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# What causes rockets and feathers? An experimental investigation☆

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ABSTRACT

Prices usually adjust much faster when costs increase than when costs decrease. In spite of the many empirical studies confirming this "Rockets-and-Feathers" phenomenon for different industries, the mechanism driving it is not well understood. We use simple experimental markets with and without search frictions and either privately or publicly observed cost shocks to study how sensitive the "Rockets-and-Feathers" phenomenon is to changes in search costs and information conditions. In contrast to standard theoretical predictions we observe price dispersion and spontaneous asymmetric price adjustments in all treatments. Neither search costs nor private information on cost shocks are indispensable for prices to adjust asymmetrically in the short term. The initial asymmetry quickly disappears if the direction of the cost shocks are publicly known, while it persists in both treatments with private information.



## 1. Introduction

Consumers usually complain that the retail gasoline prices respond faster to increases in wholesale prices than to decreases. Karrenbrock (1991), Duffy-Deno (1996) and Borenstein et al. (1997) all study the US gasoline market and conclude that their data provide strong evidence that this phenomenon is real rather than just a misperception of consumers. There is also evidence for Canada (Eckert, 2002) and for some European countries (Bacon, 1991; Galeotti et al., 2003), which shows that asymmetric price adjustment is not a US specific phenomenon. Moreover, Borenstein et al. (1997) find that this asymmetry does not only occur in the adjustment of retail prices to changes in wholesale prices, but also in the adjustment of spot oil prices to changes in crude oil prices. The gasoline industry is not the only industry where asymmetric price adjustment to cost changes occurs. Ward (1982) and Goodwin and Harper (2000) also confirm that in other markets that impact even more on consumers' daily life (e.g., meat and vegetables) price adjustment is asymmetric.

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Despite the many empirical studies showing the existence of asymmetric price adjustment to cost shocks, plausible economic theory that can satisfactorily explain this phenomenon is only emerging. In traditional microeconomic theory, variations of input prices affect the output prices through marginal cost. The transmission from marginal cost to prices is governed by market power. The direction of the cost shocks does not play a role. The first potential reason that springs to mind for why prices adjust asymmetrically to cost shocks is market power and (tacit) collusion (Borenstein et al., 1997; Tirole, 1988). However, this explanation has not been formalized in theory. Recent theoretical work by Yang and Ye (2008), Tappata (2009), Lewis (2011) and Cabral and Fishman (2012) points to search frictions and asymmetric information on cost shocks as the underlying causes of the asymmetry. The proposed mechanisms that generate the "Rockets-and-Feathers" phenomenon usually require a model with search frictions that cause equilibrium-price dispersion and asymmetric search behavior after positive and negative cost shocks. The latter is typically achieved by assuming specific forms of consumer heterogeneity and asymmetric information on cost shocks.

While both tacit collusion and asymmetric search behavior can plausibly contribute to asymmetric price adjustment, neither can be tested easily using empirical data.[1] More importantly, neither of these explanations seem to be necessary for "Rockets and Feathers" to occur. The comprehensive study of Peltzman (2000) observes asymmetric price adjustment in more than two-thirds of 242 investigated markets and does not find any relation between the degree of competition and asymmetric price adjustment, which implies that asymmetric price adjustment does not necessarily require tacit collusion. Hannan and Berger (1991) and Neumark and Sharpe (1992) find that banks adjust both mortgage rates and consumer deposit rates asymmetrically when the central bank changes its interest rate. This happens despite the fact that rate changes are publicly observable. Hence, asymmetric price adjustment occurs even if the cost shocks are publicly observed by both sides of the market. Furthermore, in a controlled laboratory experiment, Mc Gee (2012) finds that consumers, who face identical search cost, search more when prices increase and less when prices decrease even if the shifts in price distributions (potentially caused by shocks) are known to consumers. Lewis and Marvel (2011) also provides empirical evidence for asymmetric search behavior using data from a gasoline-price reporting website. Moreover, in another context, Fehr and Tyran (2001) observe asymmetric adjustments to positive versus negative money shocks in the laboratory in Bertrand markets where there are neither search nor informational frictions. Together these papers suggest that the ingredients in search-based models that ensure equilibrium price dispersion and asymmetric search behavior may not be essential in reality for asymmetric price adjustment to occur.

In this paper, we complement the current theoretical and empirical studies through a closer examination on search-based explanations. In particular, we study how sensitive the "Rockets-and-Feathers" phenomenon is to changes in search costs and to changes in information conditions (on cost shocks). For this purpose we use laboratory experiments, where search costs and information conditions (in contrast to the field) can be manipulated easily, while everything else can be kept constant.[2] The purpose of this paper is not to test any of the existing search-based models. Instead, we implement a much simpler environment, where contrary to standard equilibrium predictions we still expect asymmetric price adjustment to occur under behavioral considerations.

We start our enquiry with a treatment that contains the simplest of Bertrand price-setting games. We have two firms competing in prices with one consumer who wants to buy one unit of a good. After 15 periods a cost shock takes place, which either reduces, increases or leaves the marginal cost of both firms unchanged. The actual realization of the cost shock is known to both sellers and buyers. Given the realization of the cost shocks, we have three conditions: *Up, Constant* and *Down*, which correspond to a new cost which is higher, equal or lower than the cost in the pre-shock phase. Standard economic theory predicts that in equilibrium firms set prices to marginal costs, and there should be no asymmetric price adjustment across the three cost conditions. However, as Fehr and Tyran (2014) argue that adjustments to a negative shock can be sticky as long as sellers' expectations about other sellers' prices are sticky and prices are strategic complements, we conjecture that price adjustment can be asymmetric in this setting. Sellers expect other sellers to increase prices instantaneously after a positive cost shock,[3] but not to decrease the price a lot (if at all) until they see others have reduced the price after a negative cost shock.[4]

Based on this simplest setup, we add search frictions (i.e., positive search cost) and informational frictions (i.e., asymmetric information on cost shocks) one by one to further study to which extent asymmetries in price adjustments depend on search costs and on information about cost shocks. In our treatment with positive search costs (and publicly observed production costs after the shock), standard economic theory (Diamond, 1971) again does not predict asymmetric price adjustment (and in fact, no adjustment at all). In equilibrium both firms charge the monopoly price, which is equal to the buyers' valuation of the product and hence independent of the realization of the cost shocks. Given that we expect asym-

[1] Byrne et al. (2014) study the effect of a web-based price clearing house (www.fuelwatch.wa.gov.au) on asymmetric price adjustment and find that the website reduces both search cost (through more price transparency) and the speed of the retail price adjustments to falling costs. Byrne (2015) compares gasoline pricing in the country where search frictions are negligible to urban markets where collusive behavior and search-based explanations may co-exist. Together these studies suggest that both search frictions and tacit collusion reduce the speed of downward adjustments.

[2] The usual caveat regarding the external validity of laboratory experiments certainly applies.

[3] This maybe because the shock lends the sellers a legitimate excuse to raise the price, or because the profit margin becomes very thin (or even negative) if sellers were to keep the prices unchanged.

[4] There are quite a few experimental studies that document considerable price dispersion in settings where theory would predict the law of one price to hold (Abrams et al., 2000; Baye and Morgan, 2004; Dufwenberg and Gneezy, 2000). We also expect to see price dispersion in our experimental markets, but price dispersion itself is not the focus of our study.