Market Concentration and Price Rigidity

Kenyon Summer Scholars - Project Description

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Abstract

I present a brief history of the economic thought surrounding price rigidity, emphasizing the theory of price rigidity as coordination failure. This motivates a proposed research project that would add to the empirical literature on the relationship between the competitiveness of a market and the flexibility or rigidity of its prices. Using a panel of weekly grocery and drug store sales data spanning the period from 2001 to 2011, I propose to (1) measure the competitiveness over time of the grocery and drug store markets from which the data was drawn, (2) measure the rigidity over time of the prices in these markets, and (3) use panel analysis to assess the relationship between these two measures. Because the data set tracks a decade of sales for grocery and drug stores across the United States, the results of this analysis could have interesting relevance to a range of topics, including the effect of Walmart’s entry on grocery and drug store markets and the effect of the Great Recession on market concentration and price rigidity.
1 Background

In a neoclassical framework, an economy amounts to a network of markets. In these markets, consumers demand goods and services, firms supply goods and services, and prices exist that adjust with changing market conditions to equilibrate supply and demand and achieve efficient allocations of resources. This understanding of the economy is grounded in the assumption that prices are perfectly flexible. When prices must adjust to return the markets to equilibrium, they do so fully and instantly.

John Maynard Keynes observed the world of the Great Depression and saw an economy delivering ruinously inefficient outcomes. The reason, Keynes argued, was that prices do not behave the way neoclassical economists assumed. If the economy experiences a shock of some kind, and prices do not adjust immediately or fully to reequilibrate supply and demand, markets can suffer various inefficiencies that persist in the short run. If the shock is large enough and prices are rigid enough, these inefficiencies can amount to a full-scale depression that debilitates an economy for years. Economists after Keynes set out to formulate a theory of price adjustment in an effort to understand price rigidity and its potential macroeconomic consequences.

It became clear early on that the neoclassical story of prices adjusting to clear markets was too ad hoc. It said nothing about who or what was doing the adjusting. However, in many markets, firms decide market prices. Thus, an understanding of how firms make decisions about setting and changing prices is crucial to a theory of price adjustment. To refine this understanding, Princeton economist Alan Blinder compiled a list of the twelve theories of price rigidity that he judged to be most prominent in the profession and surveyed 200 firms, asking managers how relevant each theory was to their price adjustment decisions. The one they cited as most relevant was a theory of price rigidity as coordination failure (Blinder 1994).
The theory as Blinder invoked it was first introduced by Ball and Romer (1991). They proposed to consider price adjustment strategically. Firms in a market compete with one another, and when they make decisions about changing their prices, they consider the decisions that other firms are making about changing their prices. One manifestation of this could be a simple leader/follower dynamic. If a market endures a shock, and it behooves firms to raise prices in response, no firm wants to be the first to do so if there is a risk that no one else will. So the market wastes time waiting for a leader to emerge, and firms fail to coordinate on a full and immediate price adjustment.

More broadly, Ball and Romer conceive of the price adjustment decisions of firms in a market as strategic complements (Blinder 1994). The more everyone else adjusts their prices, the more you want to adjust yours, and the less others adjust, the less you want to adjust. In this framework, achieving the outcome of a full and immediate price adjustment depends on the ability of all firms to unilaterally coordinate price changes, which rarely happens. In this way, prices are rigid in the short run if firms fail to coordinate.

This theory relates the rigidity of market prices to the competitive activity of firms, but its implications are not entirely clear. If the coordination failure of competitive firms is an important mechanism through which prices become rigid, do we expect to see more rigidity in markets that have more competition and more firms to coordinate, or less rigidity? Rotemberg and Saloner (1987) remind us that prices charged by monopolies tend to be more rigid than prices in markets with two or three firms, but clearly this is not due to coordination failure. The predictions of this theory would be greatly clarified by empirical guidance on the relationship between market competition and price rigidity.
2 Project Description

I propose to establish empirical results about the relationship between competition and price rigidity by analyzing grocery and drug store markets. The panel I intend to use comes from the IRI market research group and contains disaggregated sales data from 451 grocery and drug stores across 40 markets, where IRI defines a market as a large metropolitan area. Price charged and quantity sold for a large sample of products were observed weekly from 2001 to 2011 for each store. The advantage of disaggregated data is that it allows me to observe almost all price changes that take place, since intra-week price movements are rare (Glandon 2013).

I will first estimate a measure of the level of competition for each of the markets in the panel. Then I will estimate how frequently each market’s prices change. Finally I will use panel analysis to evaluate any trends that emerge when these two variables are regressed over time. These three tasks constitute the primary phases of this research. As I describe them, I will do so in terms of the 40 markets that IRI defines. However, a small preliminary phase may be in order. One could also define a market as a census tract or a ZIP code. Before any research can begin, I will have to weigh the merits of several definitions to arrive at the most workable one for the road ahead.

2.1 Measuring Market Competition

A Herfindahl-Hirschman Index (HHI) is a common measure of market competition. Mathematically it is defined as

$$ H = \sum_{i=1}^{N} s_i^2, $$

where $N$ is the number of firms in the market, and $s_i$ is the market share of firm $i$. Squaring each share before summing them gives extra weight to firms that hold large
shares of the market, and the resulting HHI reports the percentage of the market held by the typical firm. When the HHI is high, much of the market is concentrated in a few firms, so there is less competition than if the HHI were low, meaning the market is spread across many firms.

Market share can be interpreted in many different ways, but interpreting it as the percentage of total market revenue held by a given firm is appropriate for the data. The IRI panel reports prices and quantities for the goods in a store. This data can be used to calculate a store’s revenue in a given week, and summing across all of the stores in a market would give an approximation of total market revenue in that week. Then market shares could be calculated for each store and used to estimate an HHI. Doing this for each week in the data would result in a new panel of the weekly HHI for each of the 40 markets across the decade. Of course, market concentration is not something we think of as changing from week to week. So, in practice, it will be useful to aggregate the data from a weekly time interval to a quarterly or biannual interval.

2.2 Measuring Price Rigidity

In the next phase of research, I will estimate how frequently prices adjust in each of the 40 markets. I will do this by measuring the number of price adjustments per period of time in each one. This could be done on a weekly basis, but the time intervals for the HHI data and the price adjustment data need to match. Whatever interval I aggregate the HHI data to, I will have to aggregate the adjustment data to as well. There is no standardized technique for sussing price adjustments out of time series data, but I will begin by implementing methods introduced by Stevens (2011).

In her article, Stevens develops the idea of pricing regimes. A pricing regime is
the distribution of prices that a firm charges for some period of time. The mode of the distribution is the regular price that the firm charges for a good in that period, and the other prices in the distribution correspond to the various sales and specials that the firm might offer. Figure 1 shows a time series of the weekly price of frozen juice at a Dominick’s. The regular price in a period clearly traces the flat portions of the series, with the frequent downward fluctuations corresponding to sales.

Stevens argues that evaluating the rigidity of prices is not as simple as analyzing how frequently prices fluctuate, because if they fluctuate due to sales, but otherwise return to the same regular price over time, the general regime of the firm’s pricing does not change. In order to evaluate whether a firm’s pricing is rigid or flexible, one must study how frequently the entire distribution of prices from which the firm is selecting changes.

In order to measure changes in pricing regimes, Stevens builds on the two-sample Kolmogorov-Smirnov test to develop a method she calls the break test. The two-sample Kolmogorov-Smirnov test (K-S test) is a nonparametric statistical method

Figure 1: A weekly price series for frozen juice (Stevens 2011)
that tests for the likelihood that two samples are drawn from the same distribution. So, changes in pricing regime are identified when the K-S test estimates that the distribution of prices in a series has changed. Stevens’ break test iteratively performs a K-S test on a series, testing the null hypothesis that no break has occurred, and estimating the location of the break if the null hypothesis is rejected. She reports that “in simulations, the break test correctly rejects the null of no break for 91% of the simulated breaks; of all the breaks identified by the test, on average less than 2% are based on an incorrect rejection of the null. Upon rejecting the null, the estimated change points coincide exactly with the true change points 94% of the time; otherwise they are off by two periods, on average” (Stevens 2011).

Once I perform this test on the IRI panel, the breaks it identifies will correspond to price adjustments. By summing breaks across the products in a store and across the stores in a market, I will have the total number of price adjustments in a market for some period of time. Adding this data to the panel of HHIs will complete a new panel where the price adjustments per period and HHI are observed for 40 grocery and drug store markets across the decade from 2001 to 2011.

2.3 Analysis

With this new panel in hand, I will use two-dimensional panel analysis to regress price adjustments per period on market concentration. The advantage of using panel data is that it controls for unobserved heterogeneity in the data that remains fixed over time. So, by observing price adjustments per period and HHI for the same sample of 40 markets over time, I have effectively controlled for a large number of unobserved variables that could be lurking. This strengthens the plausibility of any relationships suggested by the regression analysis.
Once the regression analysis is complete, the results could be applied in several fields of research. Matsa (2011) presents a study similar in flavor to the one I propose, where he examines the effects of competition on product quality in supermarkets. In his analysis, he highlights the role Walmart plays in the observed trends, stating that competition from Walmart represents “the most significant shock to industry market structure in half a century” (Matsa 2011). This is no less true for the grocery and drug store markets that I will be studying, so close attention will be paid to the effects that Walmart may be having on price adjustment behavior and certainly on the competitiveness of markets.

Because the data covers the decade from 2001 to 2011, it captures the periods spanned by both the early 2000s recession (March - November 2001) and The Great Recession (December 2007 - January 2009). The study of price rigidity was sparked by the supposed consequences that price rigidity has for macroeconomic downturns, so conducting this analysis with an eye for how competition affects price rigidity in the wake of two recessions will represent a significant test of the theory. But caution is necessary here, because grocery and drug stores are dealing largely in staples and necessities, so the effects of recessions may be less felt in these markets than in others.

3 Conclusion

Conducting this research will represent a contribution to the empirical scrutiny of a prominent theory of the business cycle. Standard macroeconomic theory blames prolonged economic downturns on the rigidity of market prices, and the coordination failure of firms has endured as a central theory of price rigidity since it was introduced in the 1990s (Nakamura and Steinnson 2012). If we ever hope to understand the causes and dynamics of the business cycle, it pays to have theories that actually describe
the realities of the data. I hope to learn whether or not price rigidity as coordination failure is one such theory.

Professor Glandon is the perfect guide for navigating this project. This research is proximally concerned with a model of price behavior — empirically analyzing it and observing ways in which it could be improved. This is Professor Glandon’s primary research interest. In Glandon (2011) and Glandon (2013) he observes that pricing models that do not incorporate sales fail to account for important empirical observations. Professor Glandon has studied the role of sales in pricing behavior, and he has worked extensively with econometric techniques that allow meaningful conclusions to be drawn from disaggregated price data. In this way, Professor Glandon has been heavily involved in the work that will inform large portions of this research.
References


