M, C4$ and K for the after-liberalization period have the expected sign, and the coefficient of $C4$ has become significant when we include the cyclical variables ($DM, DC4$ and DK). This result together with the significance of DM and DC, suggests that the way our explanatory variables impact the price cost margin of non-durables is affected by cyclical fluctuations during this period (1986-1998). We also notice, for the after-liberalization period and for these goods, that the impact of concentration diminishes as we pass from a recession to an expansion. This evidence is consistent with price wars in booms. During expansions, the gains from deviating are larger; thus, concentrated industries have a lower impact on the level of collusion. Firms sustain a lower level of collusion to prevent the appearance of defectors (see Rotemberg and Saloner, 1986, and Athey, Bagwell, and Sanchirico, 2002, for environments with imperfect information).

Table 8
Pooled Regressions: Durable Goods, Controlling for Cyclical Effects

	1980-1998	*1980-1985*	*1986-1998*
M	0.34	2.58*	-0.74*
	0.348	0.72	0.378
DM	-0.54	-1.87*	0.31
	0.33	0.83	0.35
K	-0.198*	-0.61*	-0.158
	0.076	0.14	0.48
DK	0.075	0.26	-0.28
	0.12	0.30	0.45
$C4$	0.11*	0.27**	0.33*
	0.049	0.147	0.06
$DC4$	0.017	0.07*	-0.04
	0.02	0.027	0.03
$ADJ.R2$	0.56	0.56	0.70
*Significant at 5%		**Significant at 10%	

[24] We calculated the standard deviation of the sum of the non-interacted coefficient and the interacted coefficient, and in all cases the sum is not significant in periods of economic growth.

For the case of durables, we do not see a significant impact of M and DM for the whole period (1980-1998). For the after liberalization period, none of our explanatory variables appear to be affected by business cycles. This result, together with our inference mentioned before with regard to the impact of the cycle on non-durables, show that it was reasonable to split our analysis by these two types of goods. The reader may notice that, for the after liberalization period, the coefficients of M and $C4$ remain significant after controlling for cyclical impact (the inclusion of DM, DK and $DC4$). A comparison between table 6 and 8 will show that, for all periods considered, the coefficient of $C4$ remains significant as an explanatory variable after controlling for pro-cyclical behavior.

4. Concluding Remarks

This paper looked for the determinants of price-cost margins. We found evidence that shows that the pro-competitive impact of imports reduces the price-cost margins. We also found, consistent with traditional models of oligopoly, that the impact of concentration on price cost-margins is lower as we pass from the stage before the liberalization process to the stage after the liberalization process. This evidence shows how competition from international products changes the price setting behavior of domestic firms.

With regard to the impact of the business cycle on the behavior of price-cost margins, we found that, after the liberalization period, the margins are more anti-cyclical in concentrated industries. The story is consistent with that found in models of price wars during booms (Rotemberg and Saloner, 1986; Haltiwanger and Harrington, 1991; and Athey, Bagwell, and Sanchirico, 2002). The signs and significance of the coefficients of our three main explanatory variables ($C4, K$ and M) do not change with the introduction of the cyclical variables.

Similarly to results found in other countries, we found that concentration affects the price setting behavior of durable goods. For the case of durables for the period 1986-1998, the inclusion of pro-cyclical variables does not change our basic inferences. For non-durables, and for this period, we find inferences changing with the inclusion of pro-cyclical variables. Also, for non-durables, the behavior of concentration after the liberalization period is consistent with the story about price wars during economic booms.

In the agenda for research we find the possibility of estimating the price-cost margin while measuring at the same time the impact of

the variables studied. A possible line of research would be to estimate the price-cost margin a là Hall (1988) while allowing for the same variables used in this study to affect it ($C4, M$ and K).

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Appendix 1

The data was obtained from the *Encuesta industrial anual* from 1980 to 1998. The data set includes 205 industrial classes. We took off several classes for the following reasons: We needed classes that had information on concentration indexes, and we chose classes that did not produce miscellaneous goods. Also, we found the data unreliable for classes 311404, 311501, 311405, 361203, 381404, 381412, 382101, 361201 y 361204. We kept 63 classes to run the regressions.

The classes are the following:

Class EIA 1994	*Industrial Activity*
311101	Meat packing, preservation and preparation
311201	Pasteurization and milk canning
311203	Dry and condensed milk
311301	Canned fruits and vegetables
312110	Manufacturing of instant coffe
311701	Manufacturing of oils, and butters
312200	Manufacturing of animal foods
311304	Fish and shellfish packing
311903	Manufacturing of chewing gum
312123	Manufacturing of starch and leaven
313040	Manufacturing of malt
313041	Manufacturing of beer
314002	Manufacturing of cigarettes

(*continued*)

Class EIA 1994	*Industrial Activity*
	Textiles
321202	Yarn and textile tissues of soft fibers (cotton, wool and synthetic fibers)
321205	Yarn and finishing of artificial fiber
321207	Finished of threads
	Wood
331102	Manufacturing of wood
	Paper
341010	Manufacturing of paper
341022	Manufacturing of cardboard
341031	Paper and cardboard containers
	Chemical
351300	Cellulose and synthetic fibers
352100	Pharmaceuticals
352210	Varnish and lacquer
352221	Perfumes and cosmetics
352222	Soap y detergents
351215	Other chemical
351222	Insecticides
352231	Adhesives
352240	Manufacturing of other products of rubber
355001	Manufacturing of tires
	Glass and cement
362011	Flat glass and engraved glass
362013	Glass fiber and mosaics
362021	Glass containers and glass vials
362022	Manufacturing of other glass products
369111	Manufacturing of hydraulic cement
	Another Mineral Products
361203	Manufacturing of bricks and non-refractory bricks
	Basic Metal
371001	Manufacturing of iron and steel
371006	Manufacturing of iron pipes and posts

(*continued*)

Class EIA 1994	*Industrial Activity*
372003	Melting of copper
372005	Melting of aluminum
	Metal Products
381300	Manufacturing of metal furniture
381401	Manufacturing of tools
381404	Manufacturing of metal wires
381407	Manufacturing of iron containers
	Machinery and Equipment
382101	Manufacturing and assembly of agricultural machines
382202	Towing and crane machinery
382205	Fire extinguishers
382206	Manufacturing of electrical equipment and parts
382301	Manufacturing and assemble of machines for offices
383107	Manufacturing of batteries
383109	Manufacturing of another electrical accessories
383110	Manufacturing of light bulbs
383201	Manufacturing of LPs and Radios
383202	Manufacturing of other equipment and electrical equipment
383205	Manufacturing of records and tapes
	Transport Equipment
384110	Manufacturing and assembly of automobiles
384121	Manufacturing of chassis for auto vehicles
384122	Manufacturing of engines for automobiles
384123	Manufacturing of vehicle transmissions
384124	Manufacturing of parts for the suspension of automobile vehicles
384125	Manufacturing of parts for the braking systems of automobiles
383103	Manufacturing of parts for the electrical system of automobiles

(*continued*)

Class EIA 1994	*Industrial Activity*
Other Manufacture Industries	
352233	Matches

The data gives the level of investment at nominal prices and there is no information for capital assets. Thus, we calculated the capital assets by following the perpetual inventory model. We follow the methodology suggested in Nadiri and Prucha (1996) to calculate the initial stock of capital. In that paper they define the initial stock of capital as the level of investment divided by the rate of growth of the stock of capital and the average rate of growth of depreciation for the whole period. From that date on we calculate the stock by using the investment series at constant prices and the depreciation series (also at constant prices).

To calculate the level of investment at constant prices, we deflated with an index obtained from the input-output matrix for various years. For each year we looked at the input-output matrix for that year (or the one for the closest year) and we trace, for each industry, the purchases of durables. We calculated the percentage share for each industry over the total purchases of durables made by the industry. With this information we constructed a weighted average price index by using the weights obtained from the input-output matrix, and the price indexes obtained from the national accounts information. All this procedure is done at the two digit level (since the input-output matrix is usually calculated at this level). For each class, we look at the corresponding two digit price index and we deflate the investment series with that index. For depreciation we use the same index to obtain real depreciation.

Wages and value added were deflated with the implicit price series. For intermediate inputs, we used a similar procedure to the one expressed for investment and depreciation. The only difference was that we traced the purchases of non-durables.

Appendix 2

Table A.1
Endogeneity Test for Table 2
Whole Manufacturing Sector

	Chi Square Marginal Significance Levels		
	$C4$	M^*	*$C4$ and M^* Together*
1980 - 1998	0.002965	0.676002	0.011241
1980 - 1985	0.716642	0.891263	0.929889
1986 - 1998	0.16893	0.421369	0.291823

Table A.2
Endogeneity Test for Table 3
Whole Manufacturing Sector

	Chi Square Marginal Significance Levels		
	$C4$	M/TS	*$C4$ and M/TS Together*
1980 - 1998	0.00362	0.993138	0.014298
1980 - 1985	0.78854	0.834184	0.942965
1986 - 1998	0.230047	0.923594	0.477737

The instruments used for $C4$ are the first two lagged values of the C4 variable, and the first two lagged values of the capital output ratio. For M^* the instruments used are the first two lagged values of M^* the first two lagged values of the capital output ratio. For the test of $C4$ and M^* together we used the first two lagged values of the two variables together with the first two lagged values of the capital output ratio. **A** similar reasoning applies to M/TS.