

Market Power after the Transition

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Introduction

Tortillas are a staple in Mexican diets, representing almost half of total calorie consumption. In January 2007, there were huge upswings in tortilla prices, and following public outcry the government responded by setting price caps. The public sentiment was that these upsurges in prices were caused by increased international demand for corn resulting from the expansion of corn-ethanol production in the United States, and growing demand for corn as feed in China and India. There is anecdotal evidence of another explanation: since two large firms control over 80% of corn flour production there is the potential for market power in this industry. Since corn flour is a major cost component in tortilla production, this could explain part of the price upswings. In this paper we use a NEIO approach to estimate the conduct parameters in the Mexican corn flour industry.

Corn is the major cost component of corn flour production, thus the markets are intrinsically linked, and we begin with a discussion of the corn market in Mexico. Indeed, the last two decades have heralded substantive changes in both the corn and tortilla sectors in Mexico. Before NAFTA was enacted, the Mexican state-trader CONASUPO played a large role in the corn, corn flour, and tortilla markets by setting prices, and buying and selling surpluses. In accordance with NAFTA, CONASUPO was completely dismantled by 1999 and state-owned flour producers were privatized. As markets were liberalized and reached a new equilibrium over the last ten years, both corn and tortilla prices rose, though the increase in tortilla prices was much steeper. This is particularly concerning because tortilla consumption is not uniform throughout the country; the poorest spend the highest percent of their income on tortillas, and

consumption is highest in the already-marginalized southern and central parts of the country (Flores, et. al, 2007).

There are two production methods for tortillas. The traditional method uses corn to make a wet dough, which should be processed quickly into tortillas. The more modern method mills corn into nixtamalized flour, which is processed into tortillas. Flores et. al (2007) estimate that 2.8 million tons of corn are processed into masa (dough), and 3.1 million tons into flour for tortillas in urban Mexico. The share of corn flour in tortilla production is growing because it has a much longer shelf life, and it takes fewer tortilleria employees using flour instead of masa, thus making this production method more suitable for urban lifestyles.

In addition to the bimodal methods of tortilla production, it is imperative to consider the bimodalities in the corn industry as well. Mexico is the world's largest producer of white corn, which is used to make tortillas. While the US is the largest corn producer, it grows mainly yellow (dent) corn, the majority of which is used for feed and ethanol production. While white corn can be used as feed, yellow corn is significantly starchier and is not used to make tortillas. This is of particular importance to this story, since the tortilla crisis has directed blame on; 1) the ethanol industry for its quick expansion and high use of corn, and 2) to a lesser extent, growing corn use for feed in China. While these events must have an impact on world corn prices, it also begs the question of how closely linked are the white and yellow corn markets, both internationally and in Mexico.

While we do not directly address corn price co-integration in our analysis, this question is touched on in the literature. Fleiss and Lederman (2004) found that US and

Mexican corn prices diverged after 1996, while Yunez and Barceinas (2000) found that pre-NAFTA, guaranteed prices were linked to world (US) prices as much as to national prices. Finally, Motamed, Foster, and Tyner (2008) found that US yellow corn prices and Mexican white corn prices are not integrated, and that only price shocks in the large, industrial corn producing states ripple to other states. This is not surprising, given that productivity varies widely throughout the country; industrialized farms have yields comparable to developed nations, even while the majority of production is very low yielding and takes place on small farms that consume much of their own production (Yunez, 2003).

Taken together, these studies indicate that it is crucial for our analysis to define our corn prices and markets. The basic facts remains that Mexico is food-secure in white corn, but not yellow (CEFP, 2007). After NAFTA, imports of yellow corn from the US grew despite tariffs to feed the growing livestock industries. While the historical concern that NAFTA would diminish the Mexican corn industry has been disproved (production grew), that said, demand for yellow corn is growing, so Mexico must import yellow corn or displace the white corn that is used for tortillas (Reyes Guzman, 2007). Shortages in white corn could lead to speculation, which might cause increases in corn and tortilla prices (Hernandez Navarro, 2007), but still doesn't explain the divergence of the two prices.

Model

We begin by considering a representative firm's profit maximization problem; $\max \Pi_i = P(Q)q_i - C(q_i)$. The first order condition is

$$(1) P(Q) + q_i P'(Q) \frac{\partial Q}{\partial q_i} - C'(q_i) = 0$$

The term $\frac{\partial Q}{\partial q_i} = \frac{\partial q_i}{\partial q_i} + \frac{\partial Q_{-i}}{\partial q_i} = 1 + \lambda_i$, the conjectural variation, or competitiveness of the market.

We can generalize this first order condition another way if we consider the aggregate market, per Breshnahan (1982).

$$(2) P + \theta Q P'(Q) = MC$$

Here the left hand side of equation (2) describes the perceived marginal revenue, with θ again describing the competitiveness (or conduct) in the industry; if $\theta=0$, there is competitive pricing and $P=MC$ and $\theta=1$ describes the monopoly solution. Intermediate values of θ describe an oligopoly solution where the perceived marginal revenue curve lies somewhere between marginal revenue and demand.

Assuming that firms have the same cost structures, we can rearrange (1) and (2) to yield the oligopoly pricing equation, where ϵ is the demand elasticity.

$$(3) P \left(1 + \frac{\theta}{\epsilon}\right) = MC$$

In our econometric model we estimate both parameters ϵ and θ from equation (3).

Data

We use monthly data from 2004 through 2008, giving us 60 total observations. We begin the analysis in 2004 because prior to this time period we found there might still be distortions in the national corn market, holdovers of the pre-NAFTA interventions; for

example the producer price index for corn was greater than that for the corn CPI. We use flour sales from INEGI, Banco de Informacion Economia. Because Mexico recently changed their categorization codes to correspond to the SCIAN codes, we cannot equate older data (pre-2005) with more recent reports. Using this time frame gives us the greatest number of observations.

There are two available price series for corn flour prices, both derived from price indices from the Banco de Mexico. We use the producer price in our analysis.

We use several corn prices in the analysis. The first is the internal white corn price. In Mexico there is a system of agricultural wholesale markets (CEDAs) that market everything from vegetables to grains. The SNIIM system keeps detailed records of prices in these markets. We follow Yunez (2003) and Motamed, Foster, and Tyner (2008) in using the white corn price from the CEDA-D.F., the largest in the country. We use the US gulf port price for yellow #2 corn as the world corn price. In addition, the Kansas City white corn price is the de facto white corn world price. Both these series are available from the ERS Feed Grains Database.

There are several sources of data on corn imports. We use total corn imports as defined by SIAP, Informacion Economia y de Mercados. We must note that for some months the imports are disaggregated between white and yellow, but since this information is not available for the whole series, we use total imports. We also note that these data are very similar to those listed by the FAS US Trade Database exports to Mexico.

We use interest rate as cost of capital, and exchange rate to proxy power of the Mexican Peso. The interest rate is the monthly averaged inter-bank rate, as reported by

Banco de Mexico. The exchange rate is the average interbank rate in pesos per dollar, also from the Banco de Mexico, Mercado Cambiario. The Banco de Mexico also publishes information in GDP, which would in theory be useful in our analysis. However this information is only available quarterly.

Table 1 contains summary statistics for the 60 observations of the variables used in the estimation.

Table 1: Summary Statistics of variables from January 1994 through December 2008.

Variable	Mean	Std. Deviation
Flour Sales (1000 tons)	136.83	7.19
Flour Price (PPI)	1.24	0.08
White Corn Price, Mexico (Pesos/Kg)	2.95	0.47
World Corn Price, Gulf Port (Pesos/Kg)	1.60	0.45
White Corn Price, Kansas City (Pesos/Kg)	1.47	0.53
Interest Rate (%)	8.04	1.04
Exchange Rate (Pesos/USD)	11.03	0.56
Corn Imports (1000 tons)	596.90	308.98

Estimation Strategy

The estimation strategy involves the joint estimation of demand, in order to recover the elasticity, and the pricing relationship described in (3). The specification of demand for corn flour is as follows:

$$(4) \ln Q_{flour} = \alpha_D + \beta_1 \ln P_{flour} + B_2 \ln P_{flour} * T + B_3 \ln P_{flour} * T^2 + \beta_4 \ln P_{cornDF} + \beta_5 feb$$

In order to identify the own price elasticity of corn flour, we interact corn flour price with a trend and quadratic trend, T and T² (see Mérel, 2009). We include the corn price in Mexico city (P_{cornDF}) since it is a substitute for corn flour. We also include an indicator

for February because we use monthly sales and February has fewer days of sales. The parameters to be estimated are the vector of β s and α_D .

We instrument for the flour price and interacted terms using interest rate, exchange rate, corn imports, the US white corn price, and the world corn price (Gulf Ports price), as well as these instruments interacted with the trend variables. Ideally we would also have an income variable as a demand shifter, but, as stated above, these are not available monthly.

The econometric specification of the supply equation in (3) includes a linear specification of marginal cost:

$$(5) P_{flour} \left(1 + \frac{\theta}{\epsilon_D}\right) = \alpha_S + \delta P_{cornDF}$$

We estimate the marginal cost coefficients α_S and δ , as well the conduct parameter θ .

The demand elasticity ϵ_D is a function of the demand parameters β_1 , β_2 , and β_3 . We instrument for the Mexico City corn price using US white corn price, world corn price, corn imports, exchange rate, interest rate, and the trend variable.

We estimate demand (4) and the supply relationship (5) jointly using non-linear optimal GMM. Since the data is time-series, we adjust the errors using a Newey-West correction with 3 lags. The results are presented below.

Results

We present the estimated demand coefficients in Table 2. All estimates are highly significant and have the expected signs. The coefficient on White Corn Price, D.F. (the Mexico city price) is positive, as we would expect price increases for a substitute to

increase demand. The average calculated demand elasticity was -0.821, with a standard error of 0.096, indicating it is precisely estimated – as expected, the estimated elasticity is negative and inelastic.

Table 2: Demand Equation Estimates.

	Estimate	Std. Error
log Flour Price	-0.987	0.112
log Flour Price * T	0.318	0.039
log Flour Price*T2	-0.156	0.019
log White Corn Price, D.F.	0.201	0.035
February	-0.074	0.008
Trend	0.250	0.036
Constant	8.401	0.430

The estimates from the supply relationship are presented in Table 3. The sign on White Corn Price, D.F. (the Mexico city price) is 0.022. The estimated conduct parameter is 0.703, and is highly significant, and indicates the presence of a good deal of market power in the Mexican corn flour industry.

Table 3: Supply Relationship Estimates.

	Estimate	Std. Error
White Corn Price, D.F.	0.022	0.003
Constant	0.115	0.020
Conduct Parameter	0.703	0.086

Discussion

We begin by discussing the estimated conduct parameter, which indicates a high degree of market power in the Mexican corn flour industry, in fact, since there are two dominant firms, an estimate of this size points to collusion. That said, we believe that this preliminary estimate is too high, and is perhaps an artifact of imprecise specification

of the marginal cost equation.

In this model of market power, the demand elasticity forms the upper bound on the potential estimate for the conduct parameter. When we estimated the demand equation separately, our calculated elasticity was smaller. Garcia Salazar and Williams (2004) calculated human corn demand elasticity to be -0.41, and reported other estimates of -0.32, so we might expect flour demand elasticity to be slightly lower as well.

In order to address this discrepancy we are working to improve our estimation. First, we are searching for alternate demand elasticity shifters. Second, we are working to improve the marginal cost specification by 1) accounting for all minor inputs (corn is reported to be between 70 and 85% of cost), and 2) by calculating a conversion ratio of corn to flour in order to better test the validity of our estimates.

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