



Price asymmetry revisited from a marketing perspective[☆]



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ABSTRACT

Price asymmetry is a longstanding issue in economics that pre-dates Keynes' introduction of the term, "price rigidity." Many theories provide possible explanations of price asymmetry. This paper demonstrates that asymmetric marketing decisions based on the inherent asymmetry of inventory costs over the business cycle can generate price asymmetries that match at least one important empirical regularity. The theoretical mechanism we propose follows from the observation that firms face inventory costs proportion to excess supply during recessions, which fall to zero in periods of excess demand. This asymmetry of inventory costs gives firms two incentives during recessions. First, a firm facing excess supply has an incentive to reduce price, seeking to sell larger quantities and thereby reduce inventory costs. The firm may increase its intensity of promotional activity, again seeking to sell larger quantities but with the counterintuitive effect of increasing consumers' willingness to pay which pushes prices higher. If the latter effect dominates the former effect, then prices may not fall much during recessions. A similar phenomenon occurs when the macroeconomic business-cycle faces a cost-side shock. The inventory-cost mechanism explains the empirical finding that asymmetry in gasoline prices are more severe in countries with high degrees of market concentration such as Japan and Korea. This new theoretical link tells us which kinds of industrial structures are likely to produce the most severe price asymmetries.

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1. Introduction

The prices of final goods tend to respond asymmetrically to positive and negative macroeconomic shocks, with upward price adjustments in response to expansionary shocks regularly observed to be larger and faster than downward adjustments in response to contractionary shocks of a similar magnitude. This pattern is referred to as downward price rigidity or, more generally, price adjustment asymmetry. Price adjustment asymmetry is a longstanding empirical puzzle which dates back long before the term "price rigidity" became a central theme in Keynesian macroeconomics (e.g., Mitchell, 1927). Recent interest in the phenomenon, the evidence that supports it, and its economic significance, appears to have, once again, intensified.

The empirical evidence for price adjustment asymmetry can be difficult to interpret because empirical studies have focused on a relatively

broad range of different outcome measures and classes of macroeconomic shocks. For example, some investigations focus on: demand-side shocks¹; the role of vertical asymmetry²; spatial asymmetry; asymmetries in adjustment speed; asymmetries in adjustment size; and positive asymmetry versus negative asymmetry. Positive asymmetry refers to prices that adjust upward more easily than they adjust downward (i.e., also referred to as downward price rigidity) is perhaps the most common focus among studies of asymmetric price adjustment. But negative asymmetry (also referred to sometimes as reverse asymmetry) is sometimes reported, which describes prices that adjust downward (negatively) more flexibly than they adjust upward.³ Whereas asymmetric size of price adjustments following demand-side shocks appear to

¹ For excellent discussions on price asymmetry due to demand shocks, see Cover (1992) and DeLong and Summers (1988).

² Vertical asymmetry can be interpreted as a synonym for asymmetric price transmission. Empirical studies explore the relation between prices of a raw inputs and prices of final output in vertical relationships, such as agricultural or manufacturing sectors. See Meyer and von Cramon-Taubadel (2004).

³ For general discussions on reverse asymmetry, see Tsiddon (1993) and Ball and Mankiw (1994). There are relatively few theoretical analyses of reverse asymmetry, with the important exceptions of Bennett and La Manna (2001) and Ray et al. (2005).

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have received more attention in previous decades, recent investigation tends to focus on speed of adjustment following supply-side shocks such as the price of raw materials.⁴

We believe that the former issue of asymmetric size is more fundamental than the latter issue of speed. Asymmetric size of adjustments will affect measurement of speed in studies of frictions or sticky prices. The focus on speed has theoretical appeal, because it hangs onto the possibility that the long-run sizes of price adjustment are symmetric and only asymmetric frictions are needed to account for asymmetric speeds of adjustment. In contrast, our model provides an inventory-cost mechanism in which suppliers with market power optimally adjust marketing and promotional expenditures in a manner that generates asymmetric sizes of price adjustments for final goods in response to identically-sized positive and negative shocks, respectively.

The large and growing empirical literature shows that asymmetric price adjustment is no longer an exceptional or peripheral phenomenon but is now regarded rather as a widespread (or, according to some observers, a nearly universal) phenomenon, appearing across many industries (e.g., gasoline, agriculture, manufacturing, electricity, and banking) as well as in most countries.⁵ For instance, for gasoline prices, Bacon (1991) reports evidence of asymmetric price adjustments based on biweekly data for the period 1982–1989, and Borenstein et al. (1997) also find similar relations by using semi-monthly retail prices and weekly crude oil prices from 1986 through 1990. Also, Galeotti et al. (2003) and Meyler (2009) identify similar patterns of price asymmetry based on monthly data among European countries for the period 1985–2000 and on weekly data among European countries for the period 1994–2008 respectively. Recently, McLaren (2013) also confirms price asymmetry in agricultural sectors by using a sample of 161 agricultural products produced in 117 countries over a period of 35 years. Also, Peltzman (2000) shows that prices rise in response to a negative supply-side shock (i.e., increase in cost of production) nearly twice as often as prices fall following an expansionary positive supply-side shock (i.e., decrease in cost of production) by studying the prices of 77 consumer goods and 165 intermediate goods. His finding suggests that the asymmetry arises as a fundamental of the price mechanism and not merely by chance, as Galeotti et al. (2003) point out.⁶ Following these striking empirical findings, many authors argue that price asymmetry should be regarded more as a rule rather than an exception (e.g., Ellingsen et al., 2005). Peltzman criticized orthodox economic theory's insistence on models that predict price symmetry rather than asymmetry: "In the paradigmatic price theory we teach, input price increases or decreases move marginal costs and then prices up or down symmetrically and reversibly. Usually we embellish these comparative statics results with adjustment cost or search cost stories to motivate lags in response. But there is no general reason for these costs to induce asymmetric lags. ... If that finding was shown to be general and not just limited to a few case studies, it would point to a serious gap in a fundamental area of economic theory."

Acknowledging that there are indeed many alternative theories that seek to explain price asymmetry, it is difficult to avoid the conclusion that most of these theories (including menu cost theory, inventory

management theory, search theory and coordination theory) appear inconsistent with empirical observation (Peltzman, 2000). Ellingsen et al. (2005) argue that we need a more robust theory that can fill the gap between the theory and observation based on a fundamental explanation of asymmetric price adjustment. Our paper attempts to, at least partially, fill that gap.

We propose an intuitive mechanism based on the asymmetric costs of excess inventory (which are strictly positive when there is excess supply and zero when there is excess demand) and producers' joint consideration of marketing and promotional expenditures used to optimally manage the costs of excess inventory. In standard economic theory, firms are assumed to be rather passive players that adapt to changes in the market environment by adjusting output and price. In contrast, a Schumpeterian theory of the firm views its action space as including more choice variables that are used to respond to changes in the environment in a variety of ways. One of these is marketing and promotional activity.⁷ Modern firms consider marketing as one of its essential activities, readily observable in almost all industries market structures. As Ray et al. (2005) point out, it is quite puzzling that there are only a few marketing approaches to price asymmetry in spite of the universality of firms' marketing activity, considering that marketing is a key decision often made jointly with pricing decisions or made in ways that have intended effects on the prices of goods that the firm sells. In this paper, we assume that a firm engages not only in quoting a price but also in a marketing activity including advertising and sales promotion, which we refer to simply as "promotional activity".⁸ If there is excess supply caused by a demand- or cost-shock, then additional costs of excess inventory are incurred. To reduce this excess inventory, the firm has a clear incentive to lower its price. If this were the only incentive driving price responses to a contractionary macroeconomic shock, then the inventory cost mechanism would likely generate reverse price asymmetry, because the costs of excess inventory reinforces the incentive to lower price sending it lower by more than it would rise in response to an expansionary shock of identical magnitude.

If the firm responds to a contractionary shock by re-optimizing its mix of expenditures in both production and promotions, however, the firm may choose to engage in more intense marketing activity. Increased marketing and promotion, in turn, shifts the demand curve in way that attenuates (or possibly even reverses) the price response that would have followed the same contractionary shock in the absence of optimal increases in promotional effort. The inventory-cost and promotions mechanism is simple. A contractionary shock occurs. The firm increases marketing and promotions expenditure, which moves the demand curve in a way that pushes prices higher, partially offsetting the otherwise symmetric negative price adjustment that would have occurred without having increased marketing. Our model provides a clear representation of these two motives following a contractionary shock: lowering price to clear inventory and thereby save on the costs of excess inventory; and increasing promotional effort to increase demand for goods held in inventory. If the second promotional effect dominates the first motive of discounting to liquidate inventory, then downward price rigidity occurs in our model. Our model provides analytic inequalities describing market environments that guarantee downward price rigidity. We also provide conditions and demonstrate that joint optimization of inventory costs and promotional expenditure can also explain reverse price asymmetry when the liquidation-discounting motive dominates the promotions-to-increase-demand

⁴ Bacon (1991) refers to asymmetry in price adjustment as "Rockets and Feathers," based on the speed and magnitude of the upward trajectory of a rising rocket compared to the downward trajectory of a falling feather.

⁵ See Johnson (2002) and Brown and Yucel (2000) for gasoline prices, Pick et al. (1991) for agricultural product prices, Zachmann and von Hirschhausen (2008) for electricity charges, Boyde and Bronsen (1988) for pork prices, and Neumark and Sharpe (1992) for interest rates. Verbrugge (1998, 2002) reports evidence of price asymmetry in almost all countries. There are some papers on the other side as well. For instance, Karagiannis et al. (2014) test the symmetry of price adjustments in the gasoline markets of four countries (Germany, France, Italy and Spain) and do not find that the retail fuel speed of upward/downward price adjustment is asymmetric in any of the four economies. Berument et al. (2014) find no significant asymmetry for crude oil price increases versus decreases on petroleum product prices.

⁶ Galeotti et al. (2003) assert that neither menu costs nor search costs can be the mechanism causing price asymmetry.

⁷ Schumpeter (1942)'s definition of "creative destruction" includes new ways to organize production, new products, new methods of advertising and marketing, new ways to transport products, etc.

⁸ In the marketing literature, the concept of promotion includes advertising, sales promotion, and personal sales, although it is sometimes used in a narrower sense referring only to sales promotion.

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